

A Birdview on Emerging of Bigdata in Smart Cities Development

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Abstract: In the growing scenario, development of smart cities will be the most wanted area of research whose objective is to enhance the performance and well beings of people there by reducing the cost and consumption of resources. In a smart city, core fields like transport energy, health care, water industrial control, agriculture, waste management and soon are expected to function automatically and intelligently in a distributed manner with the help of internet. In the era of Information technology, concept like Internet of things, Grid, Cloud and big data computing and analysis plays a vital role in building smart cities. In this paper, different fields of smart cities and their construction challenges are discussed. Further the role of several IT concept and their issues are summarized also various big data analytical tools and technologies needed for building a smart cities are narrated.

Keywords: Internet of Things, Cloud Computing, Grid Computing, Big Data Analysis, and Distributed file system

1. Introduction

The development in India is very rapid and forces social and many environmental challenges. The cities are categorized by strained infrastructures which manifest itself in terms of power cuts, water shortages, and excessive real estate resulting in urban sprawl and slums, high volume of traffic resulting in delays.

In building the Smart cities Internet of things (IoT) plays vital role. This IoT is used for interconnecting of uniquely identifiable embedded computing devices within the existing internet infrastructure. In the field of Computer Science distributed computing plays dynamic role. This software system where the components are located at remote places and communication is done by passing the messages. A smart city is the current trend where an Indian city sector services delivery leverages technology to enrich its resident's standard of living, provider's Positive asset climate for business and equips government to maximize resources utilization and provide transparency.

The preference to become a smart city is driven by the stimulation to surpass challenges posed by traditional cities. Overcoming these critical challenges in a methodical manner is very critical and necessary for cities inspired to the shift towards more sustainable city development measures among all

stakeholders, citizen, business and government .The quality of delivery from foundational elements of traditional cities is enhanced by leveraging technology.

2. Role of IoT in smart cities

Internet of things (IoT) is new emerging technology where the device is interconnected in a distributed manner with the help of internet. Typically it is used to connect the advanced connectivity between the systems, devices, service beyond the machine to machine communication that covers the variety of protocols, domain, and applications. In order to develop the smart cities the entire task must be automated in the form of applications. [2] There are different applications to develop a normal city into smart cities, with the help of Internet of things a smart cities has been developed. The need of the Smart cities majorly focuses on the application like Smart-Health, Smart-Parking, Smart-Environment Control, Smart-Agriculture, and Smart-Industrial Control, Smart-Water management, Smart-Metering, Smart-Animal farming etc.

In September 10 2014, our Prime Minister Narendra Modi has annoced to develop the smart cities in India. Once the annocement comes, the urban ministry of development has annoced the five major key elements for developing smart cities. In

that the first key element is to development the key infrastructure so that a city should have 24x7 water and power facility. The Second key elements are to develop the robust transport system in the country which includes the distributed public transportation system. The third key elements are to develop the social infrastructure so that city should provide the opportunities to provide jobs and livelihood for its inhabitants. The fourth key elements are to develop the proper entertainment, safety and secure of the people. The fifth key elements are to develop the energy efficiency and reduce the waste and proper recycle of the waste should be done.

3 Need and Challenges in Parking System

Nowadays many people using there two wheeler and four wheeler for their mode of transport.[3] The common place where the people used to stop their vehicles are Cinema Theater, Shopping mall, Airport, Railway station, Bus Stations. There are many issues in these places regarding the parking system, like 1. Inefficient usage of existing parking capacity 2. Parking space that are inconvenience 3. Demand for Handicapped Parking spaces 4. Record management of the vehicle is very poor 5. Inadequate pricing method for parking.



Figure 3.1 Images of improper parking System

3.1. Need of IoT in Parking-Smart Parking System



Figure 3.2 Role of IoT in Parking System

The Smart parking System works on the ultrasonic sensors, for each user space the individual sensor has to be placed and this sensor will work based on echolocation. The working of this sensors are used to transmit the sound towards the object(car) and it return back to the sensor. the time between the sending and receiving pulse will used to calculate the distance, where the time distance is long where te

absence of the car. The features IoT based sensor parking will overcome the issues is already present in the existing system 1. Detect the occupancy status of individual space for multilevel parking slot. 2. Display the number free spaces available at the entrance of the parking slot 3. Showing the free space direction in a parking slot to diver so that parking is very easy. 4. Parking and Monitoring and management software is used for parking. 5. Displaying different Colour LED for different parking spaces. 6. Line detection sensor is used for correct parking of vehicle in the parking slot.

4 Need and Challenges in E-Health

Nowadays in many family's both husbands and wife's are working in order to earn good amount of salary so that financial status may improve. Once the young people comes out for the job almost the aged people in that family will resides in the home alone. There are many issues will occur when these aged peoples are felt alone in home. 1. The most important thing is that the aged peoples are sick then monitoring of the health of the aged peoples is necessary 2. Fall detection for elderly and physically handicap people living independent. 3. Round the clock Monitoring of Patients admitted in the hospital.



Figure 4.1 Need for proper Automatic Health monitoring system

4.1 Need of IoT in E-Health-Smart Health Care System



Figure 4.2 Role for IoT in E-Health Monitoring system

A variety of sensors are used to integrated in to German's fabric it simultaneously collects all the bio-signal in a noninvasive unobtrusive way. This type of sensor works by Deploying Computing, Information

and Networking technologies to aid in preventing diseases, improving the quality of care and reduce the overall cost. The working of sensors monitors the people who are connected with this Smart application system. With the help of this smart application it can perform 1.Realtime Monitoring 2.Tele-Medicine 3.PersonalizedMedicine 4.Computer Aided Surgery 5.Population Based Care are done. This type Smart Application will send and receive data from remote location and it will reduce the hospitalization, burden of medical staff, consulting time, waiting list and overall cost.

5. Need and Challenges in Water Management

Among all the natural resources water resources is most important and incredible. There are many issues water management system in our country 1. In some places industrial wastage or Waste is mixing with the river water so that the pollution occurred 2. Finally all the polluted water are entering into the sea so entire sea will get polluted. 3. Chemical wastage from industry are mixed with water so the living organisms present in the rivers are dead and very harmful or drinking purposes. 4. Proper water levels should be maintained in dams and leakage should be timely identifiable. These are various issues present in the water management 5. Leakage of proper in hung tank should be identifiable.



Figure 5.1 Improper Water Management

5.1 Need of IoT in Smart Water Monitoring

Smart water wireless sensor platforms are used for monitor the quality water monitoring system. It is prepared with multiple sensors so it is used to measure the water quality standards in term of parameters. The “Wasp mote smart water” is the name of the sensor used for 1. Monitoring the water leakage 2. Chemical leak detection in the river 3. Remote measurement is used to seawater pollution. 4. It is used to monitor water level in dams 5. leakage in the huge water tank are monitored by

this IoT sensors, various parameters of water are considered for monitoring the water management is done.

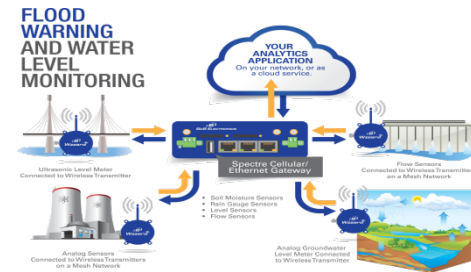


Figure 5.2 Role of IoT in Water Management System

6. Need and Challenges in Environment control

In the world the most precious things is our natural resources. Our first aim is to protect our natural resources from any natural disaster. There are many issues present in this environmental disaster namely 1. Forest fire 2. earth quake 3. land slide 4. Tsunami 5. Melting of the snow so the water level will rise so that disaster can takes. Since these disasters are known in advance we can prevent the people.

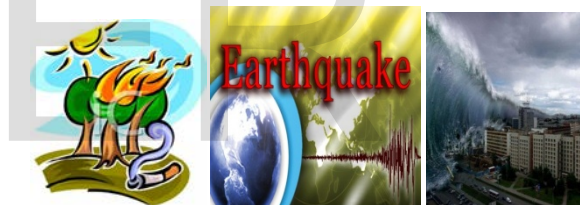


Figure 6.1 Images of various Natural Disaster

6.1 Need of IoT in Smart Environment Control

The environmental sensors are used to monitor the natural disaster in advance so that the people can be replacing to the safer places. These sensors are used to continuous monitor of the environment. 1. This sensor will intimate the abnormal temperature of the forest in advance so that forest fire will controlled 2. Monitoring of soil moisture, vibration and earth density to sense hazardous patterns in land conditions. 3. This type of sensor will detect the Snow level measurement to know in real time quality of ski tracks and allow security force avalanche prevention. 4. This Sensors will record the rising and falling vibration of the waves so that tsunami intimation can give in advance to the people.



Figure 6.2 Role of IoT in Environment control

7. Need and Challenges in Normal Home System

In this busy world, everyone is fast towards their committed work and their busy schedule. So by doing the work fast sometimes it may lead to some mistakes. The best example is when we are getting ready to office some time we may do the following things as unknown. 1. Switching off the fan and light may be possible. 2. Closing of water tap may be forgettable. 3. Doors and windows may be unlocked. 4. Closing of cooking gas may be forgettable.



Figure 7.1 Improper Home Management Systems

7.1 Need of IoT in Home Automation System

There are many sensors used for monitoring the home application, which is very useful to in our day today life. An application is built for this particular system is called home automation system, and this application is directly connected to the sensor which is connected in our home. With the help of this sensor 1. Energy and water consumption monitoring can be obtain and cost and resources are saved. 2. Sensors for remote control appliances are used to switching ON and OFF from our places which will avoid accident and save energy. 3. Intrusion Detection can be done with the help this sensors opening of windows and door opening can be monitored, which will keep away from the intruders.



Figure 7.2 Role of IoT in Home Management System

The all above applications are used to make the things as “smart” so that it can be applied in the development of smart cities in our country.

8. Role of Big data in Internet of things (IoT)

Internet of things application are connected in distributed manner, so data generated by this applications are very huge and unstructured in nature. So traditional type of analyzing the big data is impossible. So with the help of big data analytical method. Many frameworks are available in that Hadoop framework is to analysis big data by using the approaches like Mapping and reducing and Hadoop distributed file system (HDFS).

8.1 Different Big data Analytics Methods

In general the analysis of big data is possible by seven techniques namely 1. Association Rule Learning 2. Classification Tree Analysis 3. Genetic Algorithm 4. Machine Learning 5. Regression Analysis 6. Sentiment Analysis 7. Social Networking Analysis

8.1.1 Association Rule Learning

Association rule learning is the most important technique used in data mining. In the point of research the association rule mining is used to find the interesting relationship between variables. This interestingness can be calculated by using rules, in this rule there are two most parameters are used 1. Minimum support 2. Confidence. At a single time. The working principal of this rule is first it will find the minimum support in the frequently item data set in a large database and in second step is to find the confidence.

8.1.2 Classification Tree Analysis

This Classification tree analysis one of the important methods used in data mining for categorical dependent variable and used to predict the relationship between the objects in the given class. The goal of this classification tree is to predict on the categorical dependent variable by using the traditional techniques like Discriminant analysis, Cluster analysis, Non parametric statistics and nonlinear estimation. In worldwide, classification trees are not much popular in the field of probability and statistical pattern recognition (Ripley, 1996) but the classification trees are much familiar in applied field such as Medicine (for the diagnosis), Computer Science (data structures), Botany (classification) and Psychology (for decision theory).

8.1.3 Machine Learning

In Computational Intelligence Machine learning is used for training the system by using different Computational algorithms. These techniques include

advanced statistical methods are used for handling regression and classification task with multiple dependent and independent variables. There are some popular methods used for training the system namely Support vector machines(SVM) for classification and regression, Native Bayes for classification and K-Nearest Neighbours (KNN) for classification and regression.

8.1.4 Genetic algorithm

A genetic algorithm is a searching techniques used in computing to find true or approximate solution to optimization and search problems. This algorithm is used under unsupervised learning in computational intelligence. This is the model of machine learning used to find the behavior from a metaphor of the processes of evolution in nature. This process is done by Simulation by creation of machine of a population of individual represented by chromosomes or genome of the candidate solution called phenotypes to an optimization problem evolves towards better solution. In general solutions are represented in binary as string of 0s and 1s.encoding of the solution is possible in term of security.

8.1.5 Regression Analysis

The linear regression model is the significant model in regression analysis which is used to analysis the connection between the response or dependent variable and a set of independent or predictor variables. This type of relationship is expressed as an equation that used to predict the response variable as linear function of the parameter. This parameter is adjustable so that a measure of it is optimized. The primary goal of this regression analysis is to select the parameter of the particular model as so as minimize the sum of the squared residuals between the variables.

8.1.6 Sentiment Analysis

Sentiment analysis is elsenamed as Opinion mining, which is used in the area of natural language processing (NLP), Text analysis and Computational linguistics to identify and extract the subjective information in source material. This analysis method works by classifying given document, sentence, and words whether the expressed opinion in given text document is either positive, negative, neutral. With the help of this method large amount of data are analyzed.

8.1.7 Social Network Analysis

Social network analysis is the important analysis used in analyzing the bigdata. This analysis works by using the network theory to analysis the social networks like Facebook, twitter, Orkut etc. The main goal of this social network analysis is to view the social relationship in term of network theory, consisting of nodes, representing the individual actor within the network. It represents the relationship between the individual such as friendship, enemy in the form of diagrams.

9. Hadoop big data analytics tools

There are many open source framework available for analyses the Bigdata in distributed environment. Among all frameworks Hadoop is one of the most popular and open source frame work released by apache software foundation released by December 10, 2011.Apache Hadoop is made up of different set of algorithms which is widely used for open source software framework for distributed processing of bigdata on computer cluster. The main advantage of this frame work is to handle the system failure (fault of an individual machine) and replace them automatically.

Hadoop consists of two major core components namely 1.Hadoop distributed file system (HDFS) 2.MapReduce.Once the huge data is stored in HDFS then it automatically splits in to blocks in the clusters (size upto 128MB and default size as 64MB).This Apache Hadoop framework is contains of following module

- Hadoop Common-Contains archives and functions which are need by other Hadoop frameworks.
- Hadoop Distributed file system(HDFS)-stores data on Commodity machine, providing very high aggregate bandwidth used across the clusters
- Hadoop Yarn-Platform to manage and compute the resources in cluster for scheduling the user applications.
- Hadoop MapReduce- Programming model for huge scale data handling.

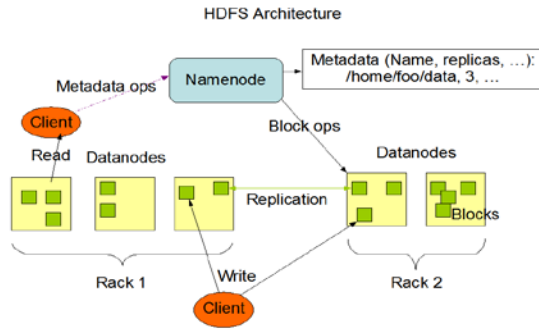


Figure9.1:HDFS file system

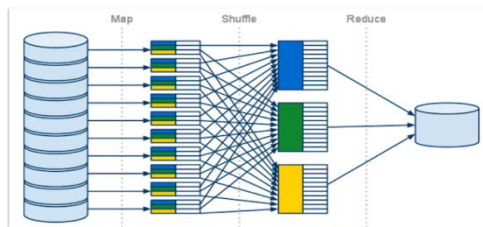


Figure9.2:MapReduce model

10. Conclusion

In this paper the need of SmartCities are discussed and various application that essential to develop a city into a Smartcity are illustrated with their own issues and challenges. The data generated from these applications are analysed with the help of Bigdata analytics method and Hadoop framework is used for analysis of the distributed file system with their own core components. Prime Minister of India Mr. Narendra Modi and President of USA Mr. Barack Obama have jointly signed the first step to develop three smart cities in India on 26th January 2015.

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