

## Internet of things and Big Data Analytics– Challenges

**Deepmala A. Sharma<sup>\*1</sup>**

*Asst. Prof., Department Of Computer Science  
Tilak Maharashtra Vidyapeeth, Gultekadi,  
Pune 411 037, Maharashtra, India.  
deepa0702@gmail.com.*

### **Abstract**

*Internet of Things (IoT) is a name which can be found commonly in today's world it is used in terms of objects that are embedded with software, sensors and other technologies that allow various devices to connect over the internet and exchanging information and data between them. The Internet of Things (IoT) provides a common platform for millions of electronic devices to communicate with each other. There are several sensors continuously collecting and transmitting data from IoT devices and storing over cloud network. Data collected through smart devices are huge in size and currently data size has almost reached to petabytes. Future estimates rise in usage of IoT devices which will lead to rise in data too. Big data analytics is popularly used in managing voluminous data. Big data analytics is merged with IoT as a need for managing data that is obtained by IoT devices appropriately. Usage of Big data in IoT has already started creating its impact by storing, obtaining and analyzing data in a better way. The information obtained can be stored and used for critical data analysis and essential decision making. Data management in IoT is critical as well as challenging task which can be efficiently managed by powerful big data analytics. However still there is a need for improvement in the field. This paper focuses on the relationship between IoT and Big data analytics and the challenges that needs scope of improvement in the field for better data processing and analytical skill required for decision making.*

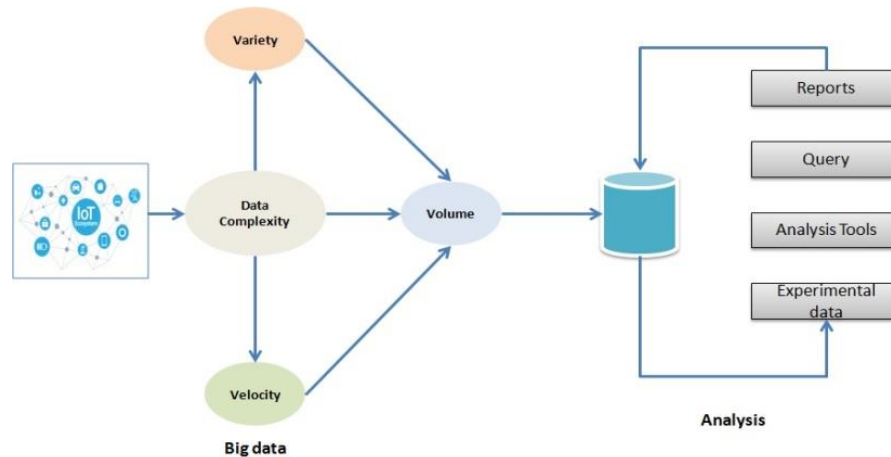
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### **Introduction**

The term IoT was coined by Kevin Ashton in 1999. The main idea behind the suggestion is based on the advancement in the field of interconnected sensors and their continuous annual growth [1]. These devices are getting smarter as they are able to communicate with each other directly to process their generated data locally for smart decision making based on defined algorithms. IoT world involves with development of gadgets, machines or devices that can be connected with each other for data sharing.

Data sharing is not only between humans but with the invention of IoT data sharing between machines has become common. There is a rise in the amount of data generated through IoT devices as there are millions of IoT devices popular in globe and are therefore used worldwide [2]. Also future world expects more and more IoT devices invention and more and more population using them. So there is a huge amount of data expected. The widespread popularity of IoT has made big data analytics challenging because of the processing and collection of data through different sensors in the IoT environment [3]. Collecting meaningful data from devices will be the greatest task of big data analytics.

The main concern is to maintain and manage the generated data efficiently so that the data becomes useful and can be applied for analysis as well. Here data can be made useful with implementation of big data analytics techniques. Big data is popularly used to handle huge amount of data. Data can be described as 'big' when it demonstrate the four 'V' qualities: veracity (accuracy), velocity (speed), volume (size) and variety (both structured and unstructured) [4]. Big data is used to process and analyze real time data that is too large in size for real time decision making. Moreover, big data analytics aims to immediately extract knowledgeable information using data mining techniques that help in making predictions, identifying recent trends, finding hidden information, and making decisions [5].



**Figure 1 : IOT Big Data Processing**  
([whizlabs.com/blog/iot-and-big-data/](http://whizlabs.com/blog/iot-and-big-data/))

### **An Overview of IoT , Big Data and Big Data Analytics :**

#### **Internet of Things (IoT)**

Internet of Things (IoT) deals with connecting of physical objects through the internet. The ‘thing’ in IoT can refer to a person or any device whose is assigned through an IP address. The interconnection of computing devices via internet have enabled object to send and receive data. The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies [6].

#### **Features of Internet of Things**

- Use to gather high-quality and sensitive data.
- The process of collection and storage of data can be pre-determined.
- Data Privacy.
- Appropriate law in case of security breaching.

#### **Big data**

Big data is basically a data that is huge or very large (peta bytes or gigabytes). Data may be available in the form of structured, unstructured or semi-structured data and further the data received may be used for analyzing those data to get the insights of trend. Big data assists IoT with easy execution but with its own challenges. Data is generated by devices connected and helps make better and profit-oriented decisions when utilizing IoT and analytics. The Digital Universe” study [7] labels big data technologies as a new generation of technologies and architectures that aim to take out the value from a massive volume of data with various formats by enabling high-velocity capture, discovery, and analysis. This previous study also characterizes big data into three aspects: (a) data sources, (b) data analytics, and (c) the presentation of the results of the analytics. This definition uses the 3V’s (volume, variety, velocity) model proposed by Beyer [8].

#### **Features of Big Data**

- The amount of data gathered can be controlled.
- The type and nature of data can be selected to get an effective result.
- Analytics and algorithms are used for processing the data.
- Implementation of inductive statistics to understand the dependencies and relationships of the data.

## Big Data Applications



**Figure: 2 Big Data Applications**  
(<https://www.digitalvidya.com/blog/big-data-applications/>)

### Big Data Analytics

Big data analytics is a form of advanced analytics, which involve complex applications with elements such as predictive models, statistical algorithms and what-if analysis powered by analytics systems [9].

Big data analytics involves the processes of searching a database, mining, and analyzing data dedicated to improve company performance [10]. Therefore, the main objective of big data analytics is to assist business associations to have improved understanding of data, and thus, make efficient and well-informed decisions. Big data analytics enables data miners and scientists to analyze a large volume of data that may not be harnessed using traditional tools [11].

### Relationship between IoT and Big Data

IoT deals with creation of smart devices with intellectual insights. Smart device requires analytical skills to respond which is possible only with the intervention of Big Data. It will not only gather accurate information but will also capture the data in a particular style. This extraction methodology enables the Big Data analytics solution to get a prompt result. IoT and Big Data are the most important part of an industry, in which IoT is utilized to capture data from various sources, which is taken care by the Big Data analytics in order to get an insight of the information. When a data is being extracted, the prime concern is to distinguish between the type of data, that is structured, unstructured, contextual, real-time, dark, images, etc. The overall perspective of the entire process is to extract valuable data from the smart devices in order to recognize the operation. It is clear from the abovementioned points that the IoT and Big Data are interrelated with each other. Although big data is a wider concept than IoT and can survive alone but without big data the existence of Internet of things is next to impossible. So big data along with powerful analytics is a essential requirement for smart IoT device management. The joint venture of both IoT and Big Data is important for the development of smart and safe devices in the modern digital world. So to conclude data remains fundamental to both. Big data involves collecting large volumes of data from sources like social media, devices, and sensors. IoT is procuring data from every device that surrounds us like home appliances. However, the underlying characteristics differ in both these technologies as they are two entirely different concepts[13].

### Steps for IoT Big Data Processing

To manage IoT Big data, the process is broadly classified into four steps, described below [14]:

- i. The first step is to manage different data sources of IoT, i.e., IoT sensor devices, where sensors in a device interact with each other with the help of different applications and generate highly unstructured, semi-structured, or structured data.

- ii. In the second step, data generated by different IoT devices called Big IoT data is collected and stored by the big data storage system. This data is based on the 3V model given by Gartner.
- iii. In Big data storage system, this IoT data is converted into shared and distributed as Big data files.
- iv. After that, it applies different analytical tools for analysis of data like Hadoop, Map-Reduce or Spark, and many more, which are further discussed in the next section.
- v. In the last step, the report corresponding to the injected data is generated and presented to the user.

### Big data challenges in IoT

As studies reveal that IoT devices generate huge amount of data and more volumes of data is expected in future but just storing and transmitting data is will not ensure reliability. As big data is not 100% accurate there are several challenges that need to be controlled. There should be a procedure to ensure that data that is captured and stored makes sense when it is used for analysis so data reliability is one of the challenges of big data [15]. Data processing is one of the major challenges even if large amount of data is collected and stored it can be useful only if it is processed accurately. So in order to make the data productive we first need to make sure that the sensors are working and processing data in a secured manner over the network. Also it is essential to distinguish from the amount of data received what data need to be stored and what not .Data storage is another concern in the field it deals with storage of information which can be used for future analysis here selection of data plays a vital role for predictive analysis. Security is a major field of concern in IoT as devices connected over the internet are never safe and vulnerable for cyber attacks also many security breaches have been found on IoT. NOSQL is another field of concern as NOSQL database has poor security. As IoT Big data have arrived recently and there are lack experts with knowledge and experience. Therefore managing and maintaining device and data security is vital as well as challenging for the success of IoT big data.

### Conclusion

The above research is a descriptive one providing an overview on current IoT and big data analytics environment. To conclude with the above research it can be said that there are several problems and challenges that need to be handled and resolved for efficient data processing. From the above study we can conclude that IoT and big data interaction is currently at a stage where processing, transforming, and analyzing large amounts of data is utmost priority. There is a need to implement appropriate machine learning algorithm which can be used for critical data analysis, extraction and storage. Also finding skilled and expertise manpower in the field are again a need which can be useful for resolving problems and providing needful solution. Security is another drawback where data stored in NOSQL lacks security features to protect data from cyber attack. As the ratio of IoT user are about to reach its peak in the coming years there is a need to develop a suitable IoT and big data analytics framework which is capable of handling device critical task along with a secured connectivity, smart data extraction, storage and powerful analytical skills as well as cost effective processing which will help IoT to expand and enhance it capabilities successfully. Big data has a high potential however there still remains lot of scope to overcome the challenges.

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