Asian Journal of Convergence in Technology Volume IV Issue I
ISSN NO: 2350-1146 I.F-5.11

Medi-Assist System

A system for remote monitoring of patients

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Abstract- Rural health care is a one of the biggest challenges in India. With more than 70% of the population living in rural areas, it becomes all the more critical and high priority challenge for the authorities. This work proposes a MediAssist system for remote monitoring of patients, especially in rural areas. The system plans to focus on the health parameters of the patients admitted in the rural health subcentres. The paper highlights the application of various technologies like IOT and technologies such as Apache Kafka for capturing and processing continuos, real time data ie patient's vital parameters such as blood pressure, pulse rate, temperature. Real time reporting of the patient's health condition is possible by capturing and processing this data.

Keywords— Internet Of Things, Rural health, Apache Kafka, real time Monitoring.

I. INTRODUCTION

It is said that "Health is Wealth". Health may not be everything, but everything one has is nothing without health. The current scenario of todays health care system in rural India is such that rural health care faces a crisis unmatched to any other social sectors.

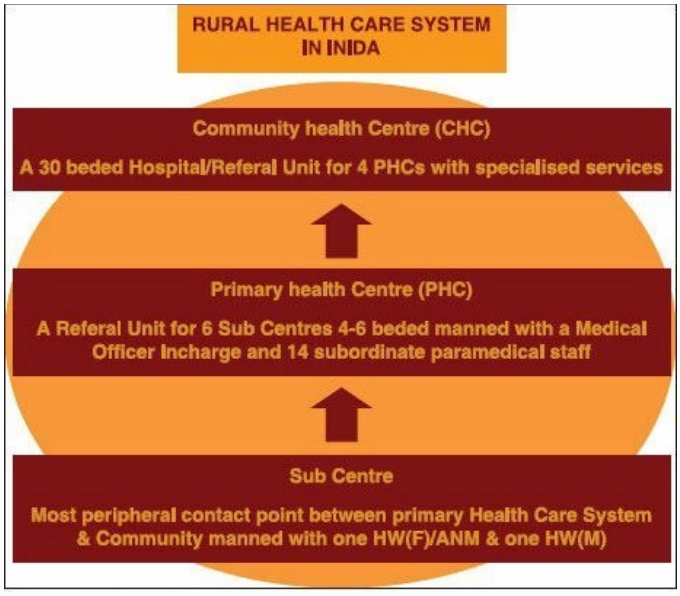

Fig. 1: Primary Health Care System in India

ImageSource:http://pubmedcentralcanada.ca/pmcc/articles/PMC4140008/figure/C1/

Nearly 86% of all the medical visit in India are made by ruralites with majority still traveling more than 100 km to avail health care facility of which 70-80% is born out of pocket landing them in poverty. [19]

The health care system in India is organized as shown in Fig 1. As can be observed in fig 1, the sub-center is thus the the first contact point between the primary health care system and the community. However, the first contact point between the community and a trained physician is the Primary Health Center(PHC).[20]

In situations where patients who are in need for regular monitoring of their condition are required to visit Primary Health Care facilities which may be very far from their location.

To overcome this situation there is a need for a system which can help the medical practitioners located at PHC, monitor the patients remotely.
This work proposes an idea in development of near real time processing of patients vital parameters and monitoring them remotely.

Real-time computing (RTC), or reactive computing describes hardware and software systems subject to a "real-time constraint". Real-time responses are often understood to be in the order of milliseconds, and sometimes microseconds[18].

The Internet of Things (IoT) is the vast network of physical devices such as smart phones and other items embedded with electronics, software, sensors, actuators. These devices are

connected to network thereby enabling them to collect and exchange data. An architectural framework, IoT, allows these devices to exchange the data between the physical world and computer systems over existing network infrastructure.

This work proposes to make use of technologies such as IOT, RTC and NoSql in order to provide a prototype model for remote monitoring of the patients

A. II. Existing Work

S.R. Shinde et al. have developed mHEALTH-PHC to address the issue of scarcity in availability of doctors in rural India. This issue was addressed through National Rural Health Mission (NRHM). In spite of huge efforts huge efforts by the Government, there is a gap in health-care delivery due to huge geographic area and small doctor – patient ratio. To address this challenge, mHEALTH-PHC - mobile based remote health-care delivery platform was developed and piloted. This platform enabled health workers to digitize the patient's data and ask questions to doctors. Doctors could see the questions along with the data and give appropriate answers. [1]

R. Issac et al. developed a prototype for Teleconsultation for trible people in Kerala. They set up a remote health centre manned by health workers. The patient comes to the centre and a health worker at the centre does a preliminary check-up and basic health details are collected. Then the patient is directed to a tele or video conference room so that patient can talk with a doctor. The doctor then provides appropriate prescriptions to the patients or refers him for further check-up and treatment. [2].

Tripathy et al. propose a health care management system which will consist of mobile based Heart Rate Measurement so that the data can be transferred and diagnosis based on heart rate can be provided quickly with a click of button. The system will consist of video conferencing to connect remotely with the Doctor.[3]

Tripathy et al. developed MediAssistEdge system which aims at conducting diagnosis remotely as well as providing basic diagnosis of diseases which does not require prescription. MediAssistEdge system consists of two subsystems to carry out the two mentioned goals. The first goal is attained by MediConnect system which provides an interface wherein patient and doctor or doctors around the world can be connected remotely.[8]

III. PROPOSED SYSTEM

Proposed Medi-Assist system is divided mainly into three modules; first module consists of sensor based system to capture vital parameters such as pulse rate, BP, Temperature of the patients. Second module focuses on accumulating & processing the data and third module is the web portal.

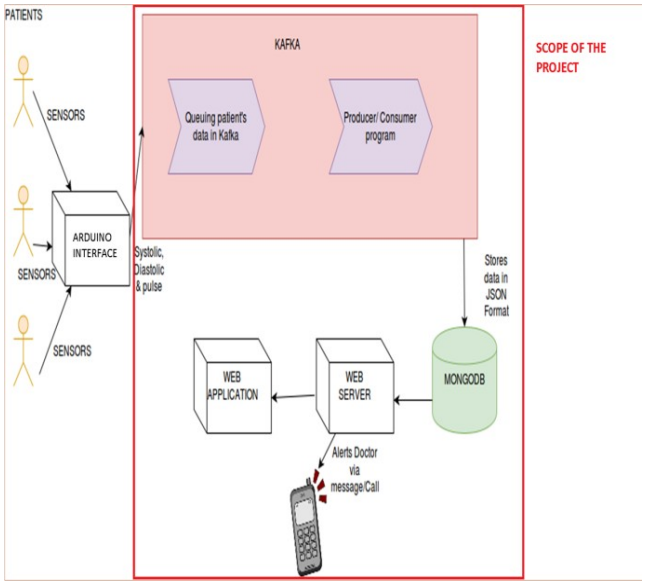

Fig 2: Proposed System block diagram

In nutshell the basic architecture shown in Fig.2.

The sensors are connected to the patients through which the parameter values are fetched and sent further for processing. The raw data enters Kafka for queuing and processing further. The processed data is then stored in the database(MongoDB) in JSON format [6]. The web server fetches the values from the database and displays it on the desktop application which is accessed by the nurses and doctors.

At the moment the first module which is an IoT based module is simulated through a Java application, which randomly and continuously generates the raw data for further processing.

In second module, called as Data processing Module, the system needs to work in a real time distributed environment, is expected to generate huge and continuous data. This data needs to be processed in real time.

Apache Kafka is a distributed publish-subscribe messaging system and a robust queue that can handle a high volume of data and allows to pass messages from one end-point to another

Apache Kafka is a unified platform for handling all the real-time data feeds. Apart from being fault tolerant Kafaka is also very fast almost performing 2 million writes/sec.

Apache Kafka helps in queuing and sorting of patients data in an appropriate order. Data is stored in the form of tuples in topic of each patient [9].

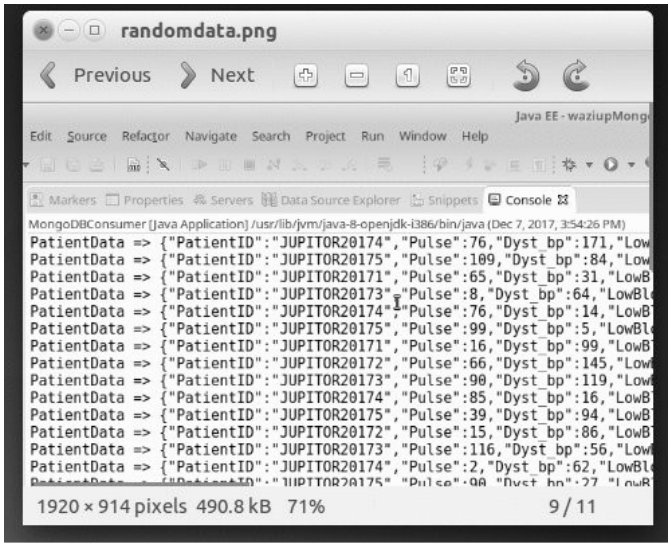

Fig 3: Random Data generated by Java Simulator and sorted using Kafka.

After the data is queued in a sequential manner it will replicate each patient data in Kafka cluster so previous data of patients would be available to doctors.

This continuous stream of data will be checked against the set threshold values.

The processed data is then stored in the database (MongoDB) in JSON format as shown in fig 4.


```
> use hospitaldb
switched to db hospitaldb
> db.patientinfo.find().pretty()
{
        "_id" : ObjectId("58db0b61db2e326779710637"),
        "PatientID" : "JUPITOR20173",
        "Pulse" : 65,
        "Dyst_bp" : 75,
        "LowBlood_Pressure_Status" : false,
        "Syst_bp" : 143,
        "Diabetes_Status" : false,
        "HighBlood_Pressure_Status" : false,
        "Sugar" : 13,
        "Date" : "2017-03-29, T06:00:00"
}
{
        "_id" : ObjectId("58db0b61db2e326779710639"),
        "PatientID" : "JUPITOR20174",
        "Pulse" : 85,
        "Dyst_bp" : 165,
        "LowBlood_Pressure_Status" : false,
        "Syst_bp" : 0,
        "Diabetes_Status" : false,
        "HighBlood_Pressure_Status" : false,
        "Sugar" : 131,
        "Date" : "2017-03-29, T06:00:00"
}
```


Fig 4 : Sorted Data in JASON format

The database that is used is MongoDB. MongoDB is used for huge amount of data storage. MongoDB is an open-source document database and leading NoSQL database. MongoDB is written in C++ and also it stores the data in document format.

The web portal is a local web portal which can be used by the health worker present in that sub-centre [20]. The patient's information is displayed in graphical format thus making it easier for doctors to understand patient's health progress. This data collected from the patients can be viewed by the assigned doctors anytime, anywhere with the use of the web portal that is generated. Fig 5

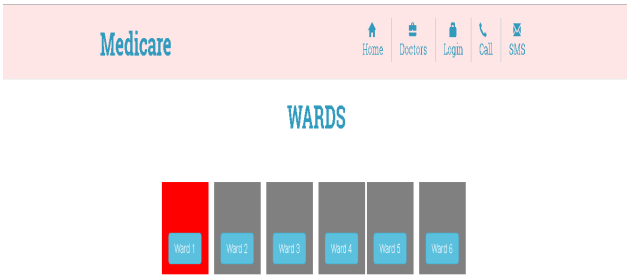

Fig 5 : Ward with the critical patient highlighted

IV. RESULTS

The web portal is used to monitor or view patient's health status. It also sends alert message to the control room in emergency situations. The message will contain the patient's information and the reason of the emergency situation[10].

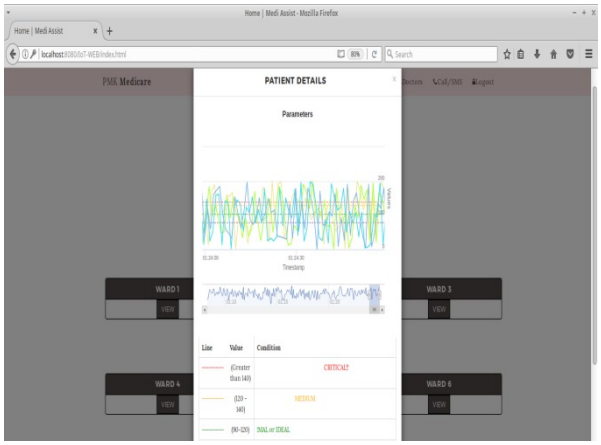

Fig.6 : Patient Report

VI. SUMMARY AND FUTURE WORK

Medi Assist system is a system which is developed for the purpose of remote monitoring of the patients – especially in rural areas where availability of doctors and good health care infrastructure is an issue . It provides easier and effortless way to monitor the patient in critical situation and keep track of their medical condition.

The project is still in its first phase where real time data is obtained and processed in real time. After cleaning and sorting data, the data is sent to the web portal where it is monitored.

Future work for this project involves replacing the Java module. which is currently simulating the IoT environment by generating the random data, with real IoT module, installing an experimental set-up of the prototype in order to test the actual accuracy, efficiency and applicability of the proposed idea.

VII ACKNOWLEDGEMENT

We would like to show our gratitude to Misba Mulla, Kajal Kadam and Paaneri Shelar, from DBIT, Mumbai, for their participartion in carying out the first phase of this project.

We would also like to thank Mr Rebeck Carvalho for sharing his pearls of wisdom with us during the course of this project.

We thank the management of Don Bosco Institute Of Technology, Mumbai for supporting this work.

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