

CLOUD ANALYSIS FOR MACHINE LEARNING METHODS IMPLEMENTATION BASED ON IOT, INFORMATION SYSTEMS, AND WEB TECHNOLOGY

ZENA A. AZIZ

IT Department Technical College of Informatics Akre, Duhok Polytechnic University, Duhok, Iraq.
Email: zena.m.aziz@gmail.com

ZAINAB SALIH AGEED

Computer Science Department College of Science, Nawroz University, Duhok, Iraq.
Email: zainab.ageed@nawroz.edu.krd

LOZAN M. ABDULRAHMAN

ITM Department Technical College of Administration, Duhok Polytechnic University, Duhok, Iraq.
Email: lozan.abdulrahman@dpu.edu.krd

TEBA MOHAMMED GHAZI SAMI

Computer Science Department Faculty of Science, University of Zakho, Duhok, Iraq.
Email: teba.sami@uoz.edu.krd

MOHAMMED JASIM AHMED

Erbil, Iraq. Email: mja.ise.1981@gmail.com

Abstract

The Internet of Things introduces rapid growth in hardware and software-based communications systems (IoT). IoT has gained a tremendous popularity in recent years and is widely used in several applications. IoT is a modern way of communication between objects and people. IoT ideas are now very influential because they create a new layer in the world of the internet. Intelligent Big Data processing and analysis is the key to intellectual IoT applications growth; logistics, transport, agriculture, health, and climate being such applications. Dynamic changes in the IoT system are caused by increasing usage of the internet and external environmental factors. To have an intellectual environment, IoT with machine learning has to be implemented. In the previous years, machinery has been widely used to recognize, extract, classify, regress, and forecast its technology. Machine learning is used to explore historical camera and sensor data and to implement network life-enhancing techniques. This article provides an insight into current research for several IoT machine learning applications. We summarize IoT strategies and tools. Additionally, we will take a look at various potential problems using summarized data. This review aims to investigate multiple IoT technologies and the impact of integrating Machine Learning into them to assist people in living in an intelligent environment.

Keywords: Co Machine Learning, Internet of Things, Sensors, Applications of Iot

1. INTRODUCTION

The importance of business automation makes people's lives easier and more relaxed. With the emergence of innovations like artificial intelligence and machine learning, apathy can be learned and intelligent, such as computers, robots, mobile telephone, etc. It was hoped that we

would see all the many things we will see around us very soon. Both of them will be linked together. To allow high-performance technology, it is necessary to combine low-power, big data, cloud, machine learning, and communication technology. The vast data produced these days would be the biggest challenge. How can the data generated be used, and what are the important questions for the data? Fortunately, an emergent technology is developing in conjunction with IoT, preventing hypoxia from being a stable environment with functional knowledge in these stagnant data lakes. Engineers may make their improvement cycles, activities, manufacturing, and extra come alive by funnelling big data into machine learning algorithms. We try to define the scope of machine education for IoT [1]. In this work. The key challenges and developments in developing information for the IoT ecosystem to simplify the devices further. The main part of IoT is its accessibility, which connects everything and ensures that it is seen in this new age of omnipresent computer science. It connects the digital world, which will lead to billions and lots of things. It means, people, that everyone is related. When using machine-learning techniques happens, it's know in seconds the status of everyone and everyone in the universe [2].

The Internet will expand; it will be extended beyond computing and linked computer devices. We now use the Internet as a service, as we essentially have a link between various computers and computer devices on the Internet. It will become the basis for everything soon by increasing the knowledge and learning algorithms to collect data and analyse in real-time. Incorporated structures and integrated processes for the creation of an extensive IoT Internet. Some areas that are known as IoT providers increase the use and development of this IoT community. The Internet of Things (IoT) is a network of physical objects, such as automobiles that are equipped with sensors and actuators. The embedded computing architecture defines the IoT modules, and they are also capable of interoperating within the current internet infrastructure [3].

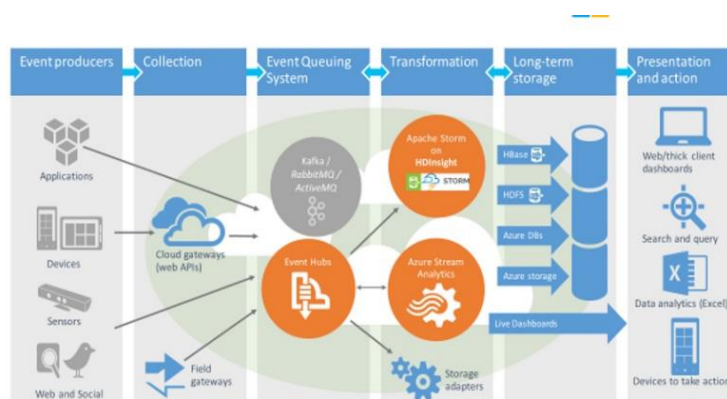


Fig 1: Internet of Things (IoT) and Machine Learning[4]

The structure of this paper is organized: Section (II) shows background theory (III) related work, in section (IV) the discussion of review is presented. The paper is finally closed in Section (V).

2. BACKGROUND THEORY

2.1 Cloud and Information Systems

Because of these improvements, corporate networks are now more comprehensive and pervasive than they have ever been before, and they are also capable of providing internet access to a bigger number of users. At the same time, the overall amount of complexity that is involved has grown, which has resulted in an increase in cost: Each year, individuals and companies in every part of the globe contribute a significant amount of money to the area of information technology (IT).

This may encompass anything from the acquisition of new hardware and software to a growth in the total number of devices that are connected to a network. Also included in this category is an increase in the overall number of people that utilize the network (in-house or out-sourced). Cloud computing has the potential to once again revolutionize commercial computing because it will make computers more like a service that can be accessed over the internet rather than like a physical piece of equipment. This change will allow cloud computing to more effectively compete with other forms of commercial computing. Because of this, there will be more flexibility and scalability[5].

The ability for end-users to instantly offer the resources they require is an essential component of cloud computing, as is a pricing model in which customers pay only for the cloud services they actually employ. Cloud computing also includes the ability for customers to share resources with other customers. The providers of cloud services may be able to generate cost savings as a result of the fact that cloud services may pool the processing capacity of its users. These providers may then be able to pass on these cost savings to their corporate IT clients.

When discussing the current enthusiasm for cloud computing, it is not unexpected that the prospect of financial savings is at the forefront of people's thoughts as one of the key driving forces. This is because cloud computing has the ability to reduce costs. The rise of cloud services, which concentrate massive quantities of processing power in concentrated pools, has made it possible to mine data at levels that were before unfathomable and unreachable. One example of this is the ability to identify patterns in large amounts of data. The term "cloud computing" was coined to describe the amalgamation of a broad range of innovative programming models and fresh methods to software development that were spawned as a direct result of this strategy. These advances in technology make it feasible to execute calculations on a vast scale, and they considerably boost the efficiency of the process by which new software is generated. Considerable progress has been made [6].

Many large multinational corporations are in the process of rethinking their approach to information technology as a result of the stratospheric surge in popularity of cloud computing over the last few years. Users get access to their data from several places at the same time thanks to cloud computing, which explains why this is possible. As a result of the unprecedented benefits provided by the "as a service" paradigm in terms of investment, distribution time, and scalability, new (mobile) products have been widely disseminated, and emerging technologies such as big data, the internet of things (IoT), and machine learning (ML)

have been brought into the spotlight. The notion of "as a service" is directly responsible for these recent advancements that have taken place.

These advancements are indicating that it is possible to expand the internationally distributed resources, which, in turn, stimulates the continuous growth of the cloud computing industry and boosts the chances of unique enterprises functioning well in global settings [7].

New computer and networking technologies are being created in order to provide users with the greatest experience possible and to take use of the shared infrastructure that is accessible in every region of the world. Because of the fact that its latency is quite low On the other hand, there are extra issues that arise when trying to monitor the quality of the services that are provided to end users in an environment that has many clouds (QoS).

The implementation of the plan is dependent on the participation of major suppliers due to the increasing relevance of SLM in the commercial sector. It is possible to reach the conclusion that the significance of environmental impacts in the decision-making process of small and medium-sized enterprises (SMEs) in India regarding the adoption of innovative technologies is primarily determined by external factors, rather than by organizational or technical considerations. This is a valid inference to make because it is possible to draw the conclusion that external factors play a larger role in determining the significance of environmental impacts. Indicating that data and the measurement of load capacities are both highly crucial for cloud storage. The results of the numerical study shed insight on the chilling influence. Finding novel methods to make QS models, which incorporate queues, more practical in the real world is one of our current research priorities [8].

When it comes to identifying the kind of aid that is necessary to cross the finish line, the use of statistics is of great assistance. The power supply of a data center is an important factor to consider when choosing a data center to provide processing capability. Service providers often publicize the fact that their prices change based on the amount of time customers spend using their products or services. There are a large number of data centers spread out over the globe.

The rest of this review article will adhere to the structure outlined in the following paragraphs. The second section offered an introduction to the primary ideas that underlie corporate cloud computing and gave an outline of these ideas. Three, an examination of the study done in the past. This issue was discussed in Section VI, which included both a discussion and a comparison of the works that were evaluated, and it was one of the topics covered in that section. Following the presentation of the conclusion in the fifth and final part, a list of the works that were cited in the discussion follows [9].

In addition to the storage of files, administration of servers and databases, and the deployment of computing devices, the more general concept of "cloud computing," which may also be referred to as "on-demand computing" or "platform computing," covers a great deal of ground and includes a wide range of services. Cloud computing may also be referred to as "on-demand computing" or "platform computing." This kind of internet infrastructure may also be described using the terms "computing on demand" and "computing platforms," which are two other terminologies that can be utilized. Due to the fact that the cloud provider uses actual computers

as servers, there is a need for new infrastructure to be set up, which is a process that takes both time and money to complete.

Cloud computing is a method of providing on-demand access to shared pools of adjustable computing resources (such as data storage and processing power), rather than a dedicated server for each individual user. This allows users to access their computing resources (such as data storage and processing power) whenever they need them. Because of this, users are able to use their own computer resources (including data storage and processing power) whenever it is convenient for them to do so. One of the other names for cloud computing is utility computing. Cloud computing also goes by a few other names [10].

Users would be better off storing their data in the cloud, where it may be available from any place at any time, rather than on a local hard drive or another backup device. Cloud storage allows users to access their data from any location at any time. The delivery of several information technology services via the use of the internet is referred to as "cloud computing." This term includes, amongst other things, the ideas of "software as a service" and "infrastructure as a service." Based on the design of the underlying network, a cloud environment may be classified as either private, public, or hybrid, depending on the kind of users that use the cloud.

The Internet of Things (IoT) is a networking system that is composed of a wide variety of components, some of which include but are not limited to sensors, actuators, protocols, cloud servers, layers, and many more. These components make up the Internet of Things, which is a networking system. Each of these various components contributes individually to the formation of a coherent whole that is the Internet of Things' core architecture. System architecture often includes a number of layers, each of which contributes in its own special way to the efforts of system administrators to evaluate, monitor, and ensure the system's safety. In most cases, the procedure will be partitioned into a number of distinct stages or steps [11].

The concept of "layering" is often used to refer to the several levels that make up a system. A system is typically built of multiple layers. As a result, it is necessary to carry out a plan in advance, just as it is necessary to carry out a plan in advance when establishing any other form of system. It is necessary to determine whether or not the organization's present procedures and apparatus are compatible with the idea that has been suggested. This objective is attainable if it is determined whether or not the innovative idea can be put into action by making use of the procedures that are presently in place.

Within its overarching framework, the architecture of the Internet of Things may be broken down into a number of discrete layers. The mission of the Perception Layer is to ascertain its current location as rapidly as possible and acquire as much information as it can about the environment in which it finds itself. It is of the highest necessity that this layer be present in the construction, since it acts as the foundation upon which the other layers are formed. It is also of the utmost essential that this layer be present [12].

It is able to recognize intelligent things or certain spatial characteristics in the environment surrounding it, and it can also identify certain spatial elements. Additionally, it is able to

examine the environment. The Transmission of Information and Messages Networks: It is the responsibility of the network layer to provide the secure transfer of sensor data to the device's central processing unit. This is the most crucial task that lies on the shoulders of the network layer. This information may be sent through either wireless or wired methods, depending on your preference. There is a good chance that infrared, WiFi, 3G, and Bluetooth, along with other technologies of a similar kind, will be used; however, this will be decided by the sensors themselves.

The information that is supposed to be sent from the perception layer to the middleware layer is going to need to be enabled by the network layer. This is the justification for the existence of the network layer. Software Designed for People Who Fall in the Middle: It is equipped with cutting-edge characteristics such as the capacity to store data, carry out calculations, go through processing, and respond in a rapid and decisive manner. Based on the address and name of the gadget, this layer is in charge of getting the pertinent data and presenting it in the right manner. This responsibility falls within its purview [13].

It is also conceivable for it to base its decisions on guesses that are obtained from the datasets that the sensors provide. The requests that were made by the application are processed by the application layer using the information that was obtained by the middleware layer. This information is then utilized to direct the processing that takes place. You may use this program to send emails, trigger alarms and security systems, turn on and off laptops, smartwatches, and even smart farms. Other functions include the ability to send and receive notifications. In addition, you have the ability to operate these tasks from a distant location.

Researchers and others working in the software industry have put a large focus on the Internet of Things (IoT) in recent years, but they have been doing so for a substantial length of time prior to that (IoT). In the year 1999, Kevin Ashton is credited with conceiving up the idea that would later become known as the Internet of Things (IoT). He did this in the hopes that he would be able to keep up with the rapid development of forward-thinking technologies such as Wi-Fi, RFID, WSN, and the cloud. This was his motivation for doing so [14].

The value of communication is significantly growing as a growing number of items become Internet-enabled, and as a direct result of this, researchers and developers have focused a significant amount of their attention on the Internet of Things (IoT). In other words, the value of communication is directly proportional to the number of items that are Internet-enabled (IoT). In the year 1999, Kevin Ashton is credited with being the first person to conceptualize what we now refer to as the Internet of Things. Because he was able to do this, he was able to keep up with the rapid development of technologies such as Wi-Fi, RFID, WSN, and the cloud. The rising prevalence of home equipment that may be linked to the internet has significantly amplified the need of having efficient two-way communication [15].

It is possible for linked devices to exchange data with one another, and these devices may collaborate to accomplish tasks. The Internet of Things (IoT) world is made up of a wide range of electronic devices of varied sizes, including but not limited to personal computers, laptops, smartphones, personal digital assistants (PDAs), tablets, and other electronic devices of diverse

shapes and sizes. Because these devices make use of highly effective wireless communication networks and sensors, they are able to connect with one another and provide the central system with essential information. Additionally, they are able to communicate with one another. In addition to this, the data is processed and delivered once it has been acquired by the Internet of Things devices that are a component of the core system [16].

The meteoric expansion of communication and Internet technologies has led us to focus less on the actual world and more on the world that we create for ourselves online. This shift in attention has been brought about by the exponential advancement of technology. As a consequence of this, our attention has been diverted away from the truth that is really taking place. Going to work, interacting with other people, and carrying out daily chores like going food shopping are all part of what it's like to live in the real world. Other aspects of life in the real world include: The following is a list of many things that can be done out there in the actual world: (which includes tending to the plants and animals that are contained inside the simulated area that is offered by the network) [17].

As a consequence of this, making the shift from human existence to one in which actions are effectively guided and carried out by robots would be an extremely challenging project to complete. This is due to the fact that the concept of replacing people with technology implies a significant level of difficulty just by virtue of its existence. To put a stop to this endeavor is going to be a very difficult undertaking.

Because the internet is such a wonderful resource, it is regrettable that the severe constraints that will be imposed by the envisaged region would work against the potential of the internet to supply further services in the not-too-distant future. The Internet of Things is capable of performing the function that its creators intended it to do, which is to successfully close the gap that exists between the fantastical and the everyday. The Internet of Things strives to accomplish a great number of things, some of which are stated below: smart health, smart living, smart goods, and smart cities. The development of intelligent environments and devices that can function on their own without human intervention is one of the key aims of the Internet of Things. One of the most important goals of the Internet of Things is to do this (IoT) [18].

The speed with which people are adopting the concept of the Internet of Things may be inferred from the rapidly growing number of consumer electronics and domestic appliances that can be connected to the internet. According to the findings of the study, this was conclusively shown to be the case. Already, there are 30 billion pieces of technology that are linked to one another, and it is estimated that there are a total of 200 billion connections between them. By the year 2020, it is expected that the income produced by these gadgets would amount to a total of 700 billion euros.

The widespread availability of devices that are capable of establishing connections with one another has the potential to revolutionize almost every facet of our day-to-day lives. Connectivity is possible at anytime, anywhere on the world, between any two persons or devices, using any service that can be reached and operating on any network that can be

reached. The improvement of the quality of life of individuals is the end goal of many projects that make use of the Internet of Things [19].

The unfortunate reality is that the vast majority of these devices and applications are not built to withstand assaults on the users' privacy and security, and as a result, these consumers are susceptible to such assaults. This is a problem because it makes these consumers more likely to become victims of such assaults. As a direct consequence of this, a sizable number of individuals are concerned about the level of privacy and safety offered by IoT networks. On a daily basis, cybercriminals and other sorts of thieves attempt to hack into devices that are linked to the Internet of Things (IoT) [20].

There is an immediate and critical need for a system that can consistently protect internet-connected devices from being hacked into by hackers and other persons behaving maliciously. This is because a study found that about seventy percent of Internet of Things devices may be hacked with just a little amount of effort. Because as many as 70 percent of devices that are linked to the internet of things are vulnerable to hacking, it is even more vital that this criteria be satisfied. An in-depth analysis of the system model was one of the research methodologies that was employed all during the course of the systematic study that was carried out to analyze the development of fog computing [21].

The study was carried out to learn more about the growth of fog computing. One good example of this would be the following: This is only one example among many others: This is only one example among many others: [Case The aim of this study was to collect fresh information on the development of fog computing, and it was effective in accomplishing that goal. If you want to have the clearest picture possible of where this technology is headed, you should familiarize yourself with the linkages that exist between traditional cloud computing, fog computing, and cloud-hosted fog computing. This will allow you to have the most complete picture possible of where this technology is headed. When that day arrives, we will have a thorough comprehension of the opportunities that fog computing has in store for the years to come [22].

The vast majority of computer tasks continue to be carried out in the same manner regardless of whether they are executed in the cloud, in the fog, or in a hybrid configuration that mixes cloud computing with fog computing. The phenomena that may be characterized by these three different approaches to computing is given the label "fog computing," which is a term that was made up specifically to refer to the phenomenon. When discussing the field of computer science, the actions described by the phrases "computing in the fog," "cloud computing with fog computing," and "fog computing with fog computing" are all synonymous with one another and refer to the same thing. It makes no difference what you call it "computing in the fog," "cloud computing with fog computing," or "fog computing with cloud computing" since the final effect is the same with any of these three techniques.

Following an examination of the data, it was determined that more research should be carried out. This section of the article provides a summary of the remaining parts of the piece, as well as an explanation of the forms that are linked with those parts: We are going to devote the second part of this lesson to learning all there is to know about clouds, fog, and distributed

computing platforms. The practical applications of the Internet of Things will be the focus of the third portion; a high-level analysis of the security demands will be provided in the fourth section; and the fifth section will dig more thoroughly into the security concerns connected with the Internet of Things. The inquiry is brought to an end in Section V, which presents a potential response analysis to the numerous assaults mentioned in Section VI. This section also serves as the conclusion of the investigation. The results of the research are discussed in further depth in this section as well [23].

A distributed system is one in which its components are kept on numerous computers and communicate with one another across a network. To put it another way, a distributed system is simply a system that is not centralized. The concept of a "dispersed system" describes a configuration in which the many elements that make up a system are kept separate and organized on individual personal computers. Because each of these computers is capable of sending and receiving messages regardless of the network to which it is linked, it is feasible for them to communicate with one another in a way that is both efficient and effective.

The branch of computer science known as distributed computing has a primary emphasis on the investigation and evaluation of distributed computing systems as its primary field of study. It is generally accepted that a system is considered distributed if its multiple components are able to communicate with one another and collaborate on the achievement of a shared objective. This makes it possible for the various parts of the system to function independently of one another. The simultaneous operation of the numerous components that make up distributed systems is one of the most difficult issues that these types of systems must overcome [24].

Distributed systems confront challenges in a wide range of diverse contexts. The absence of a universal clock, in addition to the unavoidable malfunction of any particular component, poses extra challenges that must be surmounted before success can be achieved. It is not the case that the failure of a single component will trigger a chain reaction with repercussions just as catastrophic as the initial failure. P2P apps, SOA-based systems, and massively multiplayer online games (MMOs) are just few examples of the many various types of distributed systems that are currently accessible. This technology employs a methodology that is known as "distributed programming," and the word "distributed programming" is the one that is used to define the methodology. The process of building computer programs that are meant to function in a setting where there is no centralized control is referred to as "distributed programming," and it is referred to as a process.

It is possible to build the system that is used for sending messages by making use of any one of the many different computer programs that are now available. Some examples of such implementations are message queues, RPC-like connections, and HTTP. One interpretation of the term "distributed computing" refers to the process of putting several computers, or a network of computers, to work on a single task in conjunction with one another. When a problem is solved using distributed computing, it is first broken down into a number of smaller sub problems, and then each of those sub problems is sent to its own individual computer. A technique that is known as "two-way messaging" enables machines to interact with one another.

This technique enables the machines to share information as well as instructions with one another [25].

The earliest instances of distributed systems, distributed programming, and distributed algorithms were found in computer networks in which nodes were physically located in close proximity to one another. Computer networks were the first place where these advancements were implemented. Referring to a distributed system, distributed programming, or a distributed algorithm, which are all instances of distributed vocabulary, is one way to illustrate these notions. Other examples of distributed terminology include. These phrases now have a broader meaning, and they may be used to refer to different applications that function on the same system while sharing memory. The particular features that define a distributed system are not universally agreed upon; nonetheless, the following are usually believed to be those properties of a distributed system.

Each individual computer that is a member of a distributed computing network is referred to as a node, and each node has its own disk space on which data may be kept. Distributed computing networks are becoming more popular. The various computers that work together to form a network in a distributed system are referred to as "nodes," while the distributed system itself is the name given to the network itself. Because both parties are able to send and receive messages with one another, they are able to communicate with one another and exchange information with one another [26].

Because of this, both sides have the capacity to talk with one another and share information with one another. When all of the processors in a distributed system are working together toward a common goal, such as the resolution of a difficult computing challenge, users of such systems may be tempted to view the system as a single entity. This is because the distributed system is working toward the common goal of resolving the challenging computing challenge. This is as a result of the fact that every computer that is a part of the system is working concurrently toward the completion of the same job. This is due to the fact that each and every CPU is collaborating with one another in order to accomplish the same goal.

For instance, it is not impossible for the processors in the system to be convergently working towards the same solution to a very difficult computing problem. If they were all working together, then things would turn out this way. Designs that have the capability of being implemented on many system nodes are now seeing a boom in popularity. Within the context of this specific discussion, the reference is essential. At the very least, this is what the rumors say will happen. Because each computer may be assigned to a different user who has unique requirements, the purpose of a distributed system may also be to facilitate better communication between users or to manage the allocation of shared resources in a more efficient manner [27].

This is due to the fact that each computer may be assigned to a different user. This is due to the fact that each computer might be given to a different user, each of whom has their own specific needs. This is because it is possible for many people to use the same computer at the same time, which might lead to confusion. Because it is possible for each user to have their very own

personal computer, this is the case. This is because one group of computers may support several users, all of whom may occupy the same physical position on the network. The reason for this is related to the fact that multiple users may share the same space. In addition to that, the membership of this group may be shared by both of these machines. This is because each piece of equipment has unique properties that make it adaptable to the needs of a wide variety of end users. As a result of this, there is a lot of variety in the kinds of people who can utilize these the reason for this is due to the fact that the success of a distributed system is based on its capacity of accommodating a large number of users at the same time. This is the main reason why this is the case. Nevertheless, these characteristics are only the tip of the iceberg; distributed systems also have the following characteristics in common: The system's capacity to operate properly and effectively accomplish the objectives it was supposed to achieve is directly tied to the system's tolerance for hardware faults. Tolerance is a measure of how well a system can handle hardware flaws. On the topic of the system's setup, there is no historical information that can be uncovered at this time. Unfortunately, this is the state of affairs as a result of a dearth of previous data on the topic. Some examples of these kinds of characteristics are the length of time it takes for data to transfer across the network, the number of computers that are presently making use of the network, and the physical structure of the network. It is also possible for the architecture of the system to change in the middle of the process of running a distributed application. This is a scenario that is plausible. This might take place for a variety of different causes. In addition to this, there is the prospect that the system will include a diverse selection of computer and network configurations. In the not-too-distant future, there is a very strong probability that the system will be successful in achieving this goal. The previously existing knowledge gap inside the system is exacerbated by the restricted access that individual computers have to the data because of the way the system is designed. Although it is feasible that computers will share the same quantity of information on the input that they have received, this is not something that can be relied on to always take place. This is as a result of the fact that each computer acquires its data from its own unique assortment of sources, which is why this is the case [28].

The term "distributed system" refers to a system in which several computers are linked to one another in a network and work together to complete a task in order to achieve a common goal. A "distributed computing environment" is the name given to this kind of computer setup. A collection of computers may also be referred to as "nodes," which is a phrase that is sometimes used. There is a possibility that the phrases "concurrent computing," "parallel computing," and "distributed computing," which all refer to different parts of the same overarching concept, will be difficult to differentiate from one another. Because processors in a typical distributed system collaborate to accomplish tasks, it is possible to use the words "parallel" and "distributed" to refer to the same system. This is because of the similarities between the two terms. Both of these names may now be used interchangeably as a result of this. The reasoning for this is inherent to the method in which distributed systems carry out their respective duties. As a result, any word may be used while talking about the same sort of infrastructure. The action that takes place on a computer may be classified as either parallel processing or distributed processing, depending on the particulars of the setup that are in play [29].

Customers have on-demand access to data storage, which is also referred to as "cloud storage," as well as processing power when they use a shared network of computers, which is what is meant by the name "cloud." Without a doubt, not only is this something that can be done, but it is also something that ought to be done. It is misleading to refer to the location by its name alone since it conveys the idea that activities of this kind might take place there under any conditions. Because of this, the strain that is normally put on the user to be entirely responsible for the management of these assets is relieved. The bulk of the time, the activities of a large cloud are hosted by a network that is composed of what are essentially independent data centers. This is the core concept that underpins computing performed on the cloud. There is a significant connection between the two because of the direct influence that shared resources have on the efficiency of cloud computing. Because of this direct effect, cloud computing and shared resources have a close relationship. In addition to this, it often makes use of a strategy that is known as the "pay as you go" model, which exposes clients to unforeseen charges in the long run while maybe helping to lower initial rates. Moreover, this approach is frequently used.

Those who are in favor of public and hybrid cloud computing claim that adopting these services helps organizations to reduce expenses and save money by decreasing or eliminating the need to make costly investments in information technology infrastructure. Because of this, businesses are in a better position to reduce expenses, which is good for their bottom lines. According to one school of thought, the evolution of cloud computing has made it possible for organizations to function in this fashion. Cloud computing is predicated on the idea that consumers should be able to enjoy the advantages of several technologies without being forced to have in-depth knowledge of each one independently, and this idea forms the basis of the service. Cloud computing and all of its many functions are based on this fundamental concept. The assumption that this is the case is what the cloud computing idea is based on. The fundamental aims of cloud computing are to reduce operating costs and free up client time, the latter of which may then be spent focusing on strategic business goals rather than on the resolution of technical issues. The first firms to provide cloud computing services were Amazon Web Services (often abbreviated as AWS) and Microsoft Azure (MS Azure). The use of virtualization is, by a substantial margin, the single most critical piece of technology that makes cloud computing possible. One physical piece of computer hardware may be converted into several "virtual" pieces by using software that was developed specifically for the purpose of virtualization. The virtualization of the operating system provides a more efficient use of the computer's resources, which are currently being underutilized. A scalable system that is made up of a large number of distinct computers is the answer that we come up with to this problem. Virtualization provides the nimbleness that is essential to speed up IT processes, and it does so while simultaneously lowering costs due to higher infrastructure usage. In addition to this benefit, virtualization makes it possible to speed up many IT procedures. Computers that are capable of running themselves without the need for human interaction provide the possibility of making good on the promise of automating the process by which a user meets a request for resources whenever those resources are needed. When a process is automated, not only does it become more efficient, but it also requires fewer people to carry it out and reduces the possibility that a mistake would be made as a result of human interaction. The use of concepts

derived from the area of utility computing might make it possible for cloud computing to provide measures for the services that it utilizes. Cloud computing emerged as a viable alternative to traditional grid computing as a paradigm for the storing and processing of data. This was done as part of an attempt to address problems relating to quality of service (QoS) and dependability. Some instances of comparisons that may be made between cloud computing and the following are provided below: Any sort of distributed software that puts service requesters (clients) in a relationship of separation from service providers is referred to as "client-server computing," and the name "client-server computing" refers to this kind of computing (servers). One paradigmatic example of this would be the client-server arrangement (clients). Companies that provide assistance in information technology are sometimes referred to as "computer bureaus," which is a phrase that is used in various contexts. This kind of agency had a large portion of the market share from the 1960s all the way through the 1980s. The term "grid computing" refers to a type of distributed and parallel computing in which the capabilities of a number of networked computers that are only very loosely connected to one another in order to complete extraordinarily large jobs are combined in order to create a "super and virtual computer." Combining the resources of a number of different computers results in the creation of this "super and virtual computer." [30]

This computing paradigm involves the data, processing, storage, and application services all being dispersed to clients or devices that are located geographically proximate to the users. Users will be appreciative of the simplicity that this simplification provides for them. There is a subset of hardware referred to as "network routers" that may be found within this more general category of electronic equipment. The practice of doing computer operations in environments where there is a significant amount of fog present is commonly referred to by the phrase "fog computing," which is occasionally used to define the method. Data are handled and processed locally, either on the level of the network itself or directly on the smart devices themselves, as opposed to being routed to a remote point for processing. This ensures that no sensitive information is exposed. As a result of this, there will be no need to transmit any data. This process includes both the overall network infrastructure as a whole as well as the specific smart devices themselves as individual participants. The CISCO Corporation was the first company to see the potential benefits of the technology and started incorporating it into its day-to-day operations soon after the technology was initially made available to the public. The growth of competitiveness as well as the spread of data storage and device services are two of the many potential uses for FC. There are a number of other applications that might be developed as well. In contrast to the situation with CC, it may take place in a far greater variety of environments. Only via the use of CC is it possible to have access to the internet. The phrase "near-term term" very certainly only refers to end-user equipment that is now available on the market, such as mobile phones and a wide variety of other embedded systems. This is the most plausible interpretation of the phrase. This is how it is because the technological elements of the solution dictated that it should be. [There are likely further sources that may shed light on this matter] [There are likely further sources that may shed light on this matter] FC is a serious contender, but it still has some kinks to work out, such as standardization, software package portability across different embedded computing data, container management for embedded

devices with limited resources, and a firm support mechanism for consistently communicating with the cloud. These are just some of the issues that need to be resolved. Despite the gravity of the situation, FC still has a few wrinkles that need ironing out. These are only a handful of the many problems that have not been fixed and need to be investigated further. There are a great deal more. These are only some of the many problems that have to be solved before we can go ahead with this plan. These are only some of the many problems that have to be fixed at FC before the organization can go to the next stage in its development. When it comes to the difficulties that the globe faces in the current day, these issues are only the tip of the iceberg in terms of the scope of the problem set [31].

The most basic component of parallel computing is the execution of a number of distinct calculations or processes in parallel with one another. It is feasible, in the majority of situations, to reduce an issue to a set of more manageable concerns that may be dealt with concurrently if the underlying causes of the problem are recognized and eliminated. This is only one of many various circumstances in which a challenging issue might be broken down into a set of problems that are easier to handle; there are many more. There are a great number of ways to go to this destination, and each one has to be chosen carefully. Some instances of parallel processing include those that take place at the bit level, the instruction level, the data level, and the job level, but there are many more. These are only some of the many other types of processing that may be done at the same time, and this just scratches the surface of the possibilities. Because of the physical constraints that prevent frequency extension, parallelism is now being discussed by a far bigger audience than it was previously able to attract. This is due to the fact that parallelism might contribute to an explanation as to why frequency extension is impossible. This is due to the constraints that have been mentioned in this article, which prohibit the incidence rate from rising. This is because there is simply not enough space to increase the frequency while still keeping within these restrictions, which is the reason why this is the case. This is because there is a limit that prevents the frequency from escalating to an even higher level than it already is. The reason for this restriction is because there is a limit. Over the course of the past few years, there has been an increase in people's awareness of the amount of energy that is used by computers and, as a result, the amount of heat that is produced by them. This has led to an increase in the number of people who are concerned about the environmental impact of these devices. There is a substantial link that can be shown between the two of these problems as well. When you take into account the amount of heat that is generated by computers when they are functioning, this makes perfect sense. As a direct response to the problem that is outlined in this article, the concept of doing computations in parallel has emerged as the dominant paradigm in the field of computer design [32]. The bulk of the time, parallel computing is carried out on computers that include a large number of processor cores. In spite of the fact that there is a substantial link between the two concepts, the terms "concurrent computing" and "parallel computing" are often used interchangeably and are also frequently confused with one another. The concepts of parallelism and concurrency are fundamentally incompatible with one another and, as a result, cannot coexist inside the same computing environment (such as multitasking by time-sharing on a single-core CPU). The usage of parallel computing allows for vast quantities of work to be segmented off into a

number of almost identical subtasks that may be finished independently before being recombined. The idea of "task parallelization" or anything like that is what we are going through in this particular discussion. Because of this, we will be able to do the assignment in a much shorter length of time compared to what we had initially estimated it would take. On the other hand, when concurrent computing is employed, various processes often deal with activities that are unrelated to one another and are performed in isolation from one another. However, with distributed computing, the individual tasks may take on a number of forms, and successful execution of the tasks often needs communication across various processes. This is the norm in distributed computing. This is the case in spite of the fact that the tasks of each job may or may not be comparable to one another. The reason for this is because large amounts of data work extremely well with distributed computing, which is the reason why this is the case. Examining the extent to which a computer's hardware enables parallel processing is one way to obtain a good idea of how parallel the machine in question really is. Getting an understanding of how parallel a computer actually is may be accomplished in a number of different ways, but this is one of the methods. Systems that have both a numerous number of processing cores as well as multiple processors are known as multi-core and multi-processor computers. Multi-core and multi-processor systems, in contrast to clusters, MPP systems, and grids, which employ several computers to do a single job in simultaneously, comprise numerous processing components inside a single system. Another name for supercomputers is the name given to computers that have a number of processors and/or cores in a single instance. In certain communities, computing equipment of this sort are more often referred to as supercomputers. There are several configurations of parallel computing that, in addition to the configuration, employ traditional processors. These configurations may be distinguished by the usage of conventional processors. This is done to expedite a variety of processes, including some of the ones that have been covered previously in this paragraph. The creation of sequential algorithms is simpler than the development of parallel algorithms, especially parallel algorithms that are aware of concurrency. In addition, the amount of time needed to build sequential algorithms is significantly reduced as a result of this improvement. Because of their more linear nature, sequential algorithms are simpler to implement in computer code than other types of algorithms. It is a task that is much more difficult than it would seem to be at first glance to program algorithms in a manner that is explicitly parallel. This is the case as a result of the fact that concurrency stimulates the creation of new categories of software vulnerabilities, with the race scenario being the most prevalent of these new categories. The reason for this is due to the fact that there is a possibility that new forms of software defects might be produced as a consequence of concurrency, which is the reason why this is the case. The process of generating explicit parallel algorithms is often more challenging than the process of developing sequential ones. This is the case despite the fact that bit-level and instruction-level parallelism make the idea of parallelism very clear to the programmer. The development of an explicit parallel approach may prove to be more challenging than the creation of sequential algorithms. This is due to the fact that implicit parallelism operates at a more fundamental level than bit-level or instruction-level parallelism does, which is the explanation for the outcome that was previously indicated. Problems with communication and synchronization among the numerous subtasks are at the root of many of the most significant challenges that must be conquered

before peak performance can be achieved in parallel applications. This is one of the most significant challenges that must be conquered before peak performance can be achieved in parallel applications. It is necessary to triumph over these obstacles in order to reach one's full potential in terms of performance. If we want to get the most out of the parallel programs that we are using, we will need to discover a solution to get around this obstacle. This obstacle has to be cleared away before the performance of parallel programs may achieve its maximum potential [33].

In 2011, it became abundantly clear that cloud computing would need to be supplemented by fog computing in order to accommodate the proliferation of Internet of Things sensors and the large data volumes required for real-time, low-latency applications. This became abundantly clear despite the fact that cloud computing had been around since the beginning of time. This conclusion was reached as a direct consequence of the inability of cloud computing to sufficiently handle these challenges on its own. Cloud computing is unable to adequately solve these challenges on its own. This conclusion was reached as a direct result of the realization that cloud computing on its own was insufficient to solve the problems that were being faced. Computing in the fog, often referred to as edge computing, is a kind of distributed computing that links a network of "peripheral" devices to a single remote server situated in the cloud. This type of computing is also known as fog computing. Computing in the fog is also sometimes referred to as computing at the edge. The term "edge computing" may also be heard being discussed by certain individuals at the same time as "fog computing" is being discussed. This kind of computing also goes by the titles edge computing and fog computing, to mention just a few of its other names. Even while fog and clouds have similar properties, fog is literally placed lower to the ground than clouds are. As a direct consequence of this, it is now much simpler for the many devices that make up the Internet of Things to get access to fog. These devices have a much easier time dealing with fog as a result of the fact that it is similar to clouds in certain regards. "Fog computing" is a technique that refers to the practice of spreading data processing to locations that are geographically close to the sources of the data. The term "fog computing" itself identifies the approach that is being used. Since just the processed information has to be provided at this point, the quantity of data that needs to be sent has decreased. The term "fog computing" refers to the practice of using computer nodes that are located in close proximity to the devices that are creating the data in order to do as much of the processing of that data locally as is technically possible. Instead of transmitting all of this raw data to servers that are located in the cloud, this action is taken instead. In order to do this, we make use of computer units that are physically positioned in the same space as the many equipment that are responsible for data generation. In order for us to achieve this objective, we make use of computer systems that are located inside the same room as the many equipment that are responsible for the generation of data. Because of this, transmitting information is a procedure that is both straightforward and easy. Local processing, on the other hand, happens in the same physical location as the data that is being processed, in contrast to remote processing, which takes place elsewhere. As a direct consequence of this change, the length of time necessary to get a response to an inquiry has been drastically cut down. This is owing to the fact that the individuals who were responsible for producing the data in the first place are

the ones who are in the best position to discover additional uses for it after it has been processed [34]. The following contributors are to blame for the aforementioned outcome: The fact that this is instantly available as a direct result of processing that was carried out locally is a significant additional benefit, and the rationale for this will be discussed in the next phrase. Specific pieces of hardware, such as signal-processing processors that are able to carry out Fast Fourier Transforms, have been utilized for quite some time in computer systems that are not dependent on the cloud. These types of processors have been used for quite some time. Referring to the graphics processing unit is the most effective way to illustrate this point. This has been done for some time in an effort to reduce the load that is placed on a central processing unit and to decrease the amount of time that is required for the completion of certain processes (CPU). The two components that comprise fog networking are referred to respectively as a control plane and a data plane. These two constituents are distinguished from one another by their respective names. In fog computing, for instance, data is not always preserved on servers in a central place but rather at the very edge of the network. This is in contrast to traditional cloud computing, in which data is stored on centralized servers. In conventional cloud computing, in which data is kept on servers located in the cloud, this kind of cloud computing does not include data storage. In contrast to the standard practice of storing data on a small number of centralized servers in the cloud, this strategy entails distributing data over a number of different servers. In contrast to this, the traditional method of computing includes storing data on servers that are gathered together in a single geographic location. Fog computing is an alternative to cloud computing that places an emphasis on being close to the end-users and the client's objectives (such as operational costs, security policies, and resource exploitation), dense geographical distribution and context-awareness (for what concerns computational and IoT resources), lower latency and saved backbone bandwidth to achieve better quality of service (QoS), and edge analytics/stream mining. Fog computing also places an emphasis on being close to the edge of the network, which allows it to perform edge analytics and In addition, fog computing focuses an emphasis on being located near to the network's periphery, which enables it to carry out analytics at the network's edge [35]. Fog networking is an emerging technology that has the potential to make the Internet of Things deployment process more efficient (IoT). This hypothesis proposes that in the not-too-distant future, almost all of the tools that people use on a regular basis will be able to interact with one another in some fashion. Smartphones, wearable health monitors, networked autos, and augmented reality applications that utilize technology such as Google Glass are all examples of objects that make use of the Internet of Things. The following are some further examples of applications that make advantage of the Internet of Things: The Internet of Things has a wide variety of other uses, including the following: As a result of the fact that IoT devices often have limited access to both data and computing resources, it is probable that performing cryptographic calculations on these devices may prove to be challenging. A fog node could be able to improve the safety of Internet of Things devices by carrying out cryptographic computations. Utilizing regular computers is a useful option that may be taken advantage of in order to carry out the necessary calculations (IoT). The organization that is tasked with the duty of ensuring the safety of the United States Navy's most important fixed and mobile combat assets is the one that is responsible for carrying out this duty. This duty falls under the purview of the Special Patrol

and Warfare Section, or SPAWAR, of the United States Navy. Constructing and validating a mesh network that is resilient enough to withstand interruptions brought on by failures, expansion, and other circumstances is the goal of this work package. In the event that a computer's connection to the internet is suddenly interrupted, the programs that are now running on the device will "take over" its functions and continue running in the background. Each of these apps is hosted on one of the various nodes that combine to make up the mesh. In this fictitious scenario, the Internet of Things is used as an illustration, and potential outcomes such as swarms of intelligent drones are brought up for debate. The FogBus 2 project at the University of Melbourne is attempting to find solutions for the one-of-a-kind problems posed by the numerous Internet of Things devices. These devices include, but are not limited to, cameras, ECG equipment, laptops, telephones, and a great deal of other technology as well. Even though this is just one of many potential causes, it is a problem since there isn't a technique that is clearly specified for gathering and organizing the data. However, this is only one of many plausible explanations for these issues. Oracle Cloud Infrastructure, in combination with edge computing and fog computing, is used to successfully complete real-time processing of project data. Before being made available in the "Fog" and on the "Edge," the information that is read from products that have been recognized by edge computing and are also equipped with an Automated Identification Data Carrier (AIDC), a barcode, or an RFID tag is read, evaluated, and confirmed using ISO/IEC 20248. This process takes place before the information is made accessible. As a direct result of this, the data may be read, processed, and authenticated. Furthermore, it can be made available in the "Fog" as well as on the "Edge." This method was developed by the organization known as ISO, which stands for the International Organization for Standardization. After then, the data will be able to be read, reviewed, and confirmed before they are made accessible in the "Fog" (ISO) [36].

The Internet of Things made accessible Internet Protocol (IP) addresses, which allowed previously incompatible electronic devices to connect with one another. This was made possible by the Internet of Things. The market for services associated with smart homes has grown at a rapid rate as a direct result of this trend. A smart home simulation, in contrast to the real world in which we live, gives each piece of furniture and appliance its very own separate internet connection. When a smart home has a higher number of gadgets that are linked to the internet, there is a greater potential for malicious users or other forms of third parties to create disruption. Because the automated processes in a smart home may be carried out without the assistance of a human, the likelihood of someone making an attempt to get into such a home is lower. Because of the Internet, we are able to control any of our home appliances that are connected to the web at any time and from any place on the planet. This is made possible by smart home technology. As a direct result of this, it is not beyond the realm of possibility that hostile assaults will be carried out against the aforementioned types of electronic equipment [37].

On the right is a depiction in the form of a schematic of a smart home, which includes visual representations of the four components that are required for the functioning of the smart house. The components of the system include a service platform, intelligent devices, a home gateway, and a home network. Together, these elements create the system. A home that has successfully

networked a specific number of its electrical equipment is referred to as a "smart house," and the phrase is used to describe such a household. It is not out of the question for these gadgets to be able to speak with one another and exchange data in an intelligent manner. The interactions that take place between the internet and the smart gadgets in your home are mediated by a piece of hardware known as a home gateway. This gateway works as a go-between for these communications. This piece of hardware works as a mediator for the conversations that are taking place between the different devices in your smart home and the broader internet. These conversations are taking place between the various devices in your smart home and the larger internet. The service platform gives the local area network access to the features and data made available by a variety of different service providers, allowing users to make the most of their networking experience. This capacity has just been available to us during the last little while [38].

People's day-to-day routines have been significantly altered as a result of the development of the Internet of Things (IoT), which has forced further adjustments as a consequence of the effect these changes have had. These effects have forced further adjustments as a result of the effect these changes have had. Because of the Internet of Things, our company is always vulnerable to a large variety of different kinds of security breaches that might occur. Even while there are many advantages that may be derived from technology, it also puts our safety in peril in a number of different ways. When there is a breach in security, the most common outcomes are the exposing of sensitive information or the suspension of services that are necessary for the running of the organization. The potential security flaws in the Internet of Things are directly tied to real-world dangers that might befall you if you do not take the necessary precautions to protect the devices to which you are connected. These dangers could be caused by your failure to secure the devices. When it comes to the Internet of Things, which consists of a wide variety of devices and platforms and includes the transfer of a significant quantity of personally identifiable information, it is especially important to take into account the preferences of the users. This is because the Internet of Things includes both the transfer of this information and the transfer of a significant quantity of personally identifiable information [39].

As a consequence of this, it is of the highest importance to have a solid system in place to secure sensitive information. [Cause and effect] In addition, in order to make use of the services that are made available by the Internet of Things (IoT), a broad range of devices may connect to a number of different networks. This suggests that there are substantial issues with both the security of the network layer as well as the privacy of user data. The following examples illustrate how vulnerabilities in network security might manifest themselves in a variety of different forms as a result of the Internet of Things: (IoT).

A number of sensors are often integrated into a single device in a smart house. This is done since one of the most significant roles of a smart home is to monitor the premises for possible threats such as burglars, children, and fires. These sensors are able to keep an eye on their immediate environment and sound an alarm if they detect anything that seems to be out of the norm taking place there. These sensors, if they were to fall into the wrong hands, might be used

to spy on the residence and acquire personal information from the people who live there. For reasons having to do with the safety of the data, it is necessary to devise a protocol for encrypting the data that travels between the gateway and the sensors. Another option is to identify the user, which requires setting it up. In order to safeguard the network from hackers and other malicious actors, it is essential that this step be done. It is feasible to carry out this step in order to establish precisely who has been granted authorization to use the system because of the permissions that have been granted [40].

When we talk about the "Internet of Things," we are imagining a future in which commonplace objects that have internet connections will be able to communicate with and uniquely identify themselves to other internet-connected devices as well as with each other. This future is what we mean when we refer to the "Internet of Things." When connected to the internet, the items we use on a daily basis will have the ability to speak with one another in order to exchange data and coordinate how they are put to use. The Internet of Things is made up of a diverse assortment of "smart" items, including mobile phones, tablets, and several other electronic devices. This list, obviously, does not include all there is to know about the topic in any manner, shape, or form. This system makes use of technologies like radio-frequency identification (RFID), quick-response codes (QR codes), and wireless technology in order to make it easier for the various components of the system to communicate with one another.

It is now much easier for people to form relationships not just with one another but also with the actual things that are present in their immediate surroundings. This is made possible by the Internet of Things, which connects everyday objects to the internet. To be deemed tangible, an object must be something that can be physically grasped and passed from one person to another. According to projections made by a market research company called IDC, there will be thirty billion gadgets capable of establishing a connection to the internet by the year 2020. In order for us to be able to keep up with the ever-increasing amount of data that is saved online, we need a network that is not only more efficient than the one we currently have, but also one that is one that is more secure. Only then will we be able to keep up with the amount of data that is being saved online [41].

The most major barrier to the broad adoption of the Internet of Things is posed by people's worries about their capacity to protect their personal information and remain anonymous online. Depending on the particulars of the circumstance, the people, companies, and customers whose information is obtained by IoT service providers may fit into any of the aforementioned groups, including consumers, businesses, and other persons. This information about the application must at all times be kept safe and secret in order to prevent its misuse or alteration in any way. An example of a use case for an application that is based on the Internet of Things would be the storing of important information pertaining to customers or patients, such as the results of medical tests or purchase histories. Another example of a use case for an application that is based on the Internet of Things would be the management of inventory. Despite the fact that the Internet of Things makes it easier for devices to interact with one another, there are still problems with scalability, availability, and reaction time. This progress would not have been achieved without the Internet of Things playing a pivotal role in the process. No matter

how securely the data is sent over the internet, the privacy of the individual whose information is being shared is going to be compromised in any situation. This is the case even if extra precautions are taken to protect the data. It is possible to utilize the Safety Measures Act to monitor compliance with laws such as the Health Insurance Portability and Accountability Act when information is moved across international boundaries (HIPAA). This vast sector is home to a lot of today's concerns with security that rank among the most serious and ubiquitous in the globe. One such issue is cybercrime[42].

The Internet of Things is vulnerable to a wide range of threats, including both active and passive assaults, which are not only theoretically possible but also pose a substantial threat to the network's ability to function normally. If this were to occur, it would make it impossible for anybody to take use of the opportunities presented by the network. Because the internet of things has the capability of being compatible with different networks, the occurrence of this scenario is not improbable in any way. Because they wish to avoid being found, intruders who begin their attack with a passive tactic will never resort to overt acts of violence because this is the only way for them to protect themselves from being found. People may get information from the node in one of two distinct ways: either by ingesting the data or by making direct touch with it. Both of these options are available to them. On the other hand, genuine assaults have a destabilizing affect on the levels of physical performance of the person who is the target of the attack. This is because of the stress that these attacks cause. There are many different sorts of active assaults; we may categorize them as either inside or outside assaults according to the location in which they take place. In the event that these security flaws are exploited, it is likely that the devices may lose their ability to have conversations in which they can both understand what is being said. We will need to take a wide range of security measures in order to stop malicious actors from gaining access to our technological instruments. This will need us to put in place a wide variety of security measures. We are going to have to follow this course of action if we are going to have any chance of achieving the goals that we have set for ourselves. In this part, we will discuss the many of various assaults that might take place, the dynamics of an assault, and the seriousness of the myriad of different outcomes that could follow an assault. There are, in general, four basic types of attacks, and effectively fighting against each of these assaults requires a distinct strategy. The particulars of the assault are considered in the process of selecting the appropriate approach to use [43].

When we talk about "web technologies," we're referring to the many protocols that make it possible for computers and a wide variety of other electronic devices to connect with one another through the use of the internet. This makes it possible for people all over the world to share information and collaborate on projects. In order for users to communicate with one another and exchange information with one another, they will need to make use of markup languages that are understood by the majority of people. When we speak about "internet communication," what we mean is "the process of developing information for the World Wide Web, spreading that content, and keeping editorial control by utilizing hypertext markup language" (HTML). In addition to web pages that are composed using the HTML language, the internet makes it possible for users to publish a vast array of other types of content. There is a chance that you may look for them on the internet. This is a possibility (hypertext markup

language). They believe that this is due to the fact that developments in technology have made human interaction with robots not only easier but also more natural than it was in the past. This is because of the fact that advancements in technology have made it possible for humans to interact with robots. The widespread availability of the internet has resulted in the democratization of access to a wide range of information that previously lacked accessibility or was priced beyond what was considered reasonable (WWW) [44].

There is a broad range of well-known browsers that are MIME-compatible. Some examples of these browsers include Safari, Firefox, Chrome, Opera, Internet Explorer, and Edge, amongst others. The MIME compatibility standard has been met if these browsers are able to open and correctly display your file. The term "pages" is one of the numerous titles that are given to these items; however, there are a great deal of other names as well. The definition of a website that is used the most often characterizes it as a network of connected, hierarchically-organized web pages that may exchange information with one another and update content on those sites. It is standard practice to use the word "website" to refer to a collection of linked web pages when discussing the Internet as a whole. This is because websites are collections of web pages. People often use the shortened phrases "site" or "website" when they are talking about information that may be found on the internet. Provider of Services Connected with Networking Working in the Field of the Networking Industry A Desire to Work in the Area of Information Technology, More Particularly in the Field of Computer Networking A desire to work in the field of information technology, more particularly in the field of computer networking The method of storing data on remote computers and making it available online is referred to as "cloud computing," and the phrase is used to define this activity. Cloud computing is also the name of the practice itself. The concept of "cloud computing," which refers to the process of hosting websites on a network of remote computers, is becoming an increasingly common practice [45].

Web development is the process of creating a website for either public consumption on the World Wide Web (WWW) or private usage inside an organization for the purpose of doing business online. Websites may be developed for either public or private use (a private network). Web development encompasses a wide range of methodologies, the most fundamental of which is the production of a website designed to house information. On the other end of the spectrum is the facilitation of individuals' capacity to engage in online conversation with one another through the utilization of social media, which is among the most complex of these methodologies. When someone says "web development," they may be referring to any one of a huge number of different activities; but, in fact, all of these activities are connected in some way. Despite this, it is an example of an abbreviation that is used rather often. However, the phrase "web development" refers to a discipline that encompasses a much wider domain than just the process of developing code for websites. Web development encompasses a wide range of different activities. Examples of activities that might possibly come under the larger category of "web engineering" include the building of an e-commerce platform, the installation of server and network security, and scripting executed on both the client and server sides of the equation. The examples that have been shown up to this point are, however, only the tip of the iceberg. The term "Web development" is used to refer to a broad number of subfields that are included

under the umbrella of the larger area of study that is computer science. This phrase is used inside the larger field of study that is computer science. Even more so than the visual design, markup and code are the most significant components of website building. The visual design comes in second place, after the acoustic design, which comes first. Markup and code are the two elements of our website that we place the greatest emphasis on. The process of creating graphics for a website is sometimes included in what specialists in the field of the Internet generally include in what they name "Web development," despite the fact that this word most commonly refers to only the programming of a website. This is due to the fact that the word "Web development" has enough wiggle room in it to include all phases of the process. People with little to no technical experience are able to make changes to the content of a website using a content management system, which is more often referred to as a CMS. These changes may be made in a way that is straightforward and basic. This is because CMSs are often referred to as "content management systems," despite the fact that this moniker is seldom used. The reason for this is because CMSs are designed to handle content. The reason for this is that content management systems were first designed to handle the management of content. This suggests that people with a greater diversity of experiences and backgrounds are more likely to offer their expertise to the website. It is not very common for hundreds of people (web developers) to work together to build websites for huge corporations and organizations, especially when they utilize a system that has already been tried and proven like Agile as a guide. The purpose of carrying out this procedure is to make certain that the goals of the project are, in fact, realized in a fruitful manner. It's conceivable that a small firm doesn't need more than one full-time or part-time developer, or someone whose skill set can augment that of the developers who are currently on staff (in this case, graphic design or IT). In a situation such as this one, the option that has the most potential for gain would be to collaborate with software developers that have prior expertise in both of these markets. Due to the absence of proper coordination among a large number of professional workers working in their respective areas of competence, it was impossible to outsource the process of constructing a website to a single department. This rendered the possibility of outsourcing the process null and void [46].

As its major emphasis, this project will concentrate on three separate subtopics that fall under the umbrella of the larger area of web development. These experts in the creation of software are known by a variety of titles, including back-end developers, front-end developers, and full-stack developers, amongst other designations. They may also be referred to as software engineers. "Full-stack developers" are software creators who build their applications "from the stack up," which, when translated literally, means "from the bottom up." People who are working on the "front end" of a project are the ones who are ultimately responsible for the usability of the user interface and the browser. In addition to this, they are responsible for the aesthetics of the user interface, which is the part of the software that the user actually interacts with. To restate, back-end engineers are concerned with the underlying architecture of the applications that they are creating. Tim Berners-Lee and the team he oversaw at CERN are credited with the invention of the World Wide Web (WWW). Since that point in time, its degree of popularity has skyrocketed, to the point that many people feel that it is one of the most prevalent technology advancements in the annals of human history [47].

Web designers are required to have a diverse set of skills since their professional responsibilities go beyond the initial stage of website construction and include the website's ongoing maintenance. In other words, web designers are expected to be able to do a little bit of everything. Some of the various subfields that come under the umbrella of web design include user experience design, visual design, interface design, authoring (using both open-source and commercial tools), and search engine optimization (SEO). Collaboration between several designers on a single project is by far the most common practice today. This is the situation despite the fact that there are undoubtedly quite a few really talented designers already employed in the sector today. When most people hear the term "web design," the first thing that comes to their mind is front-end design, which is also known as client-side design. This is the part of the design process that the user sees. It would seem that markup is an essential part of the process that is being carried out here. When addressing different components of the larger process known as "web development," it is usual practice to use the words "web design" and "web engineering" interchangeably. Website designers whose responsibilities include the production of markup are required to have a solid understanding of the most effective approaches that can be used to make markup accessible to users who are affected by a broad variety of impairments. This understanding is necessary so that website designers can fulfill their responsibilities [48].

The process of developing a website for use on the World Wide Web (WWW) or an internal network is referred to as "web development," which is also the term that is used to describe the creation of a website by a corporation or other entity for use on the WWW (intranet). Regardless of the specifics, this has the potential to be beneficial for both public and private networks (a private network). The act of producing anything that can be accessed on the World Wide Web is referred to as "web development." This includes anything from the most fundamental HTML page to the most complicated web-based programs, electronic companies, and social networking services.

All of these components are considered to be a part of "web development" in their contemporary sense. Web development is the process of creating content for the World Wide Web and making sure that it can be accessible by users of the internet. At the very least, it seems to be that way in the region that we call home. In certain communities, the process of making anything accessible over the Internet is referred to as "web development". Website designers and developers frequently use the term "web development" to refer to the most important processes in the production of a website, even if those processes have nothing to do with the internet. This is because the term "web development" is short for "web development and design," which describes the process of creating a website. The reason for this is because "web development" is really a shortened form of the phrase "web application development." Examples of activities that are related with the web include client-side scripting and server-side scripting, as well as e-commerce platforms, the configuration of network and server security, and scripting that runs in the background of the server [49].

The production of markup and the writing of code are only two examples of the sorts of activities that may be categorized as being within the ambit of this category. [Create markup

and write code] Users who are not well-versed in technology are able to make changes to the content of a website using a content management system (CMS), which enables them to do so in a way that is not only straightforward but also quite comfortable for them. People often refer to content management systems (CMSs) by using that term, despite the fact that the phrase "content management system" isn't used very frequently. Because of this, a considerably larger range of users are able to add content to the website's knowledge base than was before feasible.

When it comes to the planning and development of their websites, huge companies and organizations may employ hundreds of web developers to collaborate on the design and building of their websites while also making use of well-established procedures and processes, such as agile techniques. In the process of developing websites that are controlled by corporations or governments, this method, which has been used successfully for a long time, is often used. There is a chance that a small firm will not need more than one full-time or contract developer, or that it will require a developer whose area of expertise is comparable to that of the company's current employees. Either of these outcomes is a possibility. It is possible that one of these two things will happen (for example, graphic design or IT) [50].

When faced with a scenario such as this one, the action that would prove to be the wisest would be to research the option of employing a software developer that has prior knowledge in the process of working in both of these disciplines at the same time. Because it needed the coordination of efforts from a very large number of departments, it was impossible to outsource the duty of constructing the website to a single department. Web developers have the choice of specializing in either the process of building the user interface or the infrastructure that supports it, or in both of these jobs concurrently.

They also have the option of doing both of these duties simultaneously. Because of this, they have a higher amount of freedom to make adjustments to their schedule in order to meet the requirements that are imposed upon them as a result of the event. One example of a person who is accountable for both the front end and the back end of a project is a full-stack engineer. This is different for front-end developers, who focus on the user's browser, and back-end developers, who work on the servers that the application depends on. Front-end developers concentrate on the user's browser, while back-end developers work on the servers. Back-end developers focus on the servers, whereas front-end developers concentrate on the browser being used by the end user [46].

Developers who work on the back end concentrate on the servers, while developers who work on the front end focus on the browser that is being used by the customer. When working on the application's front end, developers pay particular attention to the web browser that the application's end user is using. Back-end developers often direct the bulk of their attention and efforts on application servers as the primary target of their work. There is a significant need for software developers that are proficient in both React and Node.JS all around the globe. This demand is expected to continue growing in the foreseeable future. There is a significant need for these qualified individuals. Everyone is obligated to ensure that they meet this obligation.

The word "web technologies" is a collective term that refers to the methods that allow computers and a wide variety of other electronic devices to connect to one another and share information with one another. This is a frequent term that is used to indicate a variety of different actions that need to be taken throughout the process. By using markup languages that are used by a sizable number of individuals, it is feasible to accomplish the goal of achieving symmetry. When it comes to developing material for the World Wide Web, disseminating that information, and managing its administration, the language of choice is a kind of computer programming known as HyperText Mark-up Language, or HTML for short.

This language enables machines to communicate with one another through computer-to-computer interaction (HTML). One example of the many different kinds of documents that may be seen online is a website page that was written in HyperText Mark-up Language (HTML Mark-up Language) (HTML). Having said that, the above is but one example out of thousands (hypertext mark-up language). There are a lot of people who are of the opinion that the ease with which people and robots can now communicate with one another and work together on projects in real time has resulted in an increase in the amount of dominance that humanity has over the rest of the world. This view is held by a lot of people [51].

The widespread accessibility of the Internet has made it possible for a huge number of people to gain access to a substantial quantity of knowledge that was previously outside their reach. This was not the case before the advent of the internet. They are now able to do it in a way that was before impossible because to this development. They had been kept in the dark about this knowledge up until quite recently. It is possible that this theory is accurate given the ease with which one may get access to the internet.

A file that has been prepared in a certain fashion in order to allow it to be viewed in the most clear and readable manner in a web browser such as Internet Explorer, Firefox, Chrome, Opera, Edge, or Safari. These browsers include Internet Explorer, Firefox, Chrome, Opera, and Edge. The following are some examples of these browsers: The term "pages" is often used in place of other words due to the fact that it is so pervasive and has the same meaning as those other words. The explanation for this is due to the fact that they are used on a foundation that is comparable to being constant [52].

The word "website" is the one that is used when referring to a structured collection of online pages that can be accessed by following a sequence of links in sequential order. The term "website" is the one that is used the most commonly. When we are talking about anything that is connected to the Internet in any manner, we often call these types of online destinations "websites." When speaking of a website in an environment that is not as official, the term "site" may be abbreviated to "website," or it may simply be called a "site." Both of these names are acceptable. A extremely powerful computer that plays a significant part in the functioning of the Internet by storing data that other computers connected to the network are able to access. This data may be accessed by any computer that is connected to the server. A data center is another name for this facility. Whomever it is that gives people access to the World Wide Web or the services that may be accessed on it is referred to here as the "service provider." Up until

this point, each and every part of website hosting was taken care of by a server located inside the company's premises.

Web development refers to the process of creating a website that can be visited by members of the general public through the World Wide Web as well as by workers of a particular firm via a private intranet. This kind of website may be seen both publicly and privately (a private network). The process of creating a website, whether it be a straightforward informational page or an intricate social networking platform, is commonly referred to as "web development," and the term "website" can be used to refer to any kind of website [53].

The term "web development" can also be used to refer to the process of creating a website. If you ask different people, the term "web development" could refer to a wide variety of different activities, such as "web engineering," "web design," "web content generation," "client liaison," "client-side/server-side scripting," "web server and network security settings," and "e-commerce development." If you do this, you will find that the term "web development" can refer to a wide variety of different activities. These are just a few examples of the kinds of pursuits that could fall under the umbrella of this overarching category. The development of websites calls for the fulfillment of a great number of individual processes, some of which are broken down below for your edification and convenience.

When discussing the construction of websites, the letter "p" is often used to make reference to components that are concealed from the visitors' view at first glance. "Content management systems" (CMSs), also commonly referred to as "content management" (CM) or just "content management," were developed to make it easier for users with less technical expertise to make changes to the content of a website. CMSs are also commonly referred to as "content management" (CM) or just "content management." The term "content management" is occasionally used interchangeably with CMSs (CM). When it comes to the development of websites, huge corporations and organizations may often engage dozens or even hundreds of web developers to work on the project as a team [54].

This is due to the potentially difficult nature of the labour that has to be done in order to accomplish this procedure, which needs to be done since it is required. One of these approaches is often referred to by the name "agile methodology," which describes that approach. This phrase is also used to describe the method that is being taken. It is possible for a company that is working on a straightforward project to determine that it is sufficient to hire either a single developer on a full-time or contract basis, or a developer who works in conjunction with another profession, such as a graphic designer or an IT expert. In this scenario, the company could decide that it is sufficient to hire either a developer who works in conjunction with another profession, such as a graphic designer or an IT expert. In either scenario, the organization can conclude that it would be beneficial to employ the person. It is impossible to assign the building of the website to a single division within the firm due to the large number of teams that are working on the development of the website. These teams come from all different parts of the business [55].

Full-stack development, back-end development, and front-end development are the three subfields of web development that are widely agreed upon as being the most significant. Full-stack development is advantageous for this reason, since it incorporates all facets of Web development. In addition, front-end development is recognized as an important area within the sector as a whole. When it comes to the creation of websites, the persons who are in charge of the user interface are referred to as front-end developers.

They are the ones who are responsible for creating the interface (UI). Developers that are working on the front end of the program are the ones who are tasked with the responsibility of building the user interface (UI) that end users will see while they are using the application. Front-end developers are individuals that specialize in generating graphical components and browser-based functionality that users interact with. Front-end developers are also known as "front-end designers." These designers are the ones who are accountable for the creation of these components. Back-end developers are the ones who are in charge of the servers that are used for the purpose of carrying out the software's execution. In addition to this task, the user interface is the responsibility of the front-end development team [56].

Tim Berners-Lee first conceived the idea for what would become the World Wide Web in 1989, when he was working at the European Organization for Nuclear Research (Credit: Wikipedia). This idea would eventually become the World Wide Web. There has been a substantial amount of development on the World Wide Web since that time (CERN). This is because the European Organization for Nuclear Research (CERN) is where its administrative offices are, therefore it seems sense that this would be the case (CERN).

It is possible to refer to the process of generating and maintaining a website as "web design," which can also be used to refer to the set of abilities required for a person to construct and manage a website on an individual basis on their own. Web design may also be used to refer to the process of generating and maintaining a website. It is a common misconception that the word "web design" serves as a catch-all phrase that can be used to refer to a wide range of specialized skills and information; however, this is not the case

This is owing to the fact that the construction of websites requires knowledge from such a diverse range of academic disciplines across the board. Design teams are by far the most typical structure, despite the fact that some designers prefer to work alone and are able to direct all parts of a project. This is not the standard in the industry, despite the fact that certain independent designers may be able to handle everything from the very beginning of the design process all the way through to its conclusion. The process of building a user interface for a website is known as web design, which is also sometimes referred to as "client-side" web development. Web design is another name for this process. The process of developing a user interface for a website is referred to by its official name [57].

During this stage of the process, the graphical components of the interface and the organizational structure of its navigational elements are set. In addition, the overall layout of the interface is determined at this point. The usage of HTML, which is also known as hypertext mark-up language, is not required in order to construct websites; one may choose to forego the

use of this mark-up language. When assessing the bigger picture of creating an online presence, it is common practice to see web design and web engineering as being intricately linked with one another. This is a result of the strong connection that exists between the two areas of study. When consumers hear the term "web design," a picture may pop into their thoughts, such as the design of the backend or server side of a website. This is because customers often have preconceived notions about what "web design" entails.

Web designers whose job requires them to develop mark-up have a responsibility to have a good awareness of the standards that must be followed in order to ensure that their products are accessible to persons with a wide variety of disabilities. Those individuals who are unable to read or write as a direct result of their disability will find this to be of the highest importance. In the event that they are not provided with the appropriate direction, it will be impossible for them to fulfil the responsibilities that have been placed on their shoulders.

The process of developing a website is referred to as "web development," and it is applicable regardless of whether the website will be accessible to people all over the world via the World Wide Web (WWW) or whether it will only be accessible to employees of a single organization through an intranet (a private network). "Web development" is a term that more correctly represents what takes on behind the scenes, and it refers to the process by which any and all information may be made accessible via the usage of the internet. It's possible that this is referring to anything as simple as a website developed in HTML, or it might be referring to something as complex as a digital game, app, digital company, or social networking service [58].

The term "web development" can refer to a wide variety of different subfields, such as web engineering, web design, the production of content for publication on the web, client interaction, server-side and client-side scripting, the installation of e-commerce systems, and the configuration of network and server security. These are just some of the subfields that fall under the umbrella term "web development." Web development covers not just these but also a number of other subfields. Web developers often use the term "web development" to refer to many components of the process of developing websites, even when these components have nothing to do with the aesthetics of the website.

This is done so because the word "web development" is short and easy to remember. This is because the term "web development" refers to a broad field that includes a great deal of specialized subject matter. These components may be found throughout this page in many different forms, two examples of which are the code and the markup. When web developers communicate to one another on a day-to-day basis, they often use the term "web development" to refer to the many various aspects of the process of developing websites. This is because "web development" encompasses the whole process. This is because the process of designing a website and the process of constructing a website are two separate but related processes. However, they are still connected. It is possible to construct websites with content management systems (CMS) in mind, which makes it easier for users who do not possess the required technical talents to edit the content of the website whenever it is necessary to do so. It is feasible to develop websites with CMS in mind [59].

When it comes to the design and construction of websites for companies and other organizations, collaborative web development teams that operate on a big scale use agile methodologies and other best practices in the industry. In addition to that, these teams perform their duties on a global scale. Large groups of web developers will typically collaborate on a project together the vast majority of the time. It is possible that a smaller company will only ever require the services of a single software developer, either on a part-time or full-time basis, or as a side job for someone who is already talented in another field, such as graphic design or information technology.

This scenario is possible because smaller companies are more likely to have fewer employees. Both of these possibilities are worth considering. Due to the fact that so many different kinds of individuals and organizations were engaged in the production of the website, it is hard to single out a single entity as being responsible for its development. You may learn how to create websites by focusing on either the front end or the back end of the website, or you can learn how to make websites by working on both the front end and the back end of the website at the same time. Both approaches are valid ways to learn how to make websites. These are the three potential routes, and it's possible that any one of them may result in your request being granted. Back-end developers, as opposed to front-end developers, are the ones that are accountable for the upkeep of the servers that are actually hosting the project. Front-end developers focus on the user interface and user experience [60].

The user interface is the primary emphasis of front-end developers, whereas the functionality of the program is the primary focus of back-end developers. The front-end development community places a high importance on providing end users with an interface that is comfortable to use and an experience that they will find pleasurable. Front-end developers are software engineers who concentrate their careers on developing software that can be accessed and utilized via the use of a web browser. Front-end developers are also known as front-end web developers. The creation of an application's user interface is the responsibility of developers who work on the front end of a software. In today's extremely competitive job market, it is absolutely essential to have a solid grasp of both React and Node.JS in order to achieve any level of professional achievement.

The convergence of machine learning techniques and IoT has resulted in Human life and manufacturing applications have undergone a transformation. It transforms several aspects and produces different revolutionized applications in today's trends. Many industry developments have resulted from this combination. We addressed the following emerging trends in ML and IoT [61].

2.2 Machine Learning

Machine Learning (ML) is not a brand-new concept. Machine learning and artificial intelligence are inextricably related (AI). Machine learning allows AI to become a possibility. Sorting, clustering, estimation, pattern recognition, and other tasks are taught to computer systems using machine learning. By analysing sample data with various algorithms and mathematical models, systems are taught to store the learning process. Observable

characteristics known as features are often used to characterize sample data. A machine learning algorithm [7] tries to find a connection between the features and some output values known as labels. The information collected during the training phase is then used to spot patterns or make decisions based on new information. Regression, sorting, clustering, and determining association laws are all problems that can be solved with machine learning. Based on their learning style, ML algorithms can be divided into four categories:

- a) **Supervised Learning:** Supervised learning uses algorithms like the Random Forest or Linear Regression to address regression problems such as weather prediction, life estimation, and population growth prediction. Supervised learning also uses vector support machines, Nearest Neighbours, and Random Forest algorithms to solve problems in classification such as digital identification, language recognition, diagnoses, and the detection of identity fraud. Learning is supervised in two different levels. Two stages exist planning and investigation. The training data sets must include knowledgeable marks. Algorithms predict the test data results by studying the relationship between the input values and labels [62].
- b) **Unsupervised Learning:** Unsupervised learning is used to resolve dimensional reduction for problems with big data visualization, feature elicitation and hidden structures. Supervised learning also serves to address problem clusters, such as recommendation systems, customer segmentation and targeted marketing. No labels are available in this type as opposed to supervised learning. This group of algorithms attempts to identify, cluster or forecast patterns in research information [63].
- c) **Reinforcement Learning:** The algorithms attempt to predict a problem with this form of learning using a set of tuning parameters. The calculated output would then be turned into an input parameter, and the new output determined until the desired output has been found. This is the type of learning that is subsequently presented in artificial neural networks (ANN). Strengthening is mainly used for AI gaming, skill gain, robot navigation, and decision-making in real-time [64].

2.3 IoT Layers

IoT's architecture is designed to connect and extend IoT services at any door and is a gateway of various hardware applications. In various layers of IoT architecture, various communication protocols are used to send and receive various information/dates, e.g., Bluetooth, Wi-Fi, RFID, narrow and broadband frequency, ZigBee, LPWAN, IEEE 802.15.4 [11].

a. Application Layer

The application layer for mobile and online software is the third layer of IoT systems which provides users with service. IoT has many applications in this technologically advanced world based on intelligent things' latest developments and uses. The use of the IoT system and the relentless service made living rooms, houses, construction, transport, health, education, agriculture, business, and trade smart[13].

b. Network Layer

The networking layer in IoT systems is essential. It acts as the information and data transmission medium that connects devices to innovative services using various communication protocols such as the GSM, LTA, Wi-Fi, 3-5G, IPv6, IEEE 802.15.4, etc. In the network layer, the information that operates in a middleware between the network and the next layer is stored and processed by local clouds and servers [14].

Big data is another essential component in the network layer because it reflects the interests of the growing economic market today. Physical objects in the physical layer generate a large number of information/data transmission, processing and storage by IoT systems continuously. Since information/data is crucial for smart network-level services, ML and DL are now commonly used to analysis of stored information/data using better processing methods and to derive good use for smart devices [15].

c. Perception Layer

The awareness layer, which consists of the physical (PHY) and medium access control (MAC) layers, is the first layer of IoT architecture. The PHY layer is primarily concerned with hardware, such as sensors and devices used to transfer and receive data through various communication protocols such as RFID, ZigBee, Bluetooth, etc. [16]

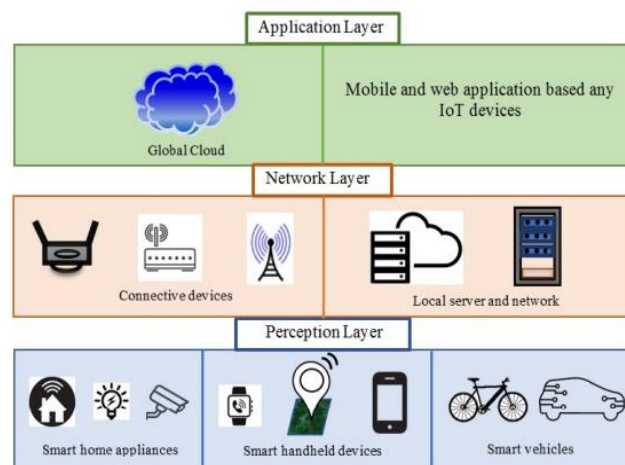


Fig 2: IoT layers architecture[65]

2.4 Machine Learning Applications in IoT

Machine learning technologies have demonstrated significant success in a variety of applications since their inception. Machine learning has taken a step forward in different fields, including image processing, fraud detection, and pattern recognition. The current IoT trend is leading us to drown in the data world. However, we can look at data insights into emerging patterns and valuable knowledge to decision-making and business management using appropriate machine learning techniques.

Machine learning and IoT are causing a new trend globally, and they are retroactively transforming the world. These result in operational improvements, cost savings, and more excellent options for customers. The most challenging task for machine learning is correctly predicting future events. It is determined by the form of data and methodology employed. However, current models are based on static data from conventional sources. The learning algorithm's output will improve overtime as more data sensed via IoT is supplied. It improves the accuracy of the machine learning algorithm's predictions. As a result, machine learning has become a hot field in the industry.

Machine learning analyses data insights in greater detail. In order to understand the past results, traditional data analyses were used. The IoT pattern is not like the static analysis; it must consider past and present data on the basis that you have to make decisions about learning the algorithm. This is a complex challenge and must be analysed in troubled production, grid, and cluster-based. With the introduction of intelligent technology such as cloud, grid, and GPU, it is easier to do this [66].

➤ **Advantages of Machine Learning**

The traditional data analysis is static and is of little use for rapidly evolving and unstructured data management. For IoT, the correlations between dozens of sensors must be identified. Sensor inputs and external factors produce millions of data points quickly. When we know the essential input variables to make the decision, machine learning is more valuable. By extracting information from the data collected, machine learning can achieve its objective [67].

➤ **Cost Savings in Industrial Applications**

The increased use of IoT and machinery learning now transforms the world into Industry 4.0, which uses this ethnology to run many of the machines, saves a great deal of money, improves production and productivity.

➤ **Adapting Experiences to Individual Needs**

IoT and machine learning turn our world into our preferences. The user preferences are used to learn the algorithm for home automation, and the correct temperature is maintained by the data learned when it comes back from work or when it is getting up early in the morning. It can also be used to forecast the occurrence of accidents and crimes. Personalized patient history monitoring is a problem in health care. Documents may be analysed to the patient more precisely based on patient wearable devices. It is easier than recruiting a staff member [68].

3. LITERATURE REVIEW

In this section different relative research has been carried out based on Machine learning algorithms for IoT technologies.

S. Ameer et al., [69] Based on four advanced regression techniques, including gradient boosting, random forest, decision tree, multi-layer perceptron's, and gradient boosting, she predicted the environmental pollution to exact standards. The authors have carried out emission studies with various datasets and IoT devices.

R. Lee et al., [70] The crucial requirement for what IoT should be prepared for various innovative city applications has been defined. Introduced also the IoT data service platform, IoTDA showed a case study where authors analysed road conditions, profound learning, and road condition analysis with the platform's help.

S. Majumdar et al., [71] Long-term memory networks were introduced to prevent congestion spread over a network of roads. Our model provides a 5-period projection of congestion in a busy town based on vehicle speed data obtained from two traffic sensors. Analysis of univariate and multivariate predictive models shows a precision of 84-95% according to the layout of the lane. This precision shows that extended short-term memory networks can be used to forecast congestion spread over road systems.

M. Raza et al., [72] In this article, a system based on the Internet of Things (IoT) is proposed to allow remote monitoring, administration, and analysis of a typical indoor environment for the patients. Both static and dynamic routing delayed analysis and priority allowed communication is provided via the proposed infrastructure. The scheme also implements machinery for the detection by audio logical inputs of Parkinson's development over six months.

E. Eziam, et al., [73] The evaluation model for detecting malicious activities in a Vehicle-Based M2M-C (VBM2M-C) network is focused on machine learning (ML) Based Trust (MLBT). The author presents the Extreme Gradient Boosting (XGBoost) model coupled with an Entropy-Based Feature Engineering (EBFE), which is optimized by the technique of binary particle swarm optimization. So e. So this paper provides an overview of the safety applicability of the VBM2M-C ML models. Detect node behaviour based on IoT sensor nodes transmitted message.

S. Dubey et al., [74] This paper focuses on waste segregation at two levels: the first level is at the individual house of the society, and the second level is at the society. The author talks about recycling biodegradable waste to make compost. For different combinations of three sensor values, a machine learning technique such as KNN produces a warning code.

N. Chakraborty et al., [75] An authentication technique suitable for mobile users is proposed for authenticating remote IoT devices. The PIN-based protocol, which can resolve various threats that are more prevalent in public domains. The author demonstrates that it can deal with sophisticated threat scenarios that are either enabled by advanced ML algorithms (including one unique to the proposed protocol) or triggered by IoT sensors. Finally, the results show that our authentication protocol offers the most usability comfort than the current state-of-the-art.

A. Makkar et al., [76] Machine learning was proposed for IoT system protection by detecting spam. IoT Spam Detection to accomplish this task, a Machine Learning System is presented. In this scheme, five machine learning models are evaluated using various metrics and a diverse collection of input feature sets. Based on the advanced input features, each model produces a spam ranking. Based on several criteria, this score represents the trustworthiness of an IoT device. The proposed methodology is validated using the REFIT Smart Home dataset. The obtained results show the effectiveness of the proposed scheme.

G. Manogaran et al., [77] The Machine Learning Supported Information Management Scheme is explored in this article to improve the efficiency of cloud-assisted IoT. Efficient data management based on the indexing methodology improves the efficiency of IoT communications. The construction of R-trees facilitates indexing, and the operations of the trees are manipulated using machine learning. The indexing method is augmented with machine learning to minimize response time and increase request processing accuracy.

A. Wheeldon et al., [78] It is proposed to create a new AI hardware architecture targeted at Internet of Things applications. The learning automata theorem, which is explained using propositional logic, serves as the foundation for architecture. The logic-based foundation enables low-energy footprints and significant learning precision during training and validation, both necessary conditions for successful AI with a long operational life.

N. U. Okafor and D. T. [79] Delaney Evaluated the efficiency in the field calibration processes of supervised Machine Learning methods for low-cost IoT sensors that were sparsely deployed for O₃ and NO₂ in urban areas. The results of IoT sensors were significantly improved when sensors were optimized using Multi Linear Regression and Artificial Network fusion methods. MAE or RMSE decreases considerably between the performance of the calibrated sensors and the actual concentration of target gasses. The results were evaluated.

N. Ravi et al., [80] A new protection framework called MDA LEDEM was introduced on the IoT server by wireless IoT. LEDEM has a semi-conducted attack detection ML model and two separate fIoT and mIoT mitigation methods. Compared to state-of-the-art solutions, we achieved a 21% increase in production. The DDoS attacks also demonstrated better value in other network efficiency metrics. Therefore, even when wireless IoT targets the IoT server, our protection framework will avoid a denial of service by its users.

J. Roldán et al., [81] The intelligent architecture incorporates the CEP technology and machine training (ML) paradigm to identify different IoT types of security threats in real-time. Intelligent architecture is being proposed. In particular, this architecture can handle event patterns efficiently, the conditions of which depend on ML algorithms. The proposed architecture has been tested for its ability to detect malicious system attacks in the sense of an IoT Healthcare Network. This architecture is effective in achieving its objectives, as the results indicate.

N. Msadek et al., [82] is demonstrated that by detecting specific patterns in IoT traffic, an intruder can disclose sensitive information about an IoT device, such as its type. We train machine-learning algorithms based on selected features extracted from encrypted IoT traffic to perform the fingerprint attack. Extensive simulations with the baseline method show that we achieve a significant mean accuracy improvement of 18.5 % and a speedup of 18.39 times in determining the best estimators.

Da Costa, et al.,[83] The presentation demonstrated how to improve IoT protection by experimenting with anomaly detections on the IoT Network Intrusion Dataset using various machine learning approaches. On the IoT Intrusion Network Dataset, the author achieved high accuracy while retaining high efficiencies.

H. Pandey [84] Cardiovascular disease is the leading cause of death worldwide. The human services sector includes a massive amount of information, and some approaches are used to handle the information. Handling or sorting is one of the most commonly used processes. As a result, this paper focused on real-time data for better prediction and precision using IoT and machine learning. The data is displayed in a Google spreadsheet before being used in machine learning algorithms. The KNN algorithm is discovered to be efficient. provides 78% accuracy, the help vector machine provides 86% accuracy, the random forest classifier provides 83% accuracy, the decision tree provides 74% accuracy, and the Naive Bayes algorithm provides 83% accuracy.

S. Hasegawa et al., [85] When there are several IoT devices on the network that causes traffic jams and packet loss, Ma et al. have proposed an IoT interface management algorithm focused on channel selection machine learning to deal with network congestion. They created a channel selection model for the Multi-Armed Bandit Tug-of-of-War problem. They used the algorithm for machine learning-based channel management to verify the algorithm in multi-scenario IoT environments. They then carry out actual trials with real wireless devices to test the proposed scheme comparison of the analysis shows that the suggested solution, which employs reinforcement learning, does better even when it operates in the presence of several IoT configurations.

M. Bagaa et al., [86] Designed an artificial intelligence (AI) driven security approach to meet the evolving security needs in the Internet of Things (IoT) space. Using network function virtualization (NFV) and SDN platforms it exploits all vulnerabilities. This hybrid AI architecture incorporates network models (such as ML and anomaly-based intrusion detection in IoT systems) with a monitoring agent that utilizes AI. It takes advantage of distributed machine learning, supervised learning, and neural networks to help in the process. The experiment was carried out in a natural Smart building environment, using a one-class Support Vector Machine learning (SVM) algorithm. Anomalies were detected at 99.71% accuracy.

A. S. A. Alrahman [87] It was discussed that supervised machine learning is a method for developing tools to help detect botnets. In light of this, the current work provided a study on the detection of botnets in the context of IoT in order to analyse the operation of machine learning techniques active in these devices. The study was carried out on an IoT network database that included three distinct behaviour profiles. Experiments on this database were carried out using active learning in a Pool Based scenario and an uncertainty-based sampling approach.

M. Jindal [88] This paper presents a brief concept of an urban IoT infrastructure designed to promote smart cities and advanced communication technologies. As a result, a detailed survey of architecture, technologies, and computational frameworks for an intelligent IoT is presented. It also addresses the principal vulnerabilities and problems that IoT faces and how machine learning is used in IoT. As a result, smart cities are considered a use case, as it illustrates how different methods are applied to data to extract great results with high performance.

Table 1: Summary of Reviewed Papers Using Machine Learning Methods for IoT.

Ref.	ML Algorithm	Objective	Dataset	Research Problem	Applied Field
[69]	Random Forest regression, Decision Tree and Gradient Boosting regression.	Predicting air pollution	Air Quality index AQI	Air Pollution	Smart City - Air Quality Environment
[70]	Deep Learning	Describing requirement on what should be made for IoT to be ready to support various smart city applications.	IoT data service platform, IoTDA	Air Pollution	Smart City – Air Quality Environment
[71]	Extreme Gradient Boosting(XGBoost), Swarm Optimization, Random Forest	The detection of the malicious activities in the M2M network.	Data from Internet of Vehicle sensor	Network security	Machine-To-Machine Communication
[72]	Scheduling Algorithm, Clustering	Intelligent monitoring and analysis systems for Parkinson's patients.	Unified Parkinson Disease Rating Scale (UPDRS)	High coast for Diagnose Parkinson's patients	Healthcare
[73]	Long Short-Term Memory	Avoid congested areas, decreasing pollutant concentration.	vehicle speed data from traffic sensors	Air Pollution	Smart City - Air Quality Environment
[74]	KNN	Decision in wireless network and other area.	IoT data service platform, IoTDA	Management system for smart cities	Environmental Pollution (household waste)
[75]	Principle Component Analysis (PCA)	Challenge-response protocol that is more secure to use in the public domain.	Biometric Sensor	Network Attack	Security
[76]	Bayesian Generalized Linear Model (BGLM), eXtreme Gradient Boosting (xgboost)	Spam Detection Technique for IoT Devices	REFIT Smart Home dataset	Network Security	Security
[77]	R-Tree, Random Forest.	Data management schema to ensure less replication and minimum service response time irrespective.	Data from Sensor	Performance of IoT communications	IoT-Cloud communication s

[78]	Learning Automata	AI hardware architecture for IoT-scale applications	ML datasets: XOR, noisy XOR and binary Iris	Energy efficiency	energy-efficient of Artificial Intelligence
[79]	Linear Regression (LR) and Artificial Neural Network (ANN)	Calibration of Low-cost IoT Sensors in Environmental Monitoring	True concentration of the gases were used.	Environmental Pollution	Environmental Monitoring
[80]	Naïve Bayes, Deep Relief Network	Detecting DDoS attack	UNB-ISCX data	Network Attack in IoT	cloud and software-defined network
[81]	KNN, SVM, Random Forest (RF), AdaBoost (AB), Extra-Trees (ET)	Engage the attention of security IoT policymakers and vendors	Real Dataset	Fingerprint Attack	Network Security
[82]	Decision Tree, Random Forest, Support Vector Machine	Intelligent decision making in IoT security attack	KDD 99	Security Attack in IoT	Healthcare
[83]	Logistic Regression (LR), Support Vector Machine (SVM), KNN, RF, and XGBoost.	Communicate securely without compromising performance	Concatenated file as data input	security of IoT networks	cyber-attacks
[84]	Random backwoods classifier, Decision Tree, SVM (Support vector machine).	Software system helps patient to predict heart disease in early stages	Patient's dataset and an information were used.	Handling or processing is symptoms	Healthcare (Coronary illness)
[85]	Reinforcement Learning	Distrusted channel selection	Real environment channels	Network congestions and packet losses.	Network
[86]	Distributed data mining system and neural network	Detecting attacks with high performance and low cost	DARPA KDD99 and DEFCON	IoT device attacks	Security of IoT domain
[87]	Particle Swarm Algorithm PSO	Present the concepts that make it possible to address, in a general way, the problem of classifying IDS data.	NSL-KDD	IoT security issue	Transport and urban communication
[88]	Naive Bayes, Support Vector Machines, KNN (K Nearest Neighbours)	Technologies, and computational frameworks is provided for a smart IoT.	UNB-ISCX data	Making smart City	Smart City (fog computing)

4. DISCUSSION

This article presents a comprehensive analysis of the several ways in which cutting-edge technologies such as artificial intelligence and the internet of things could be used in the world as it is now constituted. The results of this study throw light on the fact that a broad range of machine learning algorithms have been explored and proposed for use in smart cities. This discovery sheds light on the fact that there has been a lot of research done on machine learning algorithms. The results of this inquiry led to the formation of this suggestion as a consequence of those findings. This is something that has not been found or fully comprehended up to this point. These findings are a direct result of the research that was carried out, which prepared the way for other research to be done and made it feasible for additional research to be carried out. For instance, the authors of the study [88] created technologies and computational frameworks for intelligent IoT by using machine learning techniques such as Naive Bayes, Support Vector Machines, and KNN. These algorithms were used to create technologies and computational frameworks. The formation of the technologies and frameworks was accomplished with the assistance of these algorithms. In addition to developing their ideas and laying the technical and computational groundwork for smart cities, the authors of the study [88] created the foundations for smart cities. [88] (The K Neighbors Who Are Positioned in the Most Direct Line of Sight to You) the purpose of this research is to investigate and assess a wide range of different machine learning algorithms that have the potential to be used in edge computing. There is a possibility that such algorithms may be used there. This examination is going to place a significant amount of attention, particularly on the machine learning (ML) systems that are now functioning on edge nodes. In addition, edge server-based architectures and joint computing were taken into consideration, in addition to the absence (and its influence on privacy and local computational processes) and presence (and its impact on cloud/edge server communication) of machine learning that was sent to the edge of the network. Both of these factors were taken into account. These two considerations were taken into account simultaneously. Both of these things were taken into consideration at the same time. Both of these factors were thought about at the same time and considered simultaneously.

5. CONCLUSIONS

To phrase it another way, the potential of machine learning as a foundational technology for the Internet of Things is really substantial. In particular, the following descriptors may be used to this potential: Specifically, recent successful radiations from machine learning and the internet of things highlight their combination as a significant source in the field of data science. These radiations are produced as a consequence of applications that were carried out successfully. This presentation covers a broad variety of cutting-edge applications and technologies, as well as a discussion of the roles that these objects play in different scenarios including the Internet of Things (IoT). In this specific area of research, the approaches of machine learning are now receiving a considerable lot of attention and consideration. This website also offers a summary of the extensive research that has been done on the existing uses of IoT coupled with techniques of machine learning. You can find it in the "Research" section. That explanation is provided lower down on the page for your convenience. This research was

conducted on a comprehensive assortment of different sorts of applications across a broad variety of domains. The most recent technical advancements are shown as the victorious technologies in this cutting-edge idea of a technological artefact from the far future. This is done in order to develop links between the numerous things that make up the physical world and to provide a better, more intelligent, and more trustworthy life for living beings. Additionally, this is done so that the physical world can better accommodate intelligent and trustworthy living beings. In addition to this, this is done in order to establish connections between the many elements that comprise the physical universe.

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