

# Patient Monitoring System using Zigbee Wireless Sensor Network

Pravin M Ghutke<sup>1</sup> Pankaj Headoo<sup>2</sup> Sheetal Bhongale<sup>3</sup>

<sup>1,2</sup>M. Tech Studen <sup>3</sup>Professor

<sup>1,2</sup>WCEM, Nagpur <sup>3</sup>COEP, Pune

**Abstract**— At the present day or in fast life there is always problem of critically ill patients so we require spontaneous and accurate decision so properly diagnosis treated to the patients. In the whole world or more close in India everyday there is increases the number of patients of heart attack and not to get proper treatment at the real time ,for this we make a paper of monitoring of patients. I have designed and implement a reliable, energy efficient monitoring system. With the help of this the doctor and practitioners can treated the patients in real time (ECG, SPO2, HEARTBEAT, TEMP). In this paper we made wireless patient monitoring system which measured the real time data from patients and transmitted that data with the help of wireless topology zigbee. This project provides faster response and improves the performance with power consumption. In this project we acquire the bio signal SPO2, ECG, HEARTBEAT, TEMPERATURE from patients and acquired data is analyzed at a centralized ARM microcontroller .If patients data falls or rise the threshold value there is automatic SMS send to the preconfined doctors mobile numbers with the help of GSM module which is interface to the ARM controller. The doctors can record of particular patients information which is already feed up in his PC which continuously updated through zigbee receiver module.

**Key words:** Sensor ,GSM module, Zigbee

## I. INTRODUCTION

In day today life basically sensor based system is for research which is helpful to the home care system. In before research the transmission of physiological signal the IR to used but it is not for continuous monitoring and obstruction to that may disturbance occurred .The zigbee is low power and 24 hours monitor of communication transmission sustem. Zigbee based wireless networks were tested in various application .This monitoring system would be useful for doctors for better health diagnosis.

In the proposed system, acquisition of patients data such as ECG, TEMP, HEARTBEAT SPO2 will be continuously monitored and transmitted with the help of zigbee technology. For the zigbee technology there is specific range to be require so it is under observation of doctors.

In recent there is improvement of wireless technology but still date there is some problem occurred, whenever we applied that technology in the practical application. The proper design and implementation of that design in real time wireless system is challenging for us. In this connection a generic real time wireless communication system has been designed for short and long term remote patient monitoring, using wireless protocol.

In this system we get data such as ECG,SPO2, HEARTBEAT,TEMPERATURE. This data collected by the primary sensor (electrodes) and sent to the microcontroller at the transmitting end. The LCD system attached to the arm7 microcontroller to display the real data and then it is

transmitted via zigbee on the transmitter side to the receiver. If there is problem occurred in the patient data an alarm or alert system to concerned doctor or the nursing and a SMS is sent via GSM to the mobile of a doctor.

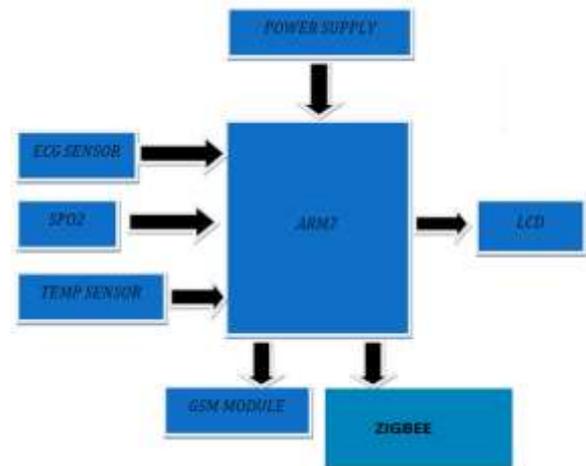


Fig. 1: Transmitting Module

In the case of patient vital sign monitoring, the data packet size is much smaller and could be in tens of hundreds of bytes, which seems to suggest that networks using such protocols might seem impractical and it's obvious that we need a low power, low cost network nodes for such applications.

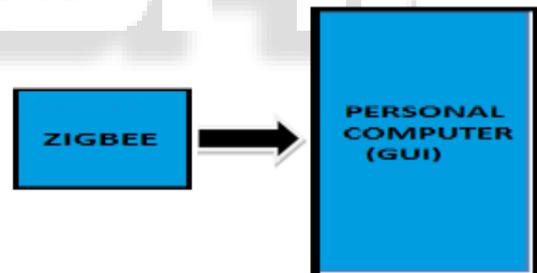


Fig. 2: Receiving Module

## II. HARDWARE USED

### A. ARM7 Microcontroller:

The microcontroller is based on a 16/32 bit ARM7TDMI-S CPU with real time emulation and embedded trace support, that combine the microcontroller with 32 kb,64 kb,128 kb,and 512 kb of embedded high speed flash memory. To process the single its include microcontroller and DSP but these two can be replaced with one single processor. We can say that the complete intelligence of the project resides in the software code embedded in the ARM7.

### B. ECG Sensor:

An ECG is the electrocardiograph which is the electrical event of heart. All the cardiac problem we can detected with the help of ECG sensor .Basically there is 3,5,12 leads electrodes system but 3 and 5 leads electrodes system used

for real time system The 3 electrodes attached to the patients as RA,LA and LL which is based on the principle of Einthoven triangle with the help of this technique we easily acquire the data from patients as a ECG graphs.

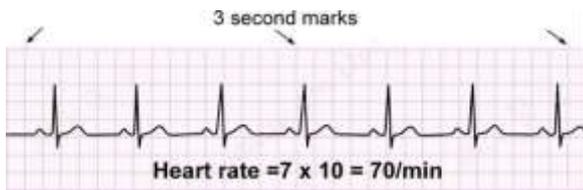


Fig. 3: ECG Graph

#### C. SPO2 Sensor:

The SPO2 sensor are for multipurpose use, when continuous non invasive arterial oxygen saturation are required. Oxygen saturation is defined as the measurement of the amount of oxygen dissolved in the blood, based on the detection of hemoglobin and deoxyhemoglobin. For the measurement of Hbo2 and Hb we require the two different light wavelength. The wavelength is require is 660nm ( RED LIGHT) & 940nm(IR LIGHT).

The SPO2 is nothing but the oxygen saturation that measure what proportion of the oxygen carrying molecules in the blood are actually carrying oxygen. The oxygen percentage range of normal person is 95% to 100%. In this sensor one side is red light and other side is detector. Absorption of light at this wavelength differ significantly between blood loaded with oxygen and blood lacking oxygen. The oxygen content Hb absorbs more IR light and passes more red light. Deoxygenated Hb allows more IR light to passed through and absorbs red light .

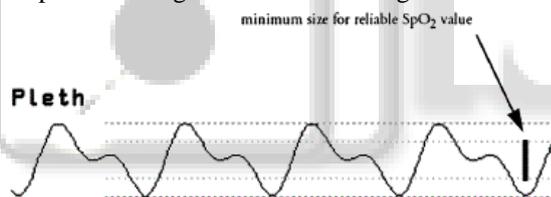


Fig. 4: Graphical Representation of SpO2

#### D. TEMPERATURE Sensor:

Temperature sensor is the important parameter if any disease with patient. It basically for sensing of body temperature. The LM35 IC is used for measuring of temperature. It is a 3 pin IC precision integration circuit temperature sensor whose output voltage is linearly proportional to the Celsius temperature. In our project the sensor side data feed to the ADC where it is converted into digital form and shown on the LCD display as a output. Most of the diagnosis treatment is on the basis of temperature so it is important to the patients point of view.

#### E. HEART BEAT SENSOR (LM358):

Heart beat is sensed by using a high intensity type LED and LDR. This sensor is not separate in the project because the SPO2 and HEARTBEAT we acquire at the same time with the same sensor, for this we require one led and detector ie LDR. A red led for illumination and a LDR as detector.

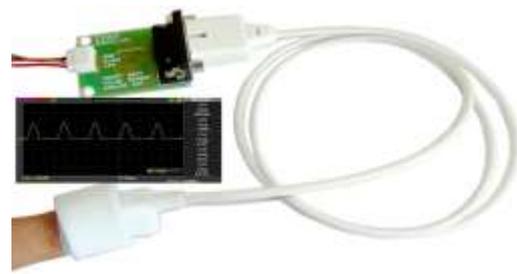


Fig. 5: Heartbeat Analog Sensor

#### F. ZIGBEE:

Wireless connectivity has been one of the prominent technological innovations of recent years, allowing freedom and ease of access to information. Its digital radio connections between computers and related devices. Transmitter section of the monitoring health care system consists of a Zigbee network which is made up of sensor nodes. The information sent by the Zigbee Module is received wirelessly by the other Zigbee module at the receiver section. There is limit code is already fed in the microcontroller. If mismatch occurs, that is if the collected data is more than the limit defined than alert signal are issued. Alert signal are is in the form of SMS sent to the pre-defined doctor mobile number. So that he can provide cure on time.

### III. RESEARCH METHODOLOGY TO BE EMPLOYED

Patient monitoring systems with advanced features, especially wireless or remote capability, are among the fastest-growing medical devices. The aging population and the associated increases in diseases such as congestive heart disease and diabetes as well as the cost of treating those conditions, is driving sales of these devices. Use of new patient monitoring technologies can result in a need for fewer personnel, increased coverage by existing personnel, and a reduction in errors and are expected to lead to better patient care and the recognition of serious health problems before they become an issue.

Advanced Remote Patient Monitoring Systems, is a comprehensive study on the patient monitoring industry, including the advanced system with remote and wireless capability to include patient monitoring equipment and devices which have advanced features. The report specifically focuses on technologically advanced (including wireless and remote) patient monitors; monitors with patient data processing applications; and monitors which are capable of data transfer to an EMR system-including equipment and peripherals which coordinate the flow of data to hospital electronic medical record systems. For the most part, devices covered in this report can provide monitoring information beyond a patient room; and provide data for an EMR system or are expected to add such features within the forecast period.

### IV. RESULT

The picture show a typical patient monitoring recording from the receiver unit connected to the display device. This technique presents a system to upgrade existing health monitoring system in the hospital by providing monitoring capability and a thus a better cure. This intelligent

monitoring system provides long term monitoring capability useful for the staff in the hospital and reduces their workload. More numbers of parameter can be included

in future progress so to provide flexibility. The main aim of the project is to provide better care and alertness to the staff so that immediate care is provided to patients.

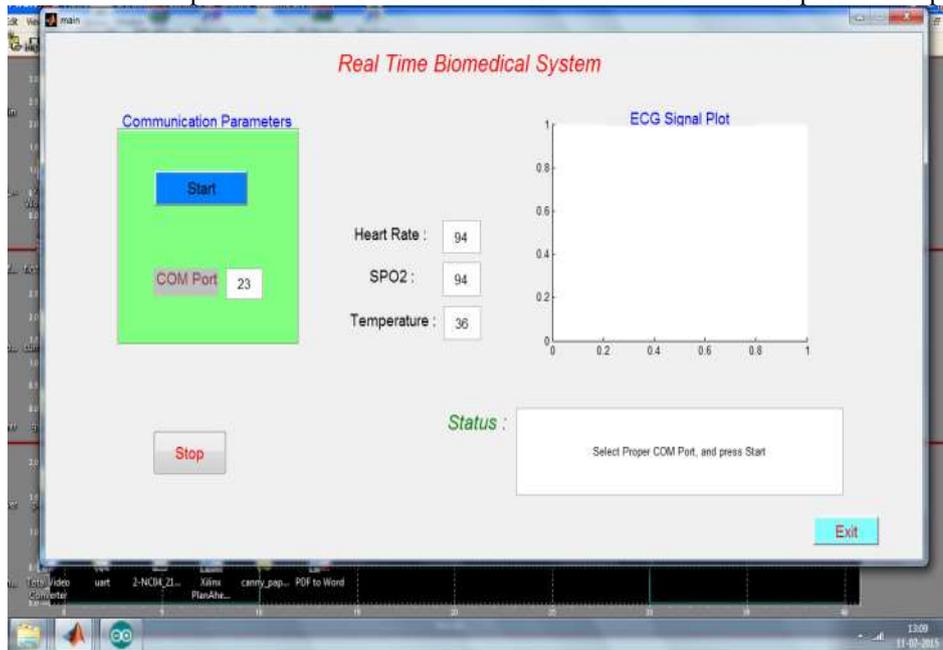


Fig. 6: Monitoring Parameters

## V. CONCLUSION

This investigation proposes portable, wireless, analyzing and physiological monitoring system. From the above designed project we can concluded that sense the data from remote patients to the doctor PC by wireless technology Zigbee. With the help of Zigbee receiver all data is received and displayed on doctor PC. If the doctor not available in the hospital campus and any parameter goes behind the limit then automatic SMS will send to predefined doctor mobile number. All sensor system should also be calibrated properly for accurate measurement of parameters. In case of emergency situation doctor to provide medication and cure to the patients.

## VI. FUTURE SCOPE

Now a day there is advanced technology invented in the field of medical technology. Many companies invented and design commercial products to solve wide ranging problems. In the project as per the requirement we can increase the communication distance so disturbance not occurs at the time of monitoring system.

If more than one patients in the critical care wards, at that time there is not possible for the doctors to visit every patients at a time so in future we will make a node system for every individual bed with our system and all that nodes connected to main node with the single GSM module interfacing to only main node so fast treatment to patient occurs if any emergency occurred. We also include some following system also

- 1) Patient Homecare
- 2) A Prehospital Mobile Database for Emergency Medical Service
- 3) To extend the distance coverage of Zigbee networks multiple numbers of patient care

monitoring devices are added. By adding multiple numbers of devices we can able to monitor more number of patients within single room and at the same time if there is any emergency we can easily identify the patient and help them. These methods provide easy maintenance and efficient patient care.

- 4) To add different types of parameter.

## REFERENCE

- [1] Sahandi, R., Noroozi, S., Roushanbakhti, G., Heaslip, V. & Liu, Y. "Wireless Technology In The Evolution Of Patient Monitoring On General Hospital Wards". *Journal of Medical Engineering and Technology*, vol.34, no.1, pp.51-63, 2010
- [2] Ovidiu Apostu, Bogdan Hagi, Sever Paşca, "Wireless ECG Monitoring and Alarm System Using ZigBee" 2011 The International Symposium on ADVANCED TOPIC IN ELECTRICAL ENGINEERING 2068-7966/ATEE 2011.
- [3] M.M. A. Hashem, Rushdi Shams, Md. Abdul Kader, and Md. Abu Sayed, "Design and Development of a Heart Rate Measuring Device using Fingertip", Department of Computer Science and Engineering, Khulna University of Engineering & Technology (KUET), Khulna 9203, Bangladesh, 2010.
- [4] J. S. Choi and M. Zhou, "Performance analysis of Zigbee based body sensor networks," in Proc. IEEE Conf. Syst., Man Cybern., 2010, pp. 2427-2433.
- [5] S. Heinisuo and J. Vanhala, "Wireless Platform for Multi-Channel Analog Measurements," 2006 28th Annual International Conference of the IEEE Engineering in Medicine and Biology Society.