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Patient Health Monitoring and Controlling System using Internet-of-Things (IoT)

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Abstract: IoT is a platform which offers various applications in different fields. IoT provides an important contribution in the field of healthcare, its principles and properties are already being applied to improve access to healthcare, improve the quality of healthcare and most importantly reduce the cost of system. The technology is used for gathering, analyzing and transmitting data in the IoT continues to new innovative healthcare applications and systems. Wireless devices are involved in medical area with a wide range of capability. To monitor the patient's health details in periodic interval is necessary in existing technologies. To overcome this we have changed recent wireless sensor technologies. In general different sensors are used to gather patient's medical information without being injecting inside the body by this we are achieving monitoring and data gathering of patients. There is no need for doctor to visit patient periodically. IoT provides new applications as well as efficient systems which helps to make an integrated healthcare system. The system provides better capability, healthcare system and costs are also reduced. Treatment outcomes are also improved.

Keywords: IoT, wireless sensor, integrated healthcare system.

I. INTRODUCTION

Internet of Things allows the physical objects to sense and collect the data and transfer it by using feature of an IP address for internet connectivity. IoT provides smart, connected healthcare with better security system. This system is useful for clinical applications in health monitoring, management and controlling for long term recording using database system. There is no need for doctor to visit patients periodically which saves the time. For Measurement of physiological body parameters wearable sensors are used. Using available data better decision support system is provided by doctor to individual patients. By using today's technological trends system provides effective improving, accuracy, low cost and improve speed. The focus on this project is to build an

Android platform based mobile application for the healthcare domain, which uses the idea of Internet of Things and cloud computing. The logged data can be uploaded to user's private centralized cloud or a specific medical cloud, which keeps a record of all the monitored data and can be retrieved for analysis by the medical personnel. The project presents an infrastructure for the healthcare domain which consists of various technologies such as microcontroller, signal processing, communication protocols, secure and efficient mechanisms for large file transfer, data base management system and centralized cloud. We focus on clinical applications for medical practice

II.LITERATURE REVIEW

1] Moeen Hassanalieragh∗, Alex Page∗, Tolga Soyata∗, Gaurav Sharma∗, Mehmet Aktas†, Gonzalo Mateos∗ Burak Kantarci‡, Silvana Andreescu§ "Health Monitoring and Management Using Internet-of-Things (IoT) Sensing with Cloud-based Processing: Opportunities and Challenges". Internet of Things provides an important application in connected health care in medical fields.
Wearable sensors on human body or sensors connected in our living environments, gathers information of our physical health which helps in monitoring of a patient. It also reduces the cost of health care and simultaneously improving outputs very efficiently. This paper focus on the opportunities and challenges for IoT in improving this vision of the future of health care.[1]

2] Babak Moatamed*, Arjun*, Farhad Shahmohammadi*, Ramin Ramezani*, Arash Naeim** and Majid Sarrafzadeh* "Low-cost Indoor Health Monitoring System". The main function of IoT is that objects with identification collects the information and can make communication and transfer of data over a network without any human or computer interactions. Different devices such as remote sensors, low energy blue-tooth and smartwatch is used in the system. The system is efficient, cost is reduced and has been tested in a rehab center and accuracy of 84% has been achieved .The system can be developed in home with minimum costs.[2]

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3] Xiaoliang Wang, Qiong Gui, Bingwei Liu, Zhanpeng Jin, Member, IEEE, and Yu Chen, Member, IEEE "Enabling Smart Personalized Healthcare: A Hybrid Mobile-Cloud Approach for ECG Telemonitoring" The challenges in healthcare system are to develop a system with more accuracy, flexible, affordable which can gather correct information and can make accurate medical diagnosis for giving a proper treatment. Hybrid mobile cloud computing has been developed which is the best solution for diagnosis and efficiency point of view. A case study of mobile-cloud based electrocardiograph monitoring and analysis is studied and developed. The limitations such as computational power, storage space, and battery life of mobile devices make it inefficient to use those mobile devices for computation and further processing .[3]

4] Sabina Manzari, Sara Amendola, Gaetano Marrocco, Rossella Lodato, Cecilia Occhiuzzi, and "RF-ID Technology for IoT Based Personal Healthcare in Smart Spaces" Internet of Things(IoT) support different sensors such as volatile compound sensor, temperature tags, digital data loggers which can be used in hospitals or home to monitor the patient's health remotely. The laboratories and worldwide research centres are making different prototypes of RFID sensors, it can be active or semi-active. This can be interfaced with architecture with compatible distance. RF-ID system is able to collect data, analyze it and further transmit it about the human body parameters with regulations.[4]

5] Andreas K. Triantafyllidis, Student Member, IEEE, Vassilis G. Koutkias, Member, IEEE, Ioanna Chouvarda, Member, IEEE, and Nicos Maglaveras, Senior Member, IEEE "A Pervasive Health System Integrating Patient Monitoring, Status Logging, and Social Sharing" This system presents an architecture of pervasive health system which enables self-management of chronic patients during their everyday activities. This system collects all information of patient health monitoring, status logging for observing various critical situations or symptoms and sharing of recorded information to particular ones.[5]

6] Unnati Dhanaliya, Anupam Devani. "Implementation of E-Health Care System using Web Services and Cloud Computing" Development of any healthcare system requires continuous patient monitoring. IoT provides best solution for a patient either hospitalized or in domestic environment that can be monitored and controlled remotely. This paper presents E-health care system using web services and cloud computing.[6]

7] Ingrid Svagård, Frode Strisland Mariann Sandsund, Hanne O. Austad, Anders E. Liverud, Trine M. Seeberg-IEEE Member,Astrid-Sofie B. Vardøy, Jon Vedum-IEEE Member, "Development of a Wearable Multisensor Device Enabling Continuous Monitoring of Vital Signs and Activity" The testing of a wearable sensors is very useful for health monitoring of patients in medical fields. The sensor measures body parameters such as heart rate, skin temperature, activity level and posture on the user's chest. The conclusion is that the improved wearable multisensor is used for monitoring is accurate, reliable, easy to use and applicable for the purpose. Different physical activities can be determined. Device can be used for daily basis application. [7]

III.SYSTEM ARCHITECTURE

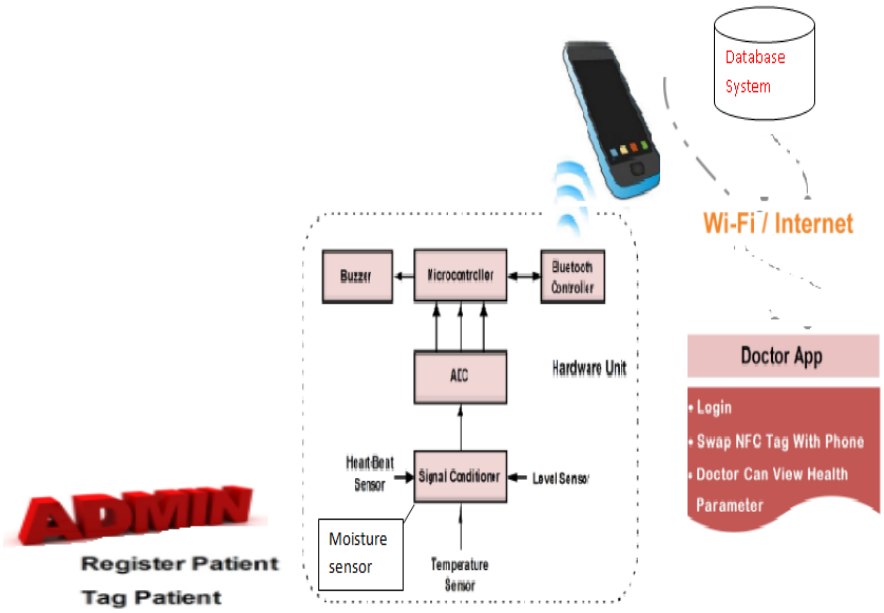

Fig.1.Block diagram of patient health monitoring and controlling system

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An embedded system (hardware and software) consists of different sensors like heart beat sensor, skin temperature sensor, level sensor and moisture sensor. This sensors sense the psychological body parameters and displays the output in analog form. It is necessary to convert it into digital form and sensed by microcontroller. Sensors output is then applied to a signal conditioner in which threshold values are fixed at low threshold and high threshold limit ranging from 0 to 256(mid value 128). If sensed value is either at low threshold or high threshold then it will raise an alarm with the help of buzzer. These values are then applied to ADC to convert it into digital form. These digital values are applied to a microcontroller (ATmega).Microcontroller sends this data to a low power Bluetooth device (HC-05).Bluetooth will send this information to cloud server via Wi-Fi or internet and all the measured body parameters are stored in a database system. Admin app is provided for registration of individual patients.NFC tag is provided to individual patient. All the data gets stored in a database system. One app is provided to a doctor in which he has to login and swap to NFC tag with his phone to view patient's health parameters. Doctor can access all the data from database via Cloud Server through Wi-Fi or internet connectivity which is Internet of Things. After raising of alarm doctor can take controlling action and provides proper treatment to a patient on right time.

IV. INTERFACE DESIGN BETWEEN DOCTOR AND PATIENT

1.Admin:This is main part in system architecture. It provides username and password for registration of patients. Registration of patient contains information such as patient's name, address, contact number, city, symptoms etc.Each patient is provided with Near Field Communication (NFC) tags.

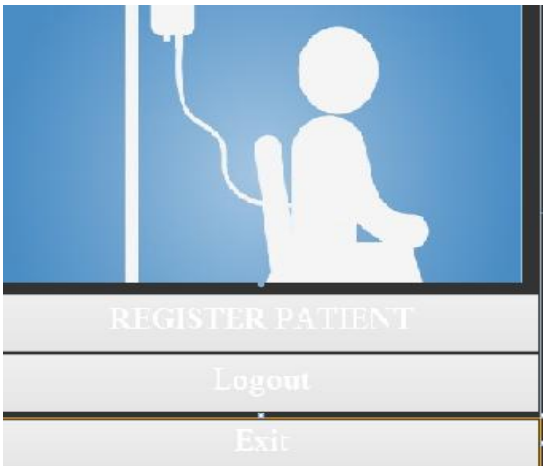

Fig.2. Patient registration and logout system

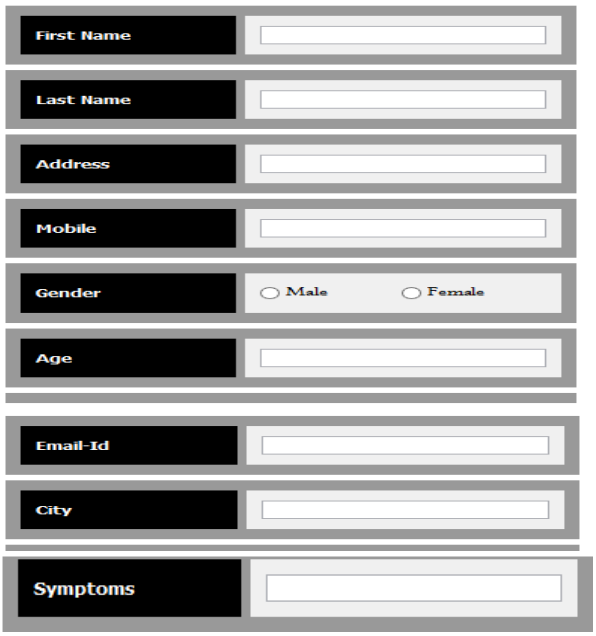

Fig. 3.Patient registration in detail

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Near Field Communication (NFC) App: This app is used for data read and write of patient's information. By entering the patient's detail and tapping NFC tag doctor can get patient's id.

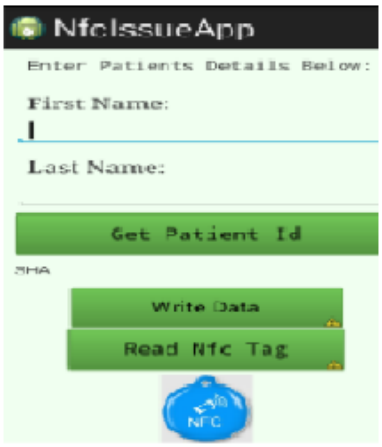

Fig.4.NFC App

2.Doctor's App: Doctor needs to install an android application on mobile phone. Doctor can login and can swap NFC tag with phone to view health parameters of a patient.

Fig.5.Doctor App

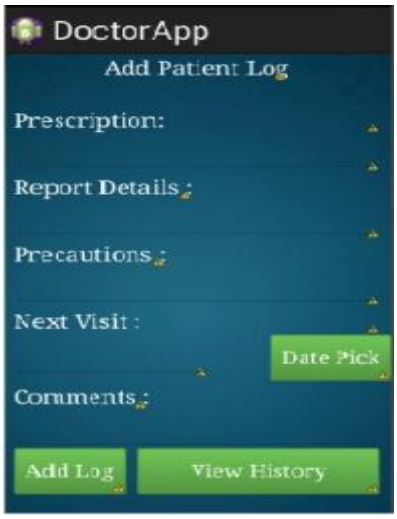

Fig.6.Doctor App for treatment to patient

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Software Result: We observed three different parameters such as body temperature, pulse rate.We also observed level indicator value.Body temperature is 30 degree celcius.Pulse rate is 56bpm which states that patient is normal.

Fig.7.Software Result

Hardware Implementation: The connectivity of the system is done as per the circuit diagram. Sensor connectivity such as thermistor, pulse rate sensor, potentiometer is done to micro-controller ATmega32.Device driver IC ULN2803 is used to drive the circuit. Bluetooth connectivity is done by using HC-05.Transformer is used to step down the voltage. Buzzer is used for alarm indication in emergency case.

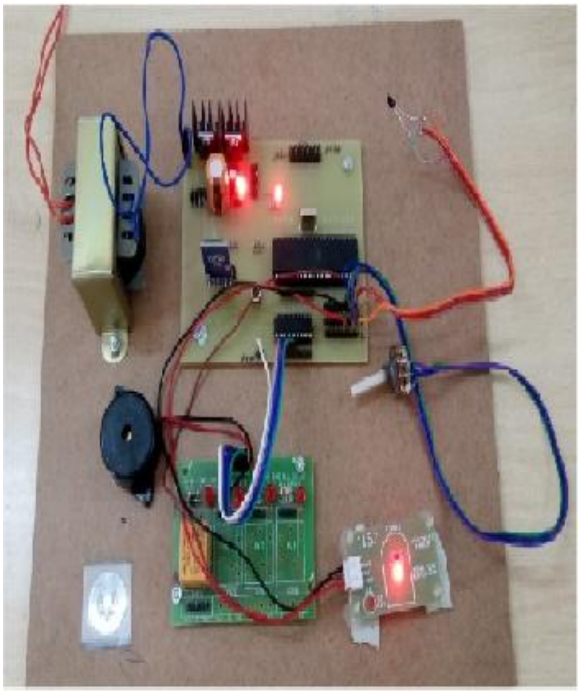

Fig.8.Hardware Implementation

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3.Database: The database used in this system is MYSQL database. It is used to store all the information such as users login ID, password and all the information regarding health parameters.

V. PROPOSED SYSTEM

We are proposing system based on IOT. We are developing an android application and through which daily consumption reports of health parameters of a patient are monitored. All values are stored maintained in central database system. Emergency will occurs if value updated crosses the threshold time, the server can determine any emergency and can report it to the system by raising buzzer.

VI. CONCLUSION

We have studied the IOT system applicable for patient health monitoring. We also studied data acquisition and data controlling system using the microcontroller IC and different sensors with the controlling components as buzzer and LEDs. We have developed android application as NFC (Near Field Communication). We created a database which includes all information, also designed patient registration android application.

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