The Amalgamated Algorithm

Devyani Jivani, Aadish Agrawal, Abhishek Mukherjee, Heli Shah

Abstract—In today's world, the main communication form on the Internet is human to human. But it is foreseeable that in the near future every object will have a unique way of identification and will be addressable so that it can be connected and can communicate interchangeably. The Internet will soon become the Internet of Things (IoT). In this paper we have discussed the applications of IoT and then further have proposed an algorithm which we have called as the 'Amalgamated Algorithm' since it uses an IoT based device as a source of input and using the Map Reduce Framework, monitors the heart beat of patients continuously for abnormalities.

Keywords—IoT; Map Reduce; medical application; heartbeat;

I. INTRODUCTION

The global network linking billions of devices across the world is known as Internet. Internet of things refers to the network linking physical objects with other physical objects and other Internet-enabled devices and systems. The term internet of things was first coined by Kevin Ashton in 1999. The Radio Frequency Identification (RFID) group defines internet of things as the world wide network of interconnected objects uniquely addressable based on standard communication protocols. It incorporates traditional fields like embedded systems, control systems and automation. Wireless sensor networks to facilitate device-to-device communication through the internet. RFID was seen as a pre-requisite for implementing systems which were classified as Internet of Things (IoT). Today it has applications for both private as well as business users. If all the objects in daily life were equipped with identifiers and wireless connectivity, these objects could communicate with each other and be managed by computers. RFID and sensor network technologies will rise to meet this new challenge, in which information and communication systems are invisibly embedded in the environment around us. This result in the generation of enormous amounts of data which have to be stored processed and presented in a seamless, efficient, and easily interpretable form.

II. APPLICATIONS OF IOT

A. Building and home automation

A universal remote that connects all the appliances of the house can be used to check power and electricity consumption be receiving details from every appliance and displaying on the television. Locking and unlocking door, turning lights or music player on and off automatically through your cell from a distance using WiFi or Bluetooth. A WiFi connected doorbell that allows you to remotely answer your door and receive picture alerts on your smart phone of person at the door. A smart thermostat that sets the room temperature according to the weather outside. By merely setting the alarm clock for the morning, your smart phone sends a chain of signals to turn the lights on, playing the music and automatically opening up the curtains.

B. Health Care

Talking medical devices have come into existence which includes devices that can remind you of taking the prescribed medicinal dose, checking blood pressure and blood sugar, taking a walk or exercise at a scheduled time. Along with these notifications, it can also provide health advises. Along with the patients the hospital staffs can also use devices based on IoT. A talking thermometer can tell the temperature just by pressing a button on it, a Band-Aid which can indicate whether the wound is healed or not, a reminder to refill once the prescription goes below a certain level.

C. Automobiles

To keep a check on the traffic level of the city, smart traffic cameras can be installed in different areas and streets which can monitor the accidents, congestion and weather conditions. These statistics can be collected in one particular center which will connect all other nearby smart traffic camera, thus creating an intelligent city wide traffic system. This information can also be passed on to other city wide transportation system. One can also check the battery life of the car through smart charge indication on our smart phone. One can also set the temperature of the car and destination prior entering the car.

D. Waste Management

IoT device can determine the filling level of waste in the containers. The data is transmitted to the management center through GRPS communication and then to the City government. It also offers different routes to collect the waste in turn helping in minimizing the cost and improvising the recycling process.

E. Server problem

- In areas of security, there are problems related to servers, data storage management and data centre network.Due to large amount of data (patient details) being stored on servers in disorganised and disintegrated form, data retrieval and data storage becomes a huge problem for IoT based servers. Another problem faced by IoT servers is the query mechanism of open source servers like apache etc. The type of queries passed in a server can be single or multi threaded. The performance of each of the query mechanism depends on the amount of data and the number of queries passed per unit time. Single threaded mechanism processes the queries in an organised manner

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while multithreaded though good for less queries per second becomes very slow for near to 8000 queries per second.

- The organisation of the data available is an important factor for the data retrieval from the servers and thus the normalized form of databases can be used for better qps performance
- Another issue is data loss due to software or hardware failures in the server. Storing data in different clusters and the type of clustering used in data storage affects the data storage and performance of the server we are using and thus helps in data retrieval in case of data loss.
- Server performance also depends upon the file system of storage which is used. Huge amount of data are required to make a system of systems which is the basic motive of IoT. This will require the data to be properly organised which otherwise may lead to overheating of storage devices.

III. ALGORITHM

Nowadays, most of the healthcare executives rely on data and analytics than experience or intuition while making their big decisions in carrying out the medical treatment especially cardiology. Many devices have emerged in the markets that provide information regarding the medical data. Along with pros of giving data, at times it gets difficult for the healthcare executives to interpret the data correctly and monitor the patients continuously. Also many times they lack the necessary skills to handle the data. We propose an algorithm for IoT based heart beat monitoring devices whichuses Map-reduce framework which will continuously monitor the heart patients and bring out the abnormalities so that the healthcare management will be able to diagnose the patient at any time and can take immediate steps for carrying out the treatment. The constant data received of the patient will be accurate and easy to understand.

In today's world amount of data involved in health care is enormous. Heart beat data involves a lot of parameters which needs to be stored and analyzed at regular intervals to arrive at conclusions. So our analysis system will be based on big data ecosystem which is at present the most scalable and secure data analysis system. major problem faced in real-time applications of Internet of Things is data storage and analysis. TheIn today's world amount of data involved in health care is enormous. Heart beat data involves a lot of parameters which needs to be stored and analyzed at regular intervals to arrive at conclusions. So our analysis system will be based on big data ecosystem which is at present the most scalable and secure data analysis system. This system uses parallel processing to analyze single or corpus of documents. As this is an IOT based system we can link in data from various parts of the world and stream that data into our analysis system to provide a wide base to our system. The algorithm of our analysis system will involve data being received at regular intervals which will include a database to store the timestamp to the data being received from time to time which will keep our data synced with our analysis results.

On the reception of data we will either divide the into a fixed block size or into block of defined number of lines. This will depend upon the amount of data being received which will have a threshold to perform any one of these operations. This data on being divided into various blocks will have multiple copies of each block stored in a multi cluster architecture so as to ensure the backup of data so to prevent data damage in case of loss of data. This data will then be fed from the rack architecture into the big data ecosystem.

The first stage of the big data ecosystem includes the very essential map reduce phase which basically makes unstructured data readable in structured data format. This phase involves three basic sub phases namely mapper, sorter and reducer. Mapper phase is mainly involved in making unstructured data into structured data. This takes in a file or a corpus of files to make it ready for analysis. This has two implications first being analyzing a part of the file or the files as a whole. The main benefit of using this ecosystem is the use of serializable objects to transfer data from one part of the network to the other. This reduces network traffic and thus ensures data transfer in a cheaper rate. In this phase we can also select particular samples of data for data analysis. This phase gives key value pairs for the particular file. In our application we aim at tracking the heartbeat rates of a person in a 24 hour day cycle. So in order to achieve this input file containing heartbeat data is taken. In the mapper phase the line number serves as the key while the information of a line serves as the value. As shown in the screenshots of input file the first column gives the value of the hour of the day while the remaining columns are the heartbeat rates for that hour. So the mapper scans through the line and gives key value pairs for hour and heartbeat respectively as output.

The flowchart of our algorithm is as shown in Fig. 1. It depicts the exact algorithm as explained heree used to detect fallacy and sharp changes in the heartbeat.

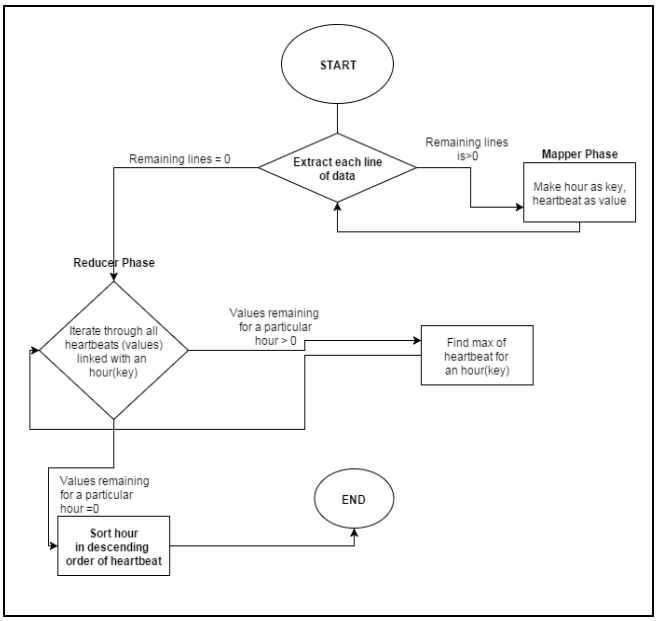

Fig. 1.Flowchart of the amalgamaated algorithm

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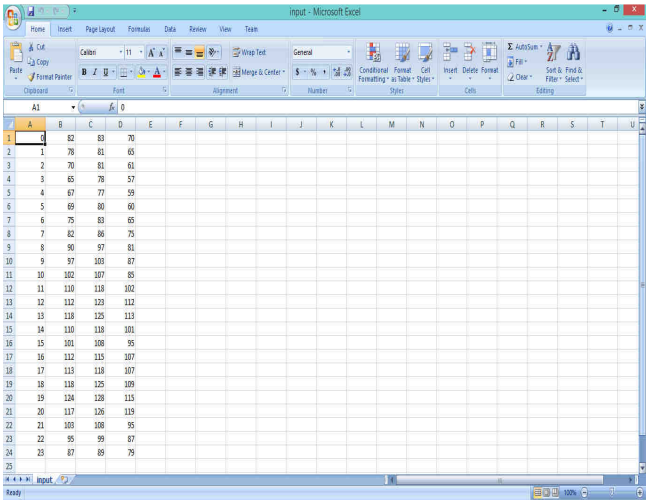

Fig. 2.Screenshot of the heartbeat values that were inputted

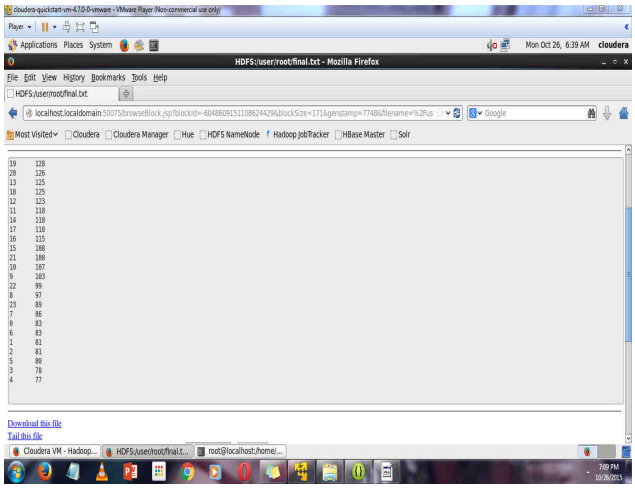

Fig. 3. Output

Now we come to the sort phase. This phase sorts the key value pairs according to its key and combines values of all distinct keys and sends the data to the reducer.This phase can b t rate of patients and club patients of similar heart beats. This will help in categorization of patients according to their crucial parameters and thus help in further processing of the available data facilitating quick tracking of emergency patients. In this phase the heartbeat of the patients are grouped by hour in which the heartbeat was measured.

The last phase reducer has the feature of selecting a particular value from the list of values for a particular values for a particular key. This phase is mainly meant to read the values with the same key and perform some operation. This phase is mainly used in statistical analysis of the available data. This phase gives final output of the map reduce algorithm which is the minimalistic conclusion from the given data so as to generate the required output. This phase also can process a particular number of keys in parallel so as to stick to the USP of the algorithm i.e. parallel processing of data i.e. key and value pairs. This happens synchronously via another phase named partitioner which not a compulsory phase of the map reduce algorithm.In this phase reducer scans through the output of the sort phase which has key and a tuple of values as pairs i.e hour as key and values as its available heartbeat data. Its scans trough this tuple and returns the maximum heartbeat value as the output for an hour which finally is sorted according to the maximum heartbeat value of any particular hour.

A. Advantages

- Map reduce uses parallel processing techniques which divides the input file into blocks of various sizes thus enabling the algorithm to process the input data in parallel.
- Map reduce algorithm uses HDFS (Hadoop distributed file system) architecture to store files thus making the storage more secure and effective.
- HDFS architecture is handled by a master slave mechanism which facilitates task scheduling and error free schemes.
- Map reduce algorithm is based on classifying data into key and value pairs which is suitable for our application.
- Map reduce can be deployed on clusters to handle real time steaming data.
- Map reduce framework can deploy many design patterns to suit our application.

IV. FUTURE WORK

The IoT is expected to transform how we live, work and play. Studies show that the number of devices which connect to the Internet is exponentially increasing. Currently there are 9 billion interconnected devices and it is expected to reach 24 billion devices by 2020. Only in 2011, the number of interconnected devices on the planet overtook the actual number of people. According to the GSMA, this amounts to $1.3 trillion revenue opportunities for mobile network operators alone spanning vertical segments such as health, automotive, utilities and consumer electronics. In the near future the Internet and wireless technologies will connect different sources of information such as sensors, mobile phones and cars in an ever tighter manner. Billions of components communicate with each other to produce consume and process information in different environments such as logistic applications, factories and airports as well as in the work and everyday lives of people. We need to create new, scalable, compatible and secure solutions for both the management of the ever broader, complexly-networked Internet of Things, and also for the support of various business models. The Internet of Things enables you to harness the data and extend digital business scenarios to leverage existing investments, creating new efficiencies and new revenue sources, thus enabling innovation. There is a long road ahead to the IoT of 2020. But one thing is for sure, it is going to be amazing.

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