

# A Review: Remote Patient Monitoring System

Amol Wanjari<sup>1</sup>, Madan Mali<sup>2</sup>

M.E. Student, E&TC, SCOE, Pune, India <sup>1</sup>

Head of Department, E&TC, SCOE, Pune, India <sup>2</sup>

**Abstract:** Technology oriented health care environment has become need of today's generation so there is a need of increasing efficiency of patient's health care and to make it more technology oriented. The actual meaning of patient monitoring is to continuously monitor number of patients for multi-parameters at a time from a remote place. Patient monitoring not only gives emergency alerts but also provides the necessary input information or data to control directly connected physiological instruments. In the modern age, advance technologies and applications are equally important for health care and also for the betterment of human being. Android based mobiles are the most accessible form of the latest technologies. Mobile technology is not only useful for medical staff but also for common people for their self-monitoring. Now it is easy to monitor, record, display and transmit the patient's physical parameters readings from the patient to any place.

**Keywords:** Android application, database, monitoring system, physical parameters.

## I. INTRODUCTION

Health care is an important and necessary part of everyday life. Everybody needs a periodic monitoring of various essential health parameters and also require its proper treatment. Recorded data can be helpful for proper diagnosis of patients. After certain age, health care is the most important, particularly for patients who bed ridden. In emergency conditions, recorded data of vital parameters can play an important role. In some situations, even a short delay may cause adverse effects[1]. So monitoring systems are a need of today's generation and are helpful for older age people or disables people. Normally vital parameters are recorded and monitored only for some discrete interval of time and this may cause loss of important data. So, there is a need of continuous monitoring of patient health. The main objective of patient monitoring system is quantitative analysis of vital biological parameters during their emergency situations. Also, it must provide long term information of vital parameters which will be helpful for diagnosis and research purpose by knowing their actual values. Patient monitoring is a process of continuous monitoring of number of patients for multi-parameters at a time from a remote place[2]. These kind of systems are able to record long term data which is not possible in spot checking. With the use of network technology and development of smartphone these systems are now based on fusion of two. Other objectives are to design a fully online system that continuously monitor and analyse the patient health parameters and upload the important data to the server for long term use, to develop an android application that helps to follow up their patients remotely. Along with the facility of emergency alarm system, if doctor unable to give response within certain time. Patient monitoring system has several advantages like, wirelessly remote care operations and also improves the efficiency of health care operations[3]. So, such kind of system could help in studying correlation and provide complete information

about the patient's health care and which will in turn analysed by professionals. Traditional technologies are not much suitable for the user movement and in addition these are too expensive. There are several proposals provided to solve these issues, but they also have some limitations. So there is a need of modern technology to solve these problems. Android based health care patient monitoring system not only speed up the information exchange but also simplifies processing and analysis. It also reduces the cost. So researchers are focusing more on wireless health care[5].

The web database is such a system in which web server continuously stores the transmitted data in a table format. MySQL database is an open source database and more convenient as compare to others. In this system, Android platform is used which is an open source and will display parameters like heartbeat, pulse rate, temperature. The system is also useful in a case; if a concern doctor is at a remote place then he/she can also access and operate by just looking at different parameters display on an android smartphone. The doctor can also send the respective feedback to the medical personnel[6].

## II. SYSTEM PLATFORMS

### 1. 3G-Mobile phones:

The advancement in the field of communication makes human everyday life easy. 3G mobile phones are revolution of latest technology. The impact of this technology is also seen in the field of medical. To provide health care over a long distance, telemedicine is one of the emerging technologies. Using 3G mobiles doctor can monitor real time data of patients by making a voice call. By using this technology doctor can access real time data, store the information and checking of patient's information [3].

2. Zigbee technology:

For wireless sensor network, over a short distance communication up to 200 meters zigbee technology is a good platform. With the help of wireless sensor network, doctor can access real time data of patients just by using small wireless sensor. By using this real time data doctor can analyse physical state of patients and provide means of diagnosis. [6]

3. Bluetooth Technology:

Bluetooth is a standard form of data exchange over a short distance for fixed and mobile devices. It is a wireless technology which can connect several devices and thus overcome a problem of synchronisation. With the help of Bluetooth technology, it's easy to design body sensor network. Bluetooth not only collects the data from hardware device (sensors) but also speed up the data transmission. It also reduces the cost of equipment and hence researchers are concentrating more on wireless technologies.

4. GSM technology:

It provides mobility to doctors and medical in some extent. Transmission of health care parameters in an accurate manner and also provides the alert system in case of emergency. Thus, GSM is a good medium for the communication between doctor and patient and also for real time data transmission. Due to real time monitoring and feedback facility, it becomes easy for doctor to take preliminary action [4].

III. EARLIER WORK

Deep Modi et.al proposed Android based patient monitoring system.[1]This system is based on android platform and able to detect various body parameters like heartbeat, pulse rate and temperature. This system suggested an advance technique of patient monitoring. The system consists of hardware block which includes sensors, microcontroller and display system. Software consists of four blocks including web server, web database, mobile(android OS), local database, GUI. The results are shown on the android smartphone screen and from this the doctor can study ECG graph of various parameters.

There is a future scope suggested in this paper as the processing part can be done by using MySQL and also can set an alarm if doctor unable to give response within certain time

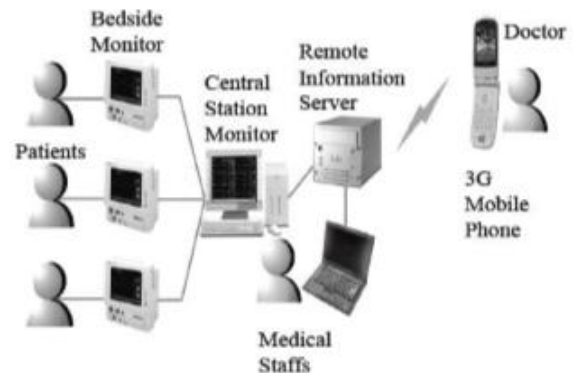


Fig 2. The overview of the system [3]

Prema Sundaram proposed patient monitoring system using android technology[2].This system measures patients crucial signs like heart beat rate, ECG, temperature, breathing rate, SPO<sub>2</sub> and enters them into the database manually which is then uploaded into web based server. There is a future scope of entering the data automatically. It suggests that the data collected from PMS can be given to two separate interfaces which displays the patient's parameters and then important data can be sync to a web based server. Pu Zhang et.al proposed A Remote Patient Monitoring System Using A Java-Enabled 3G Mobile Phone.[3] This system consists of mainly three parts including patient monitoring system, web server and 3G mobile phones based on java. The block diagram of this system as shown in fig.1.

In this system collected data from bedside monitors is provide to the central monitoring station.The various kinds of data including numeric values, signals in the central monitoring station can be extracted by remote server and then changed into recognised pattern for java based application. The overview of system is as shown in fig. 2.

PHP web application use for the development purpose. V.S. kharote-Chavan proposed Multi-parameter measurement of ICU patient using GSM and Embedded technology. [4]This paper presents three important health parameters such as blood pressure, heart rate and temperature which are measured at a particular interval and stored in a memory if they are in limit. Here temperature measured continuously using RT and then feed to ADC. It also compared temperature values with the threshold values and checks the respective values. The GSM module is used to send alerts to doctor. It is programmed in such a way that it sends SMS from monitoring system. The SMS will be sent at the end of the day and also if it crosses the threshold values. The stepper motor is used with the microcontroller which in turns receives the signals from GSM module. The GSM will move for a change in medical doses either in clockwise or anticlockwise direction. Sooyoung Yoo et.al proposed development of

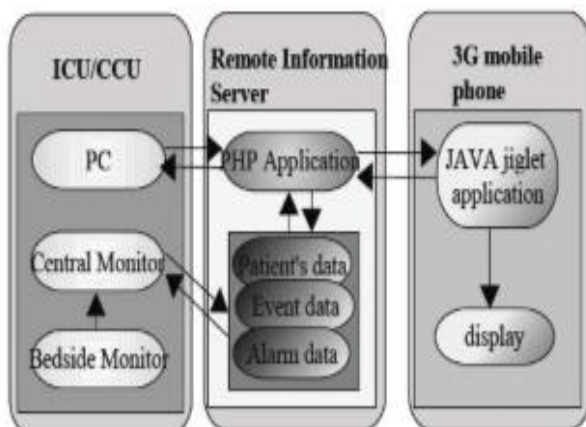


Fig.1 The working process of the system[3]

Ubiquitous health monitoring system.[5] This system monitors and stores six kinds of patient’s parameters such as blood pressure, ECG, temperature, glucose, weight, pulse rate. The system mainly works on two servers. First one is the U-house server and the other is central respiratory server. The U-house server compresses the signal data and sends it to BIRD(Biological Integrated Repository Database). The main function of BIRD is to store the patient’s data and provide simple and easy access. The ubiquitous system has many advantages but have some technical issues such as proper and efficient management of signal data. Second challenge is automatic interpretation of data. If any abnormalities are detected by the system it gives warning message to the responsible faculty. Ping Wang[1] proposed, the real-time monitoring system for in-patient based on ZigBee[6]. The paper gives the idea about ZigBee based patient monitoring system. The system consists of Data acquisition system and ZigBee based communication system.

The system continuously monitors and records the physical movement parameter with the help of sensors, which helps to analyse the state of patient. Overall architecture is as shown in the fig. 3.

The measured data can be sent to monitoring control station wirelessly. The data is stored in a database and intelligent diagnosis software can be used in case of emergency. The change in parameters can be shown in the form of graph or numeric values on display which helps to know the physical state of patient. The main limitation of ZigBee based system is that, it is limited only for short distance transmission up to 200 meters.

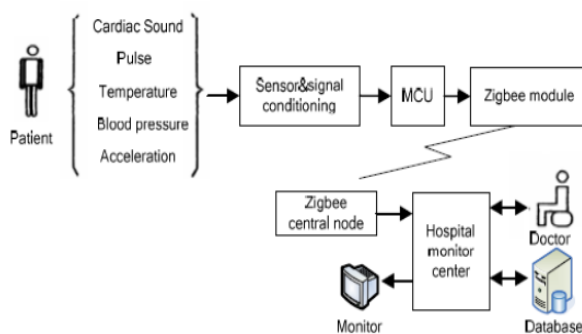


Fig. 3 The monitoring system for cardiac patient [6]

IV. METHODOLOGY

Raspberry Pi:

The raspberry pi is a small, card size controller which can be used with a computer monitor or TV. There is a need of keyboard and mouse externally. Raspberry pi is a smart controller having many features including: Easily implementable Linux based operating system, simple management of database, simple set up of control system and also portable, small, easy to maintain, and no need of extra wiring. Raspberry Pi used in this as a mini computer. There is only a need of external display, keyboard and mouse. This arrangements use instead of laptops.

Block diagram of GUI based patient monitoring system is shown in fig. 4

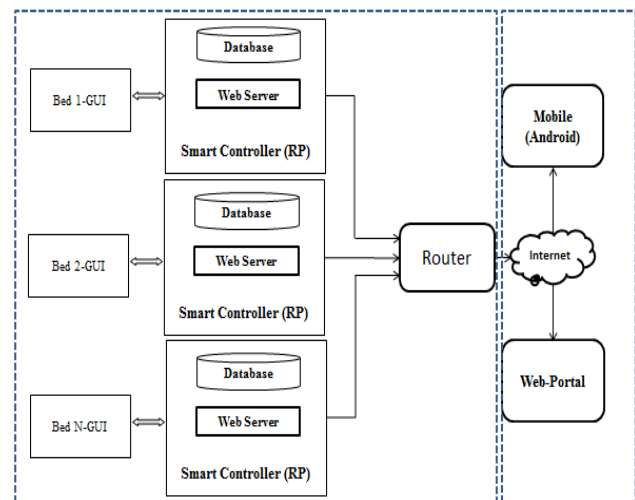


Fig. 4 Block diagram of android based PMS

The block diagram shown in fig 4 consists of hardware and software. This system helps the doctors to work from outside of hospital premises. The system monitors patient’s parameters like temperature, heartbeat, pulse rate, weight etc. The system consists of mainly raspberry pi controller, the web base server, MySQL database for storing the long term data, Graphical user interface(GUI) and an android based mobile phone for displaying the different parameters. Hardware used in this project is Raspberry Pi 2B model. This will be acts as a mini computer. Python language used for programming. The advantage of the system is that the data of health care parameters will be uploaded and stored in a regular manner and then it will displayed on an android phone.

In the system, nurse or any hospital faculty will provide the patients various parameters data manually to the controller. The controller receives the manual data and in turn sends it to the web server. For storing the web based data MySQL database will be used. There is a need of MySQL database because it is not necessary that network is always available.

If patient readings cross the threshold values there is a facility of SMS in a patient side. The emergency alerts are activated when the parameters crosses the threshold values. In case of emergency, doctor can give the feedback for respective patient.

V. CONCLUSION

SMS and alert system for emergency situations are proposed in various systems based on zigbee, bluetooth, GSM and so if the doctor does not respond in particular range of time alert system he/she will get an SMS alert. Ubiquitous system has many advantages but main disadvantage is effective management of health care data.

The table 1 shows the comparison of the above system.

Table 1 Comparison of various PMS

Sr. no.	Name of the system	Advantages
1.	Java Enabled 3G mobile phone based PMS	Transfer of data using a voice call Java applet for user interface
2.	Ubiquitous Health Monitoring System(UHMS)	Web based system Access of data at any time from remote place
3.	ZigBee based PMS	Short distance communication
4.	GSM based PMS	Long distance communication Real time access of data Text message service
5.	Bluetooth based PMS	Small and compact For only hospital use(Short distance) Results shows in the form of graphs
6.	Android Based Patient Monitoring System	Sensor data takes as input Numeric data show s in the form of graphs

**ACKNOWLEDGMENT**

Authors would like to express their gratitude towards respected PG coordinator **Prof. M.M. Jadhav** for his dynamic and valuable guidance and also grateful to him for his constant encouragement in fulfilment of paper. Authors would also like to thank **Dr. S.D. Lokhande** principal, SCOE Pune, for providing with all necessary infrastructure and facilities to complete the review paper.

**REFERENCES**

[1] Deep Modi, Jignesh Vyas, Priyank Shah, “Android Based Patient Monitoring System”, International Journal For technological Research In Engineering Volume 1, Issue 9, May-2014, ISSN (Online): 2347 – 4718.

[2] Prema Sundaram, “Patient Monitoring System using Android Technology” IJCSMC, Vol. 2, Issue. 5, May 2013, pg.191-201, ISSN 2320-088X

[3] Pu Zhang, Yuichi kogure, Hiroki Matsuoka, Masatake Akutagawa, Yohsuke Kinouchi, Qinyu Zhang, “A Remote Patient Monitoring System Using A Java-Enabled 3G Mobile Phone”, IEEE, 2007, pp. 3713-3716.

[4] V.S. Kharote-Chavan, Prof. Satyanarayana Ramachandra Rao, “Multiparameter Measurement of ICU patient using GSM and Embedded technology.

[5] Sooyoung Yoo, Sungwon Jung, Jinwook Choi, Dongwoo Rho, “Development Of Ubiquitous health Monitoring System”, IEEE, 2007, pp. 1116-1120

[6] Ping Wang1, “The real-time monitoring system for in-patient based on zigbee”, IEEE, 2008, pp. 587-590.

[7] Weibo Song, Hong Yu, Ce Liang, Qihua Wang1, Yunfeng Shil, “Body Monitoring System.