IoT and Big Data- The Current and Future Technologies: A Review

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Abstract: The Internet of Things (IoT) and Big Data are two evolving technology topics in latest years. The Internet of Things (IoT) and Big Data go hand in hand. The main idea behind the IoT is that almost every object or device will be having an IP address and will be linked to each other. Now, considering the fact that trillions of devices will be linked and will be producing massive volumes of data, the efficiency of data collection mechanism is going to be challenged. One of the most important features of IoT is its real-time or close to real-time communication of information about the "linked things". The difficulty lies in doing this at a mass amount (e.g. from 10s of thousands to 10s of millions and above) and challenging. The four main distinctiveness about IoT is a)Large data size (TBs to PBs) b) High speed of data flow, data change (OLTP) and data processing (OLAP, analytics) c) Diverse structured and unstructured data, diverse data models and query languages, diverse data sources and veracity. This review paper talks about the challenges of IoT with Big Data, the requirements, the technologies used, the data security issues, the challenges etc.

Keywords: IoT, Big Data, Size, Speed, Diverse data, veracity.

I.INTRODUCTION

IoT has become so vital in our daily life and it is going to create a big impact in the near future. For example, solutions can be provided instantly for the traffic flows, reminding about the vehicle maintenance, reduce energy consumption. Monitoring sensors will diagnose pending maintenance issues, and even prioritize maintenance crew schedules for repair equipment. Data analysis systems will help metropolitan and cosmopolitan cities to function easily in terms of traffic management, waste management, pollution control, law enforcement and other major functions efficiently. Considering it to the next level, linked devices can help the people personally like you get an alert from the refrigerator reminding you to shop some vegetables when the vegetable tray is empty, your home security systems enables you to open the door for some guest with help of connected devices(IoT). Since there is a massive growth in number of devices day by day, the amount of data generated would also be enormous. Here is where Big Data and IoT go hand in hand. Big Data manages the enormous amount of data generated using its technologies. The Internet of Things (IoT) and big data are two vital subjects in commercial, industrial, and many other applications. The name IoT was framed in approximately a decade ago and refers to the world of machines or

devices connected to the Internet, by which a large amount of big data is collected, stored and managed. Big data additionally refers to the analysis of this generated data to produce useful results. The main motivating power behind the IoT and big data has been the collection and analysis of data related to consumer activities in order to find out why and what customers buy.

II. NECESSITY OF IOT AND BIG DATA IMPLEMENTATION

IoT will enable big data, big data needs analytics, and analytics will improve processes for more IoT devices. IoT and big data can be used to improve various functions and operations in diverse sectors. Both have extended their capabilities to wide range of areas. The figure below shows the areas of big data produced. Some or the other way, data is produced through connected devices.
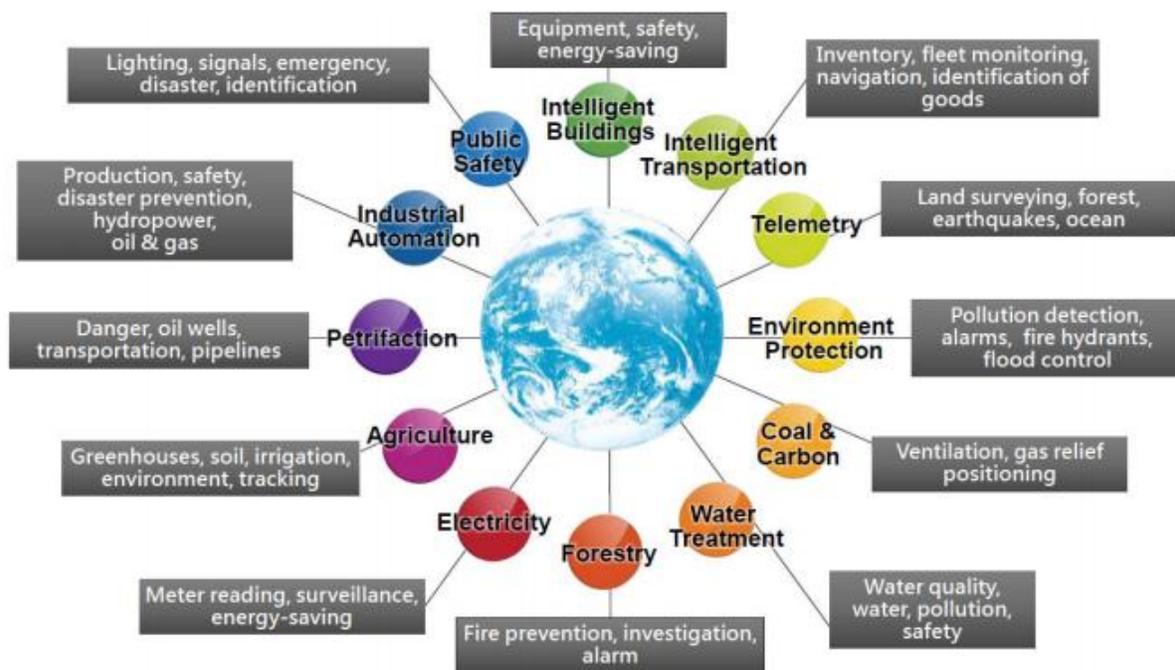

Fig 1: Big data produced across various areas [7]

The important basis behind why to implement IoT and big data are:

1. Analytical monitoring
2. More Uptime
3. Lower reject rates
4. Higher throughput
5. Enhanced safety
6. Efficient use of labor
7. Enable mass customization
8. Analyze the activities for real-time marketing
9. Improved situational alertness
10. Improved quality
11. Sensor-driven decision analytics

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12. Process optimization
13. Optimized resource utilization
14. Instant control and response in complex independent systems.

The above are some possible reasons to implement IoT and Big data. As the requirements of both the technologies go hand in hand, a proper improved system is needed to overcome the challenges they pose. Many companies strive to meet the challenges and take possible steps to overcome them.

III. IMPACTS OF IOT ON BIG DATA

IoT is a network consisting of physical devices, which are also implanted with sensors, electronics, and software, thereby allowing these devices to exchange data. This ultimately allows better incorporation between real world physical entities and computer-operated systems. IoT is the next big thing impacting our lives in major ways and number of factors. Technologies like Column-oriented databases, SQL in Hadoop, Hive, Wibidata, PLATFORA, SkyTree, Storage Technologies, Schema-less databases, or NoSQL databases, Streaming Big Data analytics, Big Data Lambda Architecture, Map-reduce, PIG, etc., helps in dealing with the enormous amount of data generated by IoT and other sources.

The main factors that big data is impacted by IoT are:

A. *Big Data storage*

At basis, the key necessities of big data storage are that it can handle very huge amounts of data and continuous balancing to keep up with expansion and that it can provide the input/output operations per second (IOPS) necessary to deliver data to analytics tools. The data is of different form and format and thus, a datacenter for storing such data must be able to handle the load in changeable forms. Obviously IoT has a direct impact on the storage infrastructure of big data. Collection of IoT Big Data is a challenging task because filtering redundant data is mandatorily required. After Collection, the data has to transfer over a network to a data center and maintained. Many companies started to use Platform as a Service (PaaS) to handle their infrastructure based on IT. It helps in developing and running web applications. By this way, Big data can be managed efficiently without the need of expanding their infrastructural facilities to some extent. IoT Big Data Storage is certainly a challenging task as the data grows in a faster rate than expected.

B. *Data Security Issues*

The IoT has given new security challenges that cannot be controlled by traditional security methods. Facing IoT security issues require a shift. For instance, how do you deal with a situation when the television and security camera at your home are fitted with unknown Wi-Fi access.
Few security problems are
1. Secure computations in distributed environment
2. Secure data centers
3. Secure transactions
4. Secure filtering of redundant data
5. Scalable and secure data mining and analytics
6. Access control
7. Imposing real time security, etc.,

A multi-layered security system and proper network system will help avoid attacks and keep them from scattering to other parts of the network. An IoT system should follow rigorous network access control policies and then allowed to connect. Software-defined networking (SDN) technologies should be used for point-to-point and point-to-multipoint encryption in combination with network identity and access policies.

C. Big Data analytics:

Data analytics is the science of examining raw data with the idea of coming to conclusions about that information. Data analytics is used in many industries to allow them to make better business decisions and in the sciences to verify or disprove existing models or theories. IoT Big data analytics is very much needed to end up in a optimized decision. Big data analytics will help you understand the business value it brings and how different industries are applying it to deal with their sole business necessities. According to the Gartner IT dictionary, Big Data is variety of information assets, high-volume, and high-velocity and, innovative forms of information processing for enhanced approach and decision making.

Volume refers to the size of data. Data sources can be social media, sensor and machine-generated data, structured and unstructured networks, and much more. Enterprises are flooded with terabytes of big data.

Variety refers to the number of forms of data. Big data deals with numbers, 3D data and log files, dates, strings, text, video, audio, click streams.

Velocity refers to the speed of data processing. The rate at which data streams in from sources such as mobile devices, click streams, machine-to-machine processes is massive and continuously fast moving. Big data mining and analytics helps to reveal hidden patterns, unidentified correlations, and other business information.

D. Impact on Day to day living:

IoT Big Data is slowly redefining our lives. Let us consider a few examples of our lives.

At work, the cctv camera in the canteen estimating the time you spend there. The class room sensors can find out how much time you spend in writing on the board. This can be just to measure the productivity of an employee.

At home, the home theatre playing the favorite movie of ours as soon as you switch on the television, smart devices could save a lot of power and money by automatically switching off electrical devices when you leave home. A smart wrist band tied to the elder people at home intimates the nearby hospital if they fall sick.

The above said is going to happen in a very short time because of the rapid development in IoT and Big Data technologies.

IV. CHALLENGES OF IOT BIG DATA

Major challenges that can fetch momentous rewards when they are solved.

1. Huge data volumes
2. Difficulty in data collection
3. Incompatible standards
4. New security threats
5. No reliability in the data
6. Fundamental shifts in business models
7. Huge amount of data to analyze
8. A rapidly evolving privacy landscape

The above points are some of the challenges that IoT big data faces. The rate in data growth in expanding every second, storage in a big challenge, processing and maintaining is even more tedious. The tools that are developed to manage the both technologies are day by day changing as per the requirements. No doubt, both technologies are going to play a major role in the information technology field.

V. CONCLUSION

This paper is a review about the IoT and Big data, the impacts of IoT on big data, the big data technologies and the challenges. Since there is a major impact of IoT on big data we need to quickly improvise the complete structure to manage the daily changing circumstances. There are a few areas of concern and security and privacy and data collection efficiency are probably the most difficult problems we are facing. Security compromise and inefficiencies in data collection mechanisms result in a loss of status, money, time and effort. But there is hope because both the IoT and the big data are at an emerging stage and there will be upgrade.

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