International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-08, Issue-07, Oct 2022

# Implementation framework of the Internet of Things (IoT) system for big data processing in human life

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***Abstract*** **- Cloud computing is used by many people, but some of the technologies created by the Internet of Things (IoT) have now made the world's devices unique and addressable through a communication protocol. standard pass. These devices generate many different types of data that must be collected, stored, and processed. This can be a big problem for a computer system. IoT is already used to help prevent a number of chronic diseases, but real-time, continuous monitoring systems are among the most important. The cloud computing model is a good idea for many things, but not all of these can fully benefit from it due to the following issues: maybe the smart device doesn't have enough power, memory or battery life (or network resources) to do what they are supposed to do. Another possibility is that the network latency for a central server in the cloud may not be good for the applications, services and resources needed to get everything quickly. Many data generated by mobile medical devices have sensors, health clouds and mobile applications all the time. Due to the speed of data created, it is difficult to collect and handle as many data in real time to act quickly in an emergency and find a hidden value. Traditional methods, restricted and takes a long time, are used instead. In addition, it may be difficult to get useful information from this huge amount of data. There's plenty of room for user needs, so they can balance workloads, improve resource allocation, deliver big data, and show better performance than other approaches have been used. use. Many people need to use real-time big data stream processing to ensure that an effective and efficient solution to this problem can be found, which can be used in a variety of ways.**

***Keywords*****- loT, Big Data, WSN, cloud server, smart environment, RFID, architecture, efficiency, performance, storage, gateway**

## I. Introduction

There is the Internet, the "internet of computers" with services like the "World Wide Web" built on top of it that was possible in the early 1990s thanks to new technology and new ideas. With Web 2.0 and the "Internet of People", there has been a huge shift in the way people talk. Wireless communication technology and the use of micro electromechanical devices (MEMs) are making the Internet more accessible to more people. They become smaller and stronger over time. There are many ways to use these utilities. They can be used with phones, laptops, tablets, and more.

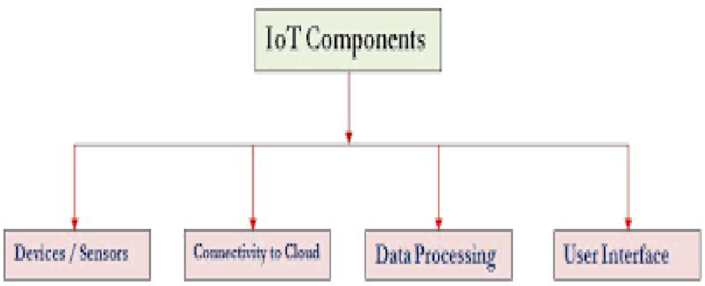


Fig 1.1: Components of IoT

 DOI : 10.35291/2454-9150.2022.0459 

**1.1. Elements of IoT :**

Hardware, middleware, and presentation are all components of the Internet of Things (IoT)

• **Hardware**: In the Internet of Things (IoT), embedded sensors, actuators, and processors play an important role.

• **Middle Ware:** Thanks to middleware technology, data analysis tools such as on-demand storage and computation are now possible. Between the technology and application levels, this program or a set of subclasses lies. In order for the programmer to be able to work on his own IoT-enabled application, he hides the complexity of various types of technology.

• **Presentation:** People interact with the environment on IoT systems, so visualization is key. Therefore, visualizations should be simple to understand, and interpretation tools should be cross-platform compatible. Useful for different purposes is needed. In this section, some of the technologies mentioned above will be discussed and how they can be used in the real world. Smart homes, smart cities, and smart nations can only become reality when the Internet of Things (IoT) is put to practical use. Real use of smart gadgets is the only way to benefit from it.

**1.2 Components of IoT**

**Wireless sensor network**: Hardware WSN: Real-time embedded systems can be seen through the prism of a Wireless Sensor Network (WSN). Unlike traditional networks that depend on infrastructure, it provides multiple uses in our daily lives. The sensor node consists of a transceiver, an onboard processor, a power supply, an interface unit, a storage unit, and other parts that work together to make it work. As long as the Internet is available, it will collect data about the environment and send it to the actuators/controllers. The sensor node in Figure 1.1 is built from start to finish. Sensor nodes may not have as much computing and processing power as actuators. Moreover, it has a much more powerful battery, which means it can work for a long time. Then action must be taken to transform the physical realm. Since the actuator has a longer battery life than the sensor, it can work longer. The energy and bandwidth available to sensor and actuator nodes are both limited. Most WSN applications fall into two main categories: tracking and tracking. Monitoring and tracking systems are widely used in the public and private sectors. To perform sensing tasks, IoT mainly relies on WSNs.

**WSN protocol layer:** Sensor nodes are often specially distributed and connected wirelessly to create a network that can be used for a variety of purposes. The receiving node is the final communication point of the WSN users. This means that MAC and routing protocols are essential when developing a sensor network architecture. Network life is directly correlated with the amount of power consumed by each node. The network becomes slower and less efficient as some nodes shut down. That is a common problem. You need a web-enabled layered architecture at your receiving node if you want to connect to the outside world.

**Secure Data Aggregation/Merging:** to keep track of what's happening; Sensor networks are often installed in hard-to-reach places. It is shared among sensors and sent to centralized or distributed systems that can perform analysis on the data to make sense of it. There are many node failures in wireless sensor networks. This does not mean that the network does not exist for a long time because each node can organize itself. So, a good data collection system is needed to keep the network running in the long run. People who need to make sure their data is safe should think about that too.

**1.2. Technologies involved in IoT**

**1.2.1. Wireless Sensor Networks:**

• **WSN hardware:** Embedded duration systems can be seen via wireless sensor network (WSN). Unlike conventional infrastructure networks, it provides a variety of uses in our daily lives. The sensor button has a transceiver, embedded processor, power source, interface, storage parts and other parts work

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together to operate it. As long as the Internet is available, it collects environmental data and sends to the transmission / controller. The sensor button shown in Figure 1.1 is built from start to finish. Sensor buttons may not have multiple calculations and energy processing as an actuator. In addition, it has more battery power means it can run for a long time. After that, it requires action to transform the physics kingdom. Because the drive has a longer battery life than the sensor, it is capable of running longer. Energy and bandwidth available for sensor buttons and transmission are restricted. Most WSN applications fall into two main categories: monitoring and monitoring. Most monitoring and monitoring systems are used in public and private sectors. To perform detection tasks, IoT depends very much on WSNS.

**•WSN protocol**

**layer:** Sensor buttons are usually dispersed ADHOC and wi relessly connected to create a network can be used in different heads. The sink button is the ultimate contact point for WSNS users. This means that routing and Mac protocols are essential when developing sensor network architectures. The life life has a direct correlation with the amount of energy that each consumption button. The network becomes slower and inefficient as the result of some buttons. It is a common problem. You need a webcapable coating architecture for your submerged button if you want to connect to the outside world.

**• Synthetic security data / Fusion**: keep an eye on what is happening; The sensor network is usually installed in difficult positions. It is shared between sensors and sent to centralized or dispersed systems that can perform data analysis to make it mean. There are many node failures in wireless sensor networks. This does not mean that the network does not exist for a long time because each node can organize itself. So, a good data collection system is needed to keep the network running in the long run. People who need to make sure their data is safe should think about that too.

### 1.2 IoT Services, Applications, Issues and Challenges

In the literature and on the Internet, several cryptographic approaches have been described. Public-key cryptography is a tragedy, but it's the norm. A private key algorithm may be developed in the future to ensure data privacy and security.

**WSN middleware technology:** All heterogeneous sensor applications can use this network in a deployment-independent manner because it is a service-oriented design and a connected sensor network (Ghose and Das, 2008). The Open Sensor Web Architecture (OSA) (Gubbet et.al, 2013) is the platform-independent middleware required to build sensor applications.

**RFID Communication:** Electromagnetic coupling and electrostatic coupling are used to identify stationary objects, animals or people being tracked by RFID. Using RFID for the first time, an automated identification center at the Massachusetts Institute of Technology has developed low-cost (standardized) transponders that can be used in the Internet of Things to identify billions of things. in 1999 (Sarma et.al, 2000). As a result, retail giants like Wall Mart and Metro have started using RFID in their supply chains. Retailers cannot see the Internet of Things in action due to the advent of RFID and other technologies. RFID has long been the primary method for creating microchips capable of transmitting and receiving data wirelessly. The cost and standardization of passive RFID has been reduced. The supply chain is not the only place using RFID. Other uses include cataloging books, tools and clothing in libraries, as well as in factories and mills. Tags can also be used to identify physical objects using radio frequency identification (RFID) or rapid response codes. This is why tags are so important (QR). Thanks to the battery, a working RFID reader can start transmitting immediately. Cargo tracking in port containers is the primary use of active RFID tags (Bonser & Keyer, 2010).

**IP Protocol:** Every object or node in the Internet of Things in the future must have an IP address and use the IP

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protocol, which is used by the Internet. IPv6 will play the most important role by assigning each smart object an IP address. Everything can be done from anywhere and at any time using internet services and applications. But so far, there is no clear picture of how to classify IPv6 in a way that allows public IP addresses to be divided and distributed freely.

**Web:** Since the Internet of Things (IoT) includes the World Wide Web (www), it is considered a vast network of smart devices. Recently, the term "Web of Things" has been used to refer to technologies that use the HTTP protocol and Web 2.0 technologies that use XML asynchronous JavaScript (Asynchronous JavaScript) (Ajax). It takes less time and money to communicate between the server and the client when Ajax is used in Web 2.0 applications. Indeed, processors embedded in the Internet of Things (IoT) use less resources than traditional web browsers. For example, web browsers and the services they provide are often referred to as URLs and operate through a basic user interface on PCs and mobile devices. As of Web 1.0, the only way to interact with a document is to read it. You can read and write in Web 2.0, as it is a two-way system that facilitates two-way communication. Podcasting, blogging, tagging, and social bookmarking are just some of the ways users can become active with the site. Web 3.0 is also not far away. An example of web 3.0 can be viewed here.

Using the Semantic Web, all information is organized in a way that can be understood by humans and machines. The Semantic Web is a concept that embodies this concept. Many believe that artificial intelligence and the Semantic Web have collaborated to make this a reality. To integrate data from multiple sources, Web 3.0 provides a common platform. The semantic web, distributed databases, machine learning, and natural language processing are just some of the technologies used. The market can be accessed using a browser.

If you have a lot of data, you will use the phrase "big data" to refer to it. It contains a variety of information. Traditional methods are used to collect data. After the data is cleaned, it is stored in a data warehouse for further analysis. When large amounts of data come from many different sources, it may not be relational data. In the context of big data, this information is relevant.

The need to process data as soon as possible becomes increasingly important as data sets become increasingly diverse, complex, and unstructured. To meet these very high criteria, traditional databases and scaling frameworks cannot do.

Big data presents many analytical and application challenges that are difficult to solve. Here are examples of what this might look like:

- A computer system capable of accepting, validating, and analyzing large amounts of data (size and/or throughput) at high speed .
- One thing to consider is mixed data (structured and unstructured) from many different places. Handles content that is unpredictable and lacks a clear structure or pattern.
- Increases the rate at which data is collected, analyzed, and feedback is provided. Businesses must continually expand their infrastructure to get the most out of data as they grow at an exponential rate. In the early days of Big Data, when Hadoop was starting to attract the attention of large enterprises, setting up a usable production system was very expensive and time consuming. People and software technology, as well as hardware, must be available to deal with the massive amounts of data and rapid queries that Big Data demands. They cannot make everything work at once in many Big Data initiatives.

Enterprise cloud analytics became increasingly popular in 2013 thanks to Amazon Web Services and many other Silicon Valley companies (VMware, Microsoft, and IBM) promoting the concept. These companies have devised their own ways for organizations to profit from cloud computing. Almost $5 billion in revenue was revealed by AWS in 2015. Then the rest of the world woke up.

As businesses of all sizes can now access the data infrastructure shown in Figure 1.2 and modern technology with just a few clicks, the cloud has revolutionized

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the business world. . This way, data admins and DevOps teams aren't the ones getting bogged down by the platform.

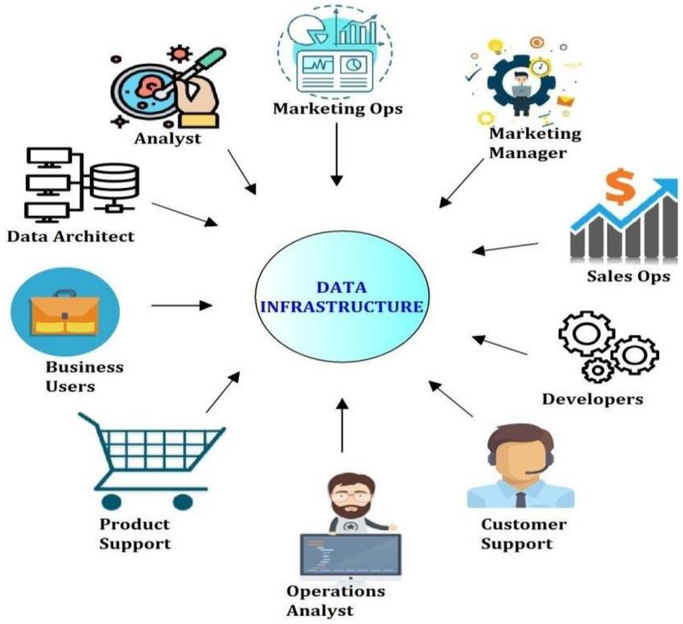


Fig: 1.2 Data infrastructure

### 1.3 Features of Big data

Big data as multimedia is a theoretical concept. Multimedia big data doesn't have a name of its own. Unlike conventional big data, multimedia data is made up of several distinct and more diverse media formats and is larger in size than regular big data.

- Multimedia big data has various features which are presented below:
- Unlike regular Big Data, Big Multimedia contains many different types of data. • Multimedia big data is more difficult to process because it includes many types of audio and video data, such as interactive movies, stereoscopic holograms, social videos, etc.
- This complicates understanding tasks. • The main multimodal data is difficult to analyze and characterize because they come from many different sources, such as mobile devices, capable utilities, Internet Internet (iodine), digital games, so virtual gender and social media.
- It is attractive to consider how the content and the multimedia context of the main data vary by time and geography. • There has been a significant increase in sensitive video data that individuals share and receive, create multimedia safety security of data.
- When the network accelerates, needs quickly and continuously analyze large volumes of multimedia data. To perform real-time calculations, large amounts of multimedia data must be saved.
- Many of these issues can be seen in the above discussion of multimedia science big data. Some examples of the complexity of perception and understanding of complex and diverse data sets, managing data security in remote environments, and ensuring quality of service to customers with applications big data multimedia. Because of the problems that arise when dealing with large multimedia data, such as how to process and store it, as well as how to transfer and analyze it, more research is needed in this area.

## II. IoT and Big Data Architecture

Industrial Internet of Things (IIoT) gateways connect several types of technologies and systems for

intelligent information storage and processing, as shown in Figure 2.1. The gateway receives a lot of information from terminals that have a very limited processing capacity. This is done by an ADC - an analog-to-digital converter, which is used to transform the analog signal from the sensor into a single digital value. Timestamp of the terminal processor and tags this data for later retrieval. Basic, like "motion detection", or more complex, like "motion + speed + car". Cards can be simple or complex. If the beacon is complex, it should be more powerful and consume less power. Not only can you reduce the amount of data and information bandwidth that you transfer to a cloud service, but you can also help speed up your response to an event.

Big data engines for information processing and discovery run in the background of the cloud cluster, providing a gateway to the data needed for processing and exploration. Machine learning or other AI approaches can be used to analyze data from different devices (summarized by tags), then integrated, classified and analyzed on a cloud server . The results of data mining can be

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viewed by viewing graphs and tables in the user interface of the IoT platform.

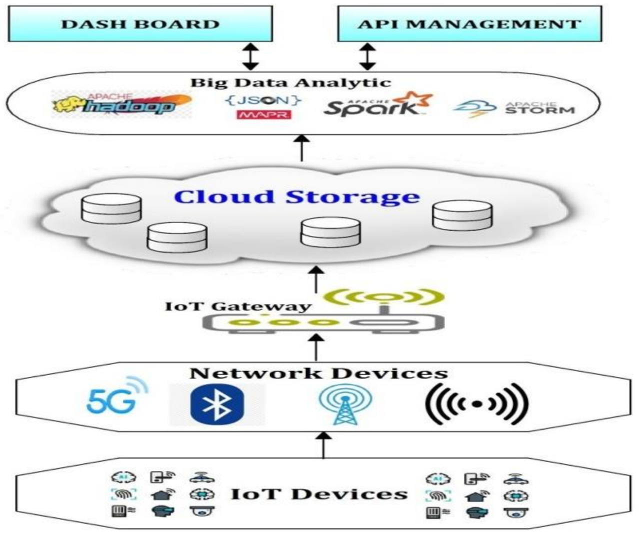


Fig 2.1: IoT and Big Data Architecture.

It is important that sensors monitor and record changes in the environment, not just their static state (such as temperature, pressure, level, vibration, etc.). Device prices are falling rapidly, allowing more data to be collected at a lower cost. Even within the same manufacturing process, many types of network connections can be established using the different types of wired and wireless networks available today.

1.2. **IoT big data processing follows four sequential steps:**

- IoT devices generate a lot of unstructured data, which is then stored in the Big Data system. The 3V factors that make this IoT-generated big data important are volume, speed, and variety.
- In big data system, a large amount of data is stored in big data files. This system, which acts as a shared distributed database, is called "big data". For example, IoT big data can be analyzed using Hadoop MapReduce or Spark.
- Report analyzed data.

**2.2 The choice of a data transmission protocol depends on the following factors:**

**Information transfer rate -** the ability to transmit a specific amount of data in a predetermined period of time;

**Power consumption -** if or if the electrical components of the terminal need to be recharged;

**Distance:** The maximum distance that data can be placed.

**Transmission frequency (measured in Hz):** available for use.

**2.3 There are two types of sensors:**

- **active -** It takes a lot of energy to send and receive signals;
- **Passive -** To save power, they only receive signals. Most sensors detect sound waves, ultrasonic waves, light and light. Devices for measuring physical properties are also available (inductance, capacitance, pressure, etc.).

IoT can be enhanced and "smart" with the use of a variety of sensors".

## III. IoT SENSOR DATA PROCESSING

Wireless communication protocols are widely used in IoT sensor networks to exchange information. Sensor implementations benefit from the enhanced adaptability and scalability offered by these communication protocols, operating in unlicensed frequency bands. On the other hand, the use of WSN communication protocols in unlicensed frequency bands will result in unmanageable disturbances. Noise, outliers, missing values, and redundant sensor readings can be caused by interfering signals. This section focuses on IoT sensor data issues such as distortion, missing data entry, identification of outliers, and data aggregation.

### 3.1 Denoising

A lot of sensor data is generated in the IoT network and it needs to be analyzed and used in real time. Sensor data has many features, including high speed, high volume, and a wide range of dynamic and value types. Various challenges must be overcome before critical data analysis and real-time decision-making can be performed. The unwanted change or modification of the original signal vectors is due to noise, an uncorrelated signal component. Due to the noise feature, resources are wasted on unnecessary data processing and management. With the use of wavelet transforms, one can accurately represent the signal as well as deal with the signal estimation problem. In other words, by removing noise from the signal, a Wavelet transform preserves the original coefficients of the signal. Therefore, an appropriate thresholding strategy

 DOI : 10.35291/2454-9150.2022.0459 

is needed to achieve this goal. Continuous time signal energy can be analyzed and synthesized using Wavelet transform.

Let e (t), t ϵ R represent the signal energy, while it must satisfy the constraint defined as:

$$\|e\|^2 = \int_{-\infty}^{\infty} |e(t)|^2\, dt < \infty 2 \qquad (1)$$

Where the signal energy e (t) that satisfies the constraint in Equation (1) belongs to the squared search space L2(R).

It is also possible to remove noise from arbitrary data by using wavelet treatment. It is possible to check the characteristics of the signal by zooming in different time-scale scale using the child wave processing method. Significant profits in denoise sens or signals have been observed in test data.

About Wavelet transformations, there are two types: CWT (continuous wavelet transformation) and DWT (discrete wavelet transformation). Convert to Continuous Wavelength (CWT): in CWT, the energy of signal e(t) is represented by a set of wavelet functions C = {Wψ(α, β)}, α ϵ R +; β ϵ R, where α represents the scaling factor and β represents the offset time position coefficient, while ψ represents the wavelet function. The wavelength coefficient on the time-frequency plane is given by equation (2).

$$W\psi\ (\alpha, \beta) = \int_{-\infty}^{\infty} \frac{1}{\sqrt{\alpha}} \psi^0 \left(\frac{\lambda-\beta}{\alpha}\right) e(\lambda) d\lambda \qquad (2)$$

Where wavelet ψ0 is the original wavelet shifted and stretched (t). CWT is a two-parameter function. The objective of CWT is to find the coefficients e(t) of the original signal as a function of the offset (β) and the expansion coefficient (α).

Discrete wavelet transform (DWT): will be the transformation of a continuous signal into a discrete signal. A subset of these coefficients is determined by this transformation.

$D = W\psi\ (2^{\alpha}, 2\alpha\beta), \alpha \epsilon Z, \beta \epsilon Z.$

For a given continuous-time signal e(λ), the DWT coefficient is obtained using the integral of the subset D, as defined in equation (3).

$$W\ (\alpha, \beta) = (\psi_{0\ (2\alpha,\ 2\alpha\beta)},\ e) = \int_{-\infty}^{\infty} 2 - {}^{\alpha}/_{2\psi 0}\,(2 - \alpha\lambda - \beta) e(\lambda) d\lambda \qquad (3)$$

Where α represents the scale factor and β indicates the localization factor. It should be noted that this is a continuous signal e(λ), and not a discrete signal.

IoT sensor device signals can have a decent signal-to-noise ratio (SNR), but they may not meet bit error rate (BER) requirements. The easiest way to solve these problems is to eliminate wavelet coefficients that are less than ideal. In this case, the SNR increases by a predefined cut-off threshold. Due to the tendency of the coefficients to be lower for noisy data, this is doable. In addition, it is important to note that energetic signals are concentrated in a certain region of the signal spectrum. As a result, wavelet coefficients are used to modify this part of the signal spectrum to increase the SNR. Therefore, wavelet coefficients play an important role in enhancing the energy of a signal containing large irregular noise regions and small regions of a smooth signal. In other words, the larger part of the wavelet coefficient will be affected if a signal function is contaminated with larger noise.

Small parts of the wavelet coefficient will comprise the original signal. Therefore, if the threshold limit is maintained, most of the noisy signals will be eliminated and the original signal coefficients will be preserved. Both the streaming sensor data and the raw sensor signal are discussed in this work to identify the characteristics and many concerns related to noise in the sensor signal.

### 3.2 Degradation of missing data

An alternative preprocessing step is necessary in data analysis when dealing with missing or erroneous data. Many industries and sectors use the Internet of Things to generate a lot of data, including smart cities, healthcare, GPS systems, and transportation systems.

**Gaussian Mixture Model:** An approach to clustering known as Gaussian mixed model (GMM) is used to distribute data points to distinct groups in a probabilistic model. A Gaussian composite is defined as follows: G = {GD1, GD2, GDk}, where k represents the number of clusters. Each GDi is a Gaussian distribution function consisting of the mean μ, representing its center, the covariance Σ, and the probability π, representing

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the size or dimensions of the Gauss function. Assuming that the dataset D is generated using GMM with k components, the function fk(GDi) represents the probability density function of the kth component. The probability that GDi, P(GDi) is generated by the GMM, is given in equation (4) below.

$$P\ (GD_i) = \sum_{i=1}^{k} \pi_i f_i(GD_i | \mu_i, \sum i \qquad (4)$$

Versioning, grouping, classification, distance measurement, and data filling are all processes of the GMM model's missing data entry workflow. Data sets D1 and D2 were first split into two separate data sets, each called D1. Unlike dataset D1, which contains all occurrences of the dataset without any missing values, dataset D2 contains all occurrences containing missing values. Next is the GMM model, based on the EM approach, which is used to aggregate all the data into D1. There is a central node for each cluster. Finally, the cluster of each D1 instance is determined. Third, a test set consisting of incomplete D2 data. Depending on the results of clustering, instances of D2 are classified differently. For example, αi ϵD2, αi if it is at euclidean distance from the center of the cluster, it is a member of this cluster. With Euclidean distance used as a distance measure, for each I case in D2, one must identify one or more complete examples closest to me in the same cluster. Filling in the missing value for an instance is done by finding the mean of its nearest cluster member.

## IV. Issues and Challenges

The main issues with Big Data and IoT are shown in Figure 4.1:

**• Data storage and management**

Much data is generated by connected devices at lightning speed, but most big data systems have limited storage space. When there is a lot of data to store and manage, this can be difficult. Since there is so much data that needs to be collected, stored and processed, it is important to create frameworks or tools to do this.

• Provide storage space for the server.

• Share huge amounts of data.

• All processing servers receive the same amount of data.

• Data queuing improves data processing speed.

• IoT data can be used to discover networks and geolinks and topologies.

**• Data visualization**

Structured, unstructured, and semi-structured data can be found in various forms from linked devices. The data is not immediately obvious. To make real-time choices and increase industrial productivity, data needs to be organized in a way that's easier to visualize and understand.

**• Security and privacy**

Complete privacy and data protection are required for all IoT enabled devices that generate large amounts of information. The data collected and recorded must be kept private and confidential as it includes personal information about the user.

**• Integrity**

Many applications benefit from the expertise of smart devices in a wide range of perceptual and communication skills. Thanks to this technology, data leaks and hacks are a thing of the past. Data aggregation techniques must strictly adhere to standard systems and procedures for scale and integrity.

**• The ability to confine energy**

Internet-connected devices require a steady and constant source of power for IoT functions to continue functioning. Due to the lack of storage space, processing capacity, and power, connected objects need lean mechanics.

**• Device security**

Big data makes analytics devices vulnerable to attacks, making them targets for hackers. Limited computing, network, and storage resources on IoT devices are a barrier to data processing. Real-time data can be obtained from many Big Data solutions. It is important to use strategies and processes specifically designed for Big Data and IoT to achieve the most accurate results. Analytical approaches may vary depending on the type of data collected from different sources.

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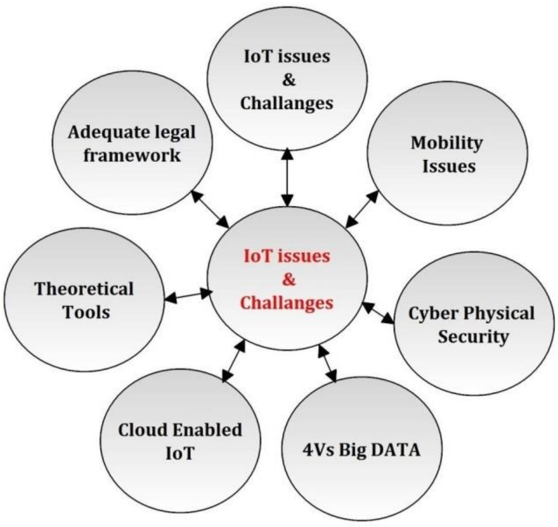


Fig 4 : Issues and Challenges in IoT and Big Data

Big data management is difficult because the data management service has a big influence on how everything works together. The ability to analyze and mine massive volumes of data from current IoT applications and computing systems using big data analytics is needed to uncover useful insights. Many end users may find this confusing and difficult to use . [10]

## V. APPLICATION

• There are many advantages to having IoT, such as the ability to communicate with each other.

• Observe their business practices in general.

• Increase customer satisfaction .

• Save time, money and resources.

• Increase employee productivity.

• Unify and align company standards.

• Make smarter business choices.

Increase your income by entering the consulting and training industry. Connected cars, Industrial Internet of Things, smart retail, and energy interoperability are all examples of IoT applications. In addition to wearables, smart retail, smart energy, and more, IoT smart homes are becoming increasingly popular.

**5.1 Some application areas include:**

Healthcare Personnel By connecting medical devices, objects and people, the Internet of Things (IoT) opens up new possibilities for improving health systems (Zhibo et al., 2013). . Internet of Things (IoT)-based healthcare services are now accessible even if you live a considerable distance away. E-healthcare or e-health services can be more cost-effective and convenient than conventional medical advice in some cases (Hossain and Muhammad, 2016; Sharma and Kaur, 2017). Anything related to healthcare can be tracked and monitored at all times with IoT's ability to identify, detect, and interact with anything (Alemdar & Ersoy, 2010; Mohammed and associates, 2014). All of these technologies can be used to build the next generation of e-health systems, including IoT, cloud computing and big data (Suciu et al., 2015). WSN and M2M networks can be used to collect a variety of medical data, which can then be analyzed. For example, it encourages researchers to shift their focus from hypothesis-driven research to data-driven research. For example, the monitoring and treatment of specific health conditions can be monitored and studied using an approach known as big data. It was recently explained and discussed how this framework works (Abawajy & Hassan, 2017). Things like clothing and shoes can be used to monitor blood sugar, blood glucose levels, blood pressure, pulse, and an electrocardiogram for an individual patient. Each user has his/her account on the same server. Cloud and IoT subsystems are connected through this server. Alerts can be sent to emergency contacts in the cloud whenever an alert is triggered by clinical data processing programs. There are also analytical tools that help healthcare professionals select the appropriate type of care based on attributes and group data (Abawajy & Hassan, 2017). Physicians and patients can benefit from the use of these systems, which can help them make more informed choices about their own treatment options. Best of all, they make it easy to pay for services, track costs, and provide patient information. Because each medical center will be able to obtain the necessary information, no matter where the tests are performed, the diagnosis will be better. In addition, test results can be recorded in real time so that judgment can be made immediately after the assessment is complete. In addition to speeding up data storage and processing, various Big Data solutions can help with research. Data from inside and outside your home will be collected by NOSQL patient monitoring technology in the future, allowing them to provide early warnings

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of health changes

and signal alarm systems. when preventive action

is needed. Shorter and shorter hospital stays due to fewer emergency room visits saves money.

**Food channel**: Many people participate in complex food supply chains (FSC), spread and difficult to manage. Things like operational efficiency, quality and safety of public food has become more difficult to control. Barcodes and wireless tracking technologies such as GPS and RFID can be used at all stages of production, processing, transportation and consumption to implement (Gia et al., 2015, for example, and coins et al., 2014). Field devices, backbone systems and communication infrastructure are part of the typical IOF solution for FSC. The scanner and RFID card are just a number of devices that can be used in the current field. Smart¬Distributed computer networks link databases, servers, and a variety of terminals to form the backbone of any system (Xuetal. 2014). environment domain

➢ **Smart Environment Domain**

**Smart electrical systems:**

“smart” cities are made possible through the Internet of Things (IoT), intelligent systems and data analytics (Stankovic, 2014). There are several ways to reduce energy costs, such as analyzing trends in household electricity consumption over time (Rathoreetal., 2017). A new study shows that smart grid technology can mitigate some of the disadvantages of existing electrical infrastructure in specific situations (Iyer & Agrawal, 2010, Parikh et al., 2010; Stojkoska & Trivodaliev, 2017).

- **Smart home:** An IoT-based smart home has been proposed by Stojkoska and Trivodaliev. They created this as a solution (Stojkoska & Trivodaliev, 2017). Suppliers of room applications, utilities and other third-party application providers are connected via cloud networks. Linked smart device data is collected with sensors on the smart grid system. Most utilities charge based on the time you use their service. Equipment such as battery chargers and web refrigerators and third-party ovens can reduce electrical costs (Lock et al., 2009). There are also webbased counter calculating electricity at the grid house based on renewable energy sources.

- **Smart environment control:** FLEA manufacturing companies, pharmaceuticals and foods often have strict instructions on how their equipment and surroundings should operate and maintain clean (Dinh et al ., 2016). Data on working conditions and the environment should be collected, recorded and analyzed in real time during the production process to determine risks and incidents. Integrated platforms for analyzing predicting and visualizing data

from analytical engines is part of the remote control system and is also available (Lee et al., 2013). Wireless sensor network (WSN) has been set to monitor plants in greenhouses. It also includes an agricultural management system (Srbinovska et al., 2015). Drops and irrigation fans can be remote control, allowing farmers to produce more crops and increase their crop quality. For commercial and administrative buildings, there is a temperature control framework in Stojkoska and colleagues, 2014. Most, the efforts of this study are devoted to the development and implementation of inter-structures New links and new sensory network nodes.

- **Security and monitoring:** The use of RFID cards on all production items in the smart environment also helps increase the safety of automation process in industrial facilities (Spiess et al., 2009 ). For safety, supervision, supervision and safety, the detection of gas beads was very important in some operations. The multi-variable sensors are connected to a new and effective approach to inform every person who can endanger, both in industrial and indoor settings (Potyrailo, 2016).

- **Smart City:** There has been a continuous increase in connection due to the urbanization process, resulting in a huge amount of data and diversity. When large data analyzes become

more popular, we will better understand what people do with citiessothatwecanprepreparefurthefutemorefective. "Light" IstheterMyrathore and colleagues (2017) to describe a smarter city and safer than the current concepts of "smart cities". Residents and Super City staff can be supported with any task at any time. Flights, theft,

 DOI : 10.35291/2454-9150.2022.0459 

violence and other crimes, as well as external dangers like pollution, are part of this responsibility. Production and data collection is part of Rathore et.a. Proposal of a super city, as well as communication, data administration and processing, as well as the interpretation of the created main data (Rathoretal 2017).

• **Production of safety exploitation:** Because underground mines are very dangerous places to work, exploitation security is a major concern in many countries. My disaster can be caused by floods, fires, gas explosions, dust explosions and coal dust and many other things that IOF technology can be used to search (Qiuping et al., 2011). People on the floor as well as on the surface are now interacting together, monitoring underground employees, analyzing important security data from chemical and biological sensors through the use of public Wireless media technology like Transportation and¬RFID and WiFi.

**logistics:** due to monitoring and modern technology, transport industry and logistics are going through a lot of technical changes. Real-time supply chain monitoring can be done with RFID and NFC technology. All designs of goods and buying raw materials through production, transportation and storage can benefit from these technologies. Distribution, sales, refunds and possible sets of applications for these containers (Luigi Atzori et al., 2010). Therefore, the delivery time is done because email providers can track items instantly with mobile applications. Temperated goods are shipped nationwide through cold chain logistics, using heat and cold packaging. Usually use WSNS in this industry (Hsueh & Chang, 2010). Now cold trucks can be required to monitor the use of Zhangetal communication technologies, sensors and wireless communication technology. (2012). There is an additional way to use WSNS Mundane, such monitoring and maintenance. In the case of general power, for example, the sensor makes it possible to monitor the health of the engine, turbines and winds of its aircraft. To this end, American Airlines has sensors capable of winning 30 gigabytes of data every trip. The car monitoring sensors of the car as well as GPS devices provide information about the location of a car so that people can determine traffic and how to make the road installed by the house Automobile production (Qinetal, 2013). Our future shipping options will be greatly affected by the concept of autonomous cars. To communicate with the network and transmit and receive sensor data, unmanned cars use WSN technology. Cars can consult databases of maps and satellite images to help them find their way around and prepare for global traffic and transportation needs. Data from the vision sensor must be analyzed in real time using a high-performance computing device such as a GPU card to ensure the safety of nearby vehicles.

**Firefighting:** Internet of Things (IoT) has been used in fire safety to identify impending fires and provide people with early warnings of fire-related tragedy. RFID tags and barcodes are being used on fire fighting equipment nationwide to build a national database. Sensor networks and wireless communication networks are also used to accomplish this task.

**6. Hardware-based application that supports WiFi for its operation:**

With smart air conditioners, people can operate their air conditioners remotely. To give users this flexibility, the air conditioner must be

connected with hardware (IoT enabled devices) and software (IoT solutions). Air conditioning, hardware, and mobile apps all work seamlessly together so data can be sent and synced quickly so you can control your devices properly. Let's have a basic picture of how the smart air conditioner works, as shown in Figure 6.1.

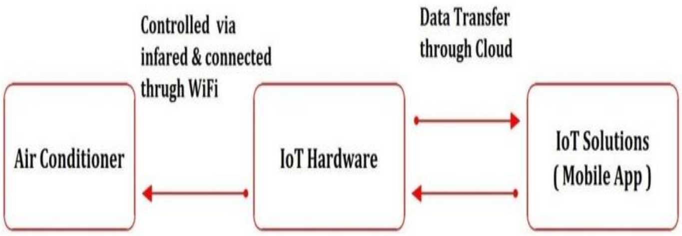


Figure 6.1 Design of Air Conditioner with IoT Enabled Hardware

The air conditioner will be linked to the IoT hardware via WiFi. Air conditioners are controlled by hardware that emits infrared waves like a remote control, like a TV remote. Cloud technology is used to move data


DOI : 10.35291/2454-9150.2022.0459

between hardware and mobile applications over the Internet. The GPS-based function will allow the AC to be turned on and off by itself. Make sure your smartphone can go where you want it to go. Now, when the device goes in and out of a certain area, the hardware will communicate with the AC over WiFi to turn the device on and off. Using cloud technology, you can allow users using only the mobile app to change the settings for the air conditioner. 7. End In the real world and the virtual world, IoT big data analytics makes decisions in the virtual world more realistic. The problems and challenges of IoT big data analytics have been discussed in this article, along with ways to solve them. There is still a long way to go to realize the big data vision of IoT until we come up with new techniques and mechanisms of the highest quality. This, in turn, will change the way we find signals in noise.

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