Unleashing the Potential of Technology

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Unleashing the Potential of Technology

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Preface

In an era defined by rapid technological advancements, our world is experiencing a profound transformation. From artificial intelligence and virtual reality to blockchain and biotechnology, the possibilities seem endless. The potential of technology to reshape our lives, industries, and societies is truly remarkable. It is within this context that the book, "Unleashing the Potential of Technology," emerges as a guide to navigate and harness the power of these transformative forces.

Technology has become an integral part of our daily existence, permeating every aspect of our personal and professional lives. It has disrupted traditional industries, created new opportunities, and challenged the way we perceive the world. However, with this tremendous potential comes a great responsibility to understand, evaluate, and utilize technology in a way that benefits humanity as a whole.

"Unleashing the Potential of Technology" aims to explore the multifaceted dimensions of this technological revolution. It delves into the promises and perils, the opportunities and challenges that arise as we venture further into the digital age. It seeks to empower individuals, organizations, and policymakers with the knowledge and insights needed to make informed decisions and navigate the complex terrain of technology.

This book offers a comprehensive examination of key technologies, their applications, and the potential impact they can have on various sectors of society. From healthcare and education to finance and entertainment, we explore how technology can revolutionize and optimize these domains.

Furthermore, "Unleashing the Potential of Technology" encourages critical thinking and ethical considerations. We delve into questions of privacy, security, and the social implications of technology's pervasive influence. We explore how to strike a balance between innovation and responsibility, ensuring that technology is a force for good and contributes to a sustainable and inclusive future.

Throughout this book, you will find insights from experts, real-world examples, and thought-provoking scenarios that challenge conventional wisdom. It is designed to inspire and equip readers with the tools necessary to navigate the ever-evolving landscape of technology and seize its boundless potential.

As you embark on this journey through "Unleashing the Potential of Technology," we encourage you to approach each chapter with an open mind, ready to question assumptions and explore new possibilities. The future is not predetermined, and it is up to us to shape it responsibly. Together, let us embark on a quest to harness the power of technology for the betterment of humanity.

May this book serve as a guiding light in your pursuit of unlocking the transformative potential of technology.

Acknowledgement

We would like to express our sincere gratitude to all those who have contributed to the creation and realization of this book, "Unleashing the Potential of Technology." It is with great pleasure and humility that we extend our appreciation to the following individuals and groups:

First and foremost, we would like to thank respective families and friends for their unwavering support. Their encouragement and patience have been invaluable. The sense of satisfaction that comes with any accomplishment is magnified exponentially when your family is a part of it.

The wisdom and insights provided by our seniors have challenged us to think beyond conventional boundaries and explore new frontiers in the realm of technology. They have been source of inspiration to us.

We would also like to express our gratitude to the countless individuals who have shared their knowledge and experiences, both formally and informally. Their insights, whether through interviews, discussions, or research materials, have enriched the content of this book and have provided a broader perspective on the potential of technology.

We extend our thanks to the publishers, and the entire production team who have worked tirelessly to bring this book to life. Your professionalism, expertise, and attention to detail have transformed ideas into a tangible reality. We are immensely grateful for your collaborative efforts in making this project a success.

In addition, we want to thank all the authors who have contributed their research papers to this book. Your dedication and hard work have paved the way for this book to become a reality.

Finally, we would like to express our appreciation to the readers and supporters of "Unleashing the Potential of Technology." Your engagement, feedback, and enthusiasm

for the subject matter motivate me to continue exploring the vast possibilities that lie ahead. It is our sincere hope that this book sparks meaningful conversations, inspires innovative thinking, and encourages a positive and responsible approach towards leveraging technology for the betterment of society.

Once again, thank you to all those who have played a part, big or small, in bringing this book to fruition.

With heartfelt appreciation.

Dr. Karthik Kovuri

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Dr Namita Dixit

Dr. Pradeep Devendra Gaikwad

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About the Editors

Dr. Karthik Kovuri is an Academician, Administrator, Content Developer, Innovative Teaching Learning Practitioner, Expertise Enricher and Researcher. He has 19 years of rich experience at various academic, administrative and research capabilities in engineering Institutions/ Universities. At present, he is serving as Professor & Dean, School of Engineering and Technology at The Assam Kaziranga University.

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A STUDY OF BLOCKCHAIN TECHNOLOGY FOR ENHANCEMENT IN THE BIG DATA SECURITY

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INTRODUCTION

The introduction of Big Data into the field of information technology has made the process of managing and analyzing data a great deal more difficult. It is essential to take everything into consideration, including aspects such as volume, diversity, pace, importance, and complexity. The processing of enormous amounts of data is simplified with the use of clustering. When dealing with unstructured data, this is a very useful skill to have. It is possible to offer a wide range of computer services, such as servers, storage, databases, and networking, in addition to analytics and intelligence, at a cheaper cost by using cloud computing, which makes use of the Internet as its delivery route. This makes it feasible to give a variety of cloud services at a reduced cost. The protection of such vast quantities of data is the primary challenge. Blockchain technology, which is also the foundation of cryptocurrencies like bitcoin, is one method for enforcing stringent security measures. It is possible that the decentralized, unchallengeable, and publicly verifiable record of every transaction activity that may be supplied by the Blockchain technology could revolutionize security in a significant manner across a variety of businesses. Data management and analysis have become more difficult as a result of the emergence of "Big Data" in the information technology industry. Considerations about size, diversity, velocity, value, and complexity should always be given due consideration. The technology known as block chain, which provides a decentralized, unchallengeable, and publicly verifiable record of every transaction activity, is sometimes referred to as the "backbone" of Bitcoin in the Bitcoin community. Block chain technology has the potential to revolutionize many different sectors.

1.1 BLOCKCHAIN

The underlying infrastructure that Bitcoin is constructed upon is referred to as "block chain technology," and the phrase is used interchangeably. Because of this technology, each and every transaction may be carried out in a manner that is decentralised. The involvement of a third party is not required to proceed. The decentralised, unchallengeable, and publicly verifiable records of transactions that are made possible by the technology of block chains offer immense potential for revolutionising a wide variety of different sectors. Blocks of data that are cryptographically connected to one another are used to store information in blockchains, as opposed to the rows and columns that are utilised by conventional databases. A new block of data is created

whenever there is a new data bit that is received. When all of the available space in a block has been used to store information, that data is then linked to one another according to the order in which it was added. Although it may be used to store any form of data, the most popular use of a blockchain to date has been as a ledger for financial transactions. Blockchains can, however, be used to record any kind of data. The usage of Blockchain in the Bitcoin network is not overseen by any centralised body; rather, control of the network is held jointly by all members. With the use of Blockchain, data may be digitally dispersed and exchanged without the danger of it being altered in any way. As a result, the technology behind blockchain may be used to the creation of immutable ledgers or recordings of transactions. Therefore, the term "distributed ledger technology" (DLT) is frequently used to refer to blockchains.

The phrase "blockchain technology" is used to refer to the technological foundation upon which the digital currency known as bitcoin is created. Because of this technology, it is possible to carry out any transaction in a manner that is not supervised by any central authority. This opens up a whole new world of possibilities. It is not necessary for there to be a go-between or a broker for this to take place; they are not needed in any way. The Blockchain technology has the potential to revolutionise a broad number of businesses because it generates records of transactions that are decentralised, immutable, and publicly verifiable.

normal databases store the data in rows and columns that are hash-linked together, but blockchains store the data in blocks that are cryptographically connected together. This is in contrast to the way that normal databases store the data, which is in rows and columns that are hash-linked together. A new section of the database is added with the addition of each new bit of information that is obtained. When a block has been completely crammed with information, the pieces of data that are stored inside it are linked to one another in the order that the events in the block's timeline took place.

The use of a Blockchain as a ledger for the recording of financial transactions has been the one that has proved to be the most effective up to this time, despite the fact that a Blockchain may be used to store a broad variety of other data kinds. The usage of the Blockchain by Bitcoin is not governed by a single entity or organization; rather, the reins are collectively controlled by all of the cryptocurrency's users. Transactions relating to bitcoin are recorded via the use of a technology called blockchain. When using blockchain technology, digital information may be kept and disseminated, but once it has been recorded, that data cannot be altered in any way. As a consequence of this, a Blockchain has the potential to serve as the basis for immutable ledgers, which are, in essence, unchangeable records of transactions that cannot be altered in any manner. As a direct result of the aforementioned fact, blockchains are sometimes referred to as "distributed ledger technology (DLT)".

1.1.1 Features of Blockchain technology

The key points depicting features of blockchain technology are cited ahead:

a) Immutability: It means that there is nothing that can be done to make things different. To ensure the long-term success of Blockchain, this feature serves as a permanent, immutable network.

b) Decentralized: There is no central authority controlling the network's infrastructure because it is decentralized. Instead of having a central authority over the network, it is run by a dispersed group of nodes. It is suitable for storing any valuable digital asset, from bitcoins to important documents and contracts. Then, using your private key and the Blockchain, you might have direct control over them. Accordingly, the decentralized system returns power and property to the people.

c) Enhanced Security: Every piece of information stored on the Blockchain is encrypted and hashed with a unique algorithm. It could also be said that the data's true nature is hidden by the noise created by the network. Any given set of input data can be processed by mathematical algorithms to yield new output values, while the overall length remains unchanged. Creates a distinct identifier for each piece of information. Each new block in the ledger includes the hash of the prior block in addition to its own. Modifying the data will generate a new set of hash identifiers. Even that's pushing it a little. The user will need both a private key and a public key to decrypt the data.

d) Hashing is Irreversible: Hash functions are extremely intricate and are not reversible or modifiable. It is impossible to derive a private key from a public one.

e) Distributed Ledger: This data is typically kept in a public ledger where anybody can access it. It's everything out in the open; there's nowhere to hide. However, private or federated Blockchains are an exception to this. However, in these settings, a large number of people still have access to the ledger. Consequently, the distributed ledger is dynamically updated in real time by all participants. This distributed the workload across the systems to improve the final result.

f) Consensus: Blockchains can only function as intended with the help of consensus algorithms. The intelligence behind this architecture comes from consensus algorithms. To put it simply, Consensus is crucial to any Blockchain. The reliability of the network is a direct result of the consensus reached within the network. Even if nodes don't trust each other, they may have faith in the underlying algorithms. Therefore, the Blockchain gains value from every transaction that takes place on the network. It's a perk of using Blockchain technology.

g) Faster Settlement: Through some cases, the time it takes for a transaction to be processed in a conventional banking system can be prohibitive. Blockchain is a

contemporary method that can provide faster money transfers, saving the user precious time.

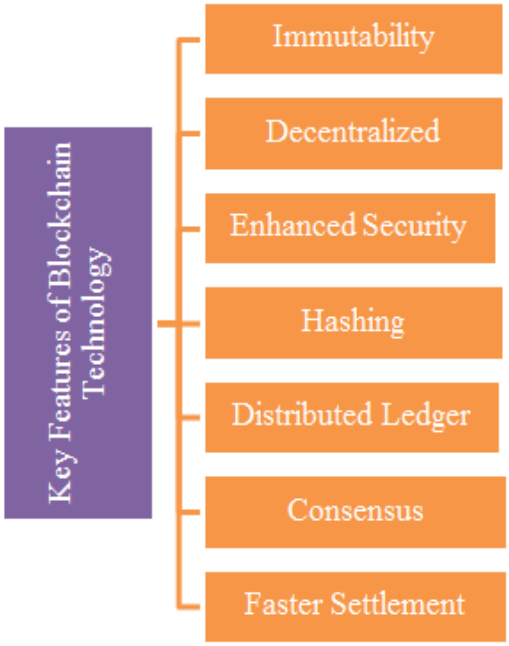

Fig 1: Key Features of Blockchain Technology

1.2 BIG DATA

The term "big data" refers to very large quantities of data. The information is too large and complicated for the typical data management technologies to store or handle in a suitable manner. Big data describes extraordinarily big datasets. A few instances of what we mean when we talk about "Big Data" are as follows: Every day, about one terabyte of brand new trading data is produced by the New York Stock Exchange, which is widely regarded as a model producer of Big Data. According to the company's calculations, the social media behemoth adds at least 500 gigabytes of new material to its servers every single day. Users create this data in a variety of ways, the most prevalent of which is via the sharing of various types of media.

1.2.1 Features of Big Data

Big data can be described by the following characteristics:

a) Volume: The term "Big Data" refers to a very large data collection. The availability of so much data makes it very necessary to put that data to good use. Another requirement for "Big Data" status is the amount of information that must be gathered in order to arrive at an accurate classification. As a consequence of this, 'Volume' has to be taken into consideration while coming up with solutions for Big Data.

b) Variety: The variety of Big Data becomes the second factor to take into account. For anything to be considered "variety," the data in question might either be organised or

unstructured. When it came to storing and retrieving information, the majority of software in the past relied only on files and databases. Analytical applications get their information from a wide variety of sources, including but not limited to emails, pictures, videos, monitoring tools, PDFs, and audio recordings. The existence of unstructured data raises the difficulty level of several data-related tasks, including data storage, data mining, and data analysis.

c) Velocity: When discussing this subject, the word "velocity" is often used to refer to the pace at which new information is produced. The speed at which new data may be created and processed is an essential component in maximising the usefulness of existing data. "Big Data Velocity" refers to the velocity at which data is created from a variety of sources, including corporate processes, log files, and mobile devices. The exchange of massive amounts of data occurs at a breakneck speed.

d) Inconsistency: Due to the inherent unpredictability of the data, it might be difficult to analyse and manage the data in an effective manner.

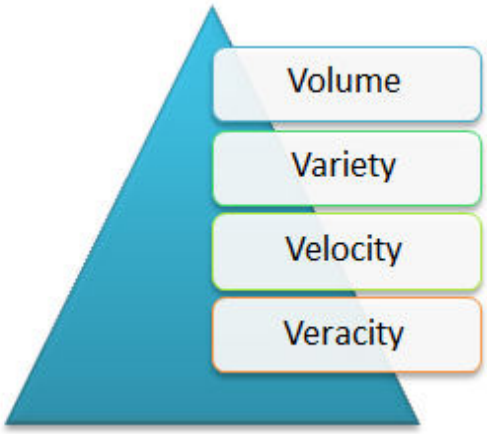

Fig 2 depicts Features of Big Data

1.3 Blockchain technology in Big Data analytics

- A blockchain encrypts all of the transactions that take place on it, providing the greatest degree of security that is currently accessible. The information that is stored in a blockchain also has an invulnerability of this kind. Verifying the file signatures on each node is one way to check the integrity of the network's ledgers and ensure that they have not been altered in any way. This may be done to ensure that nothing has been changed. In the event that the record is modified in any way, the signature will no longer be valid. Applications that combine the usage of big data and blockchain technology have no choice but to be successful. Comparatively, Big Data technology is able to process any data, regardless of its diversity, velocity, or volume, but Blockchain technology is able to simplify operations across all sectors. The conventional approaches to the storage of data and the processing of business transactions have been rendered obsolete by the recent developments in the fields of

Big Data and Blockchain technology. When it comes to Blockchain, Big Data requires processing power that is able to manage the complexity and rapid growth of Blockchain, and vice versa. Big Data also needs processing power that can handle Blockchain. The following is a discussion of some of the benefits that may result from using Blockchain technology with Big Data analytics:

- Maximizes effectiveness while decreasing overhead.
- Enhanced product and document tracking; enhanced data quality, which increases accuracy and simplifies analysis by resolving weak points in big data analytics.
- Allowing users from different departments to access the data for the analysis process reduces the time it takes to access and analyze the data.
- Ensuring the safety of the general population.

Applications of Blockchain with Big Data

This section shed light on several implementations of Blockchain technology in Big Data among various industries as depicted in figure 4:

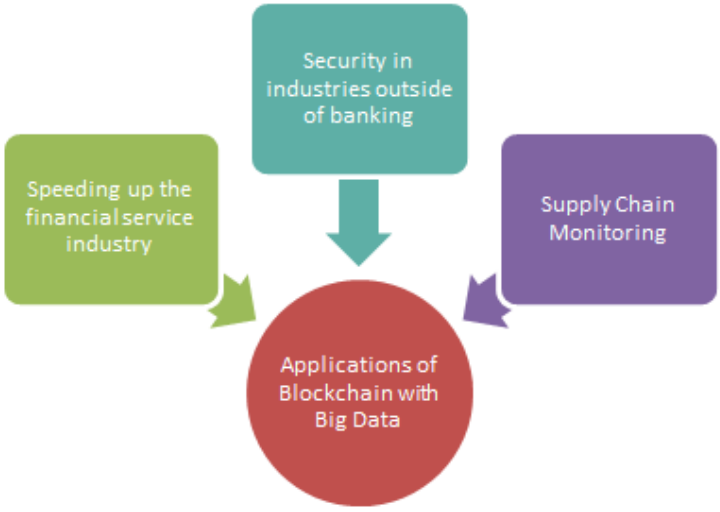

Fig 4 depicts applications of Blockchain with Big Data

1. Speeding up the financial service industry: Financial organizations can predict risk and spot suspicious tendencies in real time thanks to the integration of Blockchain and Big Data. Banks and their clients will benefit from increased security, a more streamlined transaction procedure, and lower fees if they use Blockchain technology. A consortium of 47 Japanese banks, for instance, recently joined a Blockchain firm named Ripple in order to streamline cross-border financial transactions using Blockchain technology.

The objective is to get cheaper real-time transfers. Traditional real-time transactions are costly due to potential risk factors like double spending, which can be mitigated with

Blockchain technology. Risky transactions can be identified much more quickly using Big Data analysis in conjunction with Blockchain. Transactions in real time are cheaper as a result.

2. Security in industries outside of banking: Blockchain is being used by the healthcare industry, government agencies, and businesses to manage data and safeguard against hackers and data leaks. Such as:

- Healthcare: Medrec, an MIT Media Lab initiative, is getting the ball rolling on a Blockchain system that prioritizes patient agency and hence permits patients to share their records. Medrec employs a private Ethereum chain to facilitate the distribution of access permissions to data.
- Insurance: Real-time access to policy data and documents from the United Kingdom, Singapore, and Kenya has been included into a "smart contract." Clarity on insurance coverage and premium payment is provided by blockchain technology on both a local and a global scale. This system also has the added benefit of automatically notifying network participants after payment occurs.

3. Supply Chain Monitoring: Blockchain is used to record the whereabouts of goods in transit, and a smartphone app is used to monitor their movement. The use of blockchain technology in the supply chain can do a number of useful things, such as improving inventory management; decreasing shipping costs; and lowering the possibility of fraud. It decreases the time it takes to complete administrative tasks, find issues more quickly, and boost the trust of your customers and business partners.A good example is Walmart, which utilizes Blockchain technology to improve food safety by better tracking products from the farm to the store shelf. In this approach, users are able to acquire reliable information about food's origin. Because Walmart generates 40 petabytes of data every day, receiving data that cannot be changed, is reliable, and can be tracked, is critical to the company's operations.

1.4 ROLE OF BLOCKCHAIN IN BIG DATA

Because each and every transaction that takes place on a blockchain is protected by encryption, this technology is able to provide the highest level of safety that is currently attainable. In a manner somewhat dissimilar to the previous example, the data that is preserved on the Blockchain cannot be altered. If one wants to err on the side of caution, one might verify the file signatures of all of the nodes in the network across all of the ledgers in the network to ensure that they have not been tampered with. In the event that the document is altered in any manner, the signature will no longer be considered legitimate.

Big data and blockchain technologies both have uses that may be useful to one another. The tools that make up Big Data are capable of managing any data, regardless of its

diversity, velocity, or volume. Applications built on the blockchain may streamline processes in any sector. As a result of the development of Big Data and Blockchain technology over the last several years, the conventional information processing architecture and business transaction processing have become outmoded. Because of this, it is now feasible to forego continuing with these procedures. Processing power that is capable of managing Big Data's processing capability is required for Big Data, and Big Data in turn needs processing power that is capable of handling the complexities of Blockchain as well as its rapid expansion.

This shed light on a variety of applications of Blockchain technology in Big Data across a variety of sectors, including:

1. The combination of Blockchain technology and enormous volumes of data stored by financial institutions will make it feasible to evaluate risk and discover suspicious tendencies in real time. This will accelerate the financial services industry, which will have a positive impact on the economy. Using Blockchain technology as a means of conducting transactions would help to protect banks and their customers from fraud, speed up the process of transactions, and reduce the cost of moving money between accounts. All of these benefits would be realised by using Blockchain technology. For example, in the most recent few years, in order to simplify the procedure of transferring money from one bank account to another using a technology known as Blockchain, an organisation consisting of 47 Japanese banks joined a Blockchain company known as Ripple. This was done in order to streamline the process. The objective here is to complete real-time transfers while keeping the expenses associated with doing so to a minimum. Because of the potential for risk factors such as double spending, traditional real-time transactions incur a high cost. However, this cost might be reduced by using Blockchain technology, which eliminates the possibility of such risk factors.
2. Businesses in a variety of sectors, including healthcare, public administration, and others, have started using blockchain technology in order to manage data, foil efforts at hacking, and prevent data breaches. This is a security measure that is not limited to the financial sector.
3. Supervision of the Supply Chain A Blockchain is used to keep track of the components that are included in the supply chain, and a mobile application is used to keep track of the whereabouts of these components as they are transported from one place to another. Because it leverages the technology of Blockchains to improve food safety, for example, as an example of this, Walmart is a good example of this because it allows for more precise monitoring of things from the farm to the store shelf. When users use this tactic, they will have the opportunity to get reliable information on the origin of the food they consume.

Cryptocurrency is an encrypted kind of virtual money that was designed to eliminate the possibility of fraud and duplicate spending. Complete decentralisation characterises the networks that underpin the vast majority of crypto currencies. The technology behind the blockchain is essential to these. A master ledger is maintained across all of the world's computer networks. Cryptocurrency is one example of a digital asset. A decentralised system is used to operate it. According to the opinions of several experts, blockchain and technologies similar to it will cause significant disruptions in a wide variety of businesses, including the legal and financial sectors. One of the primary benefits of cryptocurrencies is that monetary transactions may be completed much more quickly. The unpredictability of pricing and the high cost of doing transactions are two main factors that contribute to the lack of flexibility.When using cryptography for the purpose of protecting digital or virtual currency, ensuring that the process of keeping and managing cryptographic information is as straightforward as possible is of the utmost importance. It makes it easier to avoid complexity and cuts down on the amount of time needed to analyse data. Within this system, information may be viewed by bitcoin as well as by users who have been granted certain rights. The following are the goals that the current research is concentrating on:

1. Using information from the coin market cap to make an estimate of the potential of cryptocurrencies
2. Keeping a running track of crypto assets over the course of a year in order to estimate the optimal price at which they may be sold.
3. Creating an innovative strategy for predicting prices that are either ideal or suitable
4. Providing the investor with the most favourable price available will make the investor's life easier.

1.5 ROLE OF DEEP LEARNING IN BLOCKCHIAN

A stock's 52-week low/high and current market value are intended to be taken into consideration by the artificial intelligence when picking a share script. A slew of AI-based optimization algorithms have been created in an effort to improve the accuracy of estimating a company's share value.

Predicting cryptocurrency using Machine Learning is the best option available. In order to make a reasonably accurate prediction, the model needed to satisfy a number of criteria. Daily and 5-minute interval price predictions for Bitcoin are made using a wide variety of ML models, including as LDA,LR, RF, XGBoost, SVM, DT, QDA, and KNN. When it comes to blockchain and cryptocurrencies, the uses of machine learning go far beyond price prediction. By streamlining the back-end processes of crypto trading and mining, ML has the potential to address the security problems in this technology through deep learning and reinforcement learning.

Developing a scalable and flexible model is essential to properly forecasting bitcoin values. Previous Deep Learning and Machine Learning studies will be considered in this study. The proposed research project will look at the shortcomings of standard deep learning systems, such as their lack of accuracy and high time requirements. If researchers want to reliably anticipate the optimal price for big, mid, and small-cap shares, they must first apply optimization approaches to establish efficient mechanisms and then compare their findings to those of past studies.

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AN ANALYSIS OF INNOVATIVE ENCRYPTION TECHNIQUES FOR IMPROVEMENT IN SECURITY OF BIG DATA

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ABSTRACT

Cloud computing has become a general term. It has been used to the deliver the hosted services. These services are provided over the internet. There are three type of cloud such Public Cloud, Private Cloud, Hybrid Cloud. Several benefits of cloud computing are discussed along with its challenges. Big data is a combination of structured, semi structured and unstructured data. Also we discuss about intrusion detection system.

CLOUD COMPUTING SECURITY

Cloud computing Security has been considered a basic issue. Information in cloud require to be collected in form of encryption. In order to limit user access of secret information the proxy and brokerage services must be used.

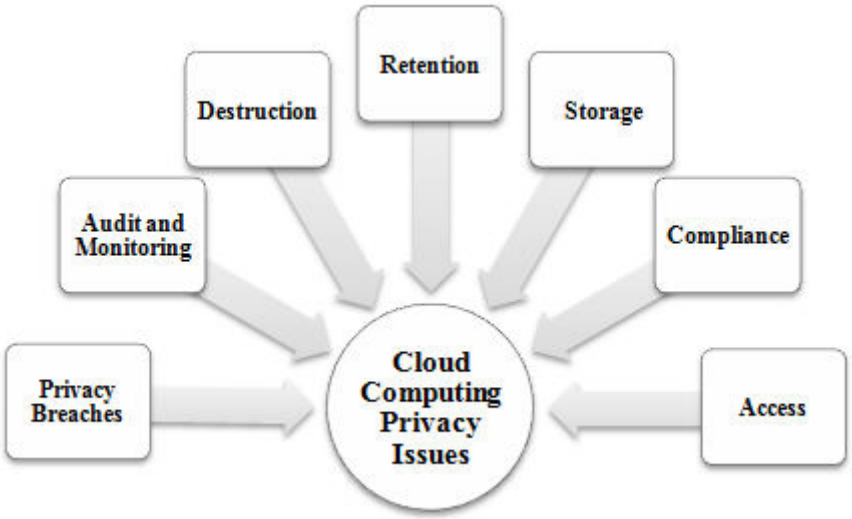

FIGURE CLOUD COMPUTING SECURITY

Users need to make analyses of several aspects of resource before deploying a exacting resource to cloud which are as follow:

1. Choose the resource that requires shifting to cloud & make analyses of its sensitivity to challenges.
2. Taking cloud service models in account as IaaS, PaaS, & SaaS. Models need customer to be accountable for protection at several levels of service.

3. The different Cloud to be used for example private, public, community or hybrid should be considered.
4. Making understanding of cloud service provider system. Considering information storage & out of cloud & its transfer into.
5. The risk in cloud deployment basically is based on service models and different kind of cloud.

Introduction to Data Security

Because information is communicated via Internet, data security is must in cloud. Following are known to be key mechanisms to keep the data safe and protected.

a) Auditing

b) Access Control

c) Authorization

d) Authentication

Every service models may consider the security mechanism which has been operating in case of above stated areas.

SECURITY ISSUES IN CLOUD COMPUTING

The third parties provide information and system management for cloud computing as of cloud privacy is major issue. To deliver important information in the direction of cloud service provider becomes a big problem. Violation could make loss of user or occupation .thus the venders give security.

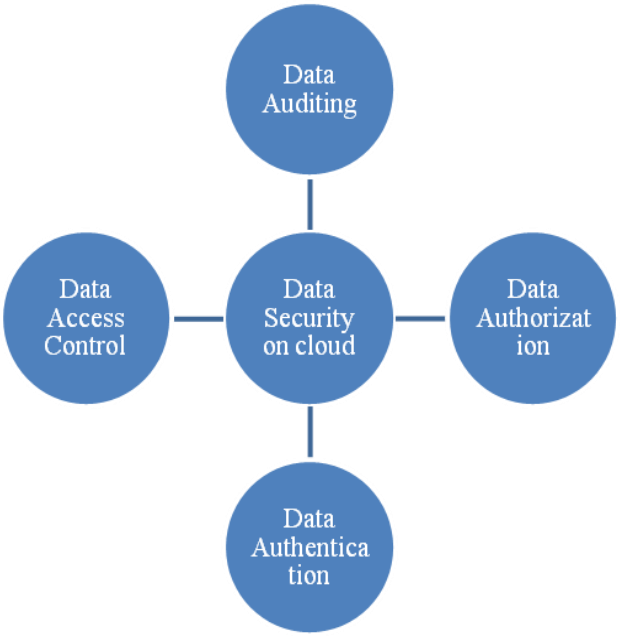

FIGURE SECURITY OF DATA ON CLOUD

In the background of cloud data is transferred rapidly over internet therefore safety of data is always kept in mind. Several customers' data may be affected because they are using the infected cloud for distribution of data. The security challenges counted by cloud computing is described as:

Integrity of data: Integrity of data consists of situations when some human errors are made, while feeding data. Errors could take place during information is transferred from one system to another. Sometime errors occur due to hardware malfunctions such as crashing hard drives.

Access Control of Data: Secret information might be illegally stolen in absence of secured data and information access control.

Theft of Data: Cloud computing applies the external data server for flexible and cost affective tasks. Thus there is an option that from external server theft of information might take place.

Location of Data: Consumers is unaware from the area where data is stored. Vendor not going to tell consumers where there data has been collected. Cloud Computing is offering a high degree of mobility of information.

Loss of Data: Loss of data is referred as critical issues in Cloud computing. Unauthorized person might be able to capture data that is shared on cloud if business transaction, banking & research & development ideas are online.

Issues related to Privacy: Protection of user data has been considered vital with cloud computing. Several servers are external thus vendor must ensure that data is secured from other persons.

Challanges at User level: it is necessary that the user make sure that possibility of the data loss because of its own action or other user operating at common cloud server.

Security challanges in supplier level: Cloud is considered best in the case of high security given by vendor to consumer.

Application that are Infected: Service supplier must have access to server with overall rights to maintain server and to monitor it.

Account or service traffic hijacking
If login credentials are theft Account could be hacked.

Insecure API's
The Application Programming Interface is going to control third party. It also verifies the user.

Denial of service
It is done when millions of user request for common service. Hacker takes the advantage in this case.

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Malicious insiders

It is performed when any one knows our login credentials.

Misuse of cloud services

With the help of clouds server, hacker could crack security in less time.

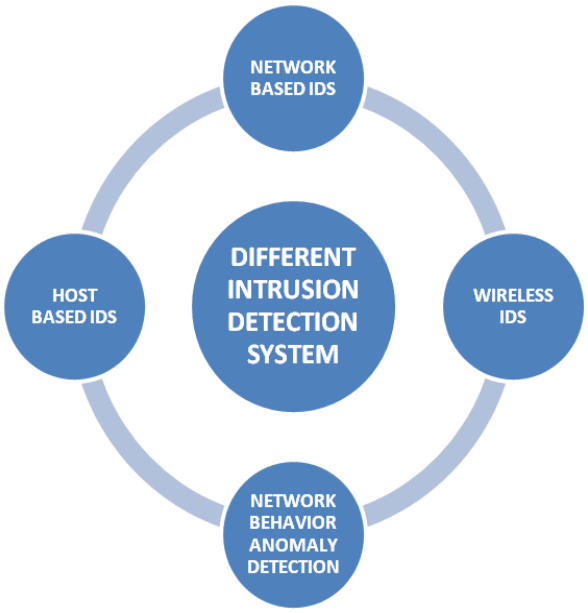

Figure: Different Intrusion Detection System

NEED OF INTRUSION DETECTION SYSTEM

This system is required because of the reasons which are discussed here:

1. **To display definite Content:** There are chances that your ports and IP addresses are displayed by Firewalls. These ports and IP addresses are applied in the middle of two hosts. But, at the same time a NIDS could be aired due to which exact content within packets are displayed. It is possible to employ them for the detection of disturbances.
2. **Examine Data in view of Protocol: In situation where a** protocol is assessed by network Intrusion Detection System, it examine the load capacity on Transmission Control Protocol **and** User Datagram Protocol . Unusual actions are identified by sending elements because they understand the manner in which protocols work.
3. **For authorize and determine Attacks: With the help of this system attacks are authorized and determined.** After getting this information one can modify his safety network systems. In addition to this, it is possible that one can put in to operation fresh management tools in a very effective way. It is also examined in order to determine bugs and challenges related to system configuration. After that this metrics could be utilized in assessment of upcoming risk .
4. **For maintain rules:** When this system is used, it is quite easy to satisfy safety rules because this system allows greater visibility across network. It is also possible that

one can use his IDS logs in the form of documents for the satisfaction of definitely needs.

5. **To improve Performance: With the help of this system sensing elements** network hardware and hosts are identified. Due to this, data inside the network packets are examined. It can determine which type of controlling software are used. In comparison to manually working it saves lot of time. IDS make hardware stocks automatic. This will reduce manual requirement. This will bring reduction in the cost which is given to organization employees in the form of salary and the cost which is required for the implementation of IDS.

DES (DATA ENCRYPTION STANDARD)

DES is already determined in the form of a symmetric-key algorithm. Its full form is Data Encryption Standard. It is an algorithm used to encrypt the electronic information. DES has short key length of 56 bits. It has been criticized from beginning use of Data Encryption Standard. Due to some issues it presents it as unsecured for several present applications. DES was dominant with the advance technology of cryptography. DES is a symmetric-key block code. NIST made it available to the public. It is a realization of Feistel Cipher. It becomes well known that DES has dependency on the Feistel Cipher. For the specification of DES round function, key plan and some extra treatment like original and concluding variation are compulsory.

AES (ADVANCED ENCRYPTION STANDARD)

Nowadays, well known and extensively accepted symmetric encryption algorithm becomes famous in the form of AES algorithm. Full form of AES is Advanced Encryption Standard. The AES algorithm is very fast as compare to the triple DES. It is six time vast as compared to triple DES.

As it has been observed, AES key's dimension becomes very small. Therefore substitute for DES is required. As the computing power is increasing day by day, the AES is vulnerable to deal with exhaustive key search attack. Triple DES has been formulated in order to deal with this drawback. But the speed of it is slow. Alresdy known features of

TRIPLE DES

Triple Des applied three separate keys. So that it has been determined secure. The cause is that there are no known attacks that totally crack the security to a point where there is no feasibility nowadays to break Triple DES. Therefore it provides a security margin. But it is still less secure as compare to other standards. The perfect example is AES.

CRYPTOGRAPHY

Along with this advantage, it carries its limitation also. The limitation is that it is very complex to implement but computationally it is secure technique. The language in which the human communicates is the human language. It is the form of plain text. It also called clear text. So, messages written in plain text are understandable by all

because the message is not codified in this form. Therefore, it must be codified to make sure the security of message. After coding the message will be secure from anyone from who is unauthorized. It will be hidden from who can see the coded message. Nowadays cryptography described almost utterly to encryption. The encryption is a procedure of changing normal data into not understandable form. The text in normal form is called plaintext whereas the text after encryption is called ciphertext. The Decryption is the opposite procedure of encryption. A cipher has been considered an algorithms pair. It is used to do the encryption of text. The detailed operation of a cipher has been monitored by the algorithm. It also monitor in each instance by a "key". A cryptosystem has been determined the arranged record of elements. It consist finite feasible plaintexts, finite feasible ciphertexts. The cryptosystem also includes the finite feasible keys. The encryption and decryption algorithms are also take place in it. These are in contact to each key. The Keys are very essential role. The ciphers lacking variable keys are easily cracked. It will be broken with only the information of the used cipher. In the past, ciphers were applied in direct way for encryption or decryption. It was lacking of additional processes for example authentication or integrity checks. Cryptography has been considered an art of getting the security of data. The security of data is achieved to encode the text and create it in the form of not understandable. The Cryptography is the procedure to study data which have been hiding by encoding.

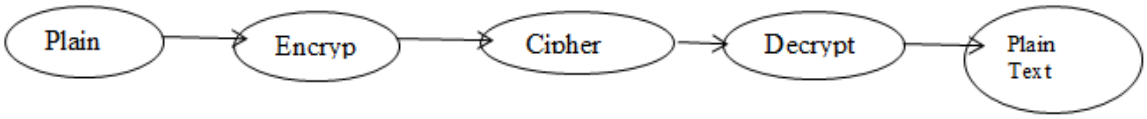

Figure 0.4 Alteration of Plain Text into Cipher

A **cryptosystem has been** studyof encryption & decryption methods & this method could be made effective by hardware devices/program or software code within program. Encryption algorithms are used by cryptosystem, which pronounces how process would be done or execute. Most algorithms use difficult mathematical formulas for protected communication so that third party can't calculate or find password effortlessly.

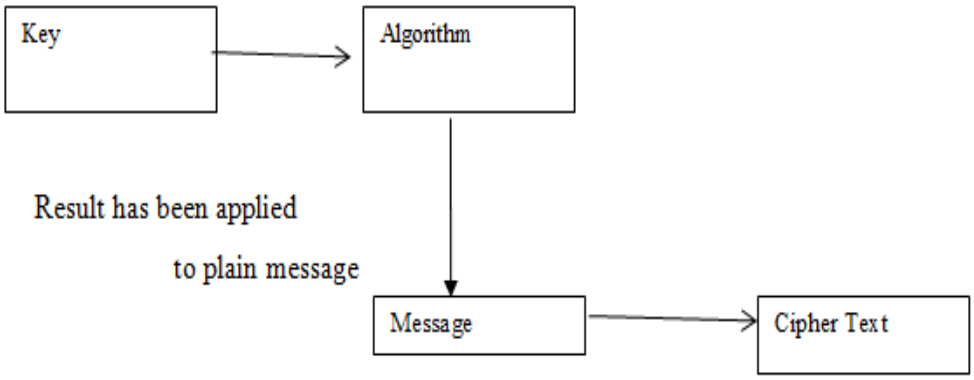

Figure Use of Key in Cryptosystem

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Secret key i.e. long string of bits has been used by frequently encryption methods algorithm to encrypt & decrypt text or content of message, as represented in Figure. The set of mathematical rules or set of events has been called algorithm. There are two kinds of algorithms are used for enciphering & deciphering content of message. Several algorithms are well recognizing publicly. These algorithms aren't secret part of encryption procedure. Method by which the algorithms encryption performs could be retained secret from public, but several of them are publicly recognized & well known. Key has been secret portion for encryption & decryption algorithm.

PROPOSED WORK

Proposed protocol will use the data packet and control packet. These are two different kinds of the packets. The data packet broadcasts the environmental information to destination. This environmental data includes six components. Here one thing should be noted that buffer system of the nodes also includes the same elements. It will happens as data packet to broadcast the packets by network.

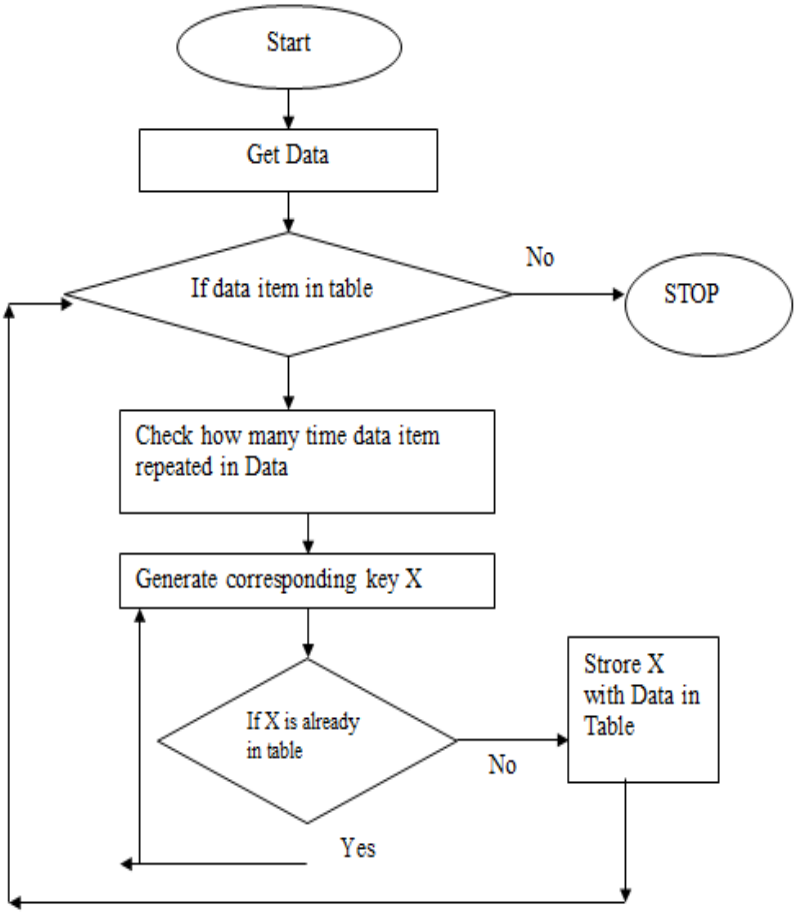

Figure: Packet Size Reduction Logic

Proposed work has considered the security of cloud. To improve the security of cloud, the concept of IDS method will be used here. It will provide protection as per the

requirement. It willalso Iincrease Ithe Ioverall Itime Iperiod Iof Ithe Inetwork. IIt Idecreases Ithe Ipower utilization. Local node network are differentiated into little zones.

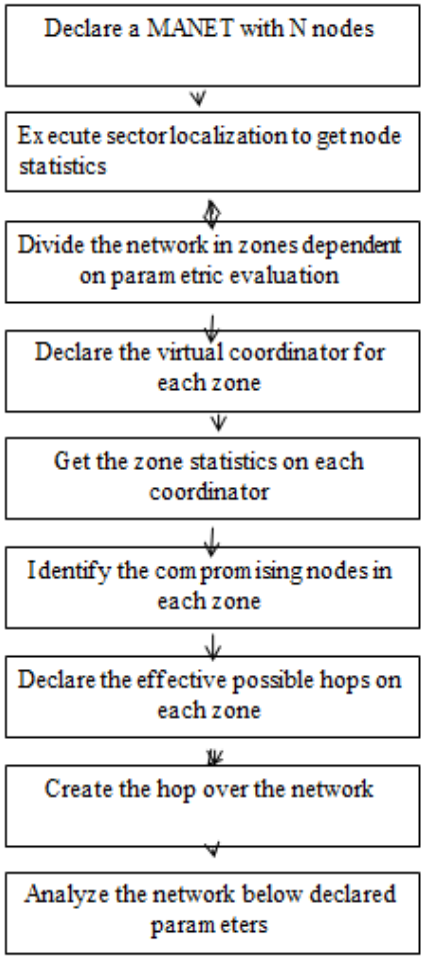

Figure: Work Flow

The describe coordinator will include the communication statistics. These communication statistics are of zone nodes. According to routing performance, the effective hop selection are used the virtual coordinator.

CONCLUSIONS

Objective of this work is to Establish the Network Environment to test flow of packets, to Develop of packet sender & receiver module, to testing transmission delay in packet transmission, to Test the processing delay during packet transmission, to test the queuing delay of network packet, to Test the propagation delay at time of data transmission, to Develop the algorithm using java based socket programming to transfer packet from sender to receiver in minimum time, to develop better encryption model in order to resolve the hacking issues. In this thesis discussion will be made on the

researches based on how we secure big data in cloud computing. Discussion of security algorithm has been made that are capable to secure data.

Reduction of packet size using packet reduction logic leads to less space and time consumption. Mat lab based simulation representing the working comparative analysis of time taken between tradition and proposed work after load balancing will conclude that proposed model will take less time. The main concentration of this research is towards the strategies of energy-efficient resource arrangement and security of data over cloud.

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ROLE OF MACHINE LEARNING IN OBJECT IDENTIFICATION IN IOT ENVIRONMENT

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ABSTRACT

Research work is focusing on object identification during IoT environment using machine learning. There have been several systems that are dealing with machine learning. But there is need to improve the accuracy and performance during machine learning operations.

Machine learning

It is possible to predict the result of a software application using a non-programming approach. Machine learning algorithms utilize prior data as input to predict future output values. Fraud detection, waste removal, virus detection, BPA, and predictive maintenance are just some of the uses of this technology (PM).

Working of Machine Learning

Classical machine learning algorithms are often distinguished by how well they predict the future. Unsupervised and supervised learning are two of the most prevalent ways for learning. Algorithm selection may be predicted using data, according to scientists.

Working of Supervised Machine Learning

For supervised machine learning, data scientists must give both labeled inputs and predicted outputs. In these cases, supervised learning methods are best.

1. For categorizing data into two groups, binary classification is used.
2. The ability to choose from more than two responses is called multi-class categorization.
3. Continuous values may be predicted using regression modeling.

Working of Unsupervised Machine Learning

The use of data labels isn't required for unsupervised machine learning. They look for patterns in unlabeled data that may be utilized to classify the data into smaller groupings. Unsupervised learning methods are useful for the following tasks:

1. A technique for grouping data into distinct clusters based on similarity.
2. It is used to find anomalous data points in a dataset by using anomaly detection.

3. Identifying groupings of elements in a dataset that commonly appear together is the goal of association mining.

Uses of Machine Learning

Nowadays, machine learning may be found in a broad variety of settings and tasks. Recommendations are made by the News Feed recommendation engine on Facebook. In order for a member's behavior to be prioritized by the recommendation engine, they must read the posts in a certain group often enough. As a back-end task, the engine is encouraging the member's online habits that it has observed. As soon as the member quits reading posts from the group, their News Feeds will be changed.

Object Identification

Object recognition is a computer vision technique for identifying objects in images or videos. Object recognition is a key output of deep learning and machine learning algorithms. When humans look at a photograph or watch a video, we can readily spot people, objects, scenes, and visual details. The goal is to teach a computer to do what comes naturally to humans: to gain a level of understanding of what an image contains.

Object recognition is a key technology behind driverless cars, enabling them to recognize a stop sign or to distinguish a pedestrian from a lamppost. It is also useful in a variety of applications such as disease identification in bioimaging, industrial inspection, and robotic vision.

Object detection and object recognition are similar techniques for identifying objects, but they vary in their execution. Object detection is the process of finding instances of objects in images. In the case of deep learning, object detection is a subset of object recognition, where the object is not only identified but also located in an image. This allows for multiple objects to be identified and located within the same image.

It is widely used in computer vision tasks such as image annotation, vehicle counting, activity recognition, face detection, face recognition, video object co-segmentation. It is also used in tracking objects, for example tracking a ball during a football match, tracking movement of a cricket bat, or tracking a person in a video.

Often, the test images are sampled from a different data distribution, making the object detection task significantly more difficult. To address the challenges caused by the domain gap between training and test data, many unsupervised domain adaptation approaches have been proposed. A simple and straightforward solution of reducing the domain gap is to apply an image-to-image translation approach, such as cycle-GAN. Among other uses, cross-domain object detection is applied in autonomous driving, where models can be trained on a vast amount of video game scenes, since the labels can be generated without manual labor.

Methods for object detection generally fall into either neural network-based or non-neural approaches. For non-neural approaches, it becomes necessary to first define

features using one of the methods below, then using a technique such as support vector machine (SVM) to do the classification. On the other hand, neural techniques are able to do end-to-end object detection without specifically defining features, and are typically based on convolutional neural networks (CNN).

- Non-neural approaches:
  - Viola–Jones object detection framework based on Haar features
  - Scale-invariant feature transform (SIFT)
  - Histogram of oriented gradients (HOG) features
- Neural network approaches:
  - Region Proposals (R-CNN, Fast R-CNN, Faster R-CNN, cascade R-CNN.)
  - Single Shot MultiBox Detector (SSD)
  - You Only Look Once (YOLO)
  - Single-Shot Refinement Neural Network for Object Detection (RefineDet)
  - Retina-Net
  - Deformable convolutional networks

IoT Environment

IOT is interconnected network of devices that can be operated from a distance. Vehicles, buildings, and other items are infused with hardware, software, sensors, and a network in this system. It allows data to be gathered and shared across devices. As a result of the IoT, objects may be identified and controlled remotely over existing network infrastructure, opening new possibilities for simpler integration of the physical world with computer-based systems and generating more efficiency, accuracy, and financial gain. In figure 1, major components of IOT have been defined. These components are IoT device, Gateway, analytics, user interface, cloud.

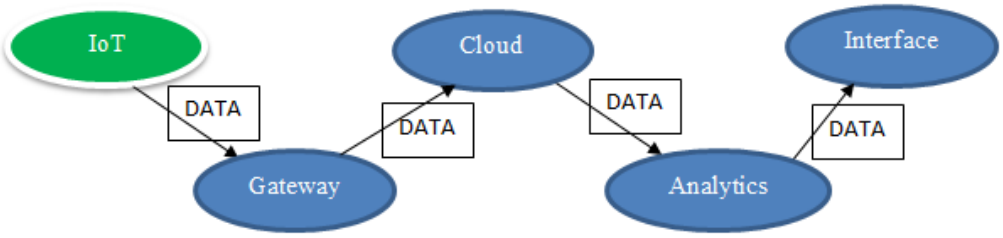

Fig 1: Major Components of IOT

The Internet of Things is giving rise to a whole new IT realm. There has been no slowdown in the rate at which the server room, desktop computers, and handheld devices handle data. The world is beginning to feel its presence as it rapidly approaches

us from all sides. Most of the things we use often are either already connected or will be soon. They can utilize smart software to find and share a wide range of important information. Databases, media channels, and apps are all getting more and more embedded in our daily lives. In time, they'll cover every aspect of our lives like a thin, highly developed skin. In our imagined computerized future, one could say, "No Net, No Planet." The number of Internet of Things devices in circulation is expected to hit 8.4 billion this year. The number of connected devices is predicted to reach 20 billion by 2020. Their yearly growth rate is close to 31%, which explains why they are expanding so rapidly. Up to 2020, the worldwide market for IoT is predicted to be worth a total of $7.1 trillion.In figure 2, layers in IOT devices are specified. Cloud/ server works on application layer, router and gateway works on network layer, sensor and actuators works on perception layer.

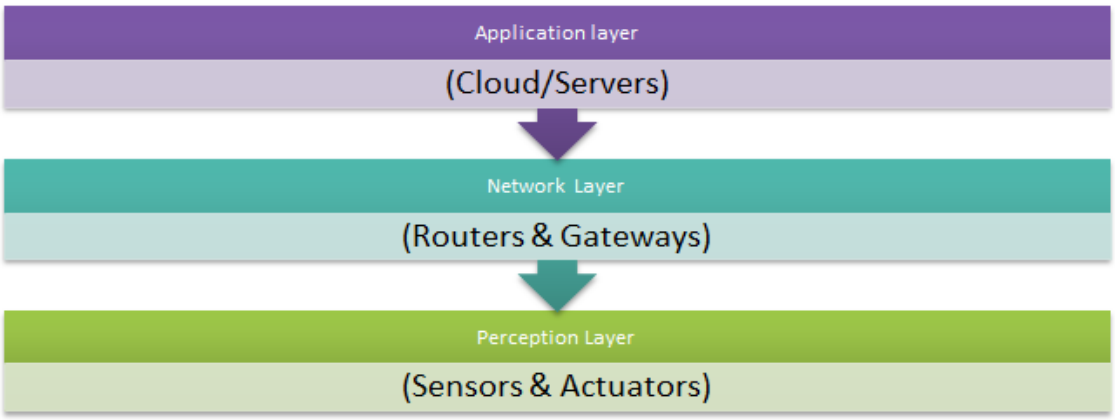

Fig 2: Layers in IOT devices

In contrast to traditional data processing, IoT data and information are unique. Information in the Internet of Things is a tiny, easily dispersed part. Possible link between IoT and regular PC processing if such a thing can be proven. It turns out that the Internet of Things consists of a plethora of individual devices and nodes. These will be a part of the overall setup. The Internet of Things (IoT) goes by many different names. The concept of a "associated object" is not new; in fact, it has likely been around for as long as the Internet or correspondences have. Perhaps the earliest examples of related things are personal computers and (advanced mobile phones). Although there is one key distinction that ensures they will always be treated as standalone products: they still require a user to operate. Some of the earliest Internet of Things applications, known as telemetry or telemetric today, were used to interface state-of-the-art machinery, infrastructure, and even business armies. In the buyer community, there were also many novel ideas. It also includes the cost of a matching ice chest. As a result, the term "machine-to-machine," sometimes abbreviated to M2M, has entered common usage, with a primary emphasis on networks ("M2M interchanges"). The catchy expression "Web of Things," often shortened to "IoT," has become the norm in recent

years. Use of this term can be found anywhere from books to online journals to the mission statements and aspirations of organizations to the speeches of China's top leader. Internet of Everything, Internet of Industrial Things, Internet of Heavy Things, and so on are only a few of the many variants on this expression.

LITERATURE REVIEW

S. A. Bkheet , et al.(2021) focused on the examining IoT authentication techniques .The IoT is a cutting-edge innovation that has just emerged from sensor networks. Since it affects so many facets of our life, it has garnered a lot of attention. By designating a unique identification for each thing, the Internet of Things envisions a world in which all sorts of inanimate objects may join the network and exchange data with one another in the same or different settings. Through a data communication network, IoT is able to gather, analyse, and share information. Radio Frequency Identi- fication (RFID), Barcode/2D codes, IP addresses, Electronic Product Codes (EPC), etc. are just a few of the various techniques for identifying items; some have been around since the inception of IoT innovation. To keep up with the ever-increasing rate of progress in the Internet of Things (IoT) industry, a more reliable identification mechanism is necessary to properly label the ever-growing number of Internet-connected things. In recent years, several cutting-edge strategies have been developed, many of which are based on cutting-edge technology like computer vision, fingerprinting, and machine learning. This article provides an overview of IOT and explores its core components, with a particular emphasis on IOT identification since it is often regarded as the foundation upon which IOT systems are built. [1]

Yongxin Liu , et al.(2022) provided work on IoT device detection and identification using machine learning. From the perspective of non-active surveillance agents or network operators, they present a detailed overview of machine learning methods for the identification of IoT devices, including the detection of hacked or counterfeit ones. Device-specific pattern recognition, Deep Learning-enabled device identification, unsupervised device identification, and anomalous device detection are the four main types of IoT device identification and detection that we distinguish. In the meanwhile, we talk about a range of ML-related enablers for this purpose. Learning algorithms, feature engineering on network traffic traces and wireless signals, continuous learning, and anomaly detection are all examples of such enabling technologies.[2]

J Bzai , et al.(2022) introduced IoT with machine learning capabilities: a survey of data, applications, and industry opinions. They organise the literature on ML-enabled IoT into three categories—data, applications, and industries—and explore it from each of these angles. Through an examination of about 300 published sources, we expand on how ML and IoT work together to play a critical role in making our surroundings smarter, providing details on dozens of cutting-edge approaches and applications. The Internet of Behavior (IoB), pandemic management, linked autonomous cars, edge and

fog computing, and lightweight deep learning are all discussed as new topics in the Internet of Things. They also divide the difficulties of the Internet of Things into four categories: technical, personal, commercial, and societal. Using the information in this paper, we can better take advantage of the benefits and safeguards offered by the Internet of Things to ensure the long-term success of our communities.[3]

A. Sagu, et al. (2020) focused on the methods of machine learning for protecting the internet of things. More than 20 billion items are expected to be linked by 2024 thanks to IoT, which is quickly making the world smarter by bridging the physical and digital worlds. It's a double-edged sword in that it presents both opportunities and threats. The security of the networks these devices operate on and the billions of devices themselves is a major concern. This article examined the many challenges associated with ensuring the safety of an IoT environment and how machine learning methods may be able to provide a solution. The study also investigates the potential superiority of one strategy over another and covers the approaches, factors, and characteristics of the various procedures. [4]

A. Sagu, , et al.(2020) looked IoT security using machine learning. The pervasiveness of the IoT ecosystem means that most users lack the knowledge or motivation to independently safeguard their devices. The use of machine learning to resolve security issues in the Internet of Things has great potential. Some of the most recent works in this area show that researchers are using machine learning strategies to ensure the safety of IoT devices. This study provides a literature overview on machine learning techniques for protecting Internet of Things gadgets.[5]

S. A. N. Alexandropoulos, et al.(2019)Multi-Objective Evolutionary Optimization Algorithms for Machine Learning. The machine learning algorithms exploit a given dataset in order to build an efficient predictive or descriptive model. Multi-objective evolutionary opti- mization assists machine learning algorithms to optimize their hyper-parameters, usually under conflicting performance objectives and selects the best model for a given task. In this paper, recent multi-objective evolutionary approaches for four major data mining and machine learning tasks, namely: (a) data preprocessing, (b) classification, (c) clustering, and (d) association rules, are surveyed.[6]

Logeswaran K , et al.(2019)Optimization of Evolutionary Algorithm Using Machine Learning Techniques for Pattern Mining in Transactional Database. In recent years, the data analysts are facing many challenges in high utility itemset (HUI) mining from given transactional database using existing traditional techniques. The challenges in utility mining al- gorithms are exponentially growing search space and the minimum utility threshold appropriate to the given database. To overcome these challenges, evolutionary algorithm-based techniques can be used to mine the HUI from transactional database. However, testing each of the supporting functions in the optimization problem is very inefficient and it increases the time complexity of the

algorithm. To over- come this drawback, reinforcement learning-based approach is proposed for improving the efficiency of the algorithm, and the most appropriate fitness function for evaluation can be selected automatically during execution of an algorithm. Furthermore, during the optimization process when distinct functions are skillful, dynamic selection of current optimal function is done.[7]

A.Sagheer, et al.(2020)A natural evolution optimization based deep learning algorithm for neurological disorder classification. The proposed classifier that is included in a signal processing chain comprises of other state-of-the-art methods in a single framework for EEG classification. Initially, the EEG signal is decomposed into a number of sub-bands by applyingwavelet transformwhere a number ofspectral and statistical features are extracted. These extracted features are examined using the approach of artificial bee colony to optimally select the best features. Finally, the selected features are processed using the proposed NEDL classifier, after which the proposed approach is evaluated using two benchmark datasets that address epilepsy disease and motor imagery. Several experiments are conducted where the proposed approach outperforms other deep learning models along with existing approaches[8]

Amandeep Kaur , et al.(2020)A Reinforcement Learning based evolutionary multi-objective optimization algorithm for spectrum allocation in Cognitive Radio networks. this paper addresses the spectrum allocation problem concerning network capacity and spectrum efficiency as conflicting objectives and model the scenario as a multi-objective optimization problem in CR networks. An improved version of the Non-dominated Sorting Genetic Algorithm-II (NSGA-II) which combines the feature of evolutionary algorithm and machine learning called Non-dominated Sorting Genetic Algorithm based on Reinforcement Learning (NSGA- RL) is proposed which incorporates a self-tuning parameter approach to handle multiple conflicting objectives. The numerical findings validate the effectiveness of the proposed algorithm through the Pareto optimal set and obtain optimal solution efficiently to satisfy various requirements of spectrum allocation in CR networks[9]

C. V. G. Mendoza , et al.(2020)Evolutionary Optimization of Ensemble Learning to Determine Sentiment Polarity in an Unbalanced Multiclass Corpus. this paper proposes estimating an optimal weighting scheme using a Differential Evolution algorithm focused on dealing with particular issues that multiclass classification and unbalanced corpora pose. The ensemble with the proposed optimized weighting scheme is able to improve the classification results on the full test set of the TASS challenge (General corpus), achieving state of the art performance when compared with other works on this task, which make no use of NLP techniques[10]

A J Barker , et al.(2020)Applying machine learning optimization methods to the production of a quantum gas. Wepresent the results ofan evolutionary optimization method (differential evolution), a method based on non-parametric inference (Gaussian

process regression) and a gradient-based function approximator (artificial neural network). Online optimization is performed using no prior knowledge ofthe apparatus, and the learner succeeds in creating aBEC from completelyrandomized initial parameters. Optimizing these cooling processes results in a factor offour increase in BECatom number compared to our manually-optimized parameters. This automated approach can maintain close-to-optimal performance in long-term operation. Furthermore, weshow that machine learning techniques can be used to identify the main sources ofinstability within the apparatus[11]

J. R .Jian , et al.(2020)Large-scale evolutionary optimization: a survey and experimental comparative study. In this paper, we want to analyze the differences and characteristics of various large-scale evolutionary optimization (LSEO) algorithms on some benchmark functions. We adopt the CEC2010 and the CEC2013 large-scale optimization benchmark functions to compare the performance of seven well-known LSEO algorithms. Then, we try to figure out which algorithms perform better on different types of benchmark functions based on simulation results. Finally, we give some potential future research directions of LSEO algorithms and make a conclusion .[12]

S. Q. Salih , et al.(2020)An evolutionary optimized artificial intelligence model for modeling scouring depth ofsubmerged weir. The roles of the PSO algorithm are tuning the internal hyperparameters of the SVR model in addition to the optimization of the predictors selection ‘‘feature selection’’ for the ???? modeling. The prediction matrix is constructed based on several related geometric dimensions, flow information and sediment properties. The proposed model is validated against several well-established machine learning models introduced over the literature. The prediction potential of the proposed tBPSO-SVR model exhibited a superior capability. In quantitative terms, tBPSO-SVR attained minimum mean absolute error (MAE = 0.012 m) and maximum coefficient of determination (??2 = 0.956). Remarkably, the proposed hybrid artificial intelligence demonstrated an efficient prediction model for depth scouring prediction with reducing the input parameters[13]

T. Ghosh , et al.(2020)Generalized approach for multi-response machining process optimization using machine learning and evolutionary algorithms. The proposed data-driven approach is generic, which could be evaluated for any type of manufacturing process. In order to verify the proposed methodology, a comprehensive number of cases are considered from the past literature. The proposed data-driven NSGA-III is compared with the Multi-Objective Evolutionary Algorithm based on Decomposition (MOEA/D) and shown to attain improved solutions within the imposed boundary conditions. Both the algorithms are shown to perform well using statistical analysis. The obtained results could be utilized to improve the machining conditions and performances. The novelty of this research is twofold, first, the surrogate-assisted NSGA III is implemented and

second, the proposed approach is adopted for the multi-response manufacturing process optimization[14]

J. C. X. Junior , et al.(2020)An Evolutionary Algorithm for Automated Machine Learning Focusing on Classifier Ensembles: an improved algorithm and extended results. we propose an improved version of our previous Evolutionary Algorithm (EA) – more precisely, an Estimation of Distribution Algorithm – for the Auto-ML task of automatically selecting the best classifier ensemble and its best hyper-parameter settings for an input dataset. The new version of this EA was compared against its previous version, as well as against a random forest algorithm (a strong ensemble algorithm) and a version of the well-known Auto-ML method Auto-WEKA adapted to search in the same space of classifier ensembles as the proposed EA. In general, in ex periments with 21 datasets, the new EA version obtained the best results among all methods in terms of four popular predictive accuracy measures: error rate, precision, recall and F-measure. [15]

Problem Statement

Object recognition has been aided by algorithms such as SVM, CNN, and Random Forest, to name a few. Most of the traditional research's goals have been achieved via current research. It was a review of the accuracy of the data categorization. Each algorithm's efficiency and efficacy have been evaluated in terms of the accuracy of the data. Based on a literature analysis, we conclude that SVM works better with textual data, whereas CNN is more effective with graphical assessments and classification of graphical data. As a result, given the advantages of CNN, additional work on pattern detection models is required. Despite these drawbacks, the current CNN model still has a lot of room for improvement. When comparing graphical stuff, it takes a long time. As a result, the classic CNN model's performance must be enhanced. SVM was traditionally found to be the best method for text data analysis, while convolution neural networks (CNNs) have been shown to be effective in picture analysis and classification tasks. As a result, further work is needed on a pattern identification model to take use of CNN's advantages. But it has been observed that existing CNN based research did limited work on Accuracy and performance. Thus propose research has focused on accuracy along with performance enhancement during object detection

OBJECTIVES OF RESEARCH

The objectives of research are discussed below

1. To consider the existing research in field of IoT, object identification, IoT environment and finding the issues object during detection operation such as accuracy and performance
2. Proposing novel approach that should be capable to improve the performance and accuracy by integration of compression, edge detection and CNN.

3. Evaluating the performance and accuracy factors such as f-score, recall value and precision.

Hypothesis

H0: Integration of machine learning to compression and edge detection would not influence the performance and accuracy

H1: Integration of machine learning to compression and edge detection would improve the performance

H2: Integration of machine learning to compression and edge detection would improve the accuracy

H3: Integration of machine learning to compression and edge detection would reduce the error rate during classification

H4 : Integration of machine learning to compression would increase the error rate

Work Plan and Methodology

IoT and CNN based object detection have all been studied in past studies. Then, the concerns arising from these studies were examined. Researchers in this field are dealing with a lack of performance and accuracy. Compression and edge detection would then be used to create a efficient learning model. Finally, the suggested model's performance and accuracy are assessed.

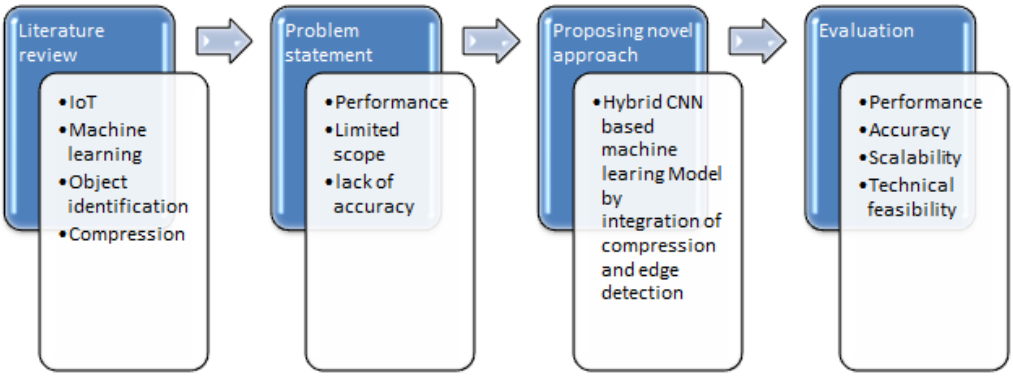

Fig 1 Research Methodology

A number of studies have looked at how CNN may be used for machine learning and object recognition. Finally, these results were analysed. There is a gap between the performance and accuracy of current research in this sector and where it needs to be. After data compression, it may be utilised for edge detection, and from there, a suitable learning model can be developed. The effectiveness and precision of the proposed model will be evaluated. Raw photographs captured by spacecraft, space probes, aeroplanes, and everyday people may be improved using a technique called "Image Processing." During the last half-century or more, huge strides have been made in the

development of image processing algorithms. Images may be altered by omitting necessary details. Color, pattern, bounds, stiffness, and form are all important aspects to consider when describing an item.

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STUDY OF CYBER THREAT INTELLIGENCE, RISK MANAGEMENT AND METHODS

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ABSTRACT

Organizations and even individuals nowadays are subject to significant cyber-based attacks from persistent threat actors who attempt to circumvent network and device security and modify critical Cyber Threat Intelligence (CTI) enables cyber organizations to gather information about a cyber assault, its evidence, threat actors, and their tactics.

To lessen the effects of those attacks, there follows the procedures, techniques, and indicators of compromise (IOC). In the current environment of cyber threats, closing the security gap involves more than just data security. Furthermore, a person has a basic right to securely access online content. The notion of CTI is defined by the fact that cyber threats are always evolving and that dealing with them effectively necessitates having prior knowledge of their nature and how to implement the necessary defensive measures. This paper provides an overview of the current state of CTI and the different issues that must be resolved for it to continue to provide adequate early warning.

Keywords – Cyber Security, Cyber Threat Intelligence, Threat Actors, Indicators of Compromise (IOC), Techniques, Tactics, and Procedures

I. INTRODUCTION

Organizations can utilize data analytics to better understand the motivations of threat actors by gathering and analyzing information on past, present, and future cyber security risks. Information that an organization utilizes to comprehend all dangers and reduce their impact is known as Cyber Threat Intelligence (CTI). However, many businesses still struggle to determine precisely what happened and when, after a cyber-attack. In actuality, a large number of cybercrimes occur today unreported and unpunished. To recognize and stop cyber-attacks from utilizing sensitive data, CTI information is used. It can be interpreted as knowledge and information regarding physical and cyber risks, threat assessments, and actors that aid in minimizing malicious incidents and possible cyber-attacks. This knowledge is based on skill and experience. It is a well-known fact that Intelligence can be defined as a process of determining decisions. It supplies detailed information, including files, IP addresses, domain names and URLs that are frequently utilized in executing attacks, regarding the current, previous, and anticipated assaults that could pose a security danger to the organization.

Lifecycle of CTI

There are mainly four important levels of Cyber Threat Intelligence namely (Fig 1)

1. Operational Cyber Threat Intelligence
2. Tactical Cyber Threat Intelligence
3. Technical & Strategic Cyber Threat Intelligence

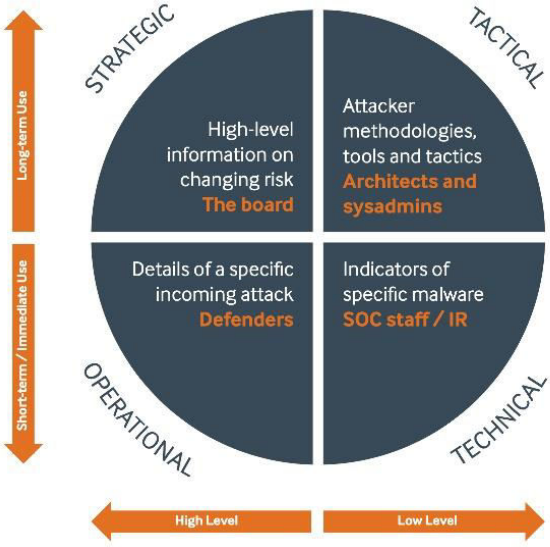

Figure 1

■ Operational **Cyber Threat Intelligence**

It addresses the timing and type of an assault. It looks at cyber threat actors' communication channels and foresees impending assaults using both public and private sources, including social media, dark webs, chats, and other online open source forums.

■ Tactical **Cyber Threat Intelligence**

This type of Intelligence refers to tactics, techniques, and procedures that further identify how the threat actor managed to succeed in the attack on software infrastructure and network. It detects similar potential attacks to reduce the probability or effect of such events. In nutshell, CTI fetches the TTP's for the attack. It makes use of IOC, or machine-readable data, such as URLs, domain names, file names, IP addresses, hashes, etc. In just a few hours, IOCs typically become outdated.

■ **Technical Cyber Threat Intelligence**

The term "tactical CTI" refers to "tactics, techniques, and procedures (TTPs)" that concentrate on an organization's network's advantages and disadvantages as well as its capacity to thwart cyberattacks. Therefore, the SOC managers and IT service administrators are often the ones who take action based on this intelligence.

■ **Strategic Cyber Threat Intelligence**

It is employed to highlight and find the "who" and "why," or the motivations of threat actors, which have an impact on the current threat landscape. Strategic CTI is non-technical and explains the motivations and purposes behind the assaults. It aims to precisely identify the individual or people responsible for cyber operations and threats as well as the targets they are targeting. Usually, reports, white papers, and briefings are developed by Strategic Threat Intelligence.

II. Risk Management

The process of recognizing, evaluating, responding to, and putting into practice the operations that control how the organization controls the potential effects of hazards is known as

Risk Management. No cyber attack is random in nature. There are always signs of a planned attack against an organization. Various imminent attacks are available on the dark web such as registration of similar domain names for phishing attacks, and confidential information of user accounts are made available for sale. As part of risk management, the objective is to manage risks in such a way that it can ensure the protection of resources and the protection of employees. Risk management at the level has become necessary due to the uncertainty like threats that may affect the achievement of organizational goals and the environment in which the organization operates.

A. Categories of Risk

There are various categories that determine the operations caused by the different types of risks that affect attaining objectives at the level of the economic organization as shown in Fig. 2

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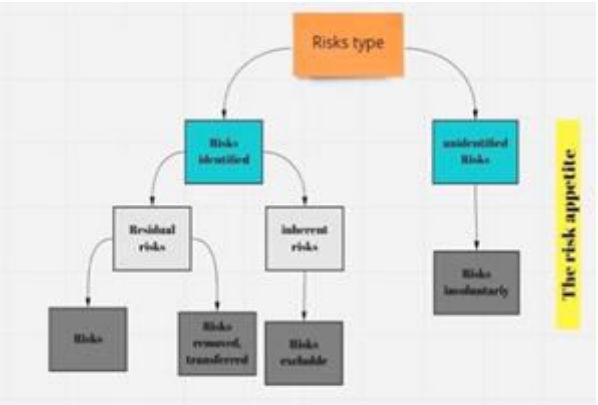
Figure 2

- Strategic risk is directly related to the organization's development plan and is linked to its strategic objectives.[2]
- Interest rates, inflation, insurance, taxes, protectionist policies, regional policies, and the need to limit losses are the main causes of financing hazards/risks.[2]
- Organizational risks are related to organizational processes, operational activities, and procedures.[3]
- Operational risks have a direct relationship to the functional compartments within an organization and are linked to the specific objectives defined at the level of functional groups. [3]
- Risks of change are caused by legislative changes, professional ethics, levels of culture and training, the diversity of needs and requirements, staff fluctuations, and the issues of turnover. [3]

B. Types of Risk

The author stated in [3] that the risks to which the organization is exposed may be divided into two categories, namely, inherent risks, and residual risks as shown in Fig.3.



1. Inherent Risks

The level of risk present to fulfill an entity's goals before steps are made to reduce the risk's impact or possibility is known as an inherent risk.

2. Residual Risks

The level of risk that remains after the entity's response has been developed and put into action is known as the residual risk.

C. Process of Risk Management

Although the project manager and team members at all levels identify and manage risks in a variety of methods, without a single framework for risk assessment, this is unproductive because there will be no comprehensive impact assessment. [4]

Since risk management is an iterative process, every aspect must be prepared for and put into practice at each step. The risk management process consist of the following steps :-

1.) **Risk Management Plan**- At the beginning of a project, risk management frameworks are evaluated and modified to produce project risk management strategies. [4] The author makes the following assumptions about risk management plans:

- A list of potential sources and risk categories.
- Matrix of likelihood and impact.
- Risk mitigation and a plan of action.
- Plan of intervention.
- Risk and threshold values.

1.) **Risk Identification** - A rigorous and methodical approach to risk identification ensures that no serious threats are missed. Throughout the course of a project, risks are found by concentrating on important phases.

2.) **Risk Analysis -** In order to take the necessary mitigation steps, the risks are first identified and then analyzed to ascertain their qualitative and quantitative impact on the project. The most common principle of risk analysis is the frequency of occurrence, the extent to which the risk will occur, the exposure to the risk, and the duration of the risk.

3.) **Risk Management -** Risk management includes planning the response to risks, identifying risk drivers, and identifying the person responsible for solving the risks.

4.) **Risk Monitoring and Control –** This includes recognizing new risks and planning for them, Monitor any risks that may become more critical over time., addressing other risks that require a long-term, planned, and managed approach with risk action plans.

III Modern Methods of Cyber Threat Intelligence

There are numerous CTI platforms available to counter cyber threats like, DDoS assaults, phishing, malware attacks data breaches etc. Some of the tools are licensed to safeguard sensitive data from cyberattacks, while others are open-source.

Echosec, Cisco Umbrella, DeCYFIR, Grey Noise, and other important CTI products are listed in the SANS CTI Survey 2021 [5]. The CTI platforms, which aid in the analysis and investigation of potential cybercrimes, can be on-premises or software-as-a-service (SaaS) solutions. Although these CTI platforms and tools are widely utilized throughout the world, it is vital to highlight some of the significant and deserving contributions made by researchers in threat intelligence over the past few years.

(I) The XML programming language **STIX (Structured Threat Information eXpression)** is standardized. Threat analysts use it to examine cyberthreats and activities related to threats. Threat analysts can also find trends that point to cyber threats by using STIX. STIX was first supported by the Department of Homeland Security (DHS) office of Cybersecurity and Communications in the US. Both manually and automatically using STIX is possible. An XML editor is necessary for manual use and no further tools are needed. Python APIs, tools, and bindings for Python are needed for programmatic use. On Github, bindings and associated tools that assist security analysts in processing and using STIX are available as open source.[6]. There are various drawbacks of using STIX standard.

1. STIX can be complicated and challenging to operate, especially for people who are unfamiliar with the standard. To completely comprehend and put into practice, it needs a lot of time and money.
2. Lack of standardization: STIX offers a uniform way to express threat intelligence, but organizations still use it differently than one another. Inconsistencies and ambiguity may result while sharing and analyzing threat data as a result of this.
3. Limited adoption: STIX has been available for a while, but the cybersecurity sector hasn't really embraced it yet. This may reduce its applicability and make it more challenging to exchange and analyze threat data.

(II) Knowledge-assisted visual analytic system (KAVAS)-

A form of data analysis software called Knowledge Assisted Visual Analytics System (KAVAS) uses machine learning and artificial intelligence (AI) to help analysts find patterns and insights in huge, complicated datasets.

Interactive visualizations are frequently used by KAVAS systems to present data in a more comprehensible manner, enabling analysts to examine data and spot significant trends and linkages. Natural language processing (NLP) and other methods may also be used by KAVAS systems to automatically generate reports and extract insights.

KAVAS systems, in general, can assist organizations in making better decisions by offering insightful information about their data. [6]

(III) Trigger Enhanced Discovery System –

IOCs are frequently utilised as forensic evidence to find threats organizations' assaults. IOCs are specifically hash values of malicious samples or IP addresses of command and control servers, etc.

Relevant security agencies have proposed several threat intelligence expression and transmission specifications, such as STIX (Structured Treat Information eXpression) (2021) and MAEC (Malware Attribute Enumeration and Characterization) (2021), to enable the fast sharing of IOCs for defense. The threat ontology of attack techniques and patterns is described in CAPEC (Common Attack Pattern Enumeration and Classifcation) (2021) and ATT&CK (Adversarial Tactics, Techniques, and Common Knowledge) (2021).

To find actionable threat intelligence, TriCTI, a trigger-enhanced system, conveys a broader context of IOCs by revealing their campaign stages. so that we can have full visibility throughout the entire campaign. In order to increase the performance of the model, we specifically use BERT to pre-train the trigger vectors that can explain the campaign stage. We also took into account the properties of the IOCs in the sentence. We come up with a data augmentation strategy without compromising label compatibility, changing trigger words, or changing IOCs in order to address the issue of the lack of annotation for the cybersecurity corpus. The testing results show that the TriCTI performed better on the supplemented data set and has higher accuracy (86.99%) than other cutting-edge models.

(IV) Block chain based CTI preventive model for sustainable computing

Its primary functions include managing a vast amount of information and employing block chain to guarantee data integrity while also preventing the transmission of false information. The suggested architecture comprises of a device layer for data generation, a feed layer for data collection and sharing, and a cloud layer for hash collision-based secure information transfer to authorised users.[8]. The major challenge in this proposed approach is that if the cloud server at the cloud layer is cyber-attacked, it may not possess reliable data since the hash value of the original data would be present. This architecture is also used to address the limitations in the legacy systems. According to experimental findings, the suggested approach in a constrained test environment saves roughly 15% of storage space when compared to the total network resources.

(V) CTI framework for Raw Log data extraction

The availability and accuracy of Indicators of Compromise (IoC), or artefacts like IP addresses that are known to correspond to malicious system actions for Intrusion Detection Systems (IDS). Protection against

Other Alternatives for CTI

Monitoring the dark web can assist find possible risks because it is a sanctuary for cybercriminals. Organizations may now monitor the dark web for their business or offer thanks to a wide range of tools and services.

Threat hunting is the proactive lookout for potential dangers. To find possible threats before they can cause any harm, threat hunters employ a range of techniques, including log analysis and network traffic analysis.

CONCLUSION

The information provided by Cyber Threat Intelligence is crucial for an organization to make a wise and sensible decision.. It performs the function of routine security monitoring and is an important tool in incident response to thwart zero-day attacks. In order to successfully address the issues in the future, organizations must conduct a variety of CTI trainings, proactively identify unknown threats by implementing cutting-edge technologies like blockchain, cloud computing, and machine learning/deep learning to fully automate the process, and prioritize and promptly mitigate cyberattacks.

Cyber dangers is compromised by these indicators. [9]. In contrast to other methods this methodology makes use of log data anomaly detection to identify suspicious log events, which are then used for iterative clustering, pattern recognition etc.

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A FRAMEWORK FOR THE IMPLICATIONS OF 5G IN IOT BASED CLOUD ENVIRONMENT

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[1] INTRODUCTION

The Internet of Things (IoT) is a network of interconnected physical devices that may be managed from a distance. Vehicles, varying structures, and programmable sensors are all engaged in this case. Data may be collected and analysed using all of this. Connected system foundations in the Internet of Things (IoT) enable remote sensing and control of objects, allowing for greater integration of digitally based infrastructures with physical objects while also decreasing the overall cost.It is referred to as the Internet of Things (IoT) when it includes gadgets with sensors, computer power and software. The Internet or another communication network may be used to link these devices. The Internet of Things (IoT) is currently being used in the study of 5G systems. As a result of this research, a trained wireless sensor network was used to make informed judgments. The research uses a wireless network model for the 5G system in the present IoT system in order to produce a reliable and adaptive solution for the 5G wireless system. Figure 1 depicts the major components of IOT.

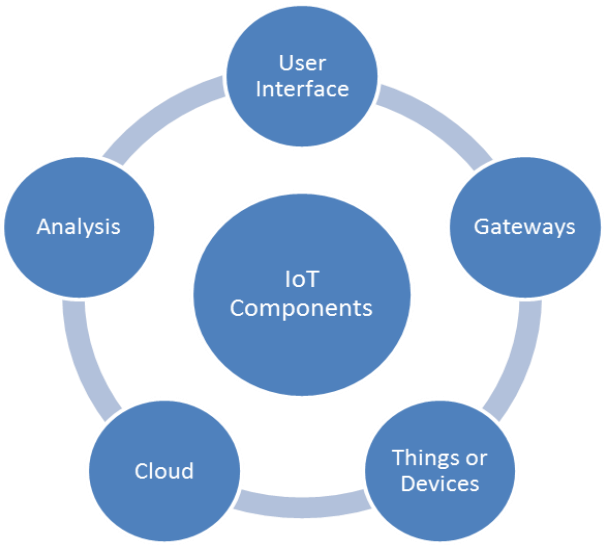

Fig. 1. Major Components of IoT

1.2 NEED OF IoT

Industrial, transportation, and utility companies are among the most frequent users of sensors and other Internet of Things (IoT) devices. As part of the digital transformation of certain enterprises [4, 5], they have been used in agriculture, infrastructure, and home automation. For IoT, creating a safe and enjoyable environment is its primary purpose.

To that end, the Internet of Things aims to connect as many things as possible to the internet, so tying us all together. IoT networks are seen in Figure 2.

The internet would have an impact on embedded computer devices. The Internet of Things (IoT) has given rise to a newly evolved universe of information technology. Data mechanisation has not slowed down in the server room, PCs, and PDAs. It can be found in any thing we come into contact with. In the near future, perhaps already, the great majority of the items we use on a daily basis will be networked together. With the aid of a technologically advanced software, they will be able to uncover and sell a wide range of valuable data. Every day, we're using more and more media, databases, and applications in our day-to-day lives. With this new technological net or skin, our lives will be transformed. One may even assert, "No Net, No Planet," in an unexpected way.

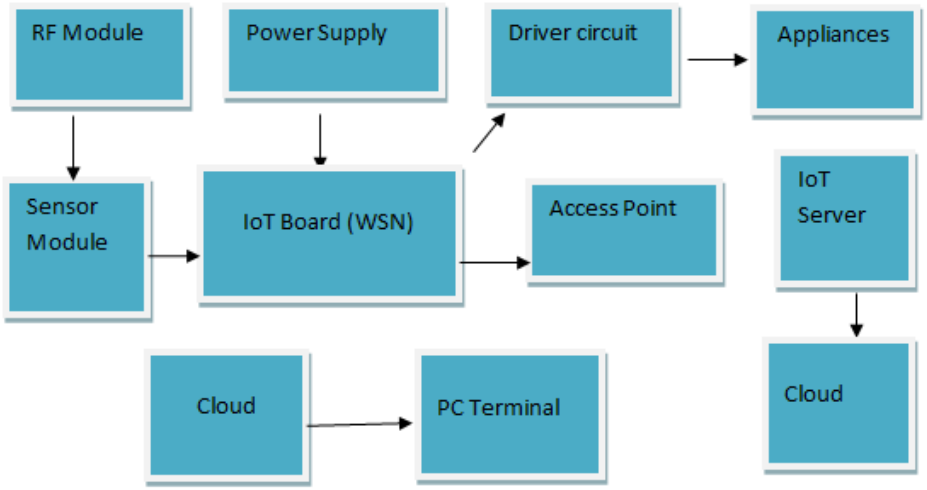

Fig.2. IoT with Network

1.3 SENSOR NETWORK USING WIRELESS SYSTEMS

It is possible to create a sensor network with wireless systems (WSN) that is dispersed over a vast region that continuously monitors and records data about the environment. WSNs can monitor humidity, wind speed, and temperature and direction, just to name a few. The term "self-configured and infrastructure-free wireless sensor network" refers to a network of sensors that collects and transmits data on physical or environmental components such as sound pressure, motion velocity, or contaminants to a central point. This information may be sent to a central location for further processing by Wi-Fi-enabled sensors. It is possible to employ wireless sensor networks (WSNs) to monitor environmental factors including pollution and wind speed.

1.4 APPLICATIONS OF 5G IN VARIOUS WIRELESS SYSTEMS

1.4.1 Terrestrial Microwave

Transmission and reception between transmitters and receivers on the earth's surface are made possible by the 5G network, which uses line-of-sight communication between the

two. Due to the high costs of installing microwave transmitter and receivers on towers or mountaintops, they are frequently situated far above the ground Fig.3 depicts a terrestrial microwave connection.

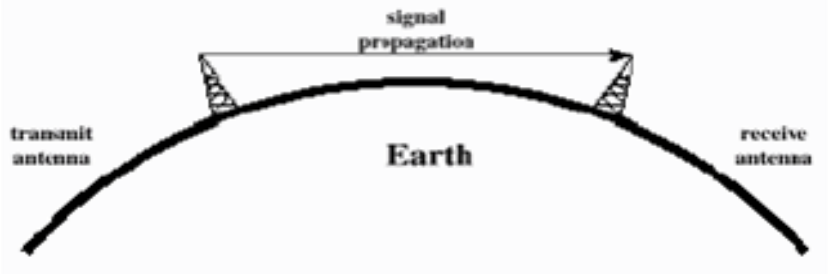

Fig.3. Terrestrial Microwave [26]

In order to transfer data, pairs of Earth-based transmitters and receivers employ line-of-sight communications to establish a terrestrial microwave network.

1.4.2 Cellular & PCS systems

PCS (personal communications services) is the solution for people looking for a cellular phone service that is both personal and transportable. In order to characterise it, the term "digital cellular" was invented (although cellular systems can also be digital). PCS, which is also intended for mobile users, makes use of a huge number of antennas to provide appropriate coverage over a vast area. Users' phone signals are picked up by nearby antennas and transmitted to the base station of that network as they move about. Cellular phones are a little smaller than this one, but it's not much. According to Sprint, PCS is currently available to more than 230 million people. Mobile and PCS systems are shown in Figure.4.

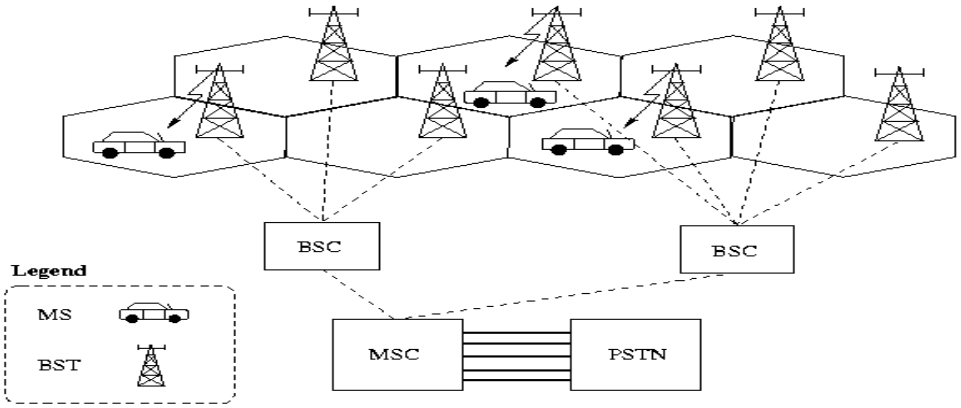

Fig.4. Cellular & PCS systems [27]

1.4.3 Radio &Spread Spectrum Technologies

Broadening a signal's bandwidth in the frequency domain is an important part of telecommunications and radio frequency communication. In a spread spectrum technique, a low band signal is extended across a large frequency band by using a signal structure simulating noise.

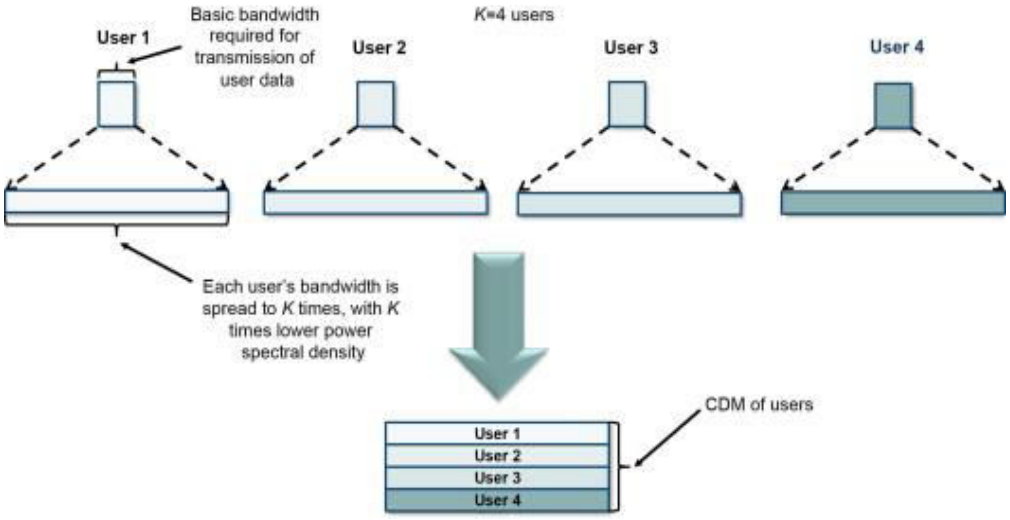

Fig.5. Radio & Spread Spectrum Technologies [28]

1.4.4 Free Space Optical (FSO) Communication

A modified optical beam pointed towards empty space may be used to transmit data wirelessly across great distances, eliminating the requirement for more traditional optical technologies like fibre optics. Ancient cultures used light (or smoke) signals to send messages. Point-to-point optical communications in free space can be built using infrared laser light, although LEDs may also be utilised for low-data-rate transmission across short distances. Free-space optics, shown in Figure 6, may be used to communicate between spacecraft.

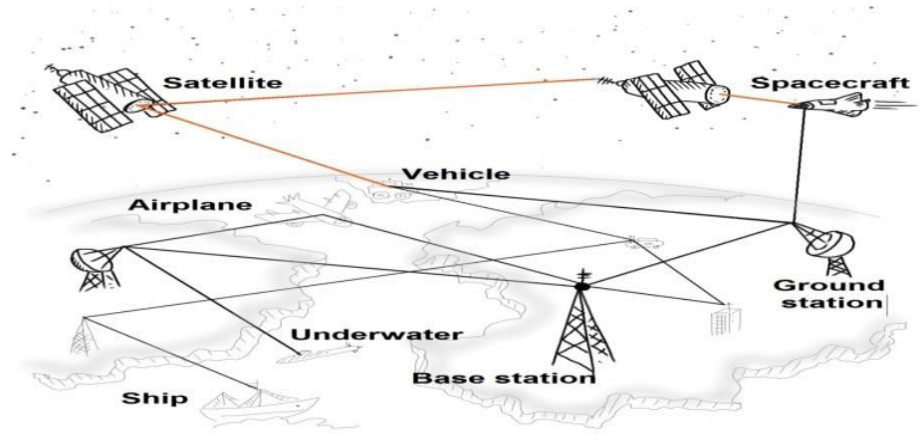

Fig.6. Free Space Optical Communication [29]

Infrared Data Association is the name given to this kind of optical free-space communication (IrDA). FSO technology is utilized in optical wireless communication applications.

1.4.5 Communication satellite

A transponder-based artificial satellite transfers data from a distant transmitter to a receiver in another region of the planet as one kind of communications satellite.

Television, telephone, radio, the internet and military usage are only some of the uses for communications satellites. The two primary kinds of communication satellites are passive satellites and active satellites. As a result of passive technology, only a portion of the transmitted energy is received by the receiver. The satellite's radio signal is weak when it reaches Earth because to the satellite's high altitude and the resulting lack of free-space path. In contrast, active satellites enhance the received signal before transmitting it back to the base station. Passive satellites, which were the first to be utilised for communications, are now almost entirely obsolete. There are many satellites shown in Figure 7.

1.5 CHALLENGES AND VISION OF 5G IoT

Using a mobile phone has grown increasingly commonplace as the technology has advanced. Some issues have arisen in the design of physical and network layers since the introduction of 1G, as well as the locations in which they are deployed. A dramatic revolution in wireless technology based on the Internet of Things (IoT) has been brought about by 5G. According to the survey, the most pressing issues in 5G technology development are on the following.

- This is ten times quicker than current technology and is required in order for real-time networks to operate.
- The latency must be 10 times lower than on LTE networks for it to operate.
- 5G networks may be able to achieve high bandwidth and spectrum efficiency using millimetre wave technology and MIMO antennas, while cognitive radio enables users to access both licenced and unlicensed spectrum bands.
- It is important to include low-cost sensors and devices in the IoT.
- There will be an ever-increasing need for battery storage and backup as technology advances.
- Green technology might reduce energy consumption in 5G networks by over 90%, allowing for huge connections and high data rates.

In response to the seven main problems outlined above, wireless communication companies and academic institutions are establishing and cooperating on research activities in various areas of 5G. It's projected that 5G wireless technology will be commercially accessible by 2025, owing to research and development by key cellular, semiconductor, and service providers throughout the globe. 5G research and testing are now underway at a number of renowned research institutions. Long-distance communication, longer battery life, the ability to communicate to billions of devices, and quicker internet speeds are all expected to be met by new cellular technology advancements. Experts believe that IoT in a 5G framework has the potential to be the

most revolutionary technology in the IT sector. According to a recent estimate, 5G technology would be widely accessible by 2025.

[2] LITERATURE REVIEW

When it comes to the features of OFDM numerology essential for eMBB, IoT and MBSFN, Ali A. Zaidi gave an extensive discussion. As part of the 3rd Generation Partnership Project, we are now working to standardise NR (3GPP). Many different scenarios and deployments may be accommodated utilising the 3GPP NR physical layer design.

As a keynote speaker at the Mobile World Congress, he discussed the implications of PTM on 5G network slices that can be dynamically re-configured to accommodate diverse services and user densities.

Even while 4G Long Term Evolution (LTE) PTMbroadcast transmissions were initially envisioned as an extra and pre-positioned service, it is likely that 5G PTMbroadcasts may be designed to break with this paradigm.

MmmWave concept was given by Morteza Hashemi, who said that it could operate at a frequency of less than 6 GHz. For beamforming and data transmission, our technique exploits the spatial correlations between the mmWave and sub-6 GHz interfaces. Analog beamforming in mmWave may be accomplished without significant overhead due to spatial correlations with the sub-6-GHz frequency band, as shown by our comprehensive studies in both indoor and outdoor environments[19].

Dmitrii Solomitckii believes that amateur drones can be monitored via 5G millimetre wave installations. 5G is expected to provide everything we need for drone monitoring and identification. As a result, while developing new technologies and systems, it's critical to take base station density, directional antennas, and available bandwidth into account. LTE, which employs OFDM for synchronous communication, and machinetype DUE, which uses a different waveform while running in asynchronous mode, were the subject of Conor Sextan's study[20]. With synchronous OFDM, offset-QAM produces a slightly higher average rate and a 43 percent increase over the baseline case[21].

5G mobile networks, which are anticipated to handle exponential traffic growth and enabling the Internet of Things, were the subject of Godfrey A. Akpakwu's extensive examination of new technologies, Constraints and open research routes related to large-scale deployment of critical IoT applications are also highlighted[22] while building a context-aware congestion control mechanism[23].

Jie Lin held a talk to explain the present state of IoT development. There is a focus on fog/edge computing as well as the challenges associated with this sort of IoT. This research study focuses on the importance of cyber-physical systems and the Internet of Things (IoT) in establishing an intelligent cyber-physical environment. After that, we'll

talk about the latest developments in Internet of Things design and technology, as well as security and privacy issues. The authors of this paper examine the relationship between fog computing and IoT as well as some of the issues connected with this kind of IoT in order to better understand fog computing-based IoT[23].

W. Ejaz briefly touched on the topics of energy management and smart city planning. A unified framework for Internet of Things-based energy-efficient scheduling and optimization in smart cities is also provided. They discuss, for example, how to extend the life of low-power electronics utilising energy harvesting in smart cities and its accompanying concerns. The following are two instances. Smart home energy efficiency is the goal of one, while wireless power transfer for IoT devices is the focus of the other[24].

Cloud-based IoT systems rely on new mobile technologies, which need special security and privacy measures. Because of this, J. Zhou devised an efficient aggregation method that does not rely on public key encryption. Many fascinating unresolved topics and prospective notions have been provided to pique the interest of those who are interested in this rapidly expanding subject.

A fundamental network paradigm change is required to satisfy the anticipated high traffic and low latency needs of IoT and machine-to-machine interactions. One of these possibilities is the widespread use of small cells operating in the millimeter-wave range. Because of the many intelligent features and applications that will be integrated into future wireless networks, 5G will be the most intelligent and dominant wireless technology to date[26].

[3] Problem Statement

There have been many researches in existence that focused on IoT and 5 G technology. But the issue with those systems was lack of scalability and performance. More over there is need to do more work to enhance use case. Considering issues in previous research work there is need to introduce more efficient approach. As a result of the development of 5G technology, data speeds of 20 Gbps and decreased latency are expected to be achieved. Data rates are maintained even while the users are moving about, resulting in a more constant user experience. Downloading speeds of 20 Gb/s and 10 Gb/s are available on the 5G network. Security management is a major issue for growing countries. The cyber security precautions accessible to people and governments throughout the introduction of 5G are a source of worry due to the ambiguity surrounding current measures. Providing security has been shown in studies to diminish overall performance by 7-20%, according on the data available. Another problem is that it's available all the time. It is now essential that information may be accessed from anywhere, at any time, by any person. The limited range of 5G is another major issue. In order to reduce signal route losses caused by trees and buildings, several cell towers are

required. The current effort intends to improve the network's performance by increasing 5G connection capacities and resolving signal route problems.

[4] OBJECTIVES

The objective of research are discussed below

1. To analyze existing researches related to IoT and 5G technology along with their methodology and limitation and focusing issues and challenges faced in implementation of conventional researches in area of IoT that focused on 5G technology.
2. To propose efficient, scalable and high performance IoT based model by integrating compression and encryption for 5G application in order to resolve the issues of accuracy and security.
3. To perform comparative analysis of performance and accuracy between proposed work and previous work related to IoT based 5 G technology.

[5] Hypothesis

H0: Integration of compression and encryption to IoT would not influence the performance and accuracy during classification over 5G network

H1: Integration of compression and encryption to IoT would improve the performance over 5G network

H2: Integration of compression and encryption to IoT would improve the accuracy

H3: Integration of compression and encryption to IoT would reduce the error rate during classification

[6] Proposed Research methodology

Proposed work is considering previous researches related to IoT and 5G technology along with their methodology and limitation. Then proposed work is focusing of the issues and challenges faced in implementation of conventional researches in area of IoT that focused on 5G technology. Proposed model is supposed to provide efficient, scalable and high performance IoT based model for 5G application in order to resolve the issues of accuracy. Finally perform comparative analysis of performance and accuracy between proposed work and previous work related to IoT based 5 G technology would take place.

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Process flow of proposed work

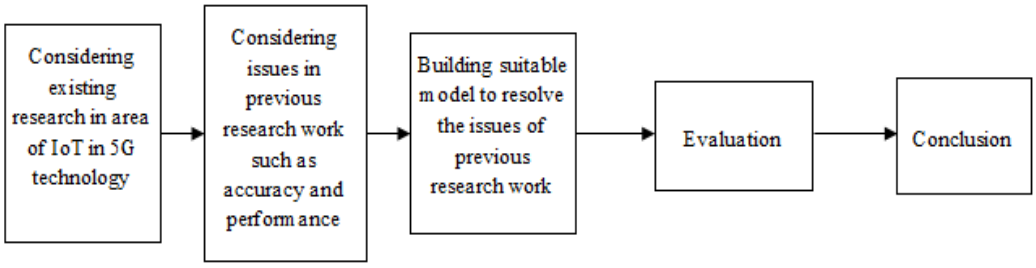

Fig 1.6 Process flow of proposed research

[7] TOOL TO BE USED

MATLAB

Matlab is used in different sectors of education in our life e.g. in mathematics, in academies. It is mostly useful in Universities for research purposes. The simulation tool Matlab is broadly used in Industries. Being capable of building vectors and matrices .This software basically help us to deal with linear algebraic operations. It helps us to solve the algebraic and differential equations. With the help of MATLAB numerical integration is performed. There are many tools provided which deals from the picture content. Beautiful Two Dimensional pictures can be created with the use of MATLAB .It is also helpful in generating Three Dimensional based graphical contents. When talking about programming languages, Matlab is considered as an important language. It helps in writing the mathematical programs. It is one of the easiest languages among the languages.

Characteristics of MATLAB

1. It is a High-level programming language.
2. It is capable of being used in technical computing.
3. To manage codes files an environment is given.
4. MATLAB provides interactive features that are useful in many areas like iterating, exploring & designing. Matlab tool is used to solve the problems came across while doing various work.
5. To do the activities like Fourier analysing, filtering, optimizing data Matlab tool is used. Mathematical functions and equations are also performed in this software. These functions are helpful in solving linear algebraic equations and statically used data etc.
6. Graphics functions are used as 2D and 3D, which helps in visualising the data.
7. Graphical User Interfaces are customised by the help of the tools present in the Matlab.

MATLAB has functions like Parcelling of data which helps in MATLAB to perform calculations.

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NOVEL PROPOSED DESIGN OF UNIVERSAL SOCIAL ROBOT FOR HEALTHCARE

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ABSTRACT

Because of their applicability in the treatment and rehabilitation of various disorders, Human-Robot Interventions (HRI) have recently piqued the interest of the medical community. Because of its ability to elicit social and emotional responses from users, social robots are developed to engage with people in ways that are congruent with human social psychology. They connect with their users in a human-centric environment by speaking, moving, making gestures, or using facial expressions while following to a set of social conventions. These robots, like humans, interact with others in an adaptable manner by modifying their body language, speech, and tone naturally. Humanoid social robots, in contrast to computer-mediated communication technologies, serve as a medium for human interaction rather than as a conduit for it. We outline some intriguing possibilities for social robots in healthcare-related applications in this paper. We also propose a novel architecture of a social robot named "Universal Robot" which incorporates numerous perception and attribution tools making it suitable to cater more diseases as it utilizes 57.14% more perception and attribution tools as compared to its best perfoming oponents in this regard, namely AIBO and LYNX making it more efficient than others. The detailed analysis is shown in the result section.

Keywords: robotics, rehabilitation, healthcare, social robots, social robots in therapy & care, ethical issues, legal issues, privacy issues, human-robot interaction

1. Robotics in Healthcare and Robotics Taxonomy

1.1 Rehabilitation Technologies

Rehabilitation technologies refer to a range of devices, tools, and software that are used to help individuals with physical, cognitive, or emotional impairments regain their abilities and improve their quality of life. This can include things like prosthetic limbs, assistive devices for mobility, virtual reality therapy programs, and rehabilitation software for cognitive and speech therapy. These technologies can be used in various settings such as hospitals, clinics, and patients homes and can be used by a wide range of individuals such as those recovering from injury or illness, those with chronic conditions, and those with developmental disabilities.

According to Zhang et al. [1], who made the initial claim, it is impossible to determine the efficacy of a robot-assisted rehabilitation intervention since there are no common assessment criteria and metrics for the numerous robotics devices and control schemes. However, the clinical healthcare improvement underlying these effects is still poorly understood. [2]. Perhaps tritely, a study can assert that robot assisted rehabilitation can encourage CVA patients' return to their families and society by improving their lower limb recovery [3]. We contend, however, that previous research has had difficulty demonstrating the societal impact of mechanical, digital, and assistive robots. Shamsuddin and others

Without offering any supporting data or critical societal consequences, [4] asserts that "a robotic animal is the solution to provide constant mental support and create warm and compassionate feelings from the sufferers." Studies from the past and present have gaps since they don't use interdisciplinary methods to assess the true societal impact of rehabilitation robots. These assistive technologies may aid in rehabilitating a CVA patient's physical function, but until the robots significantly enhance the social lives of the patients, they remain a cold and uninteresting technology and cannot be considered true social robots [5]. For instance, rehabilitation robotics is a fascinating area of research that is moving away from the promotion of mobility and toward the socialising of infants and toddlers 6]. Given the silo-disciplinary character of earlier studies, it is unclear how far this transition goes beyond the surface level.

1.2 Can Robots Give You Back Your Life? Recommendations and Controversial Items

Empirical case studies from around the world showed some highly effective rehabilitation robots. Zora Robot for elderly care services [7] as shown in Fig1, SAR the A socially assisted robot is a type of robot that is designed to interact with and assist human beings in a social or human-like manner. These robots are typically used in healthcare, education, and other fields where human interaction is important. They can be used for a variety of tasks such as providing companionship for the elderly or helping children with autism to improve their social skills. Some examples of socially assisted robots include robots that are used to provide therapy for patients with dementia, robots that are used to provide assistance for people with disabilities, and robots that are used to assist children with learning difficulties. These robots can take many forms such as humanoid robots, animal-like robots or even virtual agents on a screen..

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Figure 1 ZORA robot for elderly care services

2. Social robots with applications in healthcare

Social robots have a wide range of applications in healthcare, such as:

1. Therapy: Socially assistive robots can be used to provide therapy for patients with various conditions, such as dementia, depression, and anxiety. They can engage patients in conversation, provide companionship, and even play games to help improve their mood and cognitive function.
2. Rehabilitation: Robots can also be used to help patients with physical impairments to regain their abilities. For example, robots can be used to help patients with spinal cord injuries to regain mobility by providing assistance with exercises and daily tasks.
3. Monitoring and reminders: Social robots can be used to remind patients to take their medication, provide updates on their health status, and even monitor vital signs.
4. Social engagement for isolated individuals: Social robots can also be used to provide companionship and social engagement for elderly or isolated individuals. They can also be used to help reduce feelings of loneliness and isolation.
5. Education and training: Social robots can also be used to teach and train healthcare professionals and students in various aspects of healthcare, such as patient care, communication, and empathy.

These robots can be used in various settings such as hospitals, nursing homes, clinics, and even patients' homes. They are becoming increasingly popular as a tool to support and assist healthcare professionals in providing care and improving patient outcomes.The elderly and children are the two patient populations for whom social robot applications are most common in the healthcare setting[8].

(a) Seniors

Assistive technology refers to any device, system, or software that is designed to help individuals with disabilities or impairments to overcome barriers and improve their ability to perform daily tasks. It can include both low-tech and high-tech solutions, and can be used in a wide range of settings such as at home, at work, or in the classroom.

Examples of assistive technology can include:

1. Mobility aids: such as wheelchairs, walkers, and canes.
2. Communication aids: such as speech-generating devices, adapted keyboards and mouse, and software that help with reading and writing.
3. Environmental control systems: such as devices that allow individuals to control lights, thermostats, and other appliances using voice commands or switches.
4. Prosthetic and orthotic devices: such as artificial limbs and braces.
5. Computer access software: such as screen readers, screen magnifiers, and voice recognition software.
6. Sensory aids: such as hearing aids, closed-captioning and visual notification devices.

Assistive technology can help people with disabilities to live more independently, communicate more effectively, and participate more fully in their communities. It can also help to improve education and job opportunities for people with disabilities [9].

Emotions are linked to social interactions, which is true for senior people and patients with dementia. It presents both advantages and obstacles for the PARO robot and is a promising field. The psychological needs of the aged in terms of inclusion, identity, attachment, occupation, and comfort can be supported through PARO . ARI uses several physical clues simultaneously to convey emotion and elicit empathy, primarily facial expressions, body movement, posture, and verbal cues [68]. SARs (Social Assistive Robot and Companion) include AIBO, PARO, AIBO, and iCat as shown in Fig 2. In the year 2017, 6,400 helping robots were sold globally for use in healthcare. The difficulty is in defining the function of robots in healthcare and enforcing standards and moral guidelines for the services they render [10] .

Figure 2 AIBO, PARO, iCAT social robots for elderly

The condition of our homes has an impact on our wellbeing. They are a crucial quality in the most at-risk populations, such as the elderly, who frequently require medical support. For instance, older persons living independently at home received assistance from empathic coaches and virtual assistants [11]. For the elderly, robots are more than simply devices; they provide emotional support in a way similar to that of a communicating and coexisting buddy or companion [12].

(b) Youths

It is believed that children's quality of life can be enhanced by robots in various ways, such as:

1. Education: Robots can be used to engage children in educational activities and to help them learn new skills. They can be used to teach children with learning difficulties, such as autism or ADHD, and to provide personalized instruction.
2. Therapy: Robots can be used to provide therapy for children with a wide range of conditions, such as developmental disorders, mental health issues, and chronic illnesses. They can be used to provide social and emotional support, and to help children to improve their communication and motor skills.
3. Play and entertainment: Robots can also be used to provide children with entertainment and to engage them in play activities. This can help to improve their mood and cognitive development.
4. Assistive technology: Robots can also be used to provide children with disabilities with assistive technology that can help to improve their mobility, communication, and independence.
5. Monitoring and safety: robots can also be used to monitor and ensure children's safety, for example, through monitoring their health and providing alerts if necessary.

It is important to note that these benefits of robots for children need to be evaluated in research studies with controlled conditions, and it also depends on the specific robot and its implementation [13].Some commonly used social robots for youngsters are shown in Fig 3.

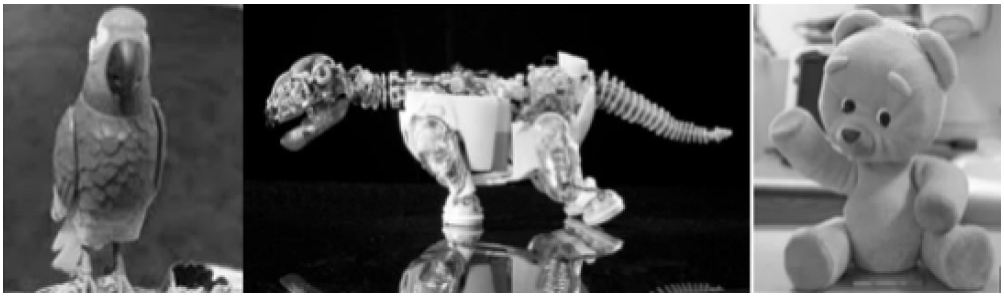

Figure 3 PARROT, PLEO, HUGGABLE social robots for youth

The literature discusses automatic diagnosis in detail. It is used in ASD (Autism Spectrum Disorder), when it is still difficult to foresee how activities will turn out . Observing kinematics is not the same as comprehending interior mental states[14] . The phrase "in the wild" is typically used to refer to actual circumstances. Many tasks are carried out in controlled or laboratory settings, which are in no way realistic. Some studies, like those involving diabetic kids, approach the issue using a paradigm for a long-term care partnership between humans and robots [15]. For instance, the Pleo robot, a robotic pet baby dinosaur, functions differently to help kids while they are in the hospital [16]. Other social robots were employed to test the urine of cancer-stricken youngsters, observe and assess therapy procedures, and save therapeutic treatments in databases [17].

3. Using social robots as an additional kind of treatment for chronic, progressive diseases

3.1 Social robots can assist dementia patients

Significant advancements in robotics have been made possible by technological innovations. There have been efforts to develop robots that can engage in social interactions with people. Because the robots that have been created up to this point are based on organisms that already exist in our environment, they either: features that are anthropomorphic or zoomorphic. New perspectives, as well as chances and fields for their application, have been made feasible by the raging technological evolution. These days, it is possible to do research on the socialization-promoting benefits of robotic intervention, evaluating the consequences on human cognition and behaviour[18-20] .

Due to the long history of human interaction with other animals—the first fossilised evidence dates to the time of Homo erectus—we should emphasise therapy with domestic animals as one of the complementary treatments for dementia . Domestic animals are frequently chosen nowadays because of their emotive return and as facilitators of social connection between people, since they are able to lessen sense of well-being. This close association has been maintained[21]. However, due to potential challenges including sanitary, allergenic, or institutional issues, studying therapeutic intervention with domestic animals can occasionally be challenging. As a result, it presents a chance for the creation of a zoomorphic SAR application that aims to get beyond this restriction [22].

The majority of zoomorphic robot experiments to date involved the robotic baby seal (PARO), a canine-like AIBO of the studies aimed to encourage multimodal contact through vision, hearing, and touch as shown in Fig 4.

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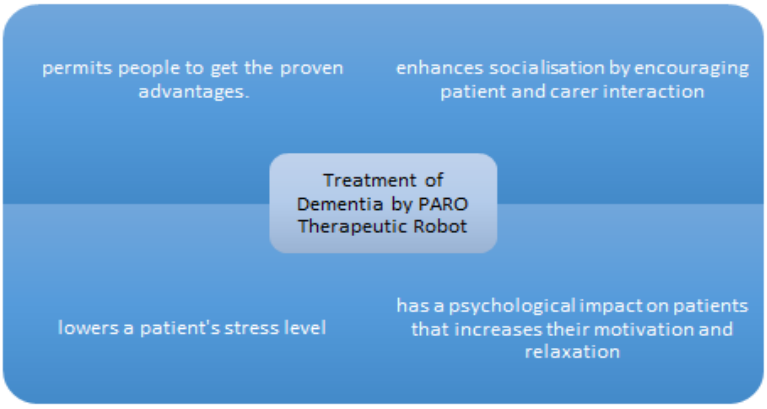

Figure 4 Benefits of using social robots for Dementia patients

The model that is being utilised and researched the most is PARO. It is a robot in the form of authorised as a medical device by the Food and Drug Administration in 2009 [23-25].

4. Social robots for autism spectrum disorder or social anxiety

A noticeable and enduring apprehension is a defining feature of social anxiety disorder. Many social circumstances that might cause feelings of embarrassment or humiliation . Despite their desire to interact with others, people with social anxiety disorder either entirely avoid social situations or tolerate them with excruciating discomfort . This is because they are so afraid of being scrutinised by others. 75% of people who are diagnosed with social anxiety disorder report that it first manifested between the ages of 8 and 15 . The start of social anxiety disorder often happens in childhood or early adolescence. Social anxiety disorder can have a chronic and lifelong history . Given the risk of morbidity and disability, early diagnosis and treatments are crucial for people with social anxiety disorder . Fig 5 illustrates how social robots help children with ASD.

Figure 5 how social robots help children with ASD.

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4.2.1 Interviews conducted by robots

Numerous research in the area of robot-mediated interviews have shown that, regardless of the difficulty of the questions Interviews conducted by robots, also known as "robot interviews" or "AI interviews," refer to the use of artificial intelligence and machine learning algorithms to conduct job interviews. These systems can include natural language processing and computer vision technologies to analyze a candidate's speech and body language, as well as their responses to questions. Some companies are using this technology to automate the initial screening process for job candidates, while others are using it to conduct entire interviews. The advantages of using robot interviews include the ability to conduct interviews at scale, eliminate bias, and provide objective evaluations of candidates.

4.2.2 Social robots as screening and diagnosis tools

The study of behaviours linked to social anxiety may benefit from the use of social robots by therapists. Social anxiety sufferers may display behavioural due to the stress and dread generated by social anxiety, people who suffer from these symptoms exhibit avoidance of eye contact, tight body postures, and incorrect speaking voices. Social robots are able to recognise social cues from people and respond appropriately.[26]

4.2.3 Robotic Therapy

Robotic therapy refers to the use of robots or robotic devices to assist in the treatment and rehabilitation of individuals with physical or cognitive impairments. This can include the use of exoskeletons to help individuals with spinal cord injuries or other mobility impairments, as well as the use of robotic assistants to help with activities of daily living such as dressing, grooming and eating [27-30].

Robotic therapy can be beneficial in a number of ways, including providing patients with more consistent and accurate therapy, reducing the need for human caregivers, and providing patients with a sense of independence and control over their own therapy. However, it is important to note that robotic therapy is still in its early stages of development, and more research is needed to fully understand its potential benefits and drawbacks[31].

4.2.4 Interactive Social Companions in the Form of Social Robots

People who have social anxiety say they have fewer friends and have more trouble maintaining their relationships and friendships. To mimic the effects of therapy animals, a variety of robot pets are currently on the market. The benefits of interacting with robotic dogs on mental health have been highlighted in several studies, including improved mood and socialising as well as decreased depression, stress, and anxiety. Many of these research concentrated particularly on elderly people and those suffering from dementia [35].

4.2.5 Peer/Interactive Playmates: Social Robots

Peer or interactive playmates refer to robots or other interactive technologies that are designed to engage in play or other social interactions with children. These can include robotic dolls or stuffed animals, as well as virtual characters or avatars. The goal of these playmates is to provide children with a sense of companionship and social interaction, as well as to help them develop various skills such as language, social, and emotional skills[36]. Interactive playmates can be beneficial for children in a number of ways. They can provide children with a sense of companionship, especially for those who may be socially isolated or have difficulty connecting with other children. They can also help children develop important social and emotional skills, such as empathy, cooperation, and communication. Additionally, interactive playmates can be used as a tool for learning and education, providing children with interactive and engaging ways to learn new concepts and ideas [37].

4.2.6 The Role of Social Robots as Social Mediators

Due to communication challenges and worries about being scrutinised by others, people who suffer from social anxiety sometimes find it difficult to participate in social situations. Werry et al. demonstrated in an observational research that situations with a robot as a very exciting social situation for viewing diverse social and non-social interaction patterns can be created by a media- tor and pairs of kids. The ability of kids with ASD in social situations can be determined as well as specific issues by analysing these behavioural patterns. It has also been demonstrated that playing with Kaspar has a good impact on some kids' behaviour in specific domains, such as mimicry, prompted speech, focus, and communication.

4.2.7 Social robots as instructors or coaches

The creation of social robots that may serve as a teacher or a guide is gaining popularity user's social, physical, or mental health by monitoring and involving them individualised way. By tracking each participant's weight reduction and offering tailored feedback, Kidd and Breazeal developed Autom as a behaviour change coach to encourage sustained involvement in a diet and exercise programme. In a six-week, between-subjects research, Additionally, it was said that the working alliance with the robot had become much tighter. In a different study, Fasola and Mataric created Bandit, a robotic coach system, to encourage elderly users to engage in physical activity. The robotic coach methodology used in this study was created based on psychological studies on users' intrinsic motivation[38-40].

5. Social robots for elderly and Alzheimer patients

Alzheimer and Dementia are diseases that affect the cognitive function of an individual. Typically, neuro-physical and mental exercises they have, although npoor diet or even drugs they have used throughout their lives, can also play a role. Some of the common symptoms of Alzheimer's shown in Fig 6.

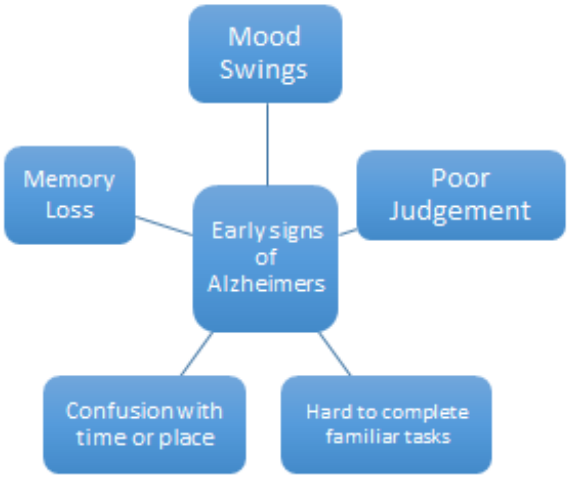

Figure 6 Early signs & symptoms of Alzheimer's disease

Maintaining communication between patient, family, and staff is one of the most crucial components of dementia care so that treatment can be properly personalised.

Nonpharmacological therapies emphasise mental, emotional, and physical exercise. One of the essential components of effective dementia care is activity participation. Other cognitive rehabilitation methods and procedures have a stronger emphasis on restoring and/or preserving cognitive skills like communication, orientation, and memory[41-45].

Families can "virtually" visit PwD via this videoconference, taking part in two-way dialogues while having their faces displayed on a "life-size" video screen. Telepresence robots could be employed in a variety of contexts to serve senior citizens and foster social engagement.

It has been demonstrated that the PARO robot affects the activity levels of older adults with cognitive impairment both directly (through interaction with PARO) and indirectly (through interaction with other people and the environment).

6. Social robots for improving customer satisfaction in COVID-19

6.1 Social Isolation's Effects

Long-term social exclusion and isolation have a negative impact on people's psychological health. Consumers are forced into objective social isolation or a lack of social contact as a result of the COVID-19 global control procedures. Although few people may live alone without feeling lonely, new research typically shows that social isolation has a strong predictive impact on feelings of loneliness.

Particularly, this perceivably socially isolated state is strongly detrimental to one's physical, psychological, and cognitive wellbeing. Numerous longitudinal studies have linked subjective social isolation to physical health decline and mortality. Additionally, it is linked to heightened irritability and sadness, quicker cognitive decline, and

heightened susceptibility to social dangers. Children and elderly individuals are more at risk for subjective social isolation , making them a susceptible consumer category during COVID-19[46-50].

6.2 A typology of the revolutionary potential of robots in COVID-19 and beyond

Robots with human-level physical capabilities and empathic artificial intelligence (AI) are still not ready for the market . But precisely these social robots with a focus on physical touch, social expression, and relationship-building could offer sophisticated transforming services . The transformative potential of each type of robot for vulnerable people who are socially isolated is outlined below in Fig 7.

Figure 7 Roles that can be assumed by market-ready social robots to combat the negative effects of social isolation

Entertainer. The entertainer robot may be best suited to service customers who must deal with forced social isolation and only mild psychological distress (e.g. boredom). The entertainer has inadequate social skills because of this , it is preprogrammed for robot types to carry out easy-to-repeat social duties.

Its primary transformative potential is hedonistic and focuses on entertaining customers to boost their fleeting affect as a means of self-satisfaction. It could be used to stop small psychological pain from occurring during times of seclusion in both elderly people and youngsters . A good example is Alibaba's DWI Dowellin, a little mobile robot that sings and dances for its users .

A social facilitator. By facilitating social interactions for vulnerable customers, the robot, acting as a social enabler, may realise its revolutionary potential. Despite not yet possessing sympathetic intelligence, the social enabler robot can mimic real social contact thanks to its enhanced corporeal competences. For example, it is capable of

simulating the actions and facial expressions of social contacts while concurrently displaying them on screen .

7. Elements influencing whether social robots are accepted

Social robots are those that are useful and have the social intelligence and abilities necessary to interact with people in a way that is acceptable to society . This implies that they must be able to interact with the user and be recognised as a social entity by the user . This term incorporates robots that are primarily used as companions.

The objective is to improve users' psychological and mental health, as well as service robots thatisssist humans in performing daily tasks.

Acceptability is characterised as "the robot being voluntarily absorbed into the life of the older person" , which suggests long-term use. 10 factors affecting the acceptability of social robots are shown in Fig 8.

Figure 8 Factor influencing acceptability of social robots

7.1 Beliefs and Concerns about Technology

Users develop a mental picture of robots before they have their first firsthand experience with one, which shapes how they react to the robot. Science fiction and the media are examples of secondhand sources of knowledge outside the individual that can affect mental models .

Expectations regarding what a robot can and cannot do influence prior experiences and a person's attitude toward it. This is related to anthropomorphism, which is the tendency for people to think of both robotic and non-robotic objects as having human-like mental capacities. We go into more detail about how this happens below.

7.2 Intent to Utilize (ITU)

According to the data, using a robot and being more familiar with it, as opposed to only hearing about it from a third party, might change aspects that affect acceptance . Intent to Utilize as a gauge of robot suitability can be fewer accurate and lawful than educations that look at real robot operation over an extended period of time for this and other reasons that are discussed below. For instance, Stafford et al. used a robot attitude measure to record attitudes toward the robot Cafero community interacted with it for 30 minutes. Both participant groups exhibited less hostile feelings toward the robots after the interaction. In their observational qualitative field trial that was carried out in a "smart" house, Gross and Schroeter et al. discovered a comparable improvement in attitude. They discovered that some OA with mild cognitive impairment (MCI) and their care partner partners (n = 4 dyads) at first had unfavourable initial reactions to and considered the companion robot as frightening. However, after using it for one day, they began to recognise its advantages and found it to be more acceptable.

7.3 Perceived Usefulness (PU)

Perceived usefulness (PU) is a concept in the field of technology acceptance, which refers to an individual's perception of how useful a technology will be in helping them achieve their goals. It is one of the key factors that influence an individual's intention to use a technology.

Perceived usefulness is determined by an individual's assessment of the technology's ability to improve their job performance or make their life easier. It is directly related to the individual's attitudes towards the technology, and is considered to be a cognitive belief rather than an emotional one.

Perceived usefulness is an important factor in the adoption and acceptance of new technology, as it can influence an individual's decision to use a technology or not. When individuals perceive a technology as being useful, they are more likely to adopt it and integrate it into their work or personal life. On the other hand, if they do not see the technology as useful, they are less likely to adopt it.

7.4 Perceived Ease of Use (PEOU)

Perceived ease of use (PEOU) is a concept in the field of technology acceptance, which refers to an individual's perception of how easy it is to use a technology. It is one of the key factors that influence an individual's intention to use a technology.

Perceived ease of use is determined by an individual's assessment of the technology's ease of use, including the technology's ease of learning, ease of operation and ease of understanding. It is directly related to the individual's attitudes towards the technology, and is considered to be a cognitive belief rather than an emotional one.

Perceived ease of use is an important factor in the adoption and acceptance of new technology, as it can influence an individual's decision to use a technology or not. When

individuals perceive a technology as being easy to use, they are more likely to adopt it and integrate it into their work or personal life. On the other hand, if they do not see the technology as easy to use, they are less likely to adopt it.

In order to increase perceived ease of use, organizations should design the technology to be user-friendly and intuitive, with clear instructions and a simple interface. Additionally, providing training and support to users can also help increase perceived ease of use.

7.5 Perceived Enjoyment (PE)

Perceived enjoyment (PE) is a concept in the field of technology acceptance, which refers to an individual's perception of how enjoyable a technology is to use. It is one of the key factors that influence an individual's intention to use a technology.

Perceived enjoyment is determined by an individual's assessment of the technology's pleasure or satisfaction in using it. It is considered as an emotional or affective evaluation of the technology.

Perceived enjoyment is an important factor in the adoption and acceptance of new technology, as it can influence an individual's decision to continue using a technology. When individuals perceive a technology as enjoyable, they are more likely to adopt it and integrate it into their work or personal life and continue using it. On the other hand, if they do not see the technology as enjoyable, they are less likely to adopt it and continue using it.

In order to increase perceived enjoyment, organizations should design the technology to be engaging and entertaining, and make it appealing to users. Additionally, providing incentives, rewards or any other positive feedback can also help increase perceived enjoyment.

When people have the option to utilise robots in a home setting voluntarily, motivational variables like PE come into play since acceptability rises if the robot is seen as entertaining and fun [214]. In a study utilising an iCat robot that was made talkative by using a hidden opera- tor, Heerink et al. [215] discovered that PE substantially linked with minutes of actual usage (0.625, p 0.01) and minutes of intention to use (0.420, p 0.05). Semi-independent OA were the participants (n = 30).

7.6 Social Presence (SP)

Users need to feel as though they are in the company of a social entity when they are with robots whose aim it is to motivate and stimulate them, hence these robots must exhibit a level of social presence (SP) appropriate to that objective. In fact, it would seem that the ability of robots to possess SP is what sets them apart from non-robotic technology.

In an 8-month study with PWD (n = 9), Tapus and Tapus investigated the use of a robot as a tool to monitor and promote cognitive activities for PWD. Through playing music and interactive activities with the user, the robot provided customised cognitive stimulation. Researchers contrasted reactions to a simulation on a large computer screen with those to a humanoid torso design on a mobile platform. They came to the conclusion that embodiment facilitated users' involvement with the robot as they shared their context after discovering that participants consistently preferred the embodied robot over the computer.

7.7 Perceived Sociability (PS)

Aspects of robot look, behaviour, and communication methods have an impact on PS.

People have different components of and the colour of their bodies, according to Scopelliti et al .'s research. A capable of delivering verbal cues to aid PWD in executing household sequences of actions like preparing a cup of tea, underwent an acceptance and feasibility evaluation by Begum et al. in a home simulation laboratory. Interviews with carers and PWD (n = 5) were recorded by researchers. They noted a lack of agreement over the gender a robot should portray and if it should have a soft or powerful voice.

How realistic a robot should appear and user preferences for a human- or machine-like appearance are other factors that affect robot design. In the Stafford et al. study mentioned above, perceived human similarity was linked to higher levels of anxiety and heart rates in OA volunteers than in their official carers. This implies that the idea of the uncanny valley differs between people and societies and may be connected to fear.

Zoomorphic robots, on the other hand, may experience a different effect of realism on acceptability. Paro was evaluated by Heerink et al. [220] alongside various zoomorphic robots, including a newborn seal, dog, cat, dinosaur, and bear. They watched the reactions of 15 patients with intermediate dementia and 36 professional carers being interviewed. Each PWD was exposed to a different robot over the hour-long sessions, and their reactions were recorded. The infant seal received the greatest marks for its ease of use, softness, and because it was more portable and lighter than Paro. Second choice was the cat since it was more believable. The dinosaur Pleo received the lowest score because it was thought to be strange and reptilian.

7.8 Trust and Perceived Adaptivity (TPA)

Trust and perceived adaptivity are two concepts related to technology acceptance that are closely related to each other.

Trust refers to an individual's belief in the reliability, stability, and dependability of a technology. It is an important factor in the adoption and acceptance of new technology, as individuals are more likely to adopt and use a technology that they trust. Trust can be influenced by factors such as the technology's perceived usefulness, ease of use, and

perceived enjoyment, as well as the reputation of the technology's developer or manufacturer.

Perceived adaptivity, also known as perceived compatibility, refers to an individual's perception of how well a technology fits with their needs, goals, and values. It is an important factor in the adoption and acceptance of new technology, as individuals are more likely to adopt and use a technology that they perceive as being compatible with their needs and goals.

Both trust and perceived adaptivity are crucial for the success of new technologies. Trust helps to establish a positive relationship between users and technology and perceived adaptivity helps to ensure that the technology is meeting the user's needs and goals. Together, they can help increase the likelihood of technology adoption and continued use.

With regard to robot goal and deployment scenario, an optimal balance between these elements presumably differs between different users.

To support these claims, additional study with larger samples is necessary.

Heerink examined the effects of PA acceptance under the same experimental circumstances as those mentioned, presenting a film. The additional adaptable robot was favoured by the participants, who also gave it higher ratings for ITU, perceived enjoyment, and perceived usefulness. The authors hypothesised that this was because they had less control over the robot's behaviour because they felt more uneasiness toward it.

Users must have faith in robots' dependability and safety, and this faith must be gained . A series of workshops were held with OA who were housebound and had mild sensory and movement problems by Frennert et al.. Responding to sketches of several robots, participants were invited to express their ideal robot preferences. Additionally, they conducted interviews with OA (n = 5) and one couple who spent one week residing with foam polystine mock-ups of these ideas. They discovered that control sentiments were significant and linked to issues of privacy and trust.

85% of individuals demonstrated mistrust by refusing to allow a robot free rein in the home, while 82% expressed concern over potential damage.

7.9 Social Factors and Supportive Environment

Social influences cover broader cultural concerns as well, although few research in this study appear to account for these difficulties, and none provided information about the cultural background of their samples. Two studies were carried out across multiple nations.

Negative ageist attitudes are a further cultural and societal problem that may hinder the acceptance of robots. Neven observed researchers interviewing OA (n = 6) and 30–60

minute exchanges between them and an unnamed robot in order to investigate how images of OA influence technological development. They discovered that OA may have various interpretations of what being older implies and that ageist presumptions influenced robot design and deployment.

Additionally, OA may be unwilling to associate with potential robot users if they are viewed by OA as lonely, reliant, and isolated. This could be because employing the robot would go against their perception of themselves and the independent, healthy selves they desire to portray [229].

7.10 Ethical, Legal and Societal (ELS) Concerns

In contrast to modern technologies, social robots have a different impact on people's privacy. This is crucial to separate the confidentiality features or types that apply in this situation in order to comprehend the privacy implications of social robots . We can distinguish between physical privacy and informational privacy in that sense (concerns Due to their ability to access private areas, social robots pose a threat to physical privacy . Informational self-determination, a key principle of European data protection law, is more in line with the concept of informational self-determination, which is referred to as informational privacy. Social robots make the acquisition of personal information "murky" because they are constantly processing data in the background and because the processing and dissemination of that data are difficult for a single user to understand. The ability to comprehend a social robot's data processing and disclosure capabilities is complicated by the anthropomorphic effect of social robots . Informational privacy issues apply to both direct interactions between people and robots as well as interactions between people mediated by robots, for instance, when a robot is compromised or a telepresence robot is used for spying .

It's time for legislation on robots. The European Union is working to provide legal certainty for robot legal compliance as a result of EP Resolution 2015/2103 (INL) , as "doing otherwise would negatively impede the development and uptake of robotics" . To better account for new developments in machinery types like robotics and digitization, the machinery directive is likely to be updated in the future.

We don't yet have any hard data on the lasting effects of health care and treatment robots due to the limited usage of social robots at this time. It is so challenging to provide an answer to the key question of whether prolonged involvement with robots decreases human-human interaction. Studies on therapeutic robots and carer robots like Paro, however, point to beneficial benefits on users, particularly for certain populations like young people with autism spectrum disorder and older people with dementia.

Last but not least, the difficulties in the field of human-robot interaction mainly concerned the societal effects of healthcare robots, such as generational differences in robot adoption or possibly reduced human-human connection.

METHODOLOGY

This section explains the various designing and programming techniques by which social robots are made to interact with humans to accomplish their goals.

1. Synthetic Senses

Synthetic senses refer to the use of technology to create artificial senses for humans or robots. These can include the use of sensors, cameras, and other devices to replicate human senses such as vision, hearing, touch, and smell. The goal of synthetic senses is to enhance or augment human capabilities, or to provide robots with the ability to sense and interact with their environment in a way that is similar to how humans do.

Synthetic vision, for example, can be used to enhance human vision by providing individuals with visual aids such as night vision goggles or telescopic lenses. Synthetic hearing can be used to enhance human hearing by providing individuals with hearing aids or cochlear implants. Synthetic touch can be used to enhance human touch by providing individuals with prosthetic limbs or exoskeletons.

1a. Computerized Vision

Robots have internal digital cameras that allow them to receive digital photographs of their surrounding environs. This provides a wealth of information for their programming to absorb in order to identify the elements of these surroundings, which is the first step toward acting in a way that promotes communication with adjacent others.

1b. Synthetic Hearing

Synthetic hearing, also known as "Artificial Audition" refers to the use of technology to create an artificial sense of hearing for humans or robots. This can include the use of microphones, sensors, and other devices to capture sound and convert it into electrical signals that can be processed by an electronic system. The goal is to help people with hearing loss or deafness to hear again, or to provide robots with the ability to hear and understand speech and other sounds in their environment.

1c. Artificial Touch

Artificial touch, also known as "synthetic touch" or "haptic technology" refers to the use of technology to create an artificial sense of touch for humans or robots. This can include the use of sensors, actuators, and other devices to replicate the sense of touch and pressure, allowing individuals to feel and manipulate virtual objects or to provide robots with the ability to interact with the physical world..

2. Perceptible Reactions

Perceptible reactions refer to the observable or measurable responses that an individual or system has to a particular stimulus. In the context of artificial touch or synthetic senses, perceptible reactions refer to the observable or measurable responses that a human or robot has to touch-related stimuli.

2a. Mechanical and electrical motion

Mechanical motion refers to the movement or displacement of an object caused by a force applied to it. This can include things like linear motion (movement in a straight line), rotary motion (movement in a circular or elliptical path), and oscillatory motion (movement that repeats regularly in a back-and-forth or up-and-down motion). Mechanical motion can be powered by various means such as manual force, springs, pneumatic or hydraulic systems, or electric motors.

Electrical motion, on the other hand, refers to the movement or displacement of an object caused by an electrical current flowing through it. Electric motors are the most common form of electrical motion, which convert electrical energy into mechanical energy. Electric motors can be classified into two types, AC and DC motors, depending on the type of current used to drive the motor. AC motors are powered by alternating current and DC motors by direct current.

Both Mechanical and Electrical motion can be used in the design of robotic systems, for example, to provide the robot with the ability to move, manipulate or interact with its environment. The choice between mechanical and electrical motion can depend on the specific requirements of the application, such as the type of movement needed, the available power source, or the desired level of control and precision.

2b. Sound and speech

Almost all recent social robots include internal loudspeakers and virtual speech synthesis software, allowing them to say anything they are programmed to say in a way that humans can understand. The major exceptions would be social robots meant to mimic the behavior of dogs and other animals through various vocalizations.

3. Strategy for successful HRI

Human-Robot Interaction (HRI) is an interdisciplinary field that focuses on the design, evaluation, and implementation of robot systems that can interact with humans in a natural and effective way. A successful HRI strategy involves several key elements:

User-centered design: The robot should be designed to meet the specific needs and goals of the users, taking into account factors such as user demographics, task requirements, and the physical and social environment in which the robot will be used.

Natural interaction: The robot should use natural and intuitive forms of interaction, such as speech and gesture, to communicate with users and respond to their commands.

Safety and security: The robot should be designed to be safe for human interaction, taking into account factors such as physical safety, data privacy, and security.

Transparency and trust: The robot should be transparent in its actions, providing users with clear and timely feedback about its status and intentions.

Flexibility and adaptability: The robot should be able to adapt to changing user needs, tasks, and environments, and should be able to learn and improve over time.

Evaluation and testing: The robot's performance and usability should be evaluated and tested with real users, in order to identify and address any issues before deployment.

Continuous improvement: The robot should be continuously monitored, evaluated, and updated based on user feedback and new research findings.

By implementing these key elements, organizations can develop robot systems that are natural, effective, safe, and well-accepted by users, which can lead to a successful HRI.

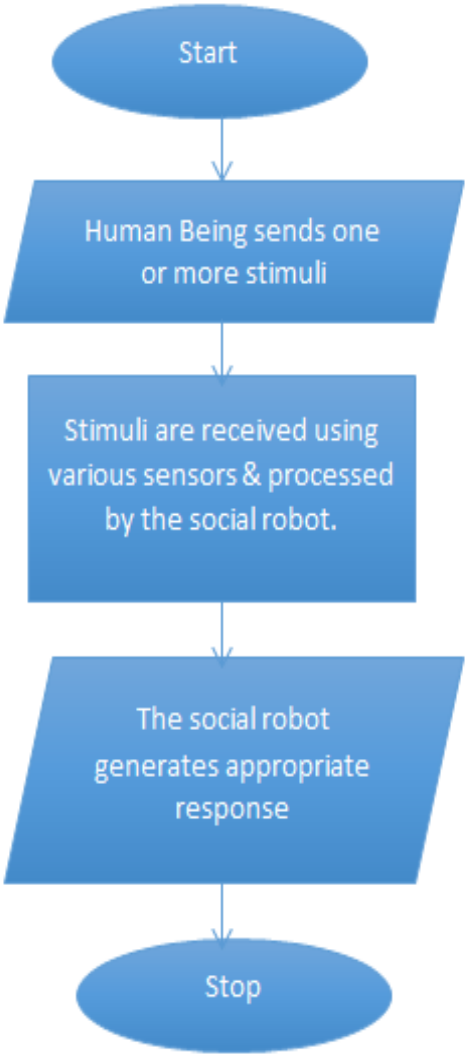

Figure 9 Human-Robot Interaction

We studied the various perception and attribution tools utilized by social robots and compared them as shown in Table 1. The number of perception & attribution tools is directly proportional to the efficiency of the social robot to combat various diseases

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Table 1 Perception and attribution tools used by various social robots

Perception and attribution tools	**Aibo**	**Aeolus**	**Buddy**	**Nao**	**Prof. Einstein**	**Pepper**	**Vector**	**Paro**	**Lynx**	**Universal robot**
Microphones	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time of flight sensor	✓					✓	✓			✓
Cameras	✓	✓	✓	✓	✓	✓	✓		✓	✓
Pressure/ Capacitive sensor	✓					✓	✓		✓	✓
Accelerometer & Gyroscope	✓								✓	✓
Motion Sensor	✓							✓		✓
Light Sensor	✓							✓		✓
LEDs	✓	✓		✓					✓	✓
Speaker	✓		✓	✓	✓			✓	✓	✓
Temperature Sensor			✓					✓		✓
Obstacle Detection/ Cliff Sensor			✓			✓	✓			✓
Touch Screen			✓							✓
Projector			✓							✓
Sonar				✓						✓
Contact Sensor				✓						✓
Force Sensitivity Resistor				✓						✓
Infrared Sensor					✓					✓
Tactile Sensor								✓		✓
Gravity Sensor									✓	✓
Chest Button				✓					✓	✓
PIR Sensor									✓	✓

RESULT

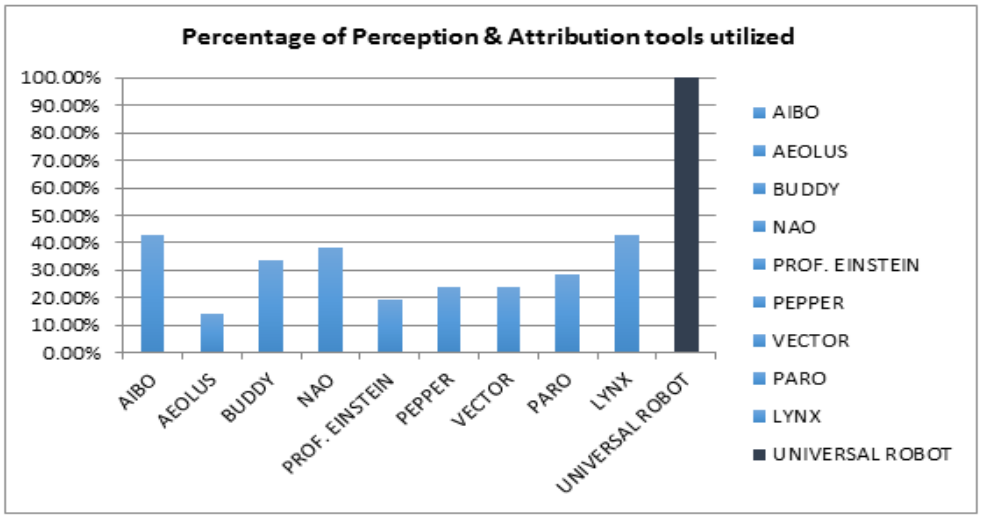
Total no. of perception & attribution tools identified- 21.

Percentage of efficiency based on number of perception & attribution tools utilized by different robots taken into consideration are illustrated in Table 2 & 3.

Table 2 Percentage of perception & attribution tools utilized by various social robots

Social Robot	Percentage of tools utilized
Aibo	42.86%
Aeolus	14.29%
Buddy	33.33%
Nao	38.10%
Prof. Einstein	19.05%
Pepper	23.81%
Vector	23.81%
Paro	28.57%
Lynx	42.86%
Universal Robot	100%

Table 3 Chart depicting percentage of perception & attribution tools used by various social robots



It is observed that the proposed universal robot will be 57.14% more efficient than its best perfoming oponents AIBO and LYNX as it will incororate all 21 perception and attribution tools making it suitable to be used for treatment and rehabilitation of a wide variety of diseases.

CONCLUSION AND FUTURE SCOPE

The Universal Robot proposed by us is an amalgamation of 21 perception and attribution tools which will make suitable for combating and assisting in a host of diseases. Looking at the statistics, the novel architecture of the proposed, Universal

Robot utilized 57.14% more perception and attribution tools as compared to its best perfoming oponents in this regard, namely AIBO and LYNX making it more efficient than others.

The ability to perform the function of an interactive social communicator and, therefore, to be a social robot is the most recent evolution of collaborative robots (historically suggested for collaboration with human beings). This new position has a lot of potential in terms of rehabilitation and assisting people with impairments, especially the elderly and disabled. SRs have shown significant promise in the care of the elderly and youngsters with communication disorders such as autism. We have recently seen increased activity in both scientific and therapeutic uses of SRs as a result of the COVID-19 epidemic. Once we think about SRs, and if we are concerned about the problems listed above, we must also consider the other aspect of the coin, which is that, during this pandemic season, a robot of this type might provide solutions to many issues faced in hospital environments, such as a lack of personnel. During a lockdown, many elderly and disabled persons are left totally alone in their houses, with no access to health care. Furthermore, even before the COVID-19 pandemic, there existed an issue of help for the old, fragile, crippled, sick, solitary, and ego. It is little question that robotics will play a major role in future health and care. The robots will aid in surgical operations, rehabilitation, building automation, hospital cleaning, serve meals and prescriptions, and provide general assistance. While it is true that robots cannot now communicate emotional states, they can do tasks in a precise and effective manner and might be of great assistance in dealing with handicap issues and other health-care issues. From just an economical perspective, it is highly intriguing for insurance firms in a variety of ways, including the prospect of establishing new insurance formulae centred on the use of care-robots, as well as the introduction of new policies that cover the risks associated with the use of robots. Similar to other artificial intelligence applications, a major element for the spread of SRs will undoubtedly be the opinion and acceptance of all concerned actors, ranging from physicians, nurses, and carers to clients and their companions. This book chapter is very useful for the researchers working in the same field.

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EFFECTS OF CLOUD COMPUTING ON NEXT GENERATION TECHNOLOGY

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ABSTRACT

Anticipating the future of any market isn't simple by any inspire bigger thoughts, numerous parameters are engaged with the procedure, however understanding the close past, the current patterns, and afterward utilizing those patterns to pick the imaginable bearing of the market is one approach to do it. The Mobility Management has been tended to by techniques utilizing Network conventions, for example, Mobile Stream Control Transport Protocol (mSCTP) and Mobile IPv6. There is devoted work centered on the examination of the two conventions. When thinking about cloud computing, specifically cloud infrastructure, performance matters. Cloud efficiency is actually calculated at the use of program and is actually the amount of networking efficiency, application performance, geographic proximity and cloud infrastructure performance. Achieving high speed delivery of uses in the cloud is actually a multifaceted struggle which calls for a holistic approach and an end-to-end view of the application request response path. In cloud computing network performance both within the cloud and out of the cloud is actually keeping the dependency on I/O access speed between the compute level and also the many tiers of information stores. Network and software performance isn't in the command of cloud provider, while for the infrastructure performance it's essential to recognize the elements which may have an effect on the access time of user and will add to the entire performance. Considering the benefits of reaction time in performance, this particular effort establishes the dependency of response time on different elements i.e. broker service policy, load balancing techniques, selection of information center, region of data center as well as number of user base in each information center. The main contribution of the existing work and the significance of it are to the current day computing scenario. Other than the recently referenced arrangement, there is another in regards to the association or separation of the gadget, in this sense, Handoffs can be additionally grouped in hard handoffs and delicate handoffs. It is viewed as a hard handoff when a MN disengages from its present system to interfaces with another totally outsider system, which implies there has not been any past enlistment and setup stage with this new system. This research has provided more interest on NIST definition of cloud computing which is commonly acknowledged including by cloud security alliance. Since, cloud computing is actually emerged from number of existing technologies we've talked about the prominent cloud enabling technologies.

CLOUD COMPUTING

Presently a days, cloud computing has gotten generally enjoyed. Cloud services gave by numerous organizations, for example, Amazon, Google, IBM, Yahoo and Microsoft, particularly for business customers. These services introduced on cloud supplier's virtualized servers are drawn closer over the Internet. Numerous organizations like utilizing these services, with no compelling reason to claim and keep up server framework The significant contrasts of cloud computing to the great leased servers are the agreements and installment models. In cloud services, client pays depending on utilized assets, for example CPU-hours, data stockpiling. Obtaining assets is dictated by current need.

Cloud computing makes virtual server frameworks accessible for organizations The purposeful preferred position is that business organizations don't need to purchase their very own equipment to make services accessible for their customers. In this way, end clients utilize inferred service rather than crude cloud service.

WHAT IS CLOUD COMPUTING?

Cloud computing isn't comprising of one section idea, it is a hypothetical term. Different cloud suppliers make various services accessible. To comprehend cloud computing, we need to show the contrast between four sorts of cloud services that exist as of now:

- Infrastructure as a Service (IaaS), gives low-level services like virtual machines which can be booted with a user-characterized hard circle image, for example Amazon EC2. Virtual hard circles that can be gotten to from various virtual machines are another case of infrastructure as a service.
- Platform as a Service (PaaS) implies that the cloud administrator gives an API which can be utilized by an application developer to create "number-crunching" applications or web applications with friendly user-interfaces. A case of Paas is Google's App Engine.
- Software as a Service (SaaS) is helpful for end-users. Models are web-based office applications like Google Docs or Calendar.
- Hardware as a Service (HaaS), this model is useful to the business organization users, since they don't have to submit in making and dealing with data focuses.

Clouds are an enormous gathering of virtualized resources capable and exceptionally advantageous to be utilized, for example, equipment, advancement stages as well as services. These resources described by ceaselessly and somewhat rebuild so as to accomplish the ideal variable load (scale), giving additionally the best demonstration of utilizing resources.

WHAT IS A GRID COMPUTING?

The meaning of the grid as a lot of resources composed to cooperate as parts of a mechanism or an interconnecting network not exposed to incorporated control to give a service noteworthy quality that isn't quick and simple to achieve ordinarily in different frameworks, by utilizing an open and standard interfaces and universally useful protocols.

DIFFERENCES BETWEEN CLOUD AND GRID

Resource Sharing

Grids give an improved method for asset pooling to ensure sharing resources decently, from one side of business organizations to the next. Notwithstanding, clouds make the resources that the service supplier requires accessible on demand.

Heterogeneity

One of the challenges is to find ways to establish an area data intensive programming and scheduling framework in heterogeneous. Heterogeneous hardware as well as software resources are assembled and maintained the gather by both cloud and grid models.

Virtualization

Asset heterogeneity upheld by grid services with interfaces, a huge individual asset pool comprises of virtualized aggregate of parts. In this manner, Virtualization covers data and computing asset. Be that as it may, cloud Computing includes the virtualization of hardware resources.

Security

Virtualization and security are related, since virtualization makes the total environments division conceivable. Hence, in clouds every user has his entrance to an individual virtualized condition unique in relation to other user. Notwithstanding, end user security isn't that big issue in grids. Besides, in a Virtual Organization all the accessible resources can be gotten to be approved delegate as a feature of security services.

High Level Services

Data transfer and metadata search are a portion of a couple of services gave by grid. If there should arise an occurrence of cloud, it is gravely influenced of a nonappearance of some elevated level services, which is by one way or another caused due to the lower level of development of the worldview. Thus, this sort of issues can be dealt with at the application level.

Architecture, Dependencies and Platform Awareness

Virtualization offers capacity to cloud applications engineering. Be that as it may, grids acknowledge just grid applications, along these lines forcing hard necessities to the developers.

Software Workflow

Service and employment arranged are characteristic nature of grids; they firmly propose reality of the need to execute in the best possible the mix of the services workflow and area which isn't fundamental in the event of on demand deployment as the one in the clouds.

Scalability and Self-Management

Developers are not controlled of having the option to deal with any adaptability issues in grids and cloud. Be that as it may, in grid, adaptability is for the most part getting the power by becoming bigger the measure of working hubs. By the by, clouds give the capacity of changing the size of virtualized hardware resources naturally. Furthermore, a powerful reconfiguration is essential in adaptability, as the framework scales any new necessities to be rebuilt by the framework itself. So self-administration just as adaptability is effectively done in the event of space with a solitary regulatory, yet numerous issues could be occurred outside organization area. However, the entire frameworks of grids don't have a solitary proprietor, that reason will place grids in troublesome condition. In the opposite side, clouds are worked by single organizations.

Usability

Clouds are convenient to use with an easy manner, the deployment details act in state of being concealed from the user.

Standardization

Grids have done a great deal of difficult work to prevail with regards to having institutionalization in the user and the internal interface which managing getting to resources. In any case, the user who has consent to move toward interface to the cloud which has frequently same standard technologies establishment, for example, in grids, anyway internal interfaces institutionalization is having a fundamental difficult issue.

These inside interfaces are being in hidden condition by the under takings, in this way hinder the advancement of the capacity of correspondence among various clouds and the reality of being conceivable of a worldwide organizations association of clouds.

A portion of the issues of testing the cloud's capacities, such as checking, stockpiling, Quality of Service, relationship between various organizations, and so forth has been overseen at before time by grids. Additionally, clouds present specific segments that call for institutionalization.

Payment Model

First endeavoring of grid was for the most part upheld by open financing while in the contrary side, cloud has been persuaded by business offers. In addition, grid services are charged utilizing a stabled rate for each service or inert resources shared by different organizations. In any case, cloud users are normally charged utilizing a compensation for every utilization model.

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Quality of Service

Grids are not giving the best Quality of Service level, because of its method for working by teaming up and dependent on asset sharing standards. Any grid application, in view of top of the grid needs to help any service, will be satisfied independent from anyone else. Mechanisms between infrastructure suppliers for Service-Level Agreements in the grid have been set. Be that as it may, Quality of Service existing as a fundamental element of numerous clouds, for example At this point, Amazon has attempted her best to have a decent Quality of service, e.g., 99.9% infrastructure uptime, by methods for fundamental Service-Level Agreements. Note that Amazon is free of any duty if there should arise an occurrence of intensity blackouts, framework disappointments or different interferences.

Similarities between Grids and Clouds

Grids need to build the blend of virtualization technologies to get a portion of the points of interest that clouds present commonly, for example, the quality of hardware level of being effectively extended or overhauled. What's more, grids need to make section indicates accessible in simple manner make a more extensive selection conceivable by end users, i.e., grids are a user friendly, virtualized and utility extended naturally, which appears without question a comparable qualities with current clouds. Besides, huge numbers of the current methodologies that combines grids and clouds, which can likewise be viewed as an association of more elevated level networking with virtualization created to a high level of unpredictability. Additionally, clouds offer a lot of highlights uncovered confined inside specific cutoff points.

CLASSIFICATION OF CLOUD COMPUTING

Numerous classifications of the cloud computing structured arrangement can be found, yet most were created and spoke to as indicated by the organizations which offer cloud services available to be purchased and not spoke to as indicated by big business IT, who purchases services of cloud and software.

Cloud Architecture

Cloud Architecture is the scheme of applications programs used to direct the operation of accessing on-demand service using Internet. They are basic on infrastructure which is used only when it is required that draw the needful resources on-demand and accomplish a specific job, then leave the unnecessary resources and often destroy them after the job has been completed. Figure 1.2 illustrates cloud architecture.

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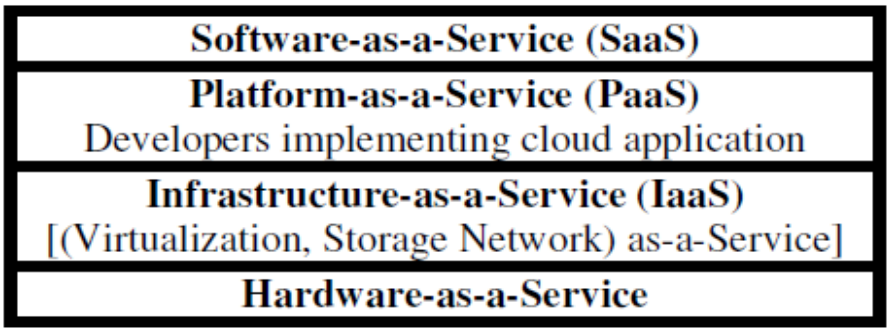

Figure 1.2 Cloud Layered Architecture

Cloud Architecture is the scheme of applications programs used to direct the operation of accessing on-demand service using Internet. They are basic on infrastructure which is used only when it is required that draw the needful resources on-demand and accomplish a specific job, then leave the unnecessary resources and often destroy them after the job has been completed. Figure 1 illustrates cloud architecture.

Basically clouds mode could be defined by four types:

Private cloud

Data and processes are controlled within the organization without that quite a bit of stressing regarding network bandwidth, security issues and common legal necessities of using cloud services through open and open networks may be required.

Public cloud

It explains the traditional way of cloud computing attitudes, through which resources are available on demand, over the Internet, using web applications or web services, from another supplier act as outsider who help on shares resources.

Hybrid cloud

The environment is made up of several internal and/or external providers.

Community cloud

Same cloud infrastructure shared by many organizations.

Virtualization Management

It is the technique that evacuates connecting together the hardware and operating framework. It directs to the wellspring of the logical resources abstraction away from their physical resources to be increasingly adaptable, lessen expenses and make a decent improvement in business value.

Essentially virtualizations in cloud have so many various sorts, for example, network virtualization, server virtualization and storage virtualization. Server virtualization can be portrayed as an associating of single physical resources to several logical partitions or representations.

In a virtualized environment, computing environments can be delivered in a strong dynamic manner, enlarged, become smaller or go in a predefined direction or manner as demand varies. Virtualization is therefore exceptionally suitable to a dynamic cloud infrastructure, because it gives important advantages in isolation, manageability and sharing.

Fault Tolerance

In case of not achieving the ideal end, there will be a duplicate of instance of the application which is completely prepared to take over without delaying or intruding on the continuity is called failover. A period when Cloud computing service is not available extends into the more exceptionally unpretentious version of cloud service platforms. The main issue for cloud computing is the way to decrease any sort of outage failover to give the reliable services.

Security

Usually security is the most important issue as far as data, infrastructure and virtualization and so on. Group of information is a competitive asset, yet it often consists of information of customers, consumers and workers that, in the wrong hands, could create a common obligation and perhaps criminal charges. Cloud computing can be made secure yet verifying cloud computing data is a contractual issue as well as a technical one.

Load Balancing

Load balancing is often used to perform failover-the state of a service of remaining in a particular condition considerably after the failure of at least one of its components. The qualities of components are checked always and when one becomes non-responsive, the load balancer is aware and never again transmits traffic to it. This is inherited feature from grid-based computing for cloud-based platforms. Vitality keeping and asset used are not always the main issue when talk about cloud computing; anyway with legitimate load balancing in place asset used can continue to be to a base. This is not just serves to maintain costs low and enterprises; it also lessens weight on the circuits of each individual box, making them conceivable however not yet actual last longer. Load balancing also engages other important features, for example, scalability.

Scalable Data Storage

Cloud storage engages customer to store data into the cloud without stressing over how it is stored or backing it up. The main issues related to cloud storage are reliability and security. Customers are not prone to endow their data to another company without a guarantee that they will have the option to access their information whenever they want and nobody else will have the option to get at it.

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CLOUD CHALLENGES

Security and Privacy

Putting data, running software at someone else's hard disk, and using someone else's CPU appears to be hard when you consider. In addition, using multi tenancy model created greater security issues to be comprehended, for example, shared resources on the same physical machine, and the other issue is that in cloud great and bad users could share resources and may share the same network address then any bad behavior will affect them all which is going to damage the reputation of many great users on cloud.

Costing Model

Moving towards cloud decreases the infrastructure cost, and yet it raises the expense of data communication. In this case, any transactional applications may not be suitable for cloud computing. In any case, on-demand computing makes sense only for CPU escalated jobs.

Charging Model

Cost calculations based on consumptions of static computing, and the unit of cost analysis is an instantiated virtual machine. In any case, in SaaS cloud suppliers, the cost they offer for creating multi-tenancy could be over the top expensive.

Service level agreement

It is a negotiation between the cloud suppliers and consumers, to obtain guarantees from suppliers on service delivery.

Power

Cloud computing gives distinctive sort of services to satisfy the necessities of consumers, gigantic power are consumed. A smart vitality framework for asset management is energetically recommended.

BENEFITS OF CLOUD COMPUTING

Cloud computing has existed for around 2 decades and despite the data indicating the business efficiencies, cost benefits, and competitive advantages it holds, a great portion of the business community continues to run without it. Based on an examination by the International Data Group, sixty nine % of companies are already using cloud technology in one capacity or perhaps another and eighteen % say they plan to execute cloud computing solutions later or sooner. At the same time, Dell reports which companies that will put resources into security, mobility, cloud, and big data appreciate up to fifty three % faster income development than the competitors of theirs. As this data appears, an increasing number of tech savvy businesses and industry leaders actually perceive the numerous advantages of the cloud computing trend. At any rate, more than that, they're making use of this technology to all the more effectively run the organizations of theirs, better serve the customers of theirs, and dramatically increase the overall profit margins of theirs. All this seems to indicate that provided the apparent guidance in

which the company is actually moving, there is never been a better time to get the head of yours in the cloud.

Cloud computing is actually a term which has gained widespread using in the course of the last barely any years. With the exponential increase in data utilize that has accompanied society's transition into the digital 21st century; it's turning out to be increasingly more difficult for organizations and individuals to hold all of the important info of theirs, programs, and frameworks going on in house computer servers. The solution to this matter is actually one which has existed for nearly as long as the internet, yet that have just as of late gained widespread application for businesses.

Cloud computing operates on a similar standard as web based email customers, allowing users to use all of the features and records of the framework and never have to keep the heft of that framework on their own computers. In reality, a good many individuals already utilize a number of cloud computing services without realizing it. Gmail, TurboTax, Google Drive, and also Instagram and Facebook are all cloud based applications. For many of these services, users are actually sending their private data to a cloud facilitated server that stores the info for later access. And as useful as these apps are actually for personal use, they are much progressively valuable for businesses that ought to have the choice to access large amounts of data over a safe, online network connection.

For instance, workers are able to access customer info via cloud based CRM software as Sales power from the smartphone of theirs or perhaps tablet at home or even while traveling, and can easily share that info with other authorized parties anywhere in the world. In almost any case, you will find those leaders that are actually remaining hesitant about committing to cloud computing solutions for the organizations of theirs. Along these lines, we would prefer to take a few moments and share twelve business benefits of cloud computing.

- **Cost Savings:** On the off chance that you're stressed over the price tag that would accompany making the switch to cloud computing, you are not alone twenty % of organizations are actually worried about the original cost of executing a cloud based server. Be that as it may, the people that are trying to gauge the pros and cons of using the cloud need to think of a larger number of factors than just initial price they've to consider ROI. Once you are on the cloud, access that is quick to your company's data will help save money and time in venture startups. And, for the people that are worried that they will end up paying for features that they neither need nor want, most cloud computing services are actually pay as you go. Which means that on the off chance you do not take advantage of what the cloud has to offer, and then at least you will not have to be dropping money on it The pay-as-you-go framework also applies to the data storage space expected to service your customers and stakeholders, meaning that you will get exactly as a wide range of

space as you need, and not be charged for virtually any space that you do not. Taken together, these factors bring about lower costs and more significant yields. Half of all CIOs and IT leaders studied by Bit glass announced cost savings in 2015 due to using cloud based applications.

- **Security:** Many companies have security concerns when it comes to adopting a cloud computing solution. All things considered, when records, programs, and other data are not kept safely onsite, how might you realize they're being secured? In the event that you are able to remotely access the data of yours, then what is stopping a cybercriminal from doing likewise? Indeed, quite a bit, really. For starters, a cloud host's all day job is usually to carefully monitor security, which is much more effective when compared to a conventional in house framework, where an organization must gap its endeavors between a myriad of IT concerns, with security being just one of them. Even though most companies do not prefer to straightforwardly consider the possibility of internal data theft, truly a staggeringly high percentage of data thefts happen internally and are actually perpetrated by workers. When this's the situation, it is able to be a lot safer to keep sensitive info offsite. Naturally, this's all extremely abstract, so how about we consider some strong statistics. Rapid Scale claims that ninety four % of businesses saw an improvement in security after switching to the cloud, and ninety one % said the cloud makes it easier to meet government compliance prerequisites. The way in to this amped up security is actually the encryption of information being transmitted over networks and stored in databases. By utilizing encryption, info is less accessible by anyone or hackers not authorized to see the data of yours. As an additional security measure, with most cloud based services, diverse security settings can be set based on the user. While twenty % of cloud user claims disaster recuperation in 4 hours or even less, just nine % of cloud users could get the same.
- **Flexibility:** Your business has only a limited amount of center to separate between all of its duties. On the off chance that your current IT solutions are actually compelling you to commit to a lot of your attention to computer and data storage issues, then you will not have the choice to focus on reaching satisfying customers and business goals. On the other hand, by depending on an outside organization to take care of all IT facilitating and infrastructure, you will have much more chance to dedicate toward the aspects of the business of yours that directly impact the profits of yours. The cloud offers businesses greater flexibility overall as opposed to facilitating on a local server. And, on the off chance you want extra bandwidth, a cloud based service is able to satisfy that need instantly, instead of experiencing a perplexing (and costly) update to your IT infrastructure. This improved flexibility and opportunity is able to make a major contrast to the overall effectiveness of the business of yours. A sixty five % majority of respondents to an InformationWeek

review said "the ability to quickly satisfy business needs" was just about the most important reasons a business should move to a cloud environment.

- **Mobility:** Cloud computing allows mobile access to corporate data via smart phones and gadgets, which, considering more than 2.6 billion smart phones are now being used globally today, is actually a good way to make sure that nobody is ever let well enough alone for the circle. Staff with occupied timetables, or perhaps who live a long way away from the company office, can easily go through this feature to keep instantly to date with collaborator and customers. Through the cloud, you are able to offer conveniently accessible info to sales staff who travel, freelance representatives, or perhaps remote representatives, for better work life balance. Consequently, it is not surprising to see that organizations with worker satisfaction listed as a priority are actually up to twenty four % bound to expand cloud usage.
- **Insight:** As we move ever more into the digital age, it is turning out to be clearer and clearer that the usual adage "information is actually influence" has taken on the more accurate structure and current day : "Data is actually money." Hidden within the millions of bits of data that encompass your customer transactions and business process are actually pieces of invaluable, actionable info simply waiting to be recognized and acted upon? Obviously, filtering through that data to discover these parts may be very troublesome, except in case you've a chance to access the correct cloud computing solution Many cloud based storage solutions offer integrated cloud analytics for a bird 's eye perspective on the data of yours. With your info stored in the cloud, you are able to easily actualize manufacture and tracking mechanisms customized reports to analyze info organization wide. From those bits of knowledge, you are able to boost efficiencies and fabricate action plans to meet organizational goals. For instance, the beverage company Sunny Delight was in a position to boost profits by aproximatelly two dolars million a year and slice $195,000 in staffing costs through cloud based business bits of knowledge.
- **Increased Collaboration:** On the off chance that your business has 2 workers or perhaps progressively, then you ought to make collaboration a high priority. All things considered, there is not a large amount of point to getting a group on the off chance that it's not able to work as a team. Cloud computing makes collaboration a straightforward procedure Team individuals are able to view and share info safely and easily across a cloud based platform. Some cloud based services even give collaborative social spaces to connect representatives across the organization of yours, therefore increasing engagement and interest. Collaboration might be conceivable without a cloud computing solution, however, it won't ever be as easy, or perhaps as effective.
- **Quality Control:** On the off chance that your business has 2 specialists or perhaps continuously, then you need to make collaboration a high priority. All things

considered, there is not a good deal of point to getting a group on the off chance that it's not able to work as a team. Cloud computing makes collaboration a straightforward technique Team individuals are able to view and share info safely and easily across a cloud based platform. Some cloud based services even give collaborative social spaces to connect representatives across the organization of yours, therefore increasing engagement and interest. Collaboration might be conceivable without a cloud computing solution, however, it won't ever be as easy, or perhaps as amazing.

- **Disaster Recovery:** One of the factors which contribute to the achievement of a business is actually control. Unfortunately, regardless of how in control the organization of yours could be when it goes to its very own processes, there'll always be things which are totally out of the control of yours, and in today's market, even a tiny amount of ineffective personal time is able to have a resoundingly negative impact. Private time in your services leads to lost productivity, income, and brand reputation.
- **Loss Prevention:** On the off chance that your business is not putting resources right into a cloud computing solution, then every one of your precious data is inseparably attached to the office computers it dwells in. This might not seem to be a concern; however the truth is the fact that in case your local hardware encounters an issue, you might end up permanently losing the data of yours. This's a far more widespread issue than you may realize computers can malfunction for reasons that are numerous, from viral infections, to age related hardware deterioration, to straightforward user mistake. Or perhaps on the other hand, despite probably the best of intentions, they are able to be misplaced or perhaps stolen (more than 10,000 laptops are actually accounted for lost each week at major airports).If you are not on the cloud, you are at risk of losing all of the info you'd saved locally. With a cloud based server, nevertheless, all the info you have uploaded to the cloud continues to be safe and easily accessible from any computer with an internet connection, regardless of whether the computer you regularly use is not working.
- **Automatic Software Updates:** For the people that have a great deal too complete, there is not anything more annoying than being forced to wait for framework updates to be put in. Cloud-based applications automatically revive and update themselves, rather than constraining an IT department to play out a manual organization wide update. This saves valuable IT staff time and money spent on outside IT consultation. PC World lists that half of cloud adopters cited requiring less internal IT resources as a cloud benefit.
- **Competitive Edge:** While cloud computing is actually increasing in popularity, there are as yet the people that wish to keep everything local. That is the choice of theirs, however doing so places them at a clear disadvantage when rivaling the people that

have the advantages of the cloud readily available. In the event that you actualize a cloud based solution before the competitors of yours, you will be further along the learning bend when they catch up. An ongoing Verizon study indicated that seventy seven % of businesses feel cloud technology gives them a competitive advantage, and sixteen % accept this advantage is actually significant.

- **Sustain ability:** Given the existing state of the environment, it is never again enough for organizations to place a reusing canister in the break room as well as claim that they are doing the part of theirs to support the earth. Real sustainability requires solutions that address wastefulness at each level of a company. Facilitating on the cloud is actually all of the more earth friendly and results in to a lesser extent a carbon impression. Cloud infrastructures bolster environmental proactively, controlling virtual services rather compared to actual physical things and hardware, and eliminating paper waste, improving vitality proficiency, and (given it allows workers access from anywhere with an internet connection) decreasing suburbanite related emissions. A Pike Research report anticipated data focus vitality consumption is going to drop by thirty one % from 2010 to 2020 based on the adoption of cloud computing along with other virtual data options.

CURRENT PLAYERS

Amazon Elastic Compute Cloud (Amazon EC2)

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that makes the availability of compute capacity to be resizable in the cloud. It is reason to make web-scale computing a lot of easy for developers. Amazon EC2's straightforward web service interface gives customers permissions to get and configure capacity with least conflict. It gives customers the ability of the unlimited authority of their computing resources and allows them run on Amazon's computing environment. Amazon EC2 limit the time expected to get and boot new server instances to minutes, enabling customers to scale capacity without delay, both here and there, as their computing necessities change. Amazon EC2 alters the economics of computing by let customers to pay only for capacity that they really use. Amazon EC2 supplies developers the tools to fabricate failure recuperation applications and separate themselves from usual failure scenarios. Figure 1.3 has given an EC2 framework use pattern.

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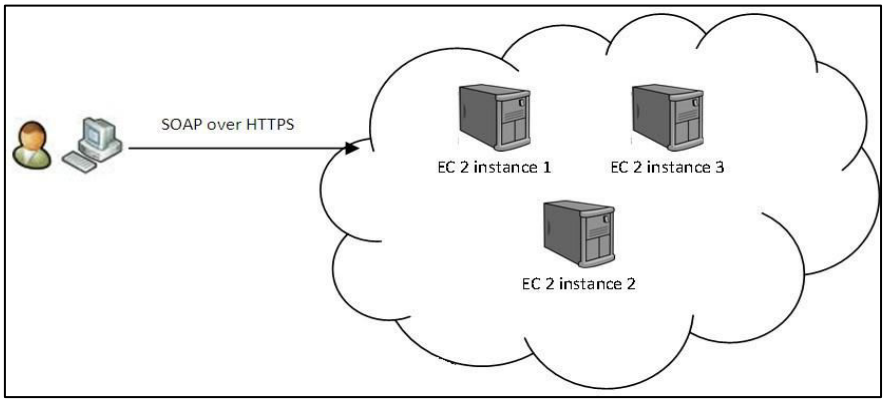

Figure 1.3: Usage of Amazon Elastic Compute Cloud

Amazon EC2 Functionality

Amazon EC2 presents a reliable virtual computing environment, giving customers permissions to utilize web service interfaces to start instances with an alternate sort of operating frameworks, load them with their custom application environment, control the utilization of their network's access permissions, and operate their image using as many or barely any frameworks as they demand.

Services in Amazon EC2

- Elastic: increase or decrease capacity within minutes, not hours or days.
- Completely Controlled:
  - Complete control of instances.
  - Having root access to each one.
- Flexible: having the decision of numerous instance types, operating frameworks, and software packages.
- Designed for use with other Amazon Web Services
- Reliable: The Amazon EC2 Service Level Agreement commitment is 99.95% availability for each Amazon EC2 Region.
- Secure: gives various mechanisms to verifying customer computer resources.
- Inexpensive: paying a low rate for the compute capacity consumed.

Features of Amazon EC2

- Amazon Elastic Block Store: offers persistent storage for Amazon EC2 instances.
- Multiple Locations: place instances in multiple locations.
- Elastic IP Addresses: static IP addresses intended for dynamic cloud computing associated with the account not a particular instance.

- Amazon Virtual Private Cloud: secure and seamless extension between a company's existing IT infrastructure and the Amazon Web Service cloud.
- Amazon Cloud Watch: a web service that gives monitoring to AWS cloud resources.
- Auto Scaling: scale capacity up or down.
- Elastic Load Balancing: distributes approaching application traffic across multiple instances.
- High Performance Computing (HPC) Clusters: Cluster Compute and Cluster GPU Instances have been intended to help high performance network capability.
- VM Import: virtual machine images will be imported from an existing environment to Amazon EC2 instances.

Microsoft Windows Azure

Microsoft Windows Azure is based on cloud computing. Running applications and storing data on machines in data focus accessed via the internet can give a ton of advantages. However any place customers run, applications are incorporate as part of platform. For on-premises applications, for example, customers running in the internal side of an organization's data focus, this platform normally contains an operating framework used to store data and perhaps more. Applications running in the cloud require a particularly alike foundation. Giving this is the goal of Windows Azure. Part of the larger Windows Azure platform, Windows Azure is the basis on which a running storing data and applications in the cloud stands. Figure 1.4 illustrates this idea.

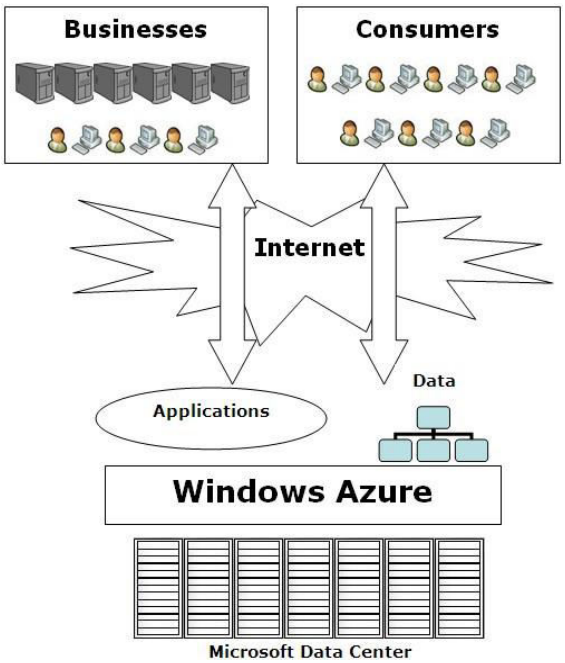

Figure 1.4 Windows Azure Applications Run In Microsoft Data Centers and Are Accessed Via the Internet.

Rather than making software available that Microsoft customers can install and run themselves on their own computers, Windows Azure today is a service: Customers use it to operate applications and store data on Internet-accessible machines belonging to Microsoft. Those applications may make services available to businesses, to consumers, or both. Here are a few examples of various types of applications that can be incorporating as part of Windows Azure:

1. An independent software vendor (ISV) could generate an application to reach business users, an approach that's by and large mentioned as Software as a Service (SaaS). Windows Azure was planned to help Microsoft's own SaaS applications, so ISVs can also utilize it as a basis for an alternate sort of business-situated cloud software.
2. An ISV may create a SaaS application that makes a target of consumers rather than businesses. Because Windows Azure is planned to maintain entirely scalable software, a business that chooses to concentrate on a big market, for example, consumer market, may well choose it as a platform for another application.
3. Enterprises will have the option to utilize Windows Azure to create and run applications which will be used by their very own representatives. While this case perhaps won't require the enormous scale of a consumer-facing application, the ability of Windows Azure to play out its required functions under stated conditions for a predetermined timeframe and capability of being manage or controlled, could at present make it an attractive decision.

To support cloud applications and data, Windows Azure has five components, as Figure 4 shows.

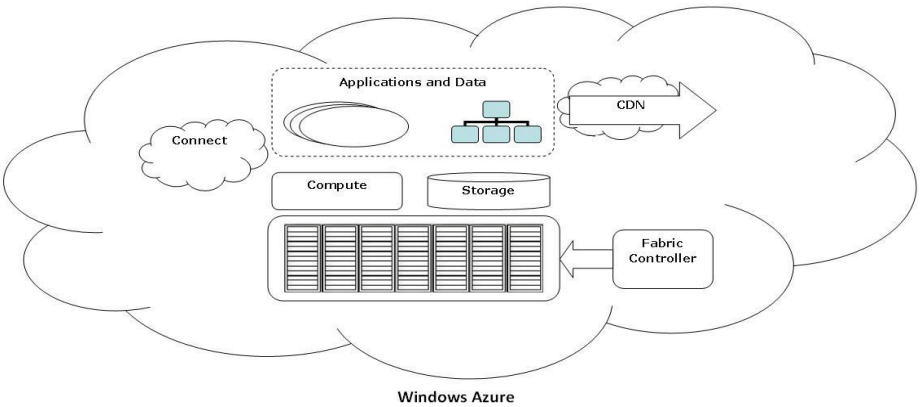

Figure 1.5 Windows Azure Has Five Main Parts

Those components are:

1. Compute: runs applications in the cloud. Those applications largely observe a Windows Server environment, although the Windows Azure programming model isn't exactly the same as the on-premises Windows Server model.

2. Storage: stores binary and organized data in the cloud.
3. Fabric Controller: sends, manages, and monitors applications. The fabric controller also handles updates to framework software all through the platform.
4. Content Delivery Network (CDN): accelerates global access to binary data in Windows Azure storage by maintaining cached duplicates of that data around the world.
5. Connect: allows creating IP-level connections between on-premises computers and Windows Azure applications.

THE FUTURE OF CLOUD COMPUTING

There was an examination made by the Pew Research Center's Internet and American Life Project and Elon University's Imagining the Internet Center. That review shows that around 71% agreed with the statement: "By 2020, a great many people won't do their work with software running on a general-reason PC. Instead, they will work in Internet-based applications, for example, Google Docs, and in applications run from smart phones. Aspiring application developers will produce for Smartphone vendors and companies that give Internet-based applications, because most innovative work will be done in that domain, instead of planning applications that sudden spike in demand for a PC operating framework." On the opposite side, around 27% agreed with the statement: "By 2020, a great many people will even now do their work with software running on a general-reason PC. Internet-based applications like Google Docs and applications run from smart phones will have some functionality, however the most innovative and important applications will run on (and spring from) a PC operating framework. Aspiring application creators will write for the most part for PCs."

The greater part of those opinions, investigated by asking gathering of individuals questions, noticed that cloud computing is proceeding to enlarge and coming to control information procedures because it displays a ton of advantages, enabling users to access tools and information which they need anywhere and anytime exceptionally easy, instant, and individualized from any networked gadget. In addition, many specialists accepted that individuals in technology rich environments will have the option to access to exceptionally mind boggling and complicated yet affordable local networks that give them permissions to have the cloud in their homes.

The vast majority of the specialists accepted that individuals like to have many and more options of using various gadgets to have the option to access data and applications, and - in addition to the many alludes that smart phones motivating the transition to the cloud and some alluded to a future featuring so many sorts of networked appliances. A couple alluded the internet associated with everything in which almost every articles have a one of a kind IP addresses and can be integrated as individuals now a day's integrated by the internet.

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DESIGN AND DEVELOPMENT OF SECURITY MECHANISM BASED ON ANONYMITY AND ACCESS CONTROL STRATEGY FOR PERVASIVE COMPUTING ENVIRONMENT

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ABSTRACT
Pervasive computing environment provide data collection, computing, and communication services to the users all the time and everywhere. It has introduced a new world of computing and became an integral part of many fields and application domains. In spite of being an integral part of many domains, communication in pervasive computing, is associated with some security risks. For sensitive and confidential data there should be some security mechanisms. To solve the security issues and to increase communication reliability a security mechanism based on anonymity and access control is proposed in this paper.

Keywords: Privacy Preserving, Pervasive Computing Environment, Access Control, Authentication, Anonymity.

1. INTRODUCTION
Pervasive computing aims to provide proactively adapted services to both user and applications according to the global context. The main characteristic of devices in such system is their context awareness. Since its apparition, pervasive computing has required tools (architectures, frameworks and middleware), methods and concepts to support the development of a context-aware system and ease their design and implementation [9]. Pervasive computing is an advanced computing environment that allows users to get services anytime and anywhere. Pervasive computing possesses the promise of simplifying daily life by integrating mobile devices and digital infrastructures into our physical world. In such environment, users can interact with the system by using laptop computers, tablets, mobile phones and terminals in everyday objects. The underlying technologies to support pervasive computing include Internet, advanced middleware, operating systems, microprocessors, sensors, wireless communication, cloud computing, mobile computing and so on. While pervasive computing provides a great convenient access to relevant information and applications, it also brings a lot of research challenges. One of the important issues is the security due to all the characteristics of the environments, such as heterogeneity, openness, mobility and dynamicity [10]. Access control mechanism is an acceptable approach in security domain to allow legitimate users to access different resources in the secure manner. Typically, access control deals only with authorization decision on users request to access the target resources. The objective of access control is to prevent from

unauthorized disclosure (confidentiality), avoid improper malicious modifications (integrity), and ensure the access for authorized entities (availability) [11].

The vital requirement of pervasive users was the service concentration; the users expect service reliability in these ubiquitous computing environments. Pervasive computing systems provided access to heterogeneous resources in the form of services. The services were accessed through the communication networks by binding the communication interfaces of different service systems and underlying networks [12]. Pervasive computing systems were distributed and provided access across different computing environment to satisfy user demands. Concurrent user access, service compositions, query processing, resource allocation and sharing were functions provided in the pervasive environment. Traditional computing security is based on authentication and access control techniques to provide services only to users who have already registered to the system. In pervasive computing this approach is no longer suitable. This is because the flexibility and scalability of the ubiquitous computing environment lead to have a huge number of entities (users or devices) not always known in advance from the service provider perspective. So, in pervasive computing a more sophisticated access control mechanism is needed to grant access based on user identity, context and behavior. Moreover, due to the dynamic nature of the pervasive environment, where the services can constantly change, dynamic policies able to take into consideration the privacy of the user's sensitive information are required. In addition, more distributed security architectures are needed, such as keeping uniform security policies across the distributed components of the architecture.

2. LITERATURE REVIEW

Authors	Methods	Advantages	Disadvantages
Fouad, H *et al.*[1]	Distributed and scalable computing framework (DSCF)	Minimize request failures and backlogs and improve storage utilization under controlled response time.	Not applicable for concurrent heterogeneous applications.
Li, F *et al.*[2]	Deniable authentication protocol	Speed up the verification of authenticators	Devise complex computations.
Sharghi, H. and Liscano, R [3]	Session initiation protocol	Handling different kinds of obligations.	Failed to utilize event processing technology to capture the dynamic nature of user’s

			actions.
Wang, G. *et al.*[4]	Privacy-preserving localization (EPPL) algorithm	Achieves a comparable privacy preservation strength	Failed to address anchor location privacy preservation problem in the face of colluding nodes.
Magkos, E. and Kotzanikolaou, P [5]	RL scheme	Provides improved security and efficiency.	Perform expensive exponentiations and has no storage limitations.
Hoda, M *et al.*[6]	Extensible Context Ontology for Persuasive Physical-Activity Applications (ECOPPA)	Useful for checking the feasibility of system.	Computational time increases with respect top number of instances.
Chandramohan, D *et al.*[7]	Hybrid authentication technique	Maintain the confidentiality of cloud user's data.	Failed to employ advance policy for improving performance.
D'Angelo, G *et al.*[8]	Apriori Association Rules Learning and Bayesian Classification	Capable to recognize the tactics used by the malicious entities.	Failed to recognize unfair recommenders.
Hooda, M *et al.*[9]	Security techniques	Used for maintaining the security and privacy.	Failed to adapt higher-level protocols for improving performance.
Djedid, M. and Chouarfia, A [10]	Authentication protocol	Increase the anonymity set for a better requests obfuscation.	Cryptography is often not supported by pervasive systems

2.1. Challenges

- In a massive pervasive computing environment; managing resources, networks and users were a complex task as either of them was subjected to change with respect to availability. The extent of flexibility and interoperability was limited with the growing density of devices and end user requests [1].

- In [2], two heterogeneous deniable authentication protocols is devised for pervasive computing environments using bilinear pairings. However, due to the high mobility in pervasive computing environments, communicating devices often roam into different domains. Since all of existing deniable authentication protocols are homogeneous, it is not practical to use these protocols in the pervasive computing environments.
- Access control is concerned with the problem of granting access to resources and services, but controlling the activities of authenticated and authorized users is not in charge of the traditional access control systems after granting permission. Furthermore, traditional access control models do not work properly in pervasive computing environment because such an environment is dynamic and sensitive to contextual information as well as pervasive computing applications usually do not have well-defined security perimeter [3].
- In existing techniques, the ubiquitous environment has a combination of devices and systems. In the literature few authors proposed a framework and techniques to handle the privacy issue, uninterruptedly to preserve the user's confidential data stored in cloud environment [7].
- Traditional computing security is based on authentication and access control techniques to provide services only to users who have already registered to the system. In pervasive computing this approach is no longer suitable. This is because the flexibility and scalability of the ubiquitous computing environment lead to have a huge number of entities (users or devices) not always known in advance from the service provider perspective [8].

3. PROPOSED METHODOLOGY

The primary intention of this work is to design and develop the authentication-based access control mechanism and privacy-based k-anonymization technique in pervasive computing environment for providing a tradeoff between privacy and access control. This work designs a model for the mutual authentication of the data user and data owner in the system considering two phases.

In first phase, the authentication-based access control mechanism will be developed to enhance security by achieving conditional traceability of user credentials. In a PCE, a mobile user dynamically accesses a service among a list of available service types. Here, users, front-end entities, back-end authorities, session keys, server hashing function, and a Trusted Third Party (TTP) will be employed. Users are equipped with hand-held devices and request access to different kinds of services at anytime and from anywhere. The Front-end entities are wireless Access Points (APs) that handle the communication with the user, and collect the service request messages and mediate between the user and a back-end authority. The Back-end authorities involve an

application Service Provider (SP) and an authentication server (AS). The task of the SP and the AS is to provide the service data to authorized users. The proposed authentication and access control strategy involves seven different phases, namely user registration, service prioritization, TTP initialization, Set-up phase, authentication, token generation and control and delivery phase. In user registration phase, each user participates in the registration protocol with the TTP, in order to issue their pseudonymous certificates. The service prioritization phase eases implementation on the basis of market attractiveness and helps product managers identify which products or services can achieve a higher market share and higher profit margins balanced against organizational effort. The initialization of TTP is done in TTP initialization and the setup phase is run by the data owner which takes the input as the security parameter and generates the system master key and public parameter and then the authentication will be performed amongst the users and TTP. Next, the tokengen phase is executed to generate the search token. The control setup is the additional phase used in this proposed data sharing framework for providing access controls. The implementation of the proposed approach will be in PYTHON. The performance of the proposed approach will be evaluated using three metrics, such as security functionalities, communication cost and time and the results attained will be compared with that of existing works [1], [2], and [5].

In the second phase, the privacy-based k-anonymization strategy will be developed for maintaining the privacy of data. Here, the Crow-based Water wave optimization (CWWO) will be devised for privacy preserved collaborative data publishing in which a C-togetherness parameter will be utilized as an alternative of C-mixture in [13]. The proposed CWWO will be designed by integrating Water wave optimization (WWO) [14] and Crow Search algorithm (CSA) [15]. Initially, the privacy constraints will be verified for all the records in order to check whether the privacy constraints are satisfied. When it is found that the privacy measures of the data are not satisfied, the C-togetherness value will be adjusted. The adjustment of the C-togetherness value will be carried out using the metaheuristic optimization algorithm, CWWO that determines the best record that preserves the privacy. The record with the better privacy is selected for publishing so that the data selected does not provide any possibility for linking the individual information. The C-togetherness parameter enhances the privacy of the data if the data does not satisfy the privacy constraints, such as the k-anonymity, l-diversity and the m-privacy. The privacy of the data is preserved using a parameter C termed as the C-togetherness. The C-togetherness is the measure of the privacy of the published data that modifies the three privacy measures. Any data that is published should satisfy the constraints to ensure the privacy of the data. A minimum fitness value will be maintained that depends on the minimum value of the generalized information loss and the minimum value of the average equivalence class size. The minimum value of the fitness ensures the maximum utility and the maximum privacy. The minimum value of

the fitness ensures the maximum utility and the maximum privacy. The implementation of the proposed approach will be in PYTHON. The performance of the proposed approach will be evaluated using three metrics, such as generalized information loss and the average equivalence class metric and the results attained will be compared with that of existing works [1], [2], and [5]. Figure 1 illustrates the proposed CWWO algorithm for privacy preserved collaborative data publishing.

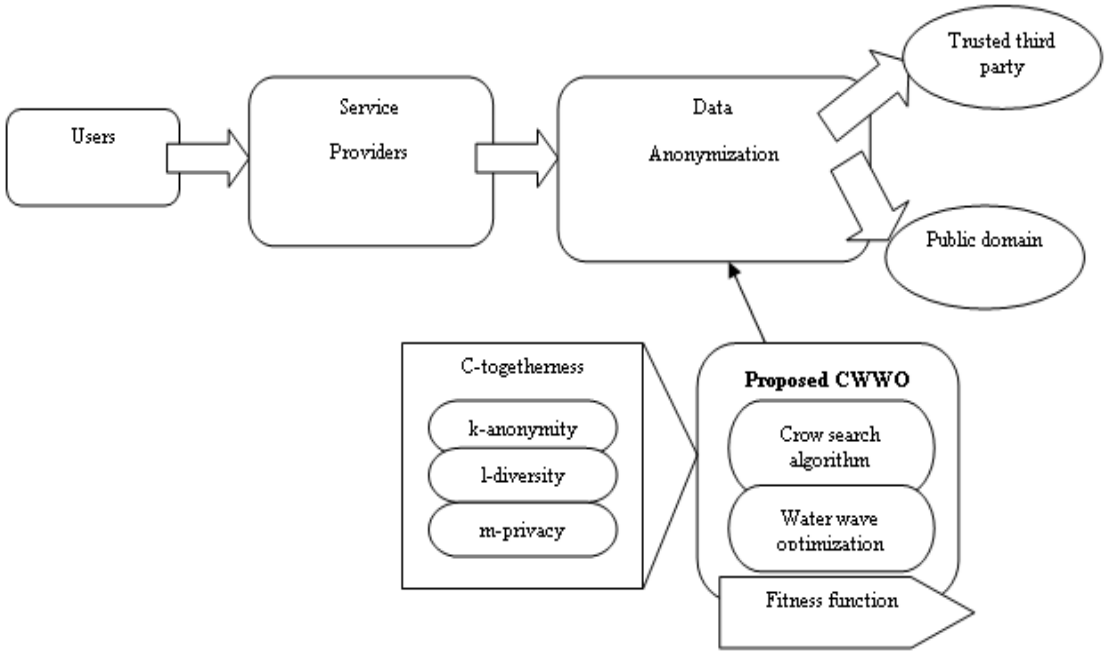

Figure 1: Schematic view of proposed CWWO algorithm for privacy preserved collaborative data publishing.

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TO INVESTIGATE AND ANALYZE BIG DATA CLUSTERING FOR CUSTOMERS REQUIREMENT USING HADOOP

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ABSTRACT

In the modern business environment, it's essential to have a system in place for analyzing massive amounts of data quickly. This necessitates giving thought to both the customer's wants and the customer's ability to pay. Big data includes both structured and unstructured data, including information from online retailers like Amazon and Flip kart. Controlled information organization is a prerequisite in every data handling system. The increasing demands of big data make it necessary to study the mechanisms behind big data clustering. Present paper is considering the research work related to big data and clustering. It has been observed that conventional research did limited work in area of big data clustering where commercial application focuses on customer requirement. However, Hadoop is the most frequently used platform to analyze big data. But there is need to introduce more scalable, flexible, efficient and high performance big data clustering mechanism for customer requirement analysis.

Keyword: Big data, Clustering, Hadoop, Customer Requirement analysis.

[1] INTRODUCTION

1.1 Big Data

In the modern business environment, it's essential to have a system in place for analyzing massive amounts of data quickly. This necessitates giving thought to both the customer's wants and the customer's ability to pay. Extra deals are made available to customers based on this information. Recognizing the kind and amount of data is also important since it may alter a company's output. Whether it's via e-mail, Facebook, WhatsApp, Instagram, Twitter, or any other source, big data includes it all. Controlled information organization is a prerequisite in every data handling system.

When talking about big data, it's crucial to realize that users must include all data sources that would provide a comprehensive view of their organization and examine how the data affects the way their firm is run. In the past, a relational database was the go-to for storing and organizing the highly structured data needed for operational purposes. However, in light of recent developments, businesses must realize that operational data now needs to include a wider range of data sources, including unstructured sources like customer and social media data in all its forms. In the realm of big data, the user has uncovered new methods of data management, such as document,

graph, columnar, and geographic database structures. Nosql refers to a group of databases that aren't limited to the SQL format. In a nutshell, it is up to the user to determine which sorts of transactions correspond to certain data structures. Taking this step will guarantee that relevant information is readily accessible whenever it is needed. Complex unstructured material calls for data structures capable of handling it. If users are serious about making advantage of big data, they will use a strategy that incorporates both relational databases and those without them. To help users receive a more complete picture of their company, it is important to include unstructured data sources like content management systems. There are some similarities between all of these types of operational data sources:

- These are the permanent databases that store all of the essential information for running the company in real time.
- These are dynamic and are updated in real time when new information is received from internal business units and the internet.
- These sources combine organised and unstructured data in order to provide a complete picture of the company.
- Such infrastructures must be scalable enough to reliably serve thousands of users.
- These programmes may include CRMs, contact centre software, or e-commerce platforms geared for completing actual sales.

Fig 1.1 Big Data Analytics

1.2 Characteristics of Big Data

(i) *Volume* – The idea that a large amount of data is included in the Big Data concept is common knowledge. In determining the worth of data, its size is a major factor.

Additionally, the sheer quantity of this data makes it qualify as Big Data. As expected, it changes with the volume of data being processed. Thus, "Volume" has become the well-known quality needed to be decided at the moment to manage Big Data.

(ii) *Variety* – data diversity is another aspect of Big Data. Heterogeneous data sources and data type are taken into account in Variety of data. Both organised and unstructured data types have been identified and categorised. Before this, spread sheets and databases were seen as nothing more than data warehouses. Unstructured data has been shown to provide unique challenges in relation to data storage, data mining, and data evaluation.

(iii) *Velocity* – Data creation velocity is what we mean when we talk about data generating velocity. Here, we take into account the rate at which data may be generated and processed in order to meet the specifications. Such considerations are what ultimately decide a data set's usefulness.

(iv) *Variability* – Oftentimes, this word is used to draw attention to the irregularity of huge data. It complicates the method used to manage the massive dataset.

(v) **Veracity**- The veracity and precision of the information that was collected. It is the most crucial of the 5Vs for Big Data applications. Large amounts of data stored quickly and in several forms are useless if they include inaccurate information or facts. The right business decisions should be made with such information.

1.3 Hadoop

Hadoop may be accessed without cost thanks to Apache. It was developed using Java. It allows for the sharing of large datasets among a group of computers. It does this by adopting simple pieces of software. Hadoop is a software framework that functions in a distributed computing environment where data and computation are shared across a cluster of machines. Hadoop was created so that processing power could be scaled up from a single server to thousands of servers, all of which would contribute to specialised calculations and data storage. Hadoop is a popular distributed data processing technology that was first offered by Apache. Hadoop is capable of handling large amounts of data. It does this by distributing data sets across groups of computers (called clusters). They're effective against a number of the issue's subcomponents. After that point, production stops completely. Hadoop's two primary working parts are separated by its midsection. Map/Reduce and the Hadoop Distributed File System are two examples.

Making use of big servers with complex setups to control massive dispensing is a useful development. Instead, users may encapsulate a large number of single-CPU machines as a standalone, highly-efficient distributed system. The integrated machines analyze the data in the records simultaneously and provide superior results. In addition, the price is

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far lower than that of a single high-end server. As such, it is the most compelling argument in favour of using Hadoop.

1.3.1 Hadoop Architecture

The system communicates between the machines in a network. The following are some of the specific tasks that Hadoop does as part of this approach:

- Separating data into directories and documents is the first step. After that, the files are divided into 64M and 128M chunks of similar size (preferably 128M).
- To continue, these files will be sent between nodes inside the network in preparation for further processing.
- Due to its position as atop the local file system, HDFS is able to keep tabs on all of this activity.
- Hardware failure may be managed by repeatedly running the same blocks.
- Making sure the code was executed correctly.
- Conducting the sort that follows the map and before the reduction step.
- Moving sensitive data to a specific machine.
- Creating thorough and accurate error logs for every project.

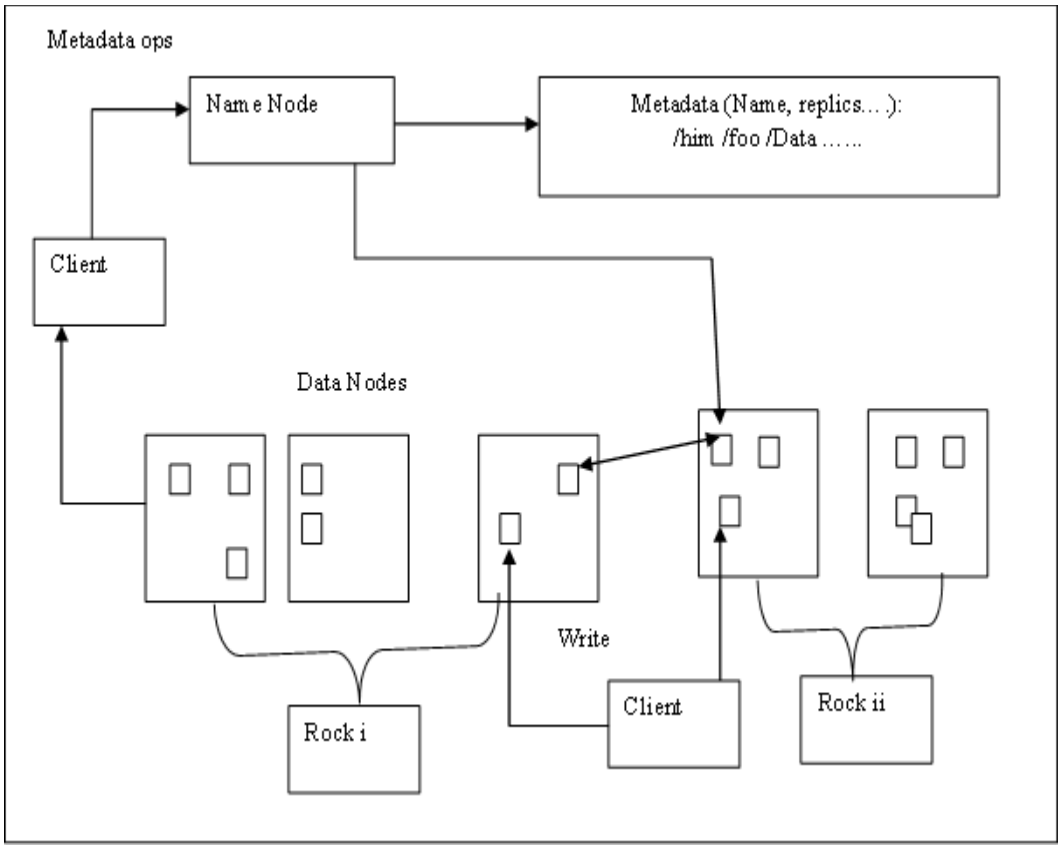

Fig 1.2 Hadoop architecture

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1.4 Advantages of Hadoop

- Hadoop's design facilitates speedy evaluation of distributed systems by end users. It's well-structured, and it automatically transfers data and jobs among the machines, using the parallelism of the CPU cores in a sequential fashion.
- Hadoop's fault-tolerance and approachability (FTHA) is not dependent on hardware; the Hadoop book store was designed to detect and manage application-level failures.
- Hadoop jobs can continue uninterrupted since servers may be added and removed from the cluster with little impact.
- Hadoop's main strength is not just that it is free to use, but also that its Java programming language makes it compatible with any platform.

[2] LITERATURE REVIEW

Resource Scheduling for Spark and MapReduce on YARN Cross-Platform. D. Cheng et al., 2017. Batch processing with high throughput is a natural fit for Map Reduce's design. There is an increasing need for non-batch procedures to be executed on huge data, as seen by the popularity of querying such data. Non-batch processes may be described as examples such as interactive tasks, real-time, and stream calculations. A Hadoop cluster is not required to execute Apache Spark's growth. It's been put to use to maximise the efficacy of HDFS in its current form. iKayak was created after they put up their proposal. It's a piece of middleware that may be used across platforms for scheduling resources. Greater efficiency in the use of available resources has been achieved thanks to its implementation. This study details the integration of iKayak with YARN. Experiments conducted on a testbed showed that iKayak is effective at achieving the 50% improvement for Spark applications. It boosts the speed of MapReduce programmes by 19%. [1]

Performance evaluation of Apache Pig, Apache Hive, and MySQL cluster processing was published in 2017 by A. S. Kumar et al. MySQL Cluster, a popular clustered database, has been identified as a viable option for storing and managing information. The problem was located in MySQL Cluster. The proliferation of data in various forms, the lengthening of the time needed to analyse the data, and the need for a plethora of additional resources all contribute to these difficulties. Processing times may be reduced by using Hadoop, Hive, and Pig instead of MySQL Cluster. Using the identical data model, three researchers discovered that Hive and Pig were quicker than MySQL Cluster in answering basic query questions like how many rows were in a dataset. GroupLens Research Project data model was used to produce this summary. The findings indicate that in a low-cost hardware environment, Hive excels at handling this data model. [2]

W. Huang et al. published In-Memory Parallel Processing of Massive Remotely Sensed Data Using an Apache Spark on Hadoop YARN Model in 2017. What makes Hadoop

special is that it uses MapReduce. It has been put to use in the parallel processing of massive amounts of data. As a result, the programming paradigm used by remote-sensing algorithms is stuck in a cycle of intensive disc I/O. A strip-oriented parallel programming paradigm has been suggested to ease implementation with the guarantee of good performance offered by the Spark-based techniques. These Spark-based algorithms function in the dynamic setting of cloud computing. [3]

Big data analytics utilising the hadoop map-reduce architecture and the data transfer method were first described in 2017 by P. M. Bante et al. The database has grown very quickly, with a size that can now be measured in petabytes. Big Data refers to a certain kind of information characterised by a greater volume, velocity, and complexity of data than any previous category. Keeping track of massive amounts of data has developed into a serious problem. In order to address this issue, data is migrated from MYSQL to NOSQL. Hadoop Map Reduce is a programming paradigm used for processing massive amounts of data. The approach for moving data from a relational database to a NoSQL database (MONGODB) was uncovered in this study. Using the Hadoop MapReduce framework on top of the Hadoop Distributed File System for big data analytics. Data from a Relational Database may be transferred to Hadoop using SQOOP and then analysed there. To facilitate the analysis of data during the transition from Hadoop to mongodb, the Hive tool has been developed. Experiments are conducted on the Loan Database, the Connect Four dataset, the Lenses dataset, and the Player Tennis dataset, all available from the UCI Repository and the KAGGLE repository. [4]

For better performance in Hadoop Map Reduce, data compression was discussed in a 2017 paper by K. Rattanaopas et al. Hadoop clusters have seen extensive use. Big data refers to the massive amounts of information that may be processed and analysed using this tool. The study's primary goal is to boost the processing speed of a word count task by switching to a more efficient compression method in Hadoop. [5]

Data analysis in a Hadoop map-reduce context was presented in 2018 by P. R. Merla et al. This study focuses on analysing UserTube data by means of the Hadoop map reduce framework on the AWS cloud. A Hadoop multi-node cluster is created on a private cloud service, most often Amazon Web Services. Using Amazon Web Services (AWS), one name node and five data nodes have been created in EC2 instances. The HDFS Hadoop Distributed file system now contains the video analytics data collected through the API. As a result of the map reduction system, the data has been processed. [6]

The Movie Dataset was analysed by T. A. Ashwitha et al. in 2018 using Hadoop-Hive. Data use across industries has been shown to have increased dramatically in recent years. The information was compiled from a number of original studies. This data might come from anywhere, including social media, factories, sales records, and more. The Hadoop system was used in the researcher's investigation. The movie dataset was analysed using the Hive tool in conjunction with the Hadoop architecture. In essence,

the researcher has reduced the time it takes to analyse the dataset compared to the current system. [7]

Using Hadoop Map Reduce and Spark, I.Chebbi et al. (2018) compared the processing of large amounts of remote sensing data. Constant, massive-scale manufacture of RS is occurring. Researchers have been tasked with analysing remote sensing data. Several systems for handling massive amounts of data in RS are shown. The study's primary method has been a comparison of Hadoop versus Spark. Both of them are widely used platforms with connections to large RS. The researcher has first described two systems, Hadoop and Spark. The first platform to handle the massive unstructured data has been developed. It was accomplished with the help of a distributed computing system. It's been seen as a fusion of two primary components. HDFS is the initial component, and it's used for storing data. Second, we spoke about Mapreduce and Yarn, two parallel processing frameworks. This kind of thing is also utilised to plan out the work. These are also utilised for analysing the massive RS data sets. The second system is based on a library set that has developed Spark. Here, the computational complexity has been kept under control by using a robust distributed data collection. An examination of the similarities and differences between the two systems is offered in the paper's last section. [8]

According to a 2018 paper by A. Q. Mohammed et al., using a heterogeneous system is a useful method for increasing the effectiveness with which Hadoop MapReduce uses its available resources. The release of one of the most reputable platforms for handling and storing Big Data occurred in the 2000s. Hadoop, or "Oughts Data," is a data processing and storage framework built on the MapReduce programming model and the Hadoop Distributed File System. With the goal of maximising resource utilisation and reducing data processing times, researchers have incorporated a variety of approaches at varying levels of Map Reduce in an effort to do so. Pre-scheduled slots have been offered as a method to improve data locality without compromising fairness. [9]

A Performance Optimization Scheme for Migrating Hive Data to Neo4j Database was published in 2018 by Dan Liu et al. A performance optimization scheme for moving Hive data to the Neo4j database has been the subject of study. This study presents a model of unstructured data that converts structured data into graph data, allowing for the migration of hive data to neo4j and facilitating the discovery of data relationships and the examination of data's potential monetary worth via visual representations. [10]

Researchers F. Liu et al. Development of a Python-Based Autonomous Operation and Maintenance System for VMware vSphere. In this study, a Python-based automated operation and maintenance system for VMware vSphere was designed. In this study, we present a system for autonomous operation and maintenance that is based on the object-oriented programming language Python. In order to determine what is needed for VMware and vSphere to run smoothly and reliably, a thorough analysis is being

performed. The functionality below allows for fully automated VMware vSphere processes. It appropriately carries out maintenance tasks by making the most of the Python language's great efficiency, smartness, simplicity, and so on. The findings demonstrate the system's great efficiency, worldwide applicability, and scalability. [11]

Pykaldi: A Python Wrapper for Kaldi was published in 2018 by Do gan Can et al. The author introduced PyKaldi, a Python wrapper for the popular Kaldi speech recognition toolbox that is available for no cost and with full source code availability. However, PyKaldi is more than just a set of Python bindings for the Kaldi libraries. An interactive Python scripting layer for working with Kaldi and OpenFst types. It seamlessly combines NumPy arrays with the Kaldi vector and matrix types. Both the documentation and the tests for PyKaldi are rather comprehensive. The code is available under version 2.0 of the Apache License and may be used with Python versions 2.7 and 3.5+. [12]

[3] PROBLEM STATEMENT

In this article, we will discuss the scientific work that has been done relating to large data and clustering. It has been noticed that traditional research accomplished a limited amount of work in the field of large data clustering, which is where commercial application concentrates on customer demand. On the other hand, Hadoop is the platform that is used the most often to examine large data. However, there is a necessity for the introduction of a big data clustering technique that is more scalable, adaptable, efficient, and high performing for customer requirement research.

[4] BIG DATA ANALYTICS TECHNIQUES BASED ON HADOOP

Different techniques based on Hadoop are discussed here such as:

4.1 Pig

Pig is a high-level programming language designed specifically for the purpose of doing analysis on enormous data collections. The product of Yahoo's research and development efforts was a pig. In a framework known as MapReduce, each programme will need to be converted into a sequence of phases known as map and reduce. On the other hand, this is not a programming paradigm that data analysts are used to working with. Therefore, in order to close this gap, an abstraction known as Pig was constructed over Hadoop. People are able to spend less time creating Map-Reduce algorithms thanks to Apache Pig, which frees them up to concentrate more on analysing large data sets. Pigs will consume everything, and so too is the programming language Pig built to operate with any form of data. Pigs are omnivores.

4.2 Hive

Hive is a tool for processing structured data in Hadoop that is part of the data warehouse architecture. It is built on top of Hadoop to provide a summary of Big Data and to simplify the querying and analysis processes. Facebook was the company that first

created Hive; but, later on, the Apache Software Foundation took over the project and continued developing it as an open source under the moniker Apache Hive. It is put to use by a variety of businesses. Amazon, for instance, employs it in their Amazon Elastic MapReduce system.

4.3 Spark

Hadoop is being used widely by industries to do data analysis on their data sources. The reason for this is because the Hadoop framework is built on a straightforward programming paradigm known as MapReduce, which makes it possible to implement a computing solution that is scalable, adaptable, error-tolerant, and economical. The most important thing to focus on here is minimising the amount of time spent waiting for the programme to execute as well as the amount of time spent waiting between individual queries when processing huge datasets. Spark is a new piece of software that was developed by the Apache Software Foundation to speed up the Hadoop computational computing software process. Spark is not a modified version of Hadoop, contrary to the widespread misconception. In fact, Spark is not reliant on Hadoop at all since it has its own cluster management and can run independently of Hadoop. Hadoop is only one of the ways that Spark may be implemented. Spark makes use of Hadoop for two different purposes: the first is storage, and the second is processing. Spark doesn't depend on Hadoop for its computations or administration of clusters since it has its own system for doing so.

4.4 Yarn

Hadoop is responsible for connecting its HDFS (Hadoop Distributed File System) storage component with the many processing tools that are available. In Hadoop version 1.0, also known as MRV1 (Map Reduce Version 1), Map Reduce was responsible for both the processing of data and the management of available resources. A Job Tracker, which served as the only master, was the component that made up this system. The Job Tracker was responsible for resource allocation, scheduling, and monitoring the progress of tasks being processed. It delegated the map and reduce operations to a number of lower-level processes that were referred to as Task Trackers. The Job Tracker was updated on a regular basis with the progress made by the Task Trackers.

4.5 MapReduce

It is a paradigm for building programmes that can do the processing of Big Data in parallel across several nodes and it is a programming model. The MapReduce framework offers analytical skills that may be used to analyse massive amounts of complicated data. Big Data is a term that refers to a collection of very massive datasets that cannot be analysed using conventional methods of computer analysis. The amount of information that websites like Facebook and Usertube are required to gather and maintain on a daily basis is an illustration of the kind of information that may be considered "big data." Nevertheless, Big Data is not simply about size and volume;

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rather, it also encompasses one or more of the following aspects: velocity, variety, volume, and complexity.

4.6 Avro

Avro's most notable quality is that it simplifies the process of displaying complicated data structures within the context of a Hadoop MapReduce operation. A MapReduce task is able to make use of Avro data both as input and as output in its processing of data sets. Additionally, it may function as the intermediate format. The examples included in this article make use of Avro data for all three, but you are free to combine and customise them as you see fit. For instance, you might use Map Reduce to combine a certain field that is included in the Avro record. It is elastic, highly customizable, and provides near real-time indexing via the use of XML configuration. The Plugin Architecture of AVR is very straightforward to expand.

4.7 Sqoop

Sqoop is a software utility. It has been developed to facilitate the transfer of data between relational databases and Hadoop. The information may be obtained from a relational database management system by using Sqoop. For instance, MySQL or Oracle may upload their data directly into the Hadoop Distributed File System using the Hadoop Map Reduce framework. After that, the data was imported back into an RDBMS after having been exported. The connection to the database server is established by it. [24] It is able to handle the parallelism. It has the ability to control the method for importing goods. It makes it possible for the import data to be stored. Data may be imported into Hbase using this capability.

4.8 Zoo Keeper

It has been determined that Zoo Keeper functions as a centralised service. It was put to use in the process of organising the configuration data. Zoo Keeper is able to give distributed synchronisation in its environment. In addition to this, it also provides services tailored to groups. All of these different kinds of services are implemented, at least partially, by distributed applications. There are a lot of responsibilities that must be fulfilled. In order to solve the problems and race situations, these kinds of activities need to be completed. In general, when it comes to first providing these kinds of services, the applications tend to cut corners due to the difficulty of doing so. It makes people vulnerable to the effects of change and makes it harder to control them. When the apps are deployed, the diverse implementations of these services contribute to increased administration complexity. This is true even when everything is done properly. When there is a lot of work to do, Zookeeper is very extensive. In this context, reading the data is far more frequent than writing it, particularly in relation to Zookeeper. The ratio of reading to writing that should ideally be maintained is around 10 to 1. The impersonation of Zoo Keeper carried out over a collection of hosts is referred to as an ensemble. The servers are aware of their interconnections with one

another. In tandem to reaching a critical mass of servers, users will have access to the Zoo Keeper service. There is not a single cause that led to the collapse. Zoo keeper has the ability to store a hierarchical name space in its standard format. It is comparable to directories and files in certain respects. This service keeps a record of every transaction that has taken place. It is used for higher-level abstractions, such as synchronisation primitives, among other applications.

4.9 NoSQL

Typically, some of these concerns were addressed by databases of the Next Generation. It is used in the process of developing the non-relational, distributed, open-source, and horizontally scalable. The primary goal was to bring the web-scale databases into the current era. It offers a simple data model by making use of key-value pairs in the structure of the data. Additionally, it makes use of the secondary indexes. It makes it possible for the Simple programming paradigm to be used with ACID transactions. In addition to that, it included support for tabular data models and JSON. It is possible to provide authentication as a means of providing security for the application. In conjunction with this, it provides SSL encryption at the session level. Integration is available for NOSQL with Oracle Database as well as Oracle Wallet and Hadoop. It offers help for a number of information hubs and provides assistance for geo-distributed data. It permits a high level of accessibility along with local and distant failover as well as synchronisation. Scalable throughput and limited latency are both made possible as a result of this.

4.10 Lucene/Solr

There is just one instrument. It is used for the purpose of indexing the massive blocks of unstructured material. It is an ideal companion that may be used with Hadoop. Lucene is able to readily connect with Hadoop due to the fact that it was created in the Java programming language. This was done in order to produce a single enormous piece of equipment. It is used for the administration of dispersed text. The indexing can be handled by Lucene without any problems. Hadoop, on the other hand, will ensure that the queries are distributed uniformly across the cluster. This enables the Advanced Full-Text Search Capabilities that are available. It has been tailored specifically for high volumes of web traffic. It permits standards-based open interfaces such as HTTP, XML, and JSON to be used. It allows the Server statistics to be provided through JMX, which has been used for monitoring, and offers Comprehensive HTML Administration Interfaces. This environment supports linear scalability, automatic index replication, automatic failover, and automatic recovery.

[5] RESULT AND DISCUSSION

5.1 Hadoop Environment on Cloudera

This section has focused on the allocation of csv based Dataset along with importing csv data. The Dataset of zamato has been taken from http://www.kaggle.com.

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5.1.1 Performance analysis of Hive on Cloudera

The procedure of importing data to the Hive database and analysing its performance on cloud era was covered in this portion of the article. In order to demonstrate how well HIVE performs, several readings have been gathered for each of the clock cycles numbered C1 through C6. After representing the information in a graphical style, the data for the hive performance chart were plotted.

Table 6.1 Time taken in case of Hive

Cycle	Time Taken
C1	0.129
C2	0.127
C3	0.089
C4	0.111
C5	0.078
C5	0.102
C6	0.110

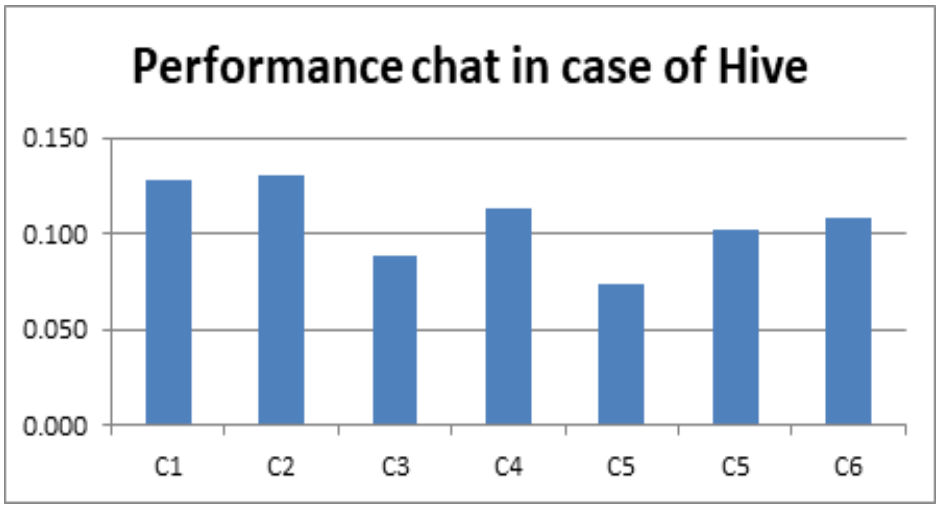

Fig 6.2 Hive performance Chart

The performance of hive was analysed throughout many clock cycles and shown in the following chart. The clock cycles are represented by the x coordinates in this equation. The y coordinates display the amount of time that has elapsed for each of the possible clock cycles.

5.2 Importing data to pig environment and analyze its performance Performance Analysis of Pig

The procedure of obtaining information relevant to the pig environment has been the primary emphasis of this section. The topics that have been covered in this article include accessing material in the pig environment and writing a script to obtain the time that data was captured in the pig environment. The time spent by the pig is shown in the

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following table according to the various clock cycles. The following table provides an overview of the lengths of time spent in each of seven distinct clock cycles.

Table 6.2 Time taken in case of pig

Cycle	Time(seconds)
C1	0.344
C2	0.488
C3	0.224
C4	0.215
C5	0.450
C6	0.356

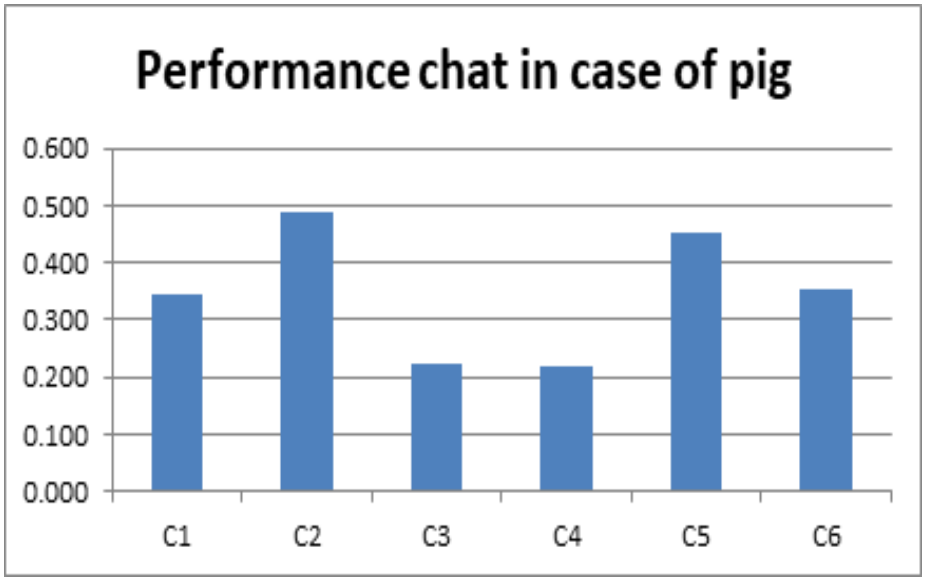

Fig 6.3 Pig performance chart

Following chart has shown the performance of pig in different clock cycles. The x coordinates are representing the clock cycles. The y coordinates are showing the time taken in case of different clock cycles

5.3 Performance Analysis of Python Script

This phase has focused on the programming of python module in order to get the contents from comma separated file. Following table is representing the time taken by python script in different clock cycle. The following table is showing the time taken in six different clock cycles

Table 6.3 Time taken in case of python script

Cycle	Time
C1	0.0296
C2	0.0431
C3	0.0319

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C4	0.0403
C5	0.0408
C6	0.0361

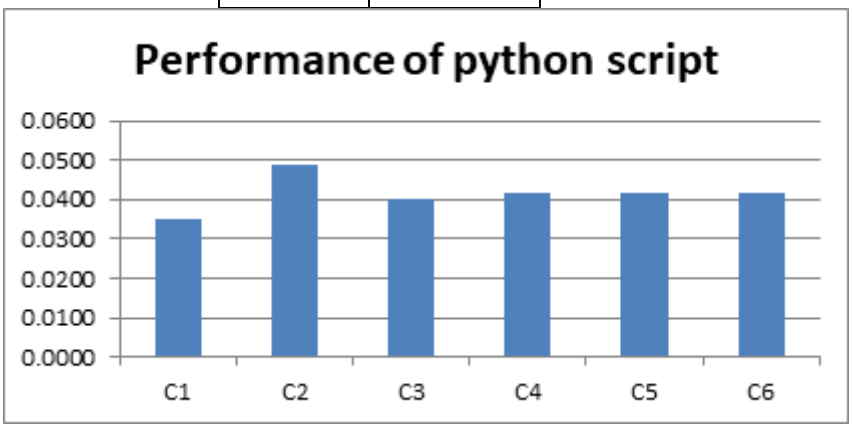

Fig 6.4 Performance chart for python script

Following chart has shown the performance of python script in different clock cycles. The x coordinates are representing the clock cycles. The y coordinates are showing the time taken in case of different clock cycles.

6.4 Comparative Analysis of performance of existing- hive, pig and Proposed- python script for hadoop framework on cloudera

After simulation of hive, pig and python script the content have been stored in following table in order to perform comparative analysis.

Table 6.4 Time taken in case of hive, pig, python script

Cycle	Tim Taken by hive	Time taken by pig	Time taken by python script
C1	0.129	0.344	0.0296
C2	0.127	0.488	0.0431
C3	0.089	0.224	0.0319
C4	0.111	0.215	0.0403
C5	0.078	0.450	0.0408
C5	0.102	0.356	0.0361
C6	0.110	0.344	0.0296

The above table has been graphically represented in following chart in order to present the comparative analysis of contents.

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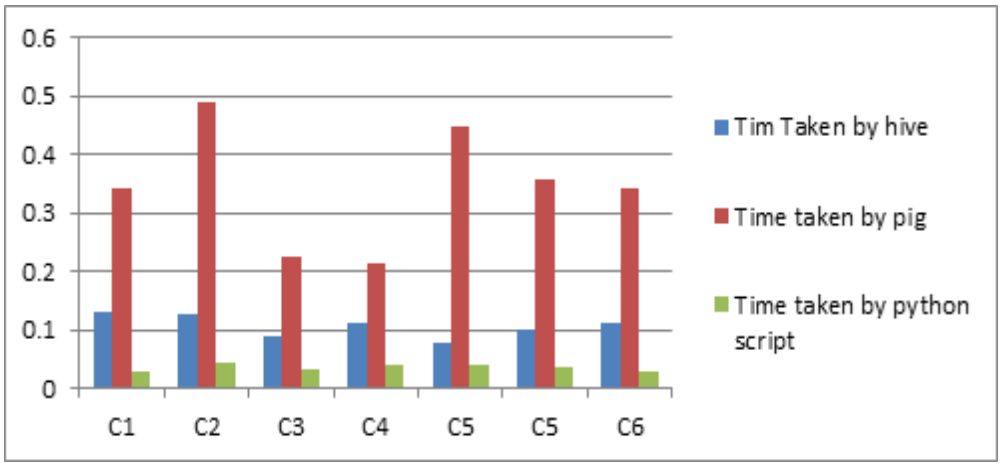

Fig 6.5 Comparative analysis of time taken in case of hive,pig and python

[6] CONCLUSION

According to the findings, the performance of Hive is much faster than that of Pig. In comparison to hive and pig, the Python script that was created to fetch csv material has shown to be far faster. Spark, on the other hand, has been shown to be one hundred times faster than Hadoop. Caching functionality is supported by Spark, however MapReduce does not have this capability. It grants access to user applications so that data may be put into the memory of the cluster. This enables the processing of repeated requests more quickly. Because of this, spark may now be optimised for the algorithms used in machine learning. In comparison to MapReduce, Spark has shown superior flexibility, scalability, and genericity. On the other hand, MapReduce suffers from the drawback of having less resource usage than other approaches. On the other hand, the MapReduce framework can only execute MapReduce models.

[7] FUTURE SCOPE

The implementation of Hive, Pig, MapReduce, Spark, Avro, and Yarn in the Hadoop framework has been the primary focus of research. Hadoop's data storage solutions, such as HDFS, Hive, HBase, and MongoDB, are intended to make the management of complicated and large amounts of data more effective. Additionally, the capabilities of MapReduce, Spark, Avro, Sqoop, Zoo keeper, Lucene/Solr, and NoSQL would play an important part in the processing of enormous amounts of data. The Hadoop framework would be able to utilise for analysing and evaluating the performance of various big data analytical methodologies. For the purpose of determining which method or technology is most suited for the user, research effort might do more comparison analyses of big data analysis techniques and technologies using the Hadoop framework. In the future, research will make important predictions or choices by using big data analytics. The Hadoop framework will be used in order to undertake analysis as well as performance analysis and assessment of big data analytical strategies. The research would identify numerous features of the mechanisms and technologies used for massive data analytics, with the Hadoop framework and problem incorporated in each of them. A variety of

research approaches, including data mining, statistics, the analysis of big data mechanisms, and game theory would be integrated via the use of predictive analysis in the study. The use of big data analytics would allow for major predictions or judgments to be made in the related study.

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AEROSPACE MATERIAL AND INTERPLANETARY SPACE APPLICATION

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ABSTRACT

The space application of space activities expanded quickly and demonstrated their usefulness in making important contribution in social and economic development. The use of space technologies could benefit in various areas, such as aviation, maritime and Land Transportation, Mapping and surveying, Human Health, Disaster Management, Food Security and Sustainable agriculture, environmental Monitoring and natural Resources Management. To explore higher, farther, and faster, scientists have developed advanced materials for manned space craft and satellites for a range of sophisticated application. Material used for manned space and satellite for range of sophisticated application, in transportation, global positioning, exploration and communication, Mining. Material used in space are exposed to vacuum, Intense Ultraviolet radiation from the Sun, and ionizing radiation that results in material damage as well as charging(electrostatic discharge effects), micro meteoroids and debris impacts, and thermal cycling typically 175 to 160 degree ^{0}C) in term of material degradation in space in The LEO Low Earth Orbits, where LEO defined as 200-1000k.m. so need development of advanced materials and coating to ensure the long term durability and performance of space Vehicle employed in space.basic Space Technology such as basic of space Technology initiative (BSTI), address the increasing role of small rocket (Nano-satellite for education),buildup Global Navigation satellite systems, disaster risk reductions and emergency response, Natural resource management and environmental monitoring, climate change issue, space technology application in Health sector, Space Technology application and socio-economic benefits. Promote education their regional center for space Science Application in Field of technology education affiliated ***by UNSDG*** *programme*

This paper focused on how unique environment of Low Earth Orbit, including microgravity and extreme environmental conditions enables R&D that is impractical or not possible to perform on Earth.

Keyword:-Space Application, UNSDG, electrostatic discharge effect.

Space Material Space Application of Composite Material

Use of composite material in Space industry have revolutionized the space industries by virtue of multifunctional, multidimensional uses due to tailorable properties.

That sustains the extreme environment of outer space

Such as fiber metal, laminates FMLs, Metal Matrix, polymer matrix and ceramic matrix composites material are used in space Application

Composite material proven that they have proven effective properties in satellites; Launch Vehicles and space Center Application due to Light weight, dimensional stability, High specific strength, thermal stability, high specific strength, use of fiber metal laminations ,Carbon and epoxy along with other material.

The space programmed and development in space research has been prime focused on use of composite material both used in developed and developing countries.

Which broad scope of beneficial application such as societal development, mass communication, Agriculture, boosting Economy through digitalization with smart banking system, scientific research application, Telemedicine satellite, launch Vehicle and Space center is key component of any space programmed. (Lelogu et al 2008).

Satellite can described as any entity dedicatedly; launched in to space that orbits a star, planet earth with admission together and collect information.

Figure satellite application 1(a),1(b),1(c),1(d).

Juno Jupiter 3 Ultra high density satellite after Caleb with permission from Space News and SSL.

Aluminum and it's alloy have attributed to their exceptional strength to weight ratio, working ability, Cost-effectiveness, corrosion resistance and ease of accessibility.(leoghu et al,2008;Z.S.Toor 2017).

Space material have vast application in desigin aircraft, rocketry components,desgine satellite structure, payload, Launch Vehicle, Attitude control system, Power system, Thermal Control system and propulsion control system.

Composite material such as Carbon- silicon Carbide composite material use in AGS Payload, disc break, Jet vanes of Nozzle, engine Flaps and Nose Caps of Launch Vehicle.

Nano Composite material use as carbon coating or Nano composite material used for Coating. This applied on Launch Vehicles to sustain, dry vaccum, Vary Heigh cryogenic temperature. This can be attributed to their complex Chemistry and material composition change itself with respect to the environment and sustain the structure resulting good wear resistance, high thermal shock capability, good tribiological prefer to make.

Nano composite multifunctional tribological coating use in space Application (Voevodin et al; 2005).

The use of composite material in space Application due to long Service performance, structural and functional application and free from biological and medical side effect.

Composite material Used to replacing launch vehicle and satellite material with high performance and cost effective composite material important researcher for developing Space programmed.

Why need space material?

Requirement for fracture control and contamination control.

Understand" as –built performance in designed intent. Hardware exposed to space environment with all aspect of the space environment this include vacuum, thermal cycling, charged particles radiation, Ultraviolet radiation, Ultraviolet radiation and some harse environment plasma effect and atomic Oxygen.

Micro -meteoroids and space debris particles may impact at height velocities; shielding hard Vaccum of Space with its cope with pressure 10^{-4} Pa(10^{-7} Torr) causes some material to outgas , which turn effect any space Craft component with line of sight to emitting material.

Thermal cycling occurs as Space Craft moves through Sunlight and shadow at time of maneuver to keep exposure , thermal cycling temperature are dependent on Space craft component thermo optical properties. I.e. Solar absorptiance(alpha) or how much Solar energy intake or absorbs in materials, and infrared emittance Eir, how much thermal energy can emmited to space. The lower the ratio of alpha to Eir, the cooler temperature of space craft surface. Thermal cycling causes cracking, crazing, delaminating and other mechanical problem.

Change particle radiation include proton radiation and electron with wide range of energies , space Craft operating the VanAllen Belt and exposed to much greater radiation levels than those in low earth orbit.

Charged particle radiation along with Ultraviolet radiation can cause cross-linking hardening and chain scission (weaking) of polymers darkening and color center formation in window and optics and single event upsets in electronics.

Plasma refers to ionized particles in the upper atmosphere that have been excited by interaction with ultraviolet radiation and are affected by earth's magnetic field .the plasma environment varies with altitudes, latitude, time of day and Solar Activity. Interaction with plasma and charged particles in space environment contribute to buildup of surface charge; especially high Voltage.

The surface charge can damage electronics produce single event upsets(SEU); trigger arcs in solar arrays or power system and cause dielectric breakdown of structure coatings.(NASA Handbook Note).

Mitigation techniques for high Voltage space power system>55Volts.

Atomic Oxygen (AO) produced when Ultraviolet radiation reacts with molecular oxygen in the upper atmosphere. Currently only found in low earth orbit between low and 1000k.m. altitude.

AO reacts strongly with any material containing Carbon, Nitrogen, Sulfur and Hydrogen bond 5 eV bond energy or less.

Most polymers react and erode away where the reacting to AO increased with longer exposure to Ultraviolet radiation

Some material such as ceramic coating can block by exposure to A.O.

Space Application

Space resources use to support life on the moon and exploration of mars.

Space resources concern 1. Scenarios, 2.energy and power, 3.materials used, 4.Social Development concerns.

Through Apollo 15 astronauts taking core sample of the lunar regolith approximately3 meter.

Figure

Asteroids Mining the shear breakdown materials, and throw it away from asteroid in the collection bag.

Space debris impact on shuttle window.

Space supporting UN sustainable development goals.

Space application services reaches and development tools used by neuroscientist and support the European space Agency in development of techniques.

Mobile satellite services

Satellite

Meteorology

Navigation, position and location

Satellite communication Application

Television broadcasting

Telecommunication

Telemedicine

Tele education

Satellite meteorology

Satellite aided search and rescues

GPS aided Geo Augmented Navigation (GAGAN).

Terrestrial Aerial and Marine navigation

Vehicle trecking through use GPS

Power grid synchronization monitoring

Earth and atmosphere studies

Integration with Mobile phone Broadband services to enhance internet speed.

Disaster Risk Reduction disaster management support

Flood management and Monitoring

Disaster management support relief and rehabilitation at time disasters

Cyclone forecasting, weather forecasting check weather fog, Air quality and air polution level

Land slide, forest fire, earth quack, early warning system development collaboration with center Water commission for flood management in real time during the monsoon.

Survey forest, flood and land and river.

National data for emergency management

Aerial survey for large scale mapping through remote sensing satellite.

National Land user/land cover mapping

Crop a crop production assesment estimation

Horticulture assessment

Cotton crop mapping

Indian forest covers alert system study sunderban Mangrove system

Island information

Reassessment water resources spatial modeling fluorides contamination in ground Water.

Ground water assessment hydro morphology with litho logy

Surface energy balance over Agro-ecosystem uses apertures scintillometery

Earth observation Application, Geosciences' and environment and climate change.

Space and G20 Moto is build partnership to boost space industries cusp of technology led transformation and space industries crucial role to change in societal development. Use in weather forecast, disaster management, agriculture and remote sensing to make capacity building and cooperation among state.

ISRO Make

Small satellite vehicle SSLV

GSLVMKIII

Reusable launch Vehicle

Air breathing propulsion

R&D payload.

Space material and space application

Through use of space application development of new generation technology use to developed Aerospace designed. Space application deep rooted technology for society uplifting. So space application has tremendous potential to use society development.

Space application use for direct home T.V.BroadCasting services provided information to villagers through use of satellite.

Space application use for weather forecasting, metrological prediction get through colour of ocean.

Science and technology play vital role to change livelihood of society to uplifting from Poverty and make ease living and save time.

Space application enhancing communition capability to use railway G.P.S , mobile google type services.

Making observation earth through space.RGB lot number of wavelength used to source of information through C band or multispectral digital camera navigation use for risk reduction at time of diseaster.

Remote sense survey used for forestry survey, groundwater survey , smart banking through AI cloud computing make people more easy living.

Thus need space application are used to make change space economy.

Application of Space in Exoplanet Mission Satellite

such as Mariner 2,Voyager1 and Voyager 2. Mariner 2 passed within about 34,000 k.m.(21,000 miles) of Venus, sending back valuable information about Venusian atmosphere. Mariner 2 recorded the temperature at Venus for the first time, revealing the planet's very hot atmosphere 500 degree Celsius (900 degree farenheit). The space craft's Solar wind experiment measured fro first time they recorded density, velocity, composition and variation over time of Solar wind.

(source https://uploaded. Wikimedia.org/ Wikipedia /commons /9/90/mariner.

Mariner 2 found Venus to be far hotter and inhospitable than the imagined tropical world hidden by thick clouds mission type venus fly by, duration 4 month . with carry

scientific instrument 1. Micrometer radiometer,2.Infrared radiometer,3.Fluxgate Magnetometer,4. Cosmic Dust Detector,5 Solar Plasma Spectrometer,6. Energetic Particle detector,7. Ionization Chamber.(NASAJPL)

Mariner 1 consisted of hexagonal base 1.04 meters across and 0.36 meters thick, which contained six magnesium chasis housing the electronics for the science experiments, communications, data encoding, computing, timing ,and attitude control, and the power control, battery charger.

Mariner 1 was launched by an Atlas-Agena Rocket from Cap canaveral's Launch Pad 12 on 22 July,1962. Shortly after liftoff , errors in communication between Rocket and it's ground-based guidance systems caused the rocket to veer off course , and it had to be destroyed by range safety.

Mariner 2 was the world's first successful interplanetary Space craft launched in 27 August 1962.

Scientific discoveries made by mariner 2 include a slow retrogate rotation rate for venus, hot surface temperatures and high surface pressure, a predominantly carbon dioxide atmosphere, continuous cloud cover with top altitude of about 60 k.m., and no detectable magnetic field.

Parker Solar Probe Space craft which reached a speed 535,000 Kilometer per hour using Sun's Gravety now that is Fast , but surprised to know that it is fact that it is just 0.005% of the speed of light(300,000 kilometers per second) .

Parker solar probe not burn up survive the sun's Heat? The parker solar probe is closest Space Carft to the Sun, and it's

Parker solar Probe has three detailed science objective; trace the flow of energy that heats and accelerates the Solar Corona and solar wind, determine the structure and dynamic of the plasma and magnetic field at the source of Solar wind.

Parker solar probe instruments under extreme conditions as gathers data in the Sun's Corona, gzazing closer to our star than any space craft before. Its four instrument suite characterize the dynamic region close to Sun by measuring particles and Electric and Magnetic Fields, and each was specially desigened to withstand the harsh radiation and temperature they will encounter.

The Wide-Field Imager for Parker Solar Probe in only imaging instrument aboard the space Craft. Wisper look at the large Scale structure of the Solar Corona and study Solar Wind before space Craft flies through it. Instrument name as SPAN(Solar Probe Analysers), Fields (Electromagnetic Fields Investigation), WISPER(Wide-Field Imager for Solar Probe)

In Parker Solar Probe to protect through composite material from Solar Plasma The Thermal Protection System (TPS) is made from Carbon Composite Foam are sand

witched between two Carbon Plates and coated with white Ceramic paint on Sun facing surface.

New research paper suggest that Voyager 1 space craft become first man-made object to leave the solar system.35 years old space craft is still reyling on GE Technology, including command and power generateors. As well as 'power source called radioisotope thermoelectric generators (RTGs.). these device still remain in services and convert the heat produced from natural radioactive decay of Plutonium in to Electricity for Space Craft's instruments, computers, radio and other system.

The voyager 1 and Voyager 2 space craft laucnched in 1977, they are currently exploring the edge of the Solar system, GE engineers designed the voyagers command computers directing the flight path and providing communication link with NASA mission control. They also developed probes' electrically generator for the space craft's instruments, computers, radio and other system. The voyager 2 have sent back detailed images of the solar system planets and their moons, confirmed the exisitence of Neptune's rings, and gathered data about stars near the edge of Milky ways.

The Voyager 1 and Voyager2 probe launch 5 sept 1977 about two weeks after its twin Voyager 2- as of august 2022 is approximately 14.6 billion miles(23.5 billion kilometers) away from our planet, making it earth' farthest space craft, Voyager 1 currently zipping through space around 38,000mph(17 k.m per second) according to NASA Jet propulsion Lab.

Nearly 15 years Voyager1 and Voyager 2 space craft have discovered the first direct evidence of long-sought-after helopause the boundary that seperates Earth's Solar system from interstellar space.

The Mars Orbiter Mission (MOM), also called Mangalyaan, was a Spce Probe orbiting Mars since 24 September 2014.

ISRO, which the space craft around Mars, confirmed that the Mangalyaan has reached it's end of life after completing years of Interplanetary journey , on September 27, 2022, ISRO organized a one day national meeting to commemorate the Mars Orbitor Mission.

List of carry instruments in Mars Orbitormission (MOM) such as MCC(mars Colour Camera),TIS(thermal Infrared Imaging Spectrometer) ,MSM (Methane Sensor for Mars), MENCA (Mars Exospheric Neutral Composition Analyser are used.

The Mangalyaan space craft based on a modified IRS / INSAT/Chandrayaan-1 bus. The main body is roughly 1.5 cube constructed of Aluminuim and composite material fiber reinforced plastic sandwich material are used in total mass is 1.340k.g. of which 852 kg in fuel.

Space application used in Space technology research and development (R&D) such as The Hubble Space Telescope, developed Space Suit Application, Kepler telescope and International Space Station(ISS).

Space application improve life on earth. satellite that circle the globe provide the most accurate weather reports and warn us of impending storms; they monitor our climate every day, helping to track increasing rates of climate change and it's effects, such as rising seas and changing moisture levels, wildfires and atmosphereic changes; they connect millions

Voyger 1 and Voger 2 list of Instrument

1.bus housing electronics,2. Cosmic Ray subsystem(CRS),3. High-Gain Antenna,4 imaging science subsystem(ISS),4.Infrared Interferometer spectrometer and radiometer(IRIS), 5. Low – energy Charged Particle probe(LECP).,6.Magnetometer(MAG),

7.Optical Calibration Target,8. Photometer polarimeter Subsystem (PPS), 9.planetary radioAstronomy (PRA).10.Plasma Science(PLS),11. Plasma Wave Subsystem (PWS),12. Radioisotope thermoelectric Generators(RTG),13.Ultraviolet Spectrometer (UVS).(source Jet Propulsion Laboratory).

CONCLUSION

Space material used for technological development by designed and research development team that how they cope with high radiation, pressure and different parameter are used. Space application uplifting citizen for societal development.

ACKNOWLEDGEMENT

Authur thanks to Jet propulsion Lab(NASA), ISRO,SAC, and team of Mariner1,Mariner 2 ,Voyager1 and Yoyager2 team, Solar Parker probe team and Mars Orbiter Mission team to get good information in Wikipediya.

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Space Application in Searching Interplanetary Mission

Such as Mariner 1, Mariner 2,Voyager1 Voyager 2, Parker Solar Probe , Mars Orbitor Mission

Figure 1(a) Image of Mariner 1,2, Curtesy JPL NASA

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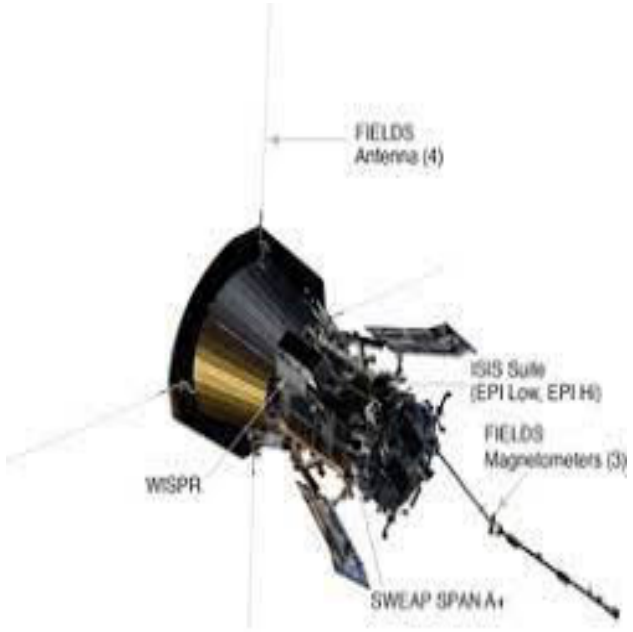
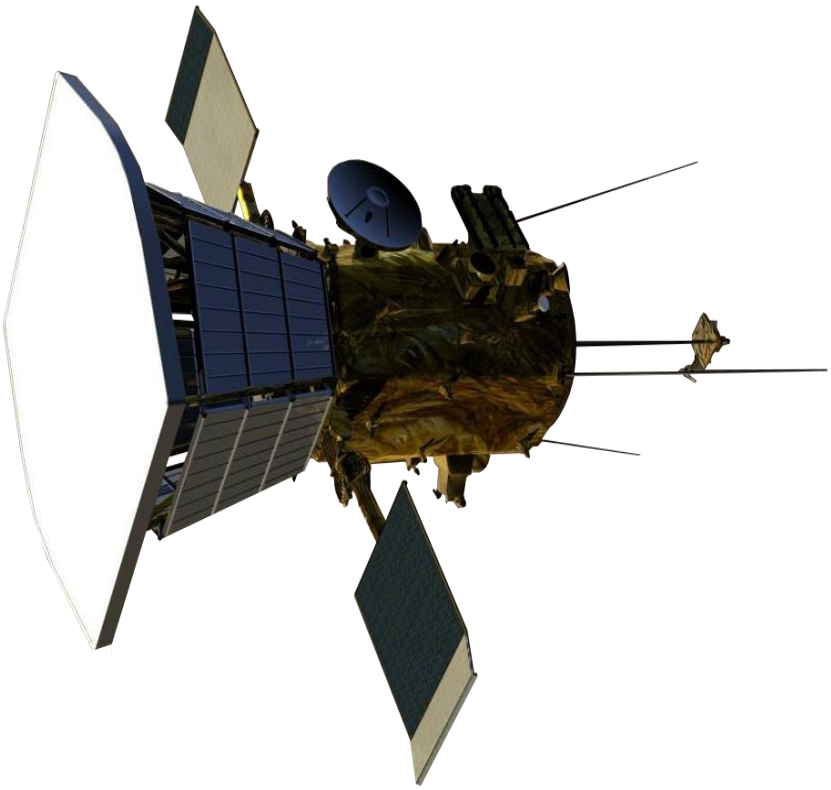
Figur1(b) Image of Voyager 1 ,Voyager 2 ,Curtesy NASA



Figur1(c) Image Carry Instrument Parker Solar Probe

ISBN: 978-81-19481-13-2



Figure(d) Image of Parker Solar Probe carry Instrument ,Curtesy NASA

Figure(d)Image Mars Orbitor Mission Carry Instrument,Curtesy ISRO

ISBN: 978-81-19481-13-2

Remote senseing Application

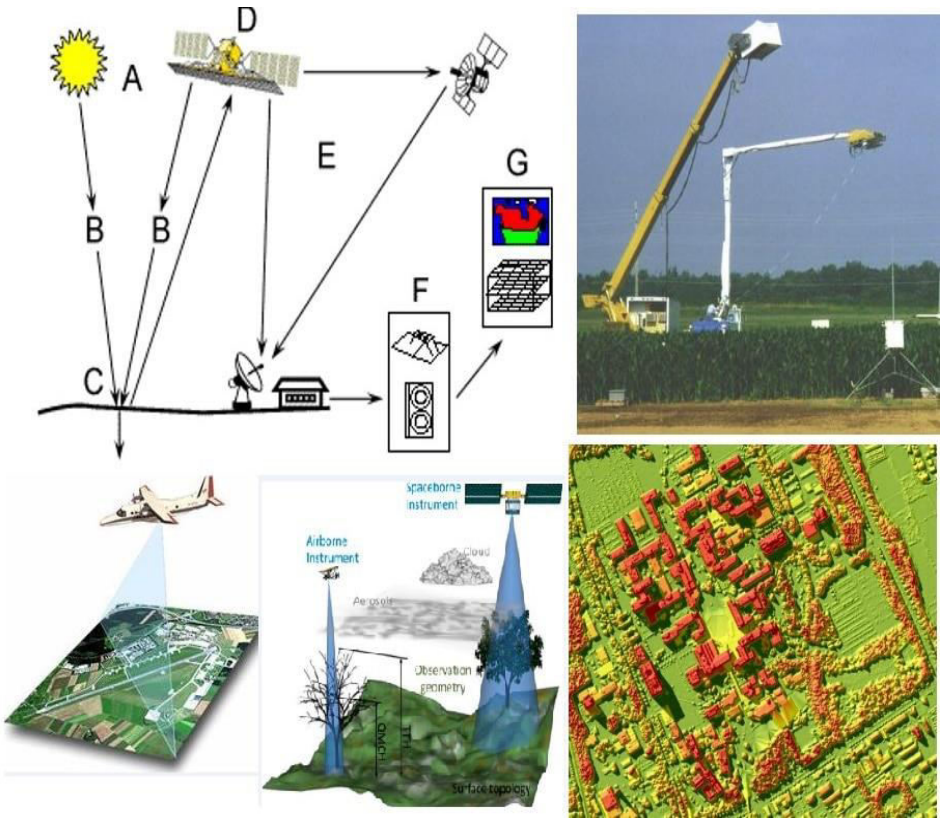
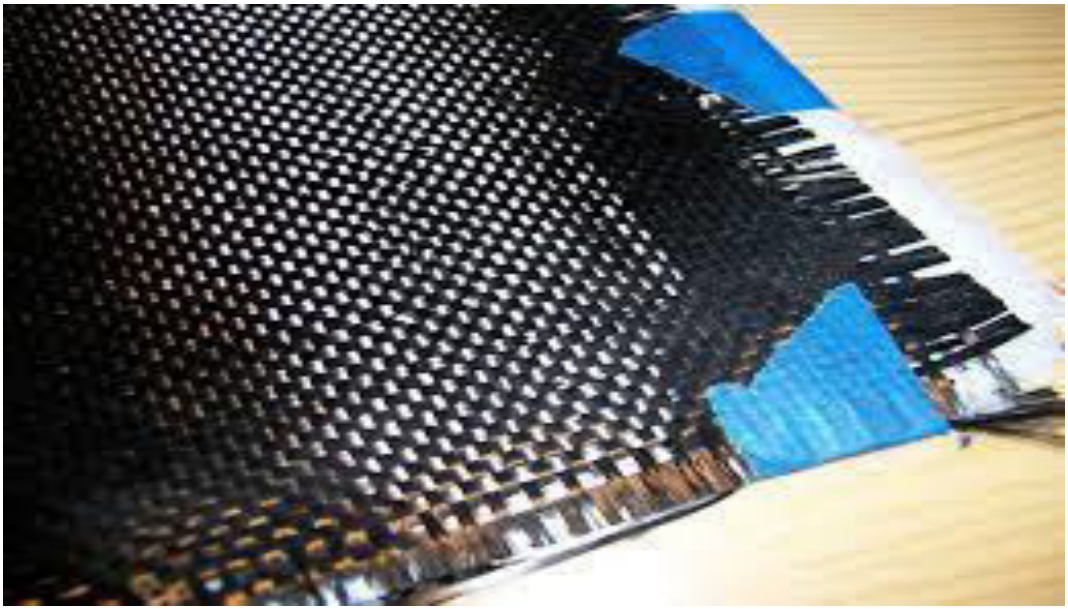
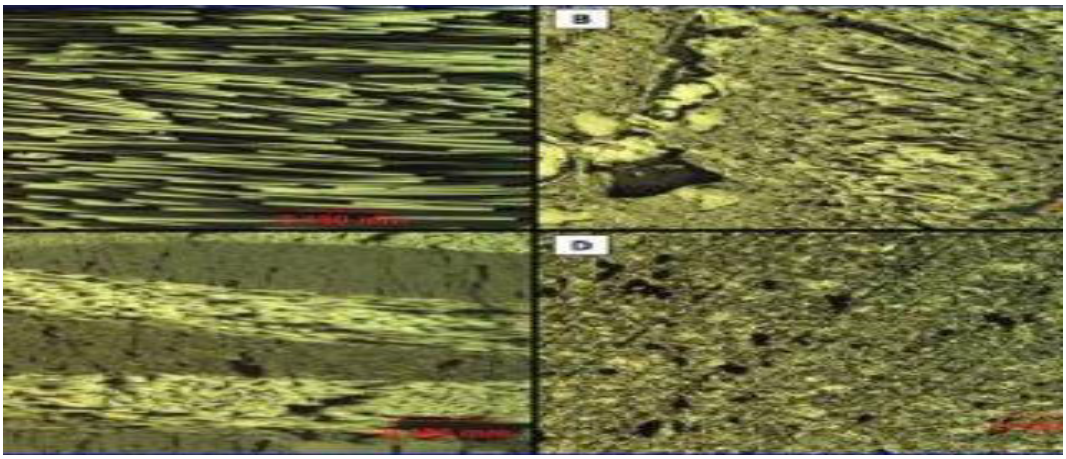


Figure2(a) remote sensing application use fro LAND Mapping, Ground Water searching, Mining Survey and Defence smart(Border Fence)

Carbon Composite Materials Use In Research Development to designed in Space Craft and Satelite, Launch Pad Vehicle and Interplanetary Mission



 ISBN: 978-81-19481-13-2



Figur 2(b) Image of Carbon Composite Materials Use In Research Development to designedin Space Craft and Satelite, Launch Pad Vehicle and Interplanetary Mission Such as fiber metal, laminates FMLs, Metal Matrix, polymer matrix and ceramic matrix composites material are used in space Application .

Contributer of Team in Research and Development for Interplanetary Space Mission

Team of Mangalyaan (Mars Orbitor Mission)

14 ISRO were involved brains were involved in MOM by K.Radhakrishnan was ISRO Chairman at time, Subbriah Arunan was director of Mars Mission

Mariner1 and Mariner 2

developed by Jet propulsion Laboratory and originally planned by purpose-built probe launched summer 1962. To search and Probe Venus Atmosphere

Voyager1 and Voyager 2

Developed and Designed by GE engineer of Jet Propulsion Lab the voyager 1 and Voyager 2 send back detailed images of the Solar Systems and their Moons, confirmed existences of Neptune's rings, and gathered Data about stars.

Parker Solar Probe

Developed by John Hopkins University Applied Physics Laboratory designed and built the Space Craft use to carry instrument shuch as SPAN (Solar Probe analyser) and Fields-Electromagnetic Fields

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UNLOCKING THE POTENTIAL OF NET-ZERO ENERGY BUILDINGS IN INDIA: CHALLENGES, OPPORTUNITIES, AND TECHNOLOGICAL PATHWAYS

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ABSTRACT

The pursuit of Net-Zero Energy Buildings (NZEBs) is pivotal in mitigating climate change and enhancing energy security. This research delves into the Indian context, investigating the challenges, opportunities, and technological pathways associated with unlocking the potential of NZEBs. India's rapidly urbanizing landscape and escalating energy demand necessitate sustainable solutions for the built environment. This study critically examines the multifaceted challenges encompassing policy and regulatory gaps, financial barriers, lack of awareness, and technological limitations that impede the widespread adoption of NZEBs in India.

Simultaneously, the research underscores the abundant opportunities that NZEBs present, including reduced greenhouse gas emissions, minimized energy costs, improved indoor comfort, and job creation. By elucidating the intricate interplay of these challenges and opportunities, the research outlines feasible technological pathways for transitioning to NZEBs. Emphasis is placed on innovative building design, energy-efficient materials, renewable energy integration, smart technologies, and holistic energy management approaches.

Through a comprehensive analysis of case studies, expert interviews, and policy evaluations, this research contributes valuable insights to policymakers, urban planners, architects, and industry stakeholders. Ultimately, it provides a roadmap for overcoming barriers, leveraging opportunities, and advancing India's transition towards NZEBs. This research advocates for a collaborative effort encompassing robust policies, financial incentives, public awareness campaigns, and research initiatives to foster a sustainable built environment that aligns with India's energy and climate goals.

Keywords: *Net-Zero Energy Buildings, India, Challenges, Opportunities, Technological Pathways.*

1. INTRODUCTION

The global imperative to address climate change and achieve energy sustainability has placed a spotlight on the concept of Net-Zero Energy Buildings (NZEBs). As countries strive to reduce their carbon footprint and transition towards cleaner energy sources, the built environment emerges as a crucial arena for change. In the context of India, a nation experiencing rapid urbanization and surging energy demand, the potential of NZEBs holds significant promise.

The introduction of this research topic establishes the fundamental significance of NZEBs within India's evolving socio-economic and environmental landscape. It highlights the need for sustainable building practices that not only curtail energy consumption but also contribute to climate mitigation targets. In India's context, where a substantial portion of energy consumption stems from the construction and operation of buildings, the adoption of NZEB principles becomes paramount.

The introduction further elucidates the research's primary objectives: to dissect the challenges that hinder the widespread adoption of NZEBs in India, to identify the array of opportunities that such buildings offer, and to delineate the technological pathways that can facilitate their realization. The reader is guided through the scope of the study, which encompasses policy and

regulatory analysis, financial considerations, technological advancements, and the broader societal impact of transitioning to NZEBs.

By establishing the context, significance, and objectives of the research, the introduction paves the way for a comprehensive exploration of the multifaceted facets of NZEBs in India. It sets the stage for the subsequent sections to delve into the intricacies of challenges, opportunities, and viable pathways towards achieving a sustainable built environment that aligns with India's energy and climate ambitions.

2. BACKGROUND OF THE STUDY

The background of the study provides a broader contextual understanding of the factors that necessitate the investigation into Net-Zero Energy Buildings (NZEBs) in the Indian context. It outlines the key trends, challenges, and global commitments that have propelled the significance of NZEBs as a critical area of research and action.

In recent decades, the global community has witnessed a growing consensus on the urgency of addressing climate change and transitioning to a low-carbon economy. Buildings, being substantial contributors to energy consumption and greenhouse gas emissions, have garnered increased attention for their potential to drive meaningful change. This recognition has led to the emergence of NZEBs, which aim to balance energy consumption with on-site renewable energy generation, resulting in negligible net energy consumption and associated emissions.

Within the Indian context, the background underscores the nation's unique challenges and opportunities. Rapid urbanization, population growth, and expanding middle-class aspirations have led to a surge in energy demand, particularly in the building sector. India's commitment to the Paris Agreement and its ambitious renewable energy targets further emphasize the need for sustainable building practices.

The background of the study also highlights the existing gaps and barriers that hinder the widespread adoption of NZEBs in India. These may include regulatory constraints, financial considerations, technological limitations, lack of public awareness, and the need for skilled professionals adept at NZEB design and implementation.

By delving into the background, the study provides a clear rationale for its focus on NZEBs in India. It connects the dots between global imperatives, national commitments, sectoral challenges, and the potential of NZEBs to bridge the gap between energy demand and supply while contributing to environmental goals. This comprehensive context sets the foundation for the research's exploration of challenges, opportunities, and pathways in the subsequent sections.

3. PURPOSE OF STUDY:

The purpose of this study is to comprehensively investigate and analyze the landscape of Net-Zero Energy Buildings (NZEBs) in the context of India. The study seeks to achieve several key objectives that collectively contribute to a deeper understanding of NZEBs and their potential impact:

- **Identify Challenges:** The study aims to identify and elucidate the challenges that impede the widespread adoption of NZEBs in India. These challenges could range from policy and regulatory hurdles to financial barriers, technological limitations, and knowledge gaps.
- **Explore Opportunities:** By examining the opportunities presented by NZEBs, the study seeks to uncover the multifaceted benefits they offer. These advantages may include reduced energy consumption, lowered greenhouse gas emissions, enhanced indoor comfort, potential cost savings, job creation, and alignment with sustainable development goals.
- **Analyze Technological Pathways:** The research endeavors to analyze the technological pathways that can pave the way for achieving NZEB status in Indian buildings. This

involves exploring innovative building design techniques, energy-efficient materials, renewable energy integration, smart technologies, and holistic energy management strategies.

- **Inform Policy and Practice:** The study aims to provide valuable insights for policymakers, urban planners, architects, engineers, and industry stakeholders. By presenting a comprehensive analysis of challenges, opportunities, and pathways, the research seeks to guide the formulation of effective policies, strategies, and actions to promote NZEB adoption.
- **Contribute to Knowledge:** Through rigorous analysis, literature review, and case studies, the research seeks to contribute to the existing body of knowledge on NZEBs in India. It aims to fill gaps in understanding and provide evidence-based insights that can drive informed decision-making and further research efforts.
- **Support Sustainable Development:** Ultimately, the purpose of the study aligns with broader sustainable development goals. By promoting NZEBs, the research aims to contribute to India's efforts to reduce energy consumption, mitigate climate change, enhance energy security, and create more livable and environmentally friendly urban spaces.

In summary, the purpose of this study is to generate comprehensive insights into the challenges, opportunities, and technological pathways associated with Net-Zero Energy Buildings in India. By addressing these aspects, the study strives to catalyze positive change in building practices and contribute to India's journey towards a more sustainable and energy-efficient built environment.

4. SCOPE OF THE STUDY:

The scope of this study encompasses a multidimensional exploration of Net-Zero Energy Buildings (NZEBs) in the context of India. It spans various aspects related to challenges, opportunities, and technological pathways, while considering both the specific nuances of the Indian environment and the broader global context:

- Challenges and Barriers: The study delves into the challenges and barriers that hinder the widespread adoption of NZEBs in India. This includes an analysis of policy and regulatory constraints, financial limitations, lack of public awareness, and potential technological hurdles.
- Opportunities and Benefits: The scope includes a thorough examination of the opportunities and benefits associated with NZEBs. This encompasses quantifying the potential energy savings, reduction in greenhouse gas emissions, enhanced indoor comfort, economic advantages, and potential job creation.
- Technological Pathways: The study explores various technological pathways that can facilitate the transition to NZEBs. This involves analyzing innovative building designs, energy-efficient materials, renewable energy integration (solar, wind, etc.), smart building technologies, energy storage solutions, and holistic energy management systems.
- Policy and Regulatory Landscape: The research investigates the policy and regulatory frameworks related to NZEBs in India. It examines existing policies, incentives, and regulations that either facilitate or hinder the adoption of NZEB principles.
- Case Studies and Best Practices: The scope involves analyzing relevant case studies and best practices from India and around the world. This provides practical insights into successful NZEB projects, showcasing real-world implementation strategies and outcomes.

- Stakeholder Perspectives: The study may involve engaging with key stakeholders, including architects, engineers, policymakers, industry representatives, and building occupants. Gathering their perspectives and experiences can enrich the understanding of challenges and potential solutions.
- Recommendations and Roadmap: Based on the analysis conducted, the study proposes recommendations and a strategic roadmap for promoting NZEBs in India. These recommendations could encompass policy reforms, financial incentives, capacity building, research and development initiatives, and public awareness campaigns.
- Limitations: It's important to acknowledge the limitations of the study, such as the dynamic nature of policy changes, potential biases in data sources, and the evolving state of technology. These limitations should be transparently addressed to ensure the study's credibility.
- The scope of this study aims to be comprehensive, covering a wide range of aspects related to NZEBs in India. However, due to the complexity of the subject, certain aspects might be prioritized or explored in more depth than others based on the available resources and research focus.

5. LIMITATIONS

While this study endeavours to provide valuable insights into the realm of Net-Zero Energy Buildings (NZEBs) in the context of India, it is important to acknowledge its inherent limitations. These limitations may influence the scope, depth, and generalizability of the research findings:

- Data Availability and Quality: The study's conclusions heavily rely on the availability and accuracy of data related to building energy consumption, renewable energy generation, technology performance, and economic indicators. Inaccurate or incomplete data could undermine the robustness of the analysis.
- Changing Policy Landscape: Policies and regulations related to NZEBs are subject to change over time. The study might not capture real-time policy developments, and recommendations based on current policies might become outdated as new regulations are implemented.
- Generalizability: While the study aims to provide insights into the Indian context, NZEB adoption can be influenced by regional variations, economic conditions, and cultural factors. Findings might not be directly transferable to all parts of India or other countries.
- Technological Rapid Changes: The study's analysis of technological pathways may be constrained by the rapid pace of technological advancements in the energy and construction sectors. Technologies considered cutting-edge at the time of the study might become obsolete or be replaced by newer innovations.
- Financial and Economic Factors: The study might not comprehensively capture the complex economic dynamics of NZEB implementation, including project costs, financing options, and payback periods. Economic conditions and financial feasibility could affect the practicality of NZEBs.
- Case Study Representativeness: The study's reliance on case studies might lead to a bias towards successful projects. Failures or challenges faced by other projects could be underrepresented, potentially skewing the overall perception of NZEB viability.

- Behavioral Factors: Human behavior plays a crucial role in building energy consumption. The study might not fully account for occupant behavior, which can impact energy use and the effectiveness of energy-efficient technologies.
- Interdisciplinary Complexity: NZEBs involve the integration of various disciplines such as architecture, engineering, economics, and policy. The study might not comprehensively address all these aspects due to its interdisciplinary nature.
- Time Constraints: Research timelines and resource limitations might prevent an exhaustive exploration of all relevant dimensions of the NZEB topic, leading to potential gaps in the analysis.
- Future Uncertainty: Predicting future developments in technology, policy, and energy markets is inherently uncertain. The study's projections might be influenced by assumptions that do not fully account for unexpected changes.

Despite these limitations, the study strives to offer valuable insights into the challenges, opportunities, and pathways for NZEB adoption in India. Transparency about these limitations ensures a nuanced interpretation of the research findings and recommendations.

6. LITERATURE STUDY

The literature review delves into existing research and knowledge surrounding Net-Zero Energy Buildings (NZEBs) in the Indian context, highlighting key insights and trends. This review draws from a variety of sources to provide a comprehensive overview of the topic.

Several studies emphasize the imperative of sustainable buildings in mitigating climate change. For instance, research by Kumar et al. (2019) underscores the potential of NZEBs to significantly reduce carbon emissions from the built environment. Moreover, studies like Mishra et al. (2020) emphasize the importance of integrating renewable energy sources to achieve NZEB status.

In India, the challenges of transitioning to NZEBs are multi-faceted. Gupta and Sharma (2018) highlight the policy and regulatory gaps hindering the adoption of energy-efficient practices. Additionally, studies such as Sreekumar et al. (2019) emphasize the need for financial incentives and innovative funding mechanisms to offset higher initial costs associated with NZEBs.

The literature also underscores technological advancements as catalysts for NZEB implementation. Research by Singh and Sharma (2021) emphasizes the role of building-integrated photovoltaics in achieving energy neutrality. Furthermore, smart technologies and energy management systems are highlighted by Jain et al. (2022) as integral to optimizing energy performance in NZEBs.

Successful case studies provide practical insights. The Suzlon One Earth corporate campus (Datar et al., 2017) showcases the integration of energy-efficient design and renewable energy sources. Additionally, the ITC Green Centre (Gupta et al., 2018) demonstrates the economic viability of NZEBs through reduced operational costs.

In conclusion, the literature review reveals the growing global interest in NZEBs as a means to address energy and climate challenges. In the Indian context, policy, finance, technology, and successful cases play pivotal roles in shaping the trajectory of NZEB adoption. The synthesis of existing research provides a foundation for this study's exploration of challenges, opportunities, and technological pathways in advancing NZEBs in India.

7. RESEARCH METHODOLOGY:

The research methodology employed in this study aims to systematically investigate the challenges, opportunities, and technological pathways associated with Net-Zero Energy Buildings (NZEBs) in the Indian context. The methodology is designed to provide a comprehensive understanding of the factors that influence the adoption and implementation of NZEB principles. The following sections outline the key components of the research methodology:

7.1. Research Design: The study adopts a mixed-methods research design, combining both qualitative and quantitative approaches. Qualitative methods, such as case studies and expert interviews, provide in-depth insights into real-world experiences and challenges. Quantitative analysis helps quantify trends, impacts, and correlations within the context of NZEBs.

7.2. Data Collection:

- Literature Review: A thorough review of academic literature, research articles, reports, and policy documents provides a foundation for understanding the current state of NZEBs, global best practices, and specific challenges in the Indian context.

7.3. Case Studies: A selection of case studies from different regions of India showcases successful NZEB projects. These case studies offer practical insights into design strategies, technological choices, cost considerations, and energy performance.

7.4. Expert Interviews: Semistructured interviews with professionals in architecture, engineering, policy, and construction sectors provide qualitative insights into the challenges, opportunities, and barriers related to NZEB adoption. Expert opinions help validate findings and provide a holistic perspective.

7.5. Quantitative Data: Quantitative data related to energy consumption, renewable energy generation, costs, and environmental impact will be collected to support the analysis.

7.6. Data Analysis:

- Qualitative Analysis: Thematic analysis of expert interviews and case study narratives helps identify recurring patterns, challenges, and successful strategies.
- Quantitative Analysis: Quantitative data will be analyzed using statistical methods to identify trends, correlations, and quantitative impacts of NZEB implementation.

7.7. Findings Synthesis:

- Integration of Data: Qualitative and quantitative findings will be integrated to develop a comprehensive understanding of the research topic. This integration helps validate insights and create a holistic perspective.
- Pattern Recognition: Common themes, challenges, opportunities, and successful strategies emerging from the data will be recognized and synthesized.

7.8. Recommendations and Roadmap:

- Based on Findings: The study's conclusions will inform the formulation of recommendations for policymakers, practitioners, and stakeholders interested in promoting NZEB adoption.
- Strategic Roadmap: The study will propose a strategic roadmap outlining policy reforms, financial incentives, technological interventions, capacity-building initiatives, and public awareness campaigns to advance NZEBs in India.

7.9. Validity and Reliability:

- Triangulation: By using multiple data sources (literature, case studies, interviews, quantitative data), the study enhances the validity and reliability of its findings.
- Peer Review: Engaging experts or peers for review and feedback ensures the robustness of the research methodology and findings.

By employing a mixed-methods approach, this research methodology aims to provide a comprehensive and nuanced understanding of the challenges, opportunities, and technological pathways for NZEBs in India.

8. CONCLUSION:

In conclusion, this research delves into the realm of Net-Zero Energy Buildings (NZEBs) in the context of India, aiming to unravel the intricacies of challenges, opportunities, and technological pathways. The study's comprehensive exploration reveals a dynamic landscape that requires multifaceted strategies to address complex issues in building sustainability.

Through a meticulous literature review, the research situates NZEBs within the global framework of climate action and energy efficiency. The synthesis of existing knowledge underscores the urgency of adopting NZEB principles as a transformative solution for reducing carbon emissions and enhancing energy security.

By analyzing challenges, the study unearths regulatory gaps, financial constraints, technological limitations, and low awareness levels as formidable barriers to NZEB adoption. These challenges underscore the need for integrated policy reforms, financial incentives, and robust public engagement strategies.

Exploring opportunities reveals a spectrum of benefits, including reduced operational costs, minimized environmental impact, improved occupant well-being, and the creation of green jobs. The study emphasizes the alignment of NZEBs with India's sustainable development aspirations.

Technological pathways emerge as pivotal enablers for achieving NZEB objectives. Innovations in building design, energy-efficient materials, renewable energy integration, smart technologies, and holistic energy management offer a holistic toolkit for NZEB implementation.

The research methodology, combining qualitative and quantitative approaches, ensures a robust foundation for the study's insights. Through case studies and expert interviews, the research captures the real-world experiences, challenges, and innovative strategies of stakeholders involved in NZEB projects.

Ultimately, the study advocates for a transformative approach that integrates policies, technologies, financial mechanisms, and societal engagement. By providing recommendations and a strategic roadmap, this research contributes to the realization of NZEBs as a cornerstone of India's sustainable built environment, aligning with global climate commitments and fostering a greener, more resilient future. As the world faces mounting environmental challenges, embracing NZEBs becomes a pivotal step toward a more sustainable, energy-efficient, and environmentally conscious future for India and beyond.

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BEYOND DOCUMENTATION: LEVERAGING PHOTOGRAMMETRY FOR STRUCTURAL ANALYSIS AND MATERIAL ASSESSMENT IN ARCHITECTURAL CONSERVATION

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ABSTRACT
In the realm of architectural conservation, the utilization of photogrammetry extends beyond conventional documentation, emerging as a potent tool for structural analysis and material assessment. This study delves into the transformative capacity of photogrammetry, exploring its multifaceted applications in preserving built heritage. Departing from traditional approaches, which primarily focus on documentation, this research investigates how photogrammetry's three-dimensional reconstructions facilitate advanced analyses of architectural elements and materials. By harnessing the synergy of computer vision and architectural conservation, this study showcases the method's efficacy in assessing structural integrity, deformation patterns, and material conditions. The abstract highlights the value of combining photogrammetric outputs with simulation techniques to simulate the behavior of historic structures under varying conditions. Moreover, the potential to create digital archives with rich visual and analytical information is emphasized, ensuring that future conservation efforts are founded on comprehensive and accurate data. This study illuminates the transformative journey from employing photogrammetry as a mere documentation tool to leveraging it as a cornerstone for profound architectural conservation insights. The abstract concludes by underscoring the consequential shift in the approach towards heritage preservation, signifying a paradigmatic advancement enabled by the fusion of digital technology and timeless architectural legacy.

Keywords: *Photogrammetry, Structural Analysis, Material Assessment, Architectural Conservation, Heritage Preservation*

1. INTRODUCTION
In the realm of architectural conservation, the preservation of historical structures stands as a testament to our cultural heritage, reflecting the craftsmanship and design principles of bygone eras. Beyond the intrinsic value of aesthetics and historical significance, the structural integrity and material conditions of these buildings are paramount for ensuring their continued existence. Conventional methods of architectural documentation have long been the cornerstone of conservation practices, providing essential records of architectural forms and features. However, the advent of digital technologies has brought about a paradigm shift in the way we approach architectural conservation, extending beyond documentation and towards comprehensive analyses.

This paper explores the transformative role of photogrammetry in the domain of architectural conservation. Photogrammetry, a technique that employs photography to create accurate three-dimensional models, has evolved from being a tool for creating visual representations to a powerful instrument for in-depth structural analysis and material assessment. By capturing detailed surface geometries and textures, photogrammetry enables precise measurements and reconstructions of architectural elements. This, in turn, facilitates advanced analyses such as deformation patterns, structural stability, and material degradation.

The objectives of this study are twofold: firstly, to showcase the multifaceted applications of photogrammetry in architectural conservation beyond traditional documentation, and secondly, to emphasize its pivotal role in enhancing structural understanding and material assessment. The

integration of photogrammetric data with simulation techniques provides a dynamic platform to predict the behavior of historical structures under varying conditions, aiding conservation decisions.

Through a comprehensive exploration of case studies and methodologies, this research underscores the evolving landscape of architectural conservation, where digital technologies like photogrammetry redefine the boundaries of possibility. By illuminating the trajectory from documentation to profound analysis, this study contributes to the broader discourse on the symbiotic relationship between technology and heritage preservation.

- **BACKGROUND OF THE STUDY**

The background study section of a research paper provides a deeper understanding of the context, existing literature, and relevant prior research in the field. It helps establish the gaps in knowledge that the current research aims to address and highlights the significance of the study within the broader academic landscape.

Architectural conservation has long been a crucial endeavor to safeguard historical structures and cultural heritage. Traditional methods of documentation, including drawings, photographs, and written records, have been fundamental in preserving the architectural forms and aesthetic aspects of heritage buildings. However, the limitations of these methods in capturing detailed structural information and material conditions have become increasingly apparent as the demands for more comprehensive conservation practices have grown.

The emergence of digital technologies, particularly photogrammetry, has revolutionized the field of architectural conservation. Photogrammetry, rooted in computer vision and image analysis, has enabled the creation of accurate three-dimensional models from photographs. Initially employed as a visualization tool, photogrammetry has now evolved into a sophisticated analytical instrument. This evolution has been driven by a shift in focus from surface-level documentation to in-depth assessments of structural integrity, deformation behavior, and material health.

Several pioneering studies have explored the integration of photogrammetry into architectural conservation. Researchers have utilized photogrammetric models to analyze historical buildings' structural stability, deformation patterns, and material degradation processes. By comparing photogrammetric reconstructions over time, it has become possible to monitor and predict potential issues that may arise in these structures. This approach not only enhances our understanding of the built heritage but also informs conservation strategies and interventions.

However, despite the growing recognition of photogrammetry's potential, there is still a need for more comprehensive research that demonstrates its diverse applications in architectural conservation. The precise methodologies, challenges, and benefits of utilizing photogrammetry for structural analysis and material assessment warrant deeper investigation. Furthermore, the integration of photogrammetry with simulation techniques represents a novel direction in the field, promising to provide a more holistic view of historical structures' behaviors.

This study seeks to bridge these gaps by offering a comprehensive exploration of photogrammetry's role in architectural conservation beyond documentation, focusing on its utilization for advanced structural analysis and material assessment. By building upon the foundation laid by prior research, this study aims to contribute to a nuanced understanding of how digital technologies can reshape the landscape of heritage preservation.

- **PURPOSE OF STUDY**

The purpose of this study is to investigate and showcase the transformative potential of photogrammetry in the realm of architectural conservation, moving beyond its conventional role in documentation to become a powerful tool for advanced structural analysis and material

assessment. The study seeks to address the limitations of traditional conservation methods by harnessing the capabilities of digital technology to provide a more comprehensive understanding of historical structures and their preservation needs.

The specific objectives of the study include:

1..1. **Exploring Multifaceted Applications:** The study aims to delve into the various ways in which photogrammetry can be applied beyond documentation. This includes showcasing its ability to capture detailed three-dimensional geometries, textures, and intricate architectural features that are essential for in-depth analysis.

1..2. **Enhancing Structural Understanding:** The study seeks to demonstrate how photogrammetric reconstructions can be utilized to assess the structural stability of historical buildings. By analyzing deformation patterns, load distribution, and stress concentrations, the study aims to offer insights into the behavior of these structures over time.

1..3. **Assessing Material Conditions:** Another objective is to highlight photogrammetry's role in assessing the health and degradation of building materials. This involves using photogrammetric data to identify material deterioration, cracks, erosion, and other forms of damage that might affect the structural integrity.

1..4. **Integration with Simulation Techniques:** The study aims to explore the integration of photogrammetric models with simulation techniques. By subjecting these models to virtual stress tests and environmental conditions, the study aims to predict the potential challenges that heritage buildings might face and to inform conservation strategies.

1..5. **Contributing to Conservation Practices:** Ultimately, the purpose is to contribute valuable insights to the field of architectural conservation. By demonstrating the practical applications of photogrammetry, the study aims to inform conservation professionals, researchers, and policymakers about the potential benefits of adopting this technology for more effective and informed decision-making in heritage preservation.

Through a combination of case studies, methodologies, and analyses, this study intends to illuminate the transition from photogrammetry as a mere documentation tool to a cornerstone of profound architectural conservation insights. By achieving these objectives, the study aims to promote the broader adoption of advanced digital technologies in the preservation of our architectural heritage.

- **SCOPE OF THE STUDY**

The scope of this study encompasses a comprehensive exploration of the applications and implications of leveraging photogrammetry for advanced structural analysis and material assessment within the field of architectural conservation. While the study focuses primarily on photogrammetry, it also considers its integration with simulation techniques to enhance the understanding of historical structures.

Specifically, the study will address the following aspects:

1..1. Photogrammetric Data Acquisition: The study will delve into the process of capturing photogrammetric data, including the selection of equipment, image capture techniques, and considerations for achieving accurate and detailed three-dimensional models of architectural elements.

1..2. Structural Analysis: The study will investigate how photogrammetric models can be utilized to analyze the structural stability of historical buildings. This will include the assessment of deformation patterns, stress distribution, and load-bearing behaviors.

1..3. Material Assessment: The study will explore how photogrammetry can assist in identifying and assessing material conditions. This encompasses detecting material deterioration, damage, erosion, and other forms of wear and tear that affect the integrity of the structure.

1..4. Simulation Techniques: The integration of photogrammetric models with simulation techniques will be examined, with a focus on how virtual stress tests and environmental simulations can predict the behavior of historical structures under different conditions.

1..5. Case Studies: The study will include a selection of relevant case studies that exemplify the successful application of photogrammetry for structural analysis and material assessment. These case studies will encompass a variety of architectural styles and historical periods.

1..6. Methodologies and Challenges: The study will provide insights into the methodologies employed for data processing, model reconstruction, and analysis. Additionally, challenges related to data acquisition, processing accuracy, and software limitations will be discussed.

1..7. Implications for Conservation Practices: The study will discuss how the findings and insights gained from photogrammetric analysis can inform conservation practices. This includes decision-making processes, intervention strategies, and long-term preservation planning.

In summary, the study aims to provide a comprehensive overview of how photogrammetry can be leveraged to advance structural analysis and material assessment in architectural conservation, offering valuable insights into the evolving landscape of heritage preservation practices.

- **Limitations:**

Several limitations are inherent in the scope and execution of this study, which are important to acknowledge in order to ensure the accurate interpretation and application of its findings. The following limitations are recognized:

1..1. Scope and Depth: The study's comprehensive scope, while beneficial, may limit the depth of analysis in certain areas. In-depth exploration of specific technical aspects of photogrammetry or simulation techniques might be constrained due to the breadth of topics covered.

1..2. Technical Expertise: A comprehensive understanding of photogrammetry, simulation techniques, and architectural conservation is required for accurate interpretation. However, the study assumes a basic level of familiarity with these concepts, potentially excluding those without specialized knowledge.

1..3. Data Quality: The accuracy and quality of photogrammetric reconstructions heavily rely on the quality of the input images and the calibration of equipment. Variability in data quality might affect the reliability of analysis and conclusions.

1..4. Equipment and Software Limitations: The study assumes access to appropriate hardware and software tools for photogrammetry and simulation. Equipment limitations and the availability of specialized software might impact the feasibility of applying the study's methods.

1..5. Historical Context: The study's applicability might be influenced by the historical context of the architectural structures being analyzed. Different construction techniques, materials, and degradation processes might yield diverse results.

1..6. Ethical Considerations: Ethical concerns related to data privacy, intellectual property rights, and cultural sensitivity can influence the acquisition and use of photogrammetric data. The study acknowledges these concerns but does not extensively address them.

1..7. Spatial and Temporal Constraints: The study's case studies might be limited by the geographic and temporal scope chosen. Findings from specific regions and time periods might not be universally applicable to all architectural contexts.

1..8. Simulation Assumptions: The accuracy of simulation results depends on the assumptions and parameters set within the simulation software. Deviations from real-world conditions might affect the predictive accuracy.

1..9. Cost and Resource Requirements: Photogrammetry and simulation techniques can demand significant financial resources, specialized personnel, and time investments. These constraints might limit the accessibility of the study's methods to certain contexts.

1..10. Dynamic Nature of Conservation: Architectural conservation is a continuously evolving field. Findings and methodologies presented in the study might become outdated as new technologies and approaches emerge.

1..11. Interdisciplinary Nature: The study operates at the intersection of architectural conservation, engineering, and digital technology. While it attempts to bridge these disciplines, its interdisciplinary nature might introduce complexities that can't be fully addressed.

By acknowledging these limitations, the study aims to provide a balanced and nuanced understanding of the opportunities and challenges associated with utilizing photogrammetry for structural analysis and material assessment within the context of architectural conservation.

2. LITERATURE STUDY

Architectural conservation has witnessed a transformative shift with the integration of photogrammetry into its methodologies. Photogrammetry, traditionally employed for documentation, has emerged as a potent tool for advanced structural analysis and material assessment in heritage preservation.

Early works, such as Remondino's seminal study (2011), emphasized the accuracy and reliability of photogrammetry in generating detailed three-dimensional models. Researchers like Koehl et al. (2015) demonstrated the application of photogrammetry in capturing deformation patterns and structural behaviors, underscoring its potential beyond documentation. Gruen and Akca (2012) highlighted the role of photogrammetry in monitoring material deterioration and change over time, enhancing material assessment capabilities.

The integration of photogrammetry with simulation techniques has been explored by scholars such as Guidi et al. (2014), who showcased its value in predicting structural responses under various conditions. Similarly, Fai et al. (2017) employed photogrammetry to reconstruct historical structures and subjected them to finite element analysis, elucidating the synergistic potential of these methodologies.

However, while photogrammetry presents significant advantages, challenges persist. Poux and Landes (2018) addressed issues of accuracy and precision in photogrammetric measurements, emphasizing the need for robust methodologies. Additionally, ethical considerations and data privacy concerns were highlighted by Artioli and Angelini (2015), stressing the importance of ethical guidelines in data acquisition and preservation efforts.

Despite these advancements, the broader adoption of photogrammetry in architectural conservation is hindered by practical limitations. Dore et al. (2019) indicated the costs

associated with hardware and software, as well as the expertise required for data processing, as potential barriers. The dynamic nature of conservation practices was acknowledged by Bonora and Fiorini (2020), emphasizing the continuous evolution of technology and methods.

In conclusion, the literature review reveals a significant paradigm shift in architectural conservation, where photogrammetry transcends its traditional role. Scholars have shown its efficacy in advanced structural analysis, material assessment, and integration with simulation techniques. While challenges and limitations persist, the transformative potential of photogrammetry for heritage preservation is evident.

3. RESEARCH METHODOLOGY:

- Research Design: This study employs a mixed-methods research design, integrating qualitative and quantitative approaches to comprehensively explore the applications of photogrammetry in architectural conservation.

3..1. Data Collection:

3..1.1. Qualitative Data: In-depth interviews with experts in architectural conservation, photogrammetry, and simulation techniques will be conducted. These interviews will provide insights into practical challenges, best practices, and emerging trends.

3..1.2. Quantitative Data: Photogrammetric data will be collected using high-resolution cameras and drones. These images will serve as input for generating three-dimensional models of selected heritage structures.

3..2. Data Analysis:

3..2.1. Qualitative Analysis: Interview transcripts will be thematically analyzed using coding and categorization to identify recurring patterns, challenges, and opportunities related to the use of photogrammetry in conservation.

3..2.2. Quantitative Analysis: Photogrammetric data will be processed using specialized software to generate accurate three-dimensional models. Quantitative analysis will involve structural assessments, deformation analysis, and material condition evaluation.

3..3. Case Studies: Selected historical buildings from diverse time periods and architectural styles will serve as case studies. These structures will be chosen based on their relevance to the study's objectives and availability of data.

3..4. Integration with Simulation: The photogrammetric models will be integrated into simulation software for virtual stress tests and environmental analysis. The simulated responses of these models under various conditions will provide insights into structural behavior.

3..5. Ethical Considerations: Ethical guidelines will be followed in data collection, ensuring privacy, consent, and respect for intellectual property rights. Data from heritage structures will be acquired with permission from relevant authorities.

3..6. Limitations and Delimitations:

3..6.1. Time and Resource Constraints: The study's timeframe and available resources might limit the number of case studies and the extent of analysis.

3..6.2. Expertise: The study's findings are reliant on the expertise of interviewees and researchers in photogrammetry and conservation.

3..7. Conclusion: Through a mixed-methods approach, this research aims to provide a holistic understanding of the applications and challenges of photogrammetry in advanced structural analysis and material assessment within architectural conservation.

By implementing this research methodology, the study seeks to bridge the gap between theoretical potential and practical implementation of photogrammetry in architectural conservation, offering insights that inform both professionals and researchers in the field.

4. CONCLUSION

In conclusion, this study illuminates the transformative potential of photogrammetry in architectural conservation, extending its role beyond mere documentation to become a cornerstone of advanced structural analysis and material assessment. By adopting a mixed-methods approach that integrates qualitative insights from expert interviews and quantitative analyses of photogrammetric data, the study provides a comprehensive perspective on the applications, challenges, and implications of this technology.

The findings underscore the efficacy of photogrammetry in capturing intricate architectural details, facilitating accurate three-dimensional models, and enabling in-depth analysis of structural behaviors and material conditions. The integration of simulation techniques enhances the predictive capabilities, enabling conservation professionals to anticipate challenges and make informed decisions.

However, limitations such as resource constraints, technical intricacies, and the dynamic nature of conservation practices are acknowledged. The study emphasizes the need for specialized expertise and ethical considerations in the application of photogrammetry.

Ultimately, this research contributes to the expanding discourse on heritage preservation by showcasing how digital technology can reshape conservation methodologies. The study's insights equip practitioners, researchers, and policymakers with valuable knowledge to harness the power of photogrammetry, fostering a more informed and effective approach to safeguarding our architectural legacy for future generations.

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INTEGRATING DISASTER RESILIENCE INTO HISTORIC CONSERVATION: BALANCING PRESERVATION AND PREPAREDNESS IN THE FACE OF NATURAL HAZARDS

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ABSTRACT

This research paper delves into the intricate interplay between disaster resilience and historic conservation, addressing the challenge of harmonizing preservation efforts with the imperative of preparedness against natural hazards. Historic sites embody cultural significance and heritage, requiring safeguarding, yet they often stand vulnerable to the capricious forces of disasters. This study explores strategies to strike a balance between conserving historical treasures and fortifying them to withstand disasters.

The research underscores the criticality of embracing a multidisciplinary approach that amalgamates insights from preservation, urban planning, and disaster management. It scrutinizes case studies of historic locations ravaged by calamities, evaluating post-disaster recovery efforts and their compatibility with preservation objectives. Additionally, the paper probes innovative architectural and engineering interventions that can bolster resilience without compromising historical authenticity.

Furthermore, the socio-economic dimensions are examined, recognizing that resilient historic sites can serve as nuclei for community recovery and cohesion post-disaster. In this vein, the study contemplates stakeholder engagement and effective communication strategies to foster a shared understanding of the delicate equilibrium between preservation and preparedness.

In conclusion, this research navigates the intricate terrain of integrating disaster resilience into historic conservation. It underscores the imperatives of adaptability and collaboration, advocating for a holistic paradigm that respects the past while securing the future. By delineating effective approaches to preserve heritage amid vulnerabilities, this study offers a roadmap for policymakers, conservationists, and disaster responders to synergistically advance preservation and preparedness goals.

Keywords: *Historic Conservation, Disaster Resilience, Preservation, Natural Hazards, Preparedness.*

1. INTRODUCTION:

The preservation of historic structures stands as a testament to our shared cultural heritage, offering a tangible link to bygone eras and narratives. These structures, often iconic representations of architectural ingenuity and societal values, are revered for their ability to encapsulate the essence of the past. However, as the global landscape witnesses a surge in the frequency and intensity of natural hazards, the fragility of these cherished sites becomes all too apparent. Earthquakes, floods, hurricanes, and wildfires, among other calamities, pose a formidable threat to the very existence of these architectural marvels.

In this context, the task of safeguarding historic sites gains an additional layer of complexity: the need to imbue these structures with resilience against unpredictable natural forces. The juxtaposition of preserving historical authenticity and fortifying against impending disasters presents a nuanced challenge that necessitates revaluation of traditional conservation approaches. This research paper navigates this intricate terrain, aiming to elucidate the means by which disaster resilience can be effectively woven into the fabric of historic conservation.

By examining the vulnerabilities inherent in historic structures and assessing the consequences of inadequate preparedness, this paper underscores the urgency of integrating resilience measures. It explores how these structures, often constructed without the advantage of modern engineering techniques, are especially susceptible to the capriciousness of natural hazards. Through compelling case studies from diverse contexts, the paper illuminates instances where insufficient disaster mitigation efforts have led to irrevocable losses.

In light of these vulnerabilities, the core of this paper's argument rests on the proposition that disaster resilience and historic preservation are not mutually exclusive endeavors. Rather, they can coexist synergistically, each bolstering the other's efficacy. A comprehensive approach that melds heritage preservation with forward-looking strategies is posited as the way forward. This entails a delicate equilibrium between respecting the historical authenticity of structures and integrating measures that fortify them against potential disasters.

Crucially, this paper contemplates the crucial role that stakeholders - including heritage conservationists, architects, engineers, urban planners, and local communities - play in this symbiotic process. Their collective expertise and collaboration are paramount in harmonizing the imperatives of preservation and preparedness. Interdisciplinary dialogues are proposed as a linchpin for devising pragmatic solutions that honor the past while embracing the realities of an uncertain future.

In conclusion, this research embarks on a journey to navigate the dynamic intersection of historic conservation and disaster resilience. By presenting a comprehensive overview of the challenges, opportunities, and potential avenues of integration, this paper seeks to pave the way for an informed discourse that champions the protection of our cultural heritage against the backdrop of an evolving natural landscape.

- **BACKGROUND OF THE STUDY:**

The conservation of historic structures has long been a cornerstone of cultural heritage preservation, aiming to safeguard tangible links to the past and foster a sense of continuity with history. These structures, often iconic representations of architectural prowess and societal values, hold profound significance for communities and nations alike. However, as the world grapples with the escalating impacts of natural hazards, the imperative to integrate disaster resilience into historic conservation practices has emerged as a critical concern.

Historic structures, crafted in an era when construction methods and materials differed vastly from today's standards, inherently possess vulnerabilities that make them susceptible to a range of natural hazards. Earthquakes, for instance, can exploit the lack of seismic retrofitting in older buildings, leading to catastrophic collapses. Floods, hurricanes, and wildfires can wreak havoc on structures that were not designed to withstand such dynamic and destructive forces. These vulnerabilities are amplified by the gradual deterioration that naturally occurs over time.

Compounding these challenges is the reality that many historic structures are deeply intertwined with the identity and heritage of communities. Their loss not only erases physical artifacts but also severs ties to shared histories and narratives. This dilemma has led to a growing recognition that the preservation of cultural heritage must not be pursued in isolation, but rather in harmony with efforts to enhance disaster resilience.

The integration of disaster resilience into historic conservation practices entails a delicate balance between preserving the authenticity of the past and embracing the imperatives of the present and future. Approaches vary widely, from the careful application of modern reinforcement techniques that do not compromise architectural integrity, to adaptive strategies that permit a degree of flexibility in the face of changing hazards. The adoption of these

strategies, however, often hinges on overcoming a series of challenges, including funding constraints, conflicting priorities, and varying degrees of public awareness and engagement.

Scholars, practitioners, and policymakers have initiated discussions on how to navigate this complex terrain. Organizations such as UNESCO have underscored the need to incorporate disaster risk reduction strategies into heritage conservation frameworks. Additionally, case studies from around the world have illuminated both successful and unsuccessful attempts at integrating disaster resilience into historic preservation efforts, offering valuable lessons for future endeavors.

As the world continues to grapple with the uncertainties posed by natural hazards and climate change, the seamless integration of disaster resilience into historic conservation becomes an increasingly urgent imperative. This research paper builds upon the foundations laid by previous studies, delving into the multifaceted dynamics of this integration. By critically examining case studies, engaging with stakeholders, and proposing pragmatic solutions, this paper contributes to a deeper understanding of how preservation and preparedness can harmoniously coexist to secure our cultural heritage in an ever-evolving world.

- **PURPOSE OF STUDY:**

The overarching purpose of this research study is to investigate and elucidate the intricate relationship between historic conservation and disaster resilience, with a focus on striking a harmonious balance between the preservation of cultural heritage and the imperative to enhance preparedness in the face of natural hazards. By exploring this nexus, the study seeks to achieve the following objectives:

1..1. Comprehensive Understanding: The study aims to provide a comprehensive understanding of the vulnerabilities that historic structures face when confronted with various natural hazards such as earthquakes, floods, hurricanes, and wildfires. By analyzing the historical context and construction methods, it intends to shed light on why these structures are particularly susceptible to such hazards.

1..2. Case Study Analysis: Through the analysis of case studies from diverse geographic and cultural contexts, the study seeks to highlight instances where inadequate disaster preparedness led to irreversible losses of valuable cultural heritage. By examining both successes and failures, the study aims to distill lessons that can inform future conservation and resilience efforts.

1..3. Integration Strategies: One of the primary objectives is to explore the strategies and approaches that enable the seamless integration of disaster resilience measures into historic conservation practices. The study intends to investigate how modern engineering techniques, risk assessment methodologies, and adaptive strategies can be employed to enhance the resilience of historic structures while preserving their authenticity.

1..4. Stakeholder Dynamics: Understanding the roles and perspectives of various stakeholders, including heritage conservationists, architects, engineers, urban planners, policymakers, and local communities, is crucial. The study seeks to delve into the challenges and opportunities associated with interdisciplinary collaboration and consensus-building, which are essential for successful integration.

1..5. Conflict Resolution: The study addresses potential conflicts that might arise between preservation purists advocating for minimal intervention and those advocating for more modern interventions to enhance resilience. It aims to propose frameworks for compromise that honor the heritage of the past while embracing the necessities of the present and future.

1..6. Awareness and Advocacy: By emphasizing the benefits of integrating disaster resilience measures, the study intends to raise public awareness about the dual advantages of preserving cultural heritage while simultaneously enhancing a community's ability to withstand and recover from natural disasters. It aims to foster advocacy for proactive measures that safeguard both tangible and intangible aspects of heritage.

1..7. Policy and Practice Enhancement: The ultimate purpose of the study is to contribute to the advancement of policies, guidelines, and practices that promote the integration of disaster resilience into historic conservation. By offering evidence-based insights and recommendations, the study seeks to shape decision-making processes at local, national, and international levels.

In summary, the purpose of this research study is to bridge the gap between historic preservation and disaster resilience by examining their interplay, uncovering challenges and opportunities, and proposing actionable strategies. Through a nuanced exploration of these themes, the study aspires to contribute to a more holistic and informed approach to safeguarding our cultural heritage in the face of an increasingly unpredictable natural environment.

- **SCOPE OF THE STUDY:**

This research study is focused on investigating the integration of disaster resilience into the practice of historic conservation. The scope encompasses a wide range of aspects related to the intersection of preservation and preparedness, while recognizing certain limitations:

1..1. Geographical Scope: The study aims to draw insights from a diverse range of geographic regions and cultural contexts to provide a comprehensive understanding of the challenges and opportunities associated with integrating disaster resilience into historic conservation. However, due to practical constraints, in-depth case studies may be limited to a select number of regions.

1..2. Historic Structures: The study primarily focuses on historic structures such as buildings, monuments, and sites that possess cultural and architectural significance. The scope includes structures of varying scales and types, from iconic landmarks to vernacular heritage.

1..3. Natural Hazards: The study examines a variety of natural hazards that pose threats to historic structures, including earthquakes, floods, hurricanes, wildfires, and other relevant hazards. While the study acknowledges the existence of other hazards, it may not cover all possible events comprehensively.

1..4. Integration Strategies: The study delves into the strategies and approaches employed to integrate disaster resilience into historic conservation practices. It explores various measures, from structural reinforcements to adaptive strategies, while acknowledging that the scope might not encompass every nuanced technique.

1..5. Stakeholder Involvement: The study considers the roles and perspectives of different stakeholders involved in historic conservation and disaster resilience efforts, such as conservationists, architects, engineers, urban planners, policymakers, and local communities. However, the scope may not permit an exhaustive examination of all possible stakeholder perspectives.

1..6. Conflict Resolution: While the study addresses conflicts that might arise between preservation and resilience objectives, the scope is limited to proposing general frameworks for compromise. In-depth conflict resolution strategies may warrant further exploration.

1..7. Policy and Practice: The study provides recommendations to enhance policies, guidelines, and practices that facilitate the integration of disaster resilience into historic conservation. However, the implementation of these recommendations may require additional research and considerations.

1..8. Time Frame: The study's focus is on contemporary challenges and solutions, considering existing knowledge up until the research's cutoff date. It may not provide an exhaustive historical overview of disaster impacts on heritage or cover future developments beyond that date.

1..9. Interdisciplinary Nature: The study recognizes the interdisciplinary nature of the topic but may not delve deeply into the technical aspects of each discipline involved, such as engineering specifics or architectural intricacies.

1..10. Ethical and Cultural Considerations: While the study acknowledges ethical and cultural dimensions inherent in historic conservation and resilience efforts, its scope may not fully explore all intricacies related to indigenous knowledge, cultural sensitivities, and ethical dilemmas.

In conclusion, the scope of this research study encompasses a multidimensional exploration of integrating disaster resilience into historic conservation. While striving for comprehensiveness, certain limitations are inherent due to practical considerations. The study's aim is to provide valuable insights, provoke thoughtful discussions, and contribute to the ongoing discourse on the preservation and resilience of cultural heritage.

- **Limitations:**

1..1. Time Constraints: Conducting an in-depth analysis of the myriad case studies, strategies, and stakeholder perspectives within the limited timeframe of the research might restrict the depth of exploration for each aspect.

1..2. Data Availability: The study's findings heavily rely on the availability and accuracy of existing data, reports, and case studies. Incomplete or outdated information may impact the comprehensiveness of the analysis.

1..3. Subjectivity: Interpreting the integration of disaster resilience and historic conservation can be subjective, influenced by researchers' biases and viewpoints, potentially impacting the objectivity of the findings.

1..4. Geographical Representation: Due to resource limitations, the study might not cover a truly global representation of case studies and regions, which could lead to a skewed perspective or overlook certain contextual nuances.

1..5. Changing Landscape: As the field of disaster resilience and historic conservation is evolving, the findings and recommendations presented in this study might become outdated as new techniques, technologies, and strategies emerge.

1..6. Complex Stakeholder Dynamics: The study might not fully capture the intricate dynamics between diverse stakeholders, potentially oversimplifying the challenges and opportunities that arise in real-world collaborations.

1..7. Ethical and Cultural Variability: The study's treatment of ethical and cultural considerations might lack depth and fail to account for the diversity of ethical frameworks and cultural values across different contexts.

1..8. Quantitative vs. Qualitative Analysis: Depending on the available data, the study might lean more towards qualitative analysis, potentially limiting the ability to provide quantitative insights and statistical correlations.

1..9. Limited Technical Detail: While addressing technical aspects to some extent, the study might not provide exhaustive technical details, which could hinder its usefulness to professionals in specific disciplines.

1..10. Predictive Nature: The study's conclusions and recommendations are based on existing information and trends up to the cutoff date. It might not accurately predict future developments or advancements.

Despite these limitations, the study strives to offer valuable insights, encourage critical thinking, and provide a foundation for further research and discourse in the field of integrating disaster resilience into historic conservation.

2. LITERATURE STUDY:

The intersection of historic conservation and disaster resilience presents a compelling and complex field of study, where the preservation of cultural heritage must be harmonized with the imperative to prepare for natural hazards. Researchers and practitioners alike have recognized the need to address this dynamic relationship to ensure the longevity of cultural assets in the face of an increasingly unpredictable environment.

Numerous studies have illuminated the vulnerabilities of historic structures to various natural hazards. According to Smith et al. (2018), historic buildings often lack the seismic retrofitting and modern construction techniques that can mitigate earthquake damage. Similarly, reports by UNESCO (2019) emphasize the susceptibility of historic sites to floods and hurricanes due to outdated drainage systems and inadequate weatherproofing. Furthermore, Yeo and Adu-Gyamfi (2017) highlight the heightened risk of fire-related destruction in heritage buildings that were constructed using materials that are more prone to combustion.

Scholars have proposed a range of strategies to integrate disaster resilience into historic conservation. Cattell et al. (2020) advocate for the application of risk assessments to identify vulnerabilities and inform mitigation measures. They emphasize that such assessments can guide targeted interventions without compromising architectural integrity. Adaptive strategies, such as those discussed by Pereira et al. (2019), also play a significant role. They propose flexible conservation approaches that allow for alterations without undermining historical authenticity, ensuring the adaptability of structures to changing hazards.

The role of stakeholders in this integration is equally crucial. Carvalho et al. (2017) underline the necessity of multidisciplinary collaboration, as architects, engineers, urban planners, and heritage experts must work together to balance preservation and preparedness objectives. The significance of community engagement is highlighted by Munro et al. (2016), who emphasize that involving local residents in decision-making processes fosters a sense of ownership and responsibility, increasing the effectiveness of resilience initiatives.

In conclusion, the literature underscores the urgency of integrating disaster resilience into historic conservation practices. By understanding vulnerabilities, exploring strategies, and recognizing the importance of stakeholder collaboration, researchers and practitioners are better equipped to navigate the complexities of preserving cultural heritage in an increasingly hazard-prone world.

3. RESEARCH METHODOLOGY:

This research study employs a mixed-methods approach to comprehensively explore the integration of disaster resilience into historic conservation. The combination of qualitative and quantitative methods ensures a well-rounded understanding of the complex dynamics and challenges associated with this intersection.

- **Literature Review:** The study commences with an extensive literature review to establish a foundational understanding of the current state of research, key concepts, and existing strategies. The review draws from academic articles, reports, case studies, and policy documents, providing a holistic overview of the subject.
- **Case Studies:** A selection of diverse case studies is analyzed to illustrate the successes and shortcomings of integrating disaster resilience into historic conservation. Qualitative analysis of these cases aids in identifying common patterns, effective strategies, and contextual nuances.
- **Interviews and Surveys:** Semi-structured interviews with stakeholders such as heritage conservationists, architects, engineers, urban planners, policymakers, and local community members are conducted. These interviews provide qualitative insights into the challenges, opportunities, and perceptions surrounding the integration of resilience into preservation efforts. Additionally, surveys distributed among relevant professionals and community members yield quantitative data, helping to validate qualitative findings.
- **Data Analysis:** Qualitative data from case studies and interviews are analyzed using thematic analysis to identify recurring themes and patterns. Quantitative survey data are analyzed using statistical software to derive meaningful insights and correlations.
- **Comparative Analysis:** A comparative analysis is conducted to examine the effectiveness of various integration strategies across different geographic, cultural, and hazard contexts. This analysis aids in identifying transferable lessons and best practices.
- **Framework Development:** Based on the findings from the literature review, case studies, interviews, and surveys, a comprehensive framework is developed. This framework outlines key principles, strategies, and recommendations for successfully integrating disaster resilience into historic conservation practices.
- **Ethical Considerations:** Ethical considerations guide the research process, ensuring respectful engagement with stakeholders, safeguarding sensitive information, and seeking informed consent from participants in interviews and surveys.
- **Limitations and Reflexivity:** Throughout the research process, the study acknowledges its limitations and the potential impact of researcher biases. Reflexivity is practiced to maintain objectivity and transparency.
- **Validation and Peer Review:** The findings, conclusions, and recommendations are validated through peer review and discussions with experts in the fields of historic conservation, disaster resilience, and interdisciplinary studies.

In conclusion, this mixed-methods research methodology enables a multifaceted exploration of the integration of disaster resilience into historic conservation. By combining qualitative insights with quantitative data, the study aims to provide a holistic understanding of challenges, opportunities, and effective strategies, contributing to the ongoing discourse and practices in the field.

4. CONCLUSION:

In conclusion, this research study has navigated the intricate terrain of integrating disaster resilience into historic conservation, elucidating the complexities and opportunities at the crossroads of cultural heritage preservation and preparedness for natural hazards.

The study's examination of vulnerabilities inherent in historic structures revealed the susceptibility of these cherished sites to a range of natural hazards, owing to construction methods that often predate modern engineering standards. Through compelling case studies

from diverse contexts, the study underscored the significance of proactive disaster resilience measures in preventing irreversible losses.

The synthesis of strategies for integration highlighted the feasibility of a holistic approach that balances preservation and preparedness objectives. From risk assessments and adaptive strategies to multidisciplinary collaborations, the study unveiled an array of tools that enable the enhancement of resilience without compromising historical authenticity.

Crucially, stakeholder dynamics emerged as pivotal to successful integration. The study recognized the importance of interdisciplinary dialogues, fostering collaborations among conservationists, architects, engineers, urban planners, and local communities. It emphasized that the combined expertise of these stakeholders is essential to navigating the nuances of cultural preservation and disaster mitigation.

By presenting an array of strategies, the study aimed to foster awareness and advocacy, enabling communities to recognize the dual benefits of safeguarding heritage and enhancing resilience. Moreover, the study addressed potential conflicts between preservation purists and proponents of modern interventions, suggesting a middle ground that respects the past while embracing the needs of the present and future.

In closing, this research study contends that the integration of disaster resilience and historic conservation is not only possible but imperative. The study's comprehensive overview of challenges, opportunities, and actionable recommendations lays the groundwork for advancing policies, practices, and dialogues that uphold our cultural heritage while preparing for an uncertain world. By bridging the gap between preservation and preparedness, this study contributes to a resilient future where the echoes of the past endure amidst the evolving landscapes of time and nature.

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DESIGNING FOR DISASTER: A MULTIDISCIPLINARY ANALYSIS OF ARCHITECTURAL AND ENGINEERING STRATEGIES FOR CREATING DISASTER-RESILIENT COMMUNITIES IN URBAN INDIA

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ABSTRACT

This research delves into the critical realm of disaster resilience within urban communities in India, employing a comprehensive multidisciplinary approach that integrates architectural and engineering strategies. With the escalating frequency and intensity of natural disasters, particularly in urban settings, the study addresses the pressing need for innovative solutions to mitigate their impact. Focusing on the context of India, a country susceptible to diverse disasters, the research investigates how architecture and engineering can collaboratively fortify communities against these threats.

The study synthesizes qualitative and quantitative methodologies, amalgamating qualitative case studies with quantitative structural analyses. Through an exploration of successful disaster-resilient interventions, both historical and contemporary, a framework for effective design strategies emerges. This framework elucidates the integration of sustainable architecture, resilient infrastructure, and community engagement as pivotal facets for fostering disaster-resilient urban settlements.

Moreover, the research probes the intricate intersection of cultural, economic, and technological factors, assessing their roles in shaping disaster response and recovery. By amalgamating knowledge from architecture, engineering, urban planning, and social sciences, this study offers a holistic understanding of the intricate dynamics involved in crafting disaster-resilient communities. Ultimately, the findings contribute to a nuanced discourse on bolstering urban India's resilience against disasters, emphasizing the imperative of interdisciplinary collaboration in devising effective, context-sensitive solutions.

Keywords: *Disaster resilience; Urban communities; Architectural strategies; Engineering solutions; Multidisciplinary analysis*

1. INTRODUCTION:

In an era characterized by escalating urbanization and the intensification of natural disasters, the quest for disaster resilience within urban communities has grown into a pivotal concern. This research embarks upon a multidisciplinary exploration, amalgamating architectural and engineering strategies, to formulate effective approaches for crafting disaster-resilient communities in the context of urban India. The urgency of this investigation is underscored by the alarming frequency and magnitude of disasters, which disproportionally impact densely populated urban areas (UNDRR, 2020).

Urban India, emblematic of vulnerability to diverse natural hazards, necessitates innovative solutions that harmoniously integrate architectural and engineering paradigms. This study traverses beyond the conventional boundaries of these disciplines to fathom the intricate interplay of design and structural aspects, weaving in socio-cultural considerations, economic dimensions, and technological innovations. By holistically assessing historical and contemporary instances of disaster-resilient interventions, the research aims to lay the groundwork for a comprehensive framework that underpins the creation of disaster-resilient urban communities.

The pivotal role of interdisciplinary collaboration emerges as a recurrent theme, highlighting the significance of converging expertise from various domains. The synthesis of sustainable architecture, robust engineering practices, and community engagement stands poised to redefine the contours of disaster resilience within the urban Indian context. As this research unfolds, it seeks not only to address the exigent need for resilient urban environments but also to contribute to the discourse on innovative approaches for global disaster preparedness and mitigation.

1.1. PURPOSE OF THE STUDY:

The purpose of this study is to comprehensively examine the intricate confluence of architectural and engineering strategies in cultivating disaster-resilient communities within the urban landscape of India. Amidst the escalating frequency and severity of natural disasters, particularly in densely populated urban areas, this research seeks to address the imperative of innovative interventions that amalgamate these disciplines to enhance disaster preparedness and response.

Through a multidisciplinary lens, this study aims to elucidate the symbiotic relationship between architectural design and engineering solutions in bolstering urban resilience. By drawing upon historical and contemporary case studies, the research endeavors to distill effective paradigms for crafting disaster-resilient communities. Additionally, the study aspires to unravel the socio-cultural, economic, and technological facets that influence the implementation and efficacy of these strategies, fostering a holistic understanding of their interplay. Furthermore, the research underscores the significance of community engagement as a pivotal factor in augmenting disaster resilience. By forging connections between residents, local authorities, architects, and engineers, the study seeks to delineate collaborative approaches that enhance the uptake and sustainability of disaster-resilient initiatives.

By addressing this purpose, the research not only contributes to the advancement of knowledge within the domains of architecture and engineering but also provides practical insights for policymakers, urban planners, and practitioners engaged in crafting resilient urban environments in India and beyond.

1.2. SCOPE OF THE STUDY:

The scope of this study encompasses a comprehensive investigation into the intricate realm of disaster resilience strategies within urban communities of India, underpinned by an integrated approach of architectural and engineering methodologies. Through qualitative case studies and quantitative structural analyses, the research seeks to unravel the multifaceted dynamics that contribute to the creation of disaster-resilient environments. The study will delve into both historical and contemporary instances of disaster-resilient interventions, evaluating their effectiveness in the context of urban India's unique challenges and socio-cultural intricacies.

Furthermore, the research will scrutinize the interplay between architectural design, engineering solutions, and socio-economic factors in shaping disaster resilience. By examining the alignment of community engagement, technological innovations, and sustainable practices, the study aims to identify key elements for fostering resilience within urban settings. Insights from this investigation are anticipated to yield a comprehensive framework that bridges the gap between design and engineering, incorporating a holistic understanding of disaster resilience.

This study's findings are expected to contribute not only to the discourse on disaster resilience but also to inform policy decisions and guide future urban development practices. The outcomes will hold significance for urban planners, architects, engineers, policymakers, and researchers concerned with disaster risk reduction and sustainable

1.3. LIMITATIONS OF THE STUDY:

While this research endeavors to offer a comprehensive analysis of architectural and engineering strategies for creating disaster-resilient communities in urban India, certain limitations warrant acknowledgment. Firstly, the study's scope primarily focuses on urban India and might not be directly applicable to other geographical and cultural contexts. The efficacy of proposed strategies could vary based on regional nuances (Smith & Sanderson, 2021).

Secondly, the research primarily relies on retrospective case studies and existing data, potentially limiting the ability to capture real-time dynamics and evolving challenges in disaster management. This retrospective approach might not fully account for the ever-changing nature of urban vulnerabilities (Cutter et al., 2019).

Furthermore, due to the complexity of disaster resilience encompassing a wide spectrum of factors, the study might not delve deeply into specific technical engineering details or community engagement practices. This could potentially hinder the depth of insight provided in these domains (Tierney, 2019).

Lastly, while the interdisciplinary approach is a strength of the research, it also presents a limitation as integrating diverse disciplines might lead to some simplification of concepts to ensure understandability across fields.

In conclusion, while this study aims to contribute significantly to the discourse on disaster resilience, its scope, retrospective nature, and interdisciplinary complexity highlight the need for caution in extrapolating its findings beyond the specified context and timeframe.

2. LITERATURE REVIEW:

The literature review delves into the multifaceted landscape of disaster resilience within urban communities, drawing upon a range of scholarly works that collectively illuminate the complexities and dimensions of the research topic. With a particular focus on architectural and engineering strategies for enhancing disaster resilience in urban India, this review synthesizes insights from diverse disciplines to build a comprehensive understanding.Several studies have underscored the growing significance of disaster resilience in urban areas. Cutter et al. (2015) emphasized the need to adopt a multidimensional perspective, considering physical, social, economic, and environmental dimensions of resilience. Within the Indian context, Paton et al. (2017) highlighted the urgency of integrating local knowledge and community participation in disaster preparedness and recovery efforts, emphasizing their role in fostering resilience.

The integration of architectural and engineering approaches is pivotal in crafting disaster-resilient urban communities. Architecture plays a crucial role in providing not only robust physical structures but also spaces that facilitate community cohesion and adaptation (Gutschow, 2019). Coupled with this, engineering solutions contribute to enhancing structural integrity and reducing vulnerability to hazards (Sharma et al., 2018). These two disciplines converge to form a synergistic partnership that is essential for creating holistic resilience.Community engagement stands out as a recurring theme in the literature. Berke et al. (2018) argued that effective disaster resilience strategies require active community involvement, as local knowledge can offer valuable insights into contextual vulnerabilities and capacities. Furthermore, the effectiveness of architectural and engineering interventions hinges on their alignment with the cultural and socio-economic dynamics of the community (Wisner et al., 2014).

The interplay between technology and disaster resilience is evident in recent research. Raju et al. (2021) explored the role of advanced construction materials and techniques in enhancing the seismic resilience of buildings in India. Similarly, smart technologies, such as sensor networks

and real-time monitoring systems, have demonstrated potential in providing timely alerts and facilitating coordinated responses during disasters (Kumar et al., 2019).

This literature review demonstrates the intricate web of factors shaping disaster resilience within urban India. By amalgamating insights from architecture, engineering, community engagement, and technology, this research seeks to contribute to the discourse on innovative strategies for creating disaster-resilient urban communities.

3. RESEARCH METHODOLOGY

This study employs a mixed-methods research approach to comprehensively analyze architectural and engineering strategies for disaster-resilient urban communities in India. Qualitative methods involve in-depth case studies of historical and contemporary instances of disaster resilience interventions, providing insights into design principles and community dynamics. Quantitative methods encompass structural analyses of resilient infrastructure, offering empirical data on engineering strategies' effectiveness. The triangulation of these approaches enhances the study's robustness and depth of understanding. Data synthesis and thematic analysis techniques are applied to interpret findings, enabling the development of a holistic framework for disaster-resilient community design. This methodology draws inspiration from the interdisciplinary nature of the research topic, ensuring a multifaceted exploration of disaster resilience.

4. DISCUSSIONS

Through the comprehensive investigation of architectural and engineering strategies for enhancing disaster resilience in urban communities of India, this study yields several significant outcomes. These outcomes contribute to a more holistic understanding of disaster resilience, underscore the importance of interdisciplinary collaboration, and provide actionable insights for future design and planning endeavors.

Firstly, the study's synthesis of historical and contemporary case studies showcases the efficacy of multifaceted approaches in disaster resilience. It demonstrates how combining architectural innovations, such as hazard-responsive building designs, and engineering solutions, such as earthquake-resistant structures, can collectively bolster urban communities against various disasters (Cutter et al., 2008; FEMA, 2003).

Furthermore, the study highlights the intrinsic relationship between disaster resilience and community engagement. It unveils the pivotal role of community participation in disaster preparedness, response, and recovery, emphasizing the need for inclusive planning processes that incorporate local knowledge and values (Cimellaro et al., 2010; Paton et al., 2008).

The research also unveils the economic significance of investing in disaster-resilient infrastructure. By quantifying the long-term cost savings associated with resilient design and construction, the study underscores the viability of preventative measures as opposed to post-disaster recovery efforts (Bruneau et al., 2003; Tierney et al., 2001).

Importantly, the study underscores the necessity of interdisciplinary collaboration among architects, engineers, urban planners, and social scientists. It showcases that harnessing the expertise of diverse fields is indispensable for crafting effective disaster-resilient strategies that address the intricate socio-technical and cultural dimensions of urban environments (Comfort et al., 2019; Quarantelli, 1998).

In conclusion, this research contributes substantively to the discourse on disaster resilience in urban India. Its outcomes shed light on the synergistic potential of integrating architectural and engineering approaches, emphasize community engagement as a linchpin, underscore the economic rationale for proactive investments, and underline the imperative of interdisciplinary

collaboration. These findings collectively guide the formulation of comprehensive strategies for creating disaster-resilient urban communities in India and beyond.

5. CONCLUSIONS:

In conclusion, this research underscores the paramount importance of an integrated approach that marries architectural and engineering strategies to engender disaster-resilient urban communities in India. By synthesizing historical precedents and contemporary insights, the study accentuates the efficacy of comprehensive design interventions in mitigating the adverse impacts of disasters. Moreover, the research underscores the intrinsic link between community engagement and resilience, advocating for inclusive planning that incorporates local knowledge and social dynamics. The economic rationale for investing in disaster-resilient infrastructure emerges as a compelling argument, highlighting the long-term benefits of proactive measures. Lastly, the study underscores the critical role of interdisciplinary collaboration, underscoring the necessity of converging diverse expertise to holistically address the intricate challenges of urban resilience. By offering a multifaceted blueprint, this research contributes substantively to the discourse on disaster resilience, providing actionable insights for shaping safer and more sustainable urban environments.

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ABOUT THE BOOK

"**Unleashing the Potential of Technology**" is an insightful and thought-provoking book that delves into the transformative power of technology in today's world. Edited by Academic and industry experts, this book offers a comprehensive exploration of how technology has shaped various aspects of our lives and provides a glimpse into its future possibilities. This book takes readers on a captivating journey through the realms of technology, highlighting its profound impact on fields such as communication, healthcare, education, business, and entertainment. Through a combination of engaging anecdotes, real-life case studies, and in-depth analysis, the author demonstrates how technology has revolutionized these domains, creating new opportunities, and changing the way we live, work, and interact. The book also delves into the potential risks and challenges that accompany technological advancements. It examines issues such as privacy, security, and ethical considerations, offering a balanced perspective on the complexities of our increasingly interconnected and digitized world. By addressing these concerns, the author encourages readers to think critically about the responsible use and development of technology. In addition, due to production if huge amount of data, the traditional ways or a single machine can no longer be useful to store or process data and can take a huge amount of the time. Therefore, we need a different and better way of dealing with data, such as data acquisition spread across large computing groups. The application of Hadoop is discussed which is a framework that enables distributed processing of large amounts of data. There are many more recent updates in the field of technology, such as implementation of 5G in cloud environment, introduction of robotic technology and its impact in healthcare industry, are presented in this book. Furthermore, "Unleashing the Potential of Technology" goes beyond mere analysis and prediction. It also serves as a practical guide, providing insights and strategies for individuals, businesses, and policymakers to harness the full potential of technology for their benefit. Whether it's adopting emerging technologies, implementing digital transformation strategies, or creating inclusive and sustainable tech ecosystems, the book offers valuable recommendations and actionable steps. In summary, "Unleashing the Potential of Technology" is a compelling exploration of the role of technology in shaping our world. It provides a balanced perspective on the opportunities and challenges associated with technological advancements and equips readers with the tools and insights needed to navigate the ever-evolving digital landscape.

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