Weather Based Information System using IoT and Cloud Computing

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ABSTRACT

Internet of things connect physical world, interact with them and compute the inputs obtained from the physical scenario. Weather based Information System using IoT and Cloud Computing adopts both the advantages of cloud computing and internet of things. The proposed system uses sensor network for the data acquisition and cloud computing platform for storage and processing. Big data is a big concern to internet of things, which is impossible to handle. The proposed system solves the problem by storing the enormous amount of data in cloud provided datacenters and analyze the large amount of data using k medoid clustering algorithm. K medoid algorithm outperforms other clustering algorithm when the data consists of outliers and noise.

Keywords: Internet of Things, Bigdata, Cloud Computing, Clustering.

1. INTRODUCTION

Climate change is the transformation in the statistical circulation of weather patterns and the change exists for a large period of time. Climate change may also be defined as change in weather conditions, or in the time alteration of weather around longer-term. Biotic processes, changes in solar radiation in Earth, volcanic eruptions results climate change. Human activities also results climate change and one such example is global warming.

Be a part of twenty first century and hailing in a modern society most of the people are entirely acquainted with the Internet. Nowadays the success of a business, research and study depends on powerful usage of the Internet. Most of the activities are based on valid information collected from the Internet and using the services offered. Every endeavor we do is becoming connected to the internet in multiple facets that can range from the search of information in the web, the communication between people at different places and information storage at the cloud. Everything looks to be so nifty and so intended to endorse our life and supply our requirements for work, learning or leisure activities. Internet has a bazillions of opportunities to be in touch, to convey ideas and information and to get reviews or news and entertainment news, as it occurs, with online newspapers, magazines, the blogosphere, books and social networks. With the amalgamation of Internet in our day today lives, people are transforming from traditional lifestyle to an Internet supported lifestyle with many Internet based pursuits accomplished by each human being.

According to Nikola Tesla "When wireless is perfectly applied, the whole earth will be converted into a huge brain, which in fact it is, all things being particles of a real and rhythmic whole." The general and universal

perception of the Internet of Things is old. The new fractions are the capabilities of the nodes and the edges, in a biological way the dendrites and the axons, the workstations and the network. Internet of Things portrays a threshold, not an invention. We are building a world where things, also be called as smart objects interact intelligently and collaborate with each other to achieve aspirations without evident supervision from human operators.

It is projected there are over a billion internet users and it is rapidly increasing. More than people there are other stuffs in the internet world. That is Internet of Things. There are millions of trillions of gadgets connected with sensors and RFID tags that are attached together in a network that engender a sea of unstructured data. With the benefit of integrated information processing capacity, industrial products will take on smart capabilities. They may also take on electronic identities that can be queried remotely, or be equipped with sensors for tracking physical changes around them. The Internet of Things will enable forms of collaboration and communication between people and things, and between things themselves, so far unknown and unimagined.

The Internet of Things (IoTs) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the World Wide Web where the devices are intelligently linked together enabling new forms of communication between things and people, and between things themselves. Fostering IoTs has increased drastically in the last couple of years since it has added a new flavor to the world of information technology. Now anyone, from anytime and anywhere can have connectivity for anything and it is expected that these connections will extend and create an entirely advanced dynamic network of IoTs. The development of the Internet of Things will transfigure a number of facets, from wireless sensors to nanotechnology.

One of the most crucial questions that evolve now is, how do we renovate the data obtained or captured by IoT into knowledge or information to bestow a more suitable atmosphere to people? Here comes the data mining technologies and knowledge discovery in databases. The above specified technologies grant solutions to extract information from the data of IoT, which boost the efficiency of the system or enhance the value of services offered by the environment. So there are several researches focusing on how we can use data mining tools and techniques for Internet of Things. The outcomes point out that data mining algorithms can be utilized to make IoT more knowledgeable and intelligent, thus imparting smarter services.

The massive size of data over IoT is itself a serious problem. Wireless sensors beget billions and trillions of data. Big Data along with its security make the situation thornier. Massively distributed computing and storage is an exhilarating concept, but the tool chain for ripping computations over a thousand idle Fit bits just isn't here yet. If it is exists further doings are so strenuous. Cloud computing is an outstanding concept that prevails today for the efficient management of data over IoT. But security is a serious problem again.

The management of environmental emergency is one of the most interested fields that scientists are working to develop, where rapid environmental changes call for continuous surveillance and on-line decision making. The complexity of environment problems make necessary the development and applications of new monitoring and

management systems capable of processing not only numerical aspects, but also the experience from experts and wide public participation, which are all needed in decision system. As a part of decision support system for environmental emergency management, the data mining plays a main role in extracting data, analysis, and prediction. For Weather based Information System using IoT and Cloud Computing data come from sensors that deployed in the real environment that placed in different locations, and the measurements flow from several sensors to support decision makers.

Weather based Information System using IoT and Cloud Computing propounds the efficacy in collecting, storing, processing and management of data. The projected system consists of sensor technology for collecting the data from different locations. The data consists of temperature, humidity, precipitation, rainfall, and wind speed data. Weather data of distinct places are collected or acquired using the sensors deployed at distinct time and frequent intervals. These measures are stored in a platform that helps in processing and management and that is cloud platform. Not only it stores the humongous amount of data, it also bestows resources for the computation of the collected data. For the analytics of the data clustering algorithm can be used. There are different types of clustering algorithms; they are k means, k medoid algorithm. Form that k medoid algorithm is used for clustering the weather data, because it works for the data that consists of outliers and noise. Section 2 describes the related work; section 3 defines the proposed system and section 4 conclusion and future work.

2. RELATED WORK

Environmental informatics officially started budding in the early 1990s in Europe to collaborate and coordinate various informatics technologies and helps in facilitating decision-making and extracting information. Environmental informatics derives several methods for collecting, processing and examining data, but it has some disadvantages, which led to the advent of Internet of things. From the late 2000s, IoT epitomize how the internet extends into people's day to day lives through an array of exclusive objects that interconnected using a medium and it foresees that IoT will endorse the environment monitoring and management to a new aspect in the near prospect. One of the biggest shortcomings of IoT is in handling the large amount of data; technocrats call this humongous amount of data as "Big Data". For the proper conduct of big data in both industrial and scientific field different procedures for acquisition, processing, transmission and storage are needed.

2.1 INTERNET OF THINGS

The concept of Internet of Things was coined due to the advent of RFID technology. It has become more prominent because of the expansion and wide range of applications in the field of mobile devices, embedded systems etc. The idea of internet of things evolved due to the rapid and enormous progression in the area of microelectronics and nanotechnology. Moreover, the diminishing size and decreasing prices of chips and sensors will endorse their usage in everyday life. It is expected that there would be 50 billion smart objects or smart gadgets, especially wearable gadgets by 2020. The formation of the Internet was an important transition in the manner people acquires information, how they interact with each other, and make judgments from the information obtained. Now, the Internet is extending its hand to a wide variety of devices that can gather and analyze physical data and react to that data in a variety of applications that we've never seen in our early life.

This "Internet of Things" marks another dynamic shift in the history of technology.

How to define internet of things? According to Cisco it can also be called as Internet of Everything [10]. A system falls under the Internet of Things definition if it meets the following criteria, known as the 3 Cs. The three 3 Cs are connect, compute and communicate. It connects to the physical world, interacts with them and compute the information collected from the physical world [10]. The concept of IoT has been proposed more than 10 years, and it is not just staying at the concept level but is becoming a reality with the rapid development and wide application of wireless sensor network (WSN) [7] and cloud computing. The IoT is not a tangible reality but an upcoming vision of a number of technologies of which RFID is the base [12]. RFID and sensors creates basement for IoT.

Cloud platform allows small organizations to think bigger and bigger. Cloud platform helps to deploy new business capabilities. The risk in business innovation is comparatively low in cloud computing platform. It grants global scope and global scale. With respect to advantages there are some disadvantages too. One important issue is outsourcing the computing process to an external provider. But storing the data outside the organization is clearly a risk.

Sensor networks promise to enable an entirely new class of distributed monitoring applications. For this promise to fully materialize tools from a variety of traditionally disparate disciplines have to be brought together, including signal processing, networking and protocols, database and information management and distributed algorithms. Information processing in sensor networks is the central theme that binds all these components together and dictates how they must interoperate. Internet has always played a key part of sensor networks. Cloud computing becomes extremely useful when the heavy computationally intensive work like data analytics needs to be done on sensor data [5].

3. PROPOSED SYSTEM

The changes in the environment and hazards that evolved due to the uneven climate changes are very big crisis for the entire world. Taking decision and finding solutions to the problems in the environment is becoming more challenging. Environmental data sets impart a number of data management difficulties including data collection, data integration, and mining information from the data. Weather based Information System using IoT and Cloud Computing uses sensor network for collecting weather data. Temperature, humidity, precipitation data can be collected using sensors and smart objects. ZigBee protocol is used for connecting the devices.

After collecting the data, it is transmitted to the application gateway. These signals are transmitted to the application gateway, where signals converted to readable format. The gateways are responsible for collecting, processing and transmitting the data to the server. The gateways collects data from sensors, process the data, store it, and periodically transmit the field data to the application server using long-range communication medium if the sensors are placed at different places. Cloud platform is used for storing the large amount of data generated by the different sensors displayed at different places. Cloud platform helps us in preprocessing the data before analytics. In this case it allows us to extract necessary information from the humongous amount of data created by the sensor. Because in cloud platform computation is performed at different places, the reason it has to deal

with big data. The data mining algorithms are not suited for implementing in different platforms. So first the data important for data mining are extracted with the help of cloud computing resources. After that selected data are transferred to the database. Then implement K medoid algorithm to the data in the database for finding the patterns and for extracting knowledge form the selected data.

3.1 SYSTEM ARCHITECTURE

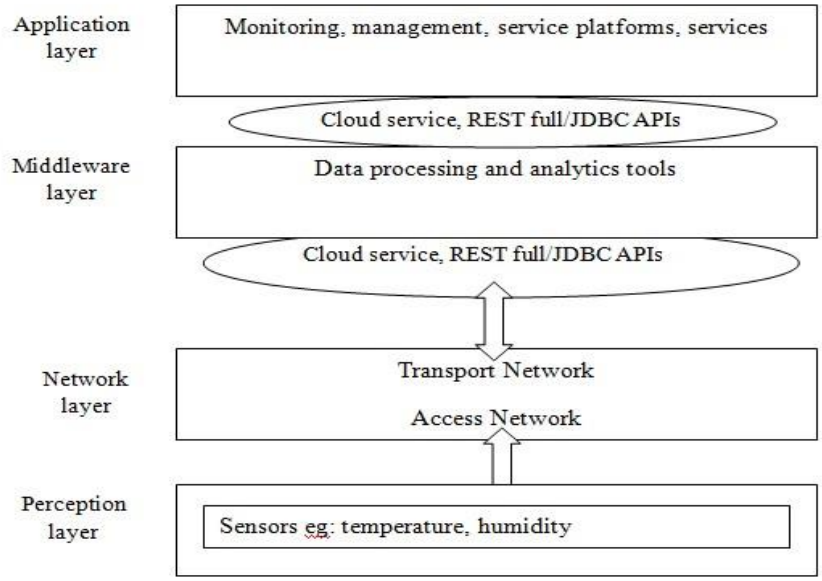

Fig 3.1 System Architecture

The architecture contains four layers: perception layer, network layer, middleware layer, and application layer. The perception layer is mainly utilized for acquiring data and other information related to physical world in environmental monitoring and management, usually it includes real time data, models, knowledge etc. The real time data collected based on internet of things is allied to sensors, mobile, ecological instruments, and remote sensors such as balloons, aircraft and RFID etc. The network layer is responsible for transmission of data and the connection between the sensors and platforms. The network layer mainly contains two types of networks; access networks and transport networks. Access network is used to connect sensors and devices. They are short range communication mechanism. Transport networks correspond to long range communication [1].

The middleware layer is in between the network layer and the application layer. This layer uses databases for the better management of massive data collected by sensors and devices. Database is also utilized for storing and management of data models, knowledge, and other information. Interaction between the visual interface and the sensors is attained through REST ful/ JDBC connectivity. The data created form the sensors are transferred to the database by means of a web interface and cloud platform is used for extracting important data from the enormous amount of data created form smart devices. Cloud platform enable the storage of large amount of data. The application layer of the weather based information system using IoT and cloud computing mainly consisted of cloud computing platform and application support platforms. This layer stores, process, and display the environmental data and information that attained form the sensors and other smart objects. Applications layer provides a web interface for the display of information obtained from sensor generated data.

3.2 SYSTEM WORKFLOW

Figure 3.2 represents system workflow design of IoT based integrated information system for environmental monitoring and management. The system components are sensor nodes, application gateways, and application servers. The sensor nodes are allotted for real world data acquisition using sensors, and transmitting the data to the gateways using short range communications. The sensors are connected to the gateways by means of Wi-Fi, ZigBee, NFC, Bluetooth etc. The connection between the sensors, gateways and between gateways and system depends upon the application. The application server is responsible long term data storage, and interface and process by users. Application servers provide an interface to the users by means of a web application, that the users can access the data in a visual model format. Cloud platform is used for storing the data files generated by the gateways that transferred to the system.

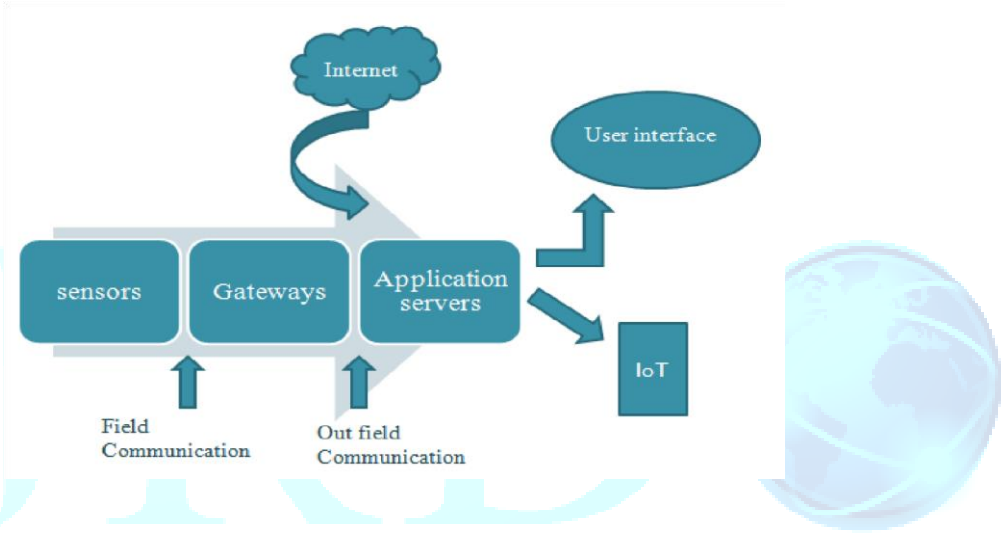

Fig 3.2 System Workflow

4. CONCLUSION

A number of difficulties limits the execution of fully fledged weather based information system, such as the complex nature of the information system, the standardized processing and management of unstructured and structured data from multi-sensors, security and privacy challenges, effectiveness in heterogeneous sensing, people centric sensing platforms, new protocols and APPs, and so on. In future, security and privacy measures should be tackled for the effective use of Internet of Things. Because the data is available in the internet and smart devices can monitor and collect data without the consent of users, which lead to privacy and security issues. Weather based information system using IoT and cloud computing uses sensor network for the collection of data from the real world and transfer the data to application server database for further analysis. K Medoid algorithm is used for clustering the datasets obtained from different medium. K medoid algorithm outperforms k means in the case of outliers and noisy data. Applications are in the fields of agriculture, fire detection in forest, weather forecasting and researching climate changes which helps to increase the habitat.

The biggest issue regarding IoT is big data. Cloud platform provides solutions for the storage and for processing the large amount of data. But the security of the data is not enabled in the cloud platform. To tackle the security

issue during the storage and computation of this large amount of data homomorphic encryption mechanism can be used. Homomorphic encryption mechanism allows computation in encrypted data. Thus the encryption provides privacy as well as security for the storage and computation process.

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