

Novel Wireless Biometric System with Sensor Analysis

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Abstract — With increase in complexity of current Health & Disease scenario in society, Modern medical practices greatly relies on technology for analyzing patient's health condition & for arriving at suitable best possible treatment. Use of technology is greatly assisting medical profession for quick & accurate decisions making but at the same time exponentially increasing medical expenses making it un-accessible to wide range of social class. Statistics reveal that every minute a human is losing his/her life across the globe. Motivation of this paper is to develop efficient & affordable wireless biometric system that can monitor multiple patients' health parameters simultaneously and can effectively deliver the data to a patient monitoring system where it is stored permanently. It enables the doctors to monitor many parameters of patient's health, in that our project investigates the potential of wireless biometric system to reliably, wirelessly collect, send and process the temperature & heart rate of multiple patients simultaneously. Thus we have designed and developed a reliable, energy efficient patient monitoring system. Use of suitable wireless communication technique to manage interference & accurately deliver information at user interface (output device) is one of major challenge that is considered here. We have tried to address this challenge by adopting scheduling scheme in data transmission & using unique ID for each patient's noted parameters. The system also alerts the doctor/nurse of some measured value cross threshold limits. On the basis of monitored data performance evaluation is to be done which helps for performance of sensors. A data storage mechanism employed here become of help as a ready past data reference and remedial action by the doctor. At present, under current medical practice, there is individual patient monitoring system for every patient which makes it expensive, whereas our proposed system uses the same resources to monitor multiple patients, with more comfort and convenience which can pave way to distribute cost of system to multiple patients at the same time maintaining flexibility expected by and useful for the healthcare professionals. This project helps to provide a solution which not only is reliable and flexible but also affordable which is need of time considering huge burden of Medical Expenses which are hardly manageable by for vast range of patients.

Keywords: *Wireless sensor networks; multiple health parameters; sensors; patient monitoring system.*

I. INTRODUCTION:

In the health care domain, a major challenge is how to provide better health care services to an increasing number of people using limited financial and human resources. Wireless biometric patient monitoring has the potential to support these multiple and conflicting requirements. It is based on wireless sensor networks which is an emerging technology and has great potential to be employed in critical situations [01]. The Zigbee technology provides a good solution for wireless transmission through sensor signals & its power consumption is very small, which can monitor and transmit distance physiological data [02].

A lot of research has been carried out in the field of health care monitoring. Continuous monitoring of the health parameters of patients is one of the major problems faced by the hospital authorities nowadays. Monitoring should be accurate & precise. In the recent years, developing of wireless health care monitoring system has emerged as an area of research. This project investigates the potential of Wireless biometric system to reliably, wirelessly collect, send and process these multiple parameters of multiple patients simultaneously. Various health parameters such as blood pressure, temperature, heart rate, ECG, EEG etc. are monitored in order to track patient's health performance using wireless monitoring system. Amongst all

the parameters, temperature and heart rate are the two parameter taken into consideration. Fundamental cause to concentrate on this temperature Sensor & heart rate are due to their significant features as body temperature is an important, regulated physiological parameter & undergoes natural variations where as by monitoring patient heart rate, one can scientifically measure with great accuracy the effort your body expends .hence performance evaluation of temperature sensors & Heart rate sensors is consider for demonstration. . Each patient is identified using an identifier makes it simpler for a doctor in identifying the patient's current health status. The monitored parameters are processed and compared with the individual threshold limits of each patient and is networked to the patient monitoring system in doctors room. Hence in case of doctor's absence since the monitored data being stored, an experienced nurse can convey the status of certain patient's parameter to doctor's mobile phone [03]. Thus the necessary health aid can be provided and once the doctor arrives the results of concerned patients can be checked.

The objective of the presented work is to develop a system for health care monitoring based on wireless network. The developed system must have the following capabilities:

1. Low power consumption.
2. Low manufacturing cost.
3. Compact size.

4. Long distance of communication.
5. Reliable/secure communication
6. Expandable

II. PROBLEM STATEMENT

The problem that prepares a system, to resolve the difficulty to monitoring multiple patients' health conditions recorded by healthcare providers and also a performance evaluation between the sensors. In case of large hospital authorities where multiple patients need to be monitored simultaneously a separate monitoring system for each patient is inefficient. By employing a single system for multiple patients there will be a huge reduction in cost as well as power consumption. Data being recorded can be used for further research purposes if needed. It also provides flexibility to doctors.

III. RELATED WORK

For hospitalized patients, a two-tier clinical warning system was mentioned in [04], which consists of an Early Warning System (EWS) which identifies at-risk patients from existing real-time Electronic Medical Record (EMR) data, with the help of Algorithms. Mobile patient monitoring systems, which integrates current personal digital assistant (PDA) technology where used in [05] and [06]. It uses PDA with wireless local area network & discussed the possibility of using Bluetooth technology [07].

The recent research on the technology and emphasizes the use of Zigbee in various applications, explanation will be focused on the related field of health care monitoring and wireless sensor network. Research and findings have been conducted in order to design and develop Health Care Monitoring Using Wireless Network that will suit the aims and objective in this project. Zigbee is the type of wireless sensor network system which chosen by researchers in order to employ the designs. Zigbee is the only standards-based wireless protocol technology that addresses the unique needs of remote monitoring and control and sensor network applications.

The Zigbee wireless standard enables broad based deployment of wireless networks with low cost, low power solutions providing the ability for devices to run for years on inexpensive batteries in a typical monitoring application. The Zigbee standard operates on the IEEE 802.15.4 physical radio specification. The sensor modules were designed for low power operation with a program that can adjust power management depending on scenarios of power source and current power operation.

The technologies of wireless sensors and data transmission, and their ability to meet the needs of patient monitoring in the operating room and the intensive care unit are reviewed [08].

IV. PROPOSED SYSTEM

The proposed system makes use of the idea of network technology with wireless applicability. Each patient is identified using a unique identifier of RFID Tag makes it

simpler for a doctor in identifying the patient's current health status. The monitored parameters are processed and compared with the individual threshold limits of each patient and is networked to the patient monitoring system in doctors room. Hence in case of doctor's absence since the monitored data being stored, an experienced nurse can convey the status of certain patient's parameter to doctor's mobile phone with the help of GSM Modem.

Also in addition to the system, we have performance Evaluation of different sensors so that the monitored data should be more Accurate & precise. It's beneficial to the patient that effective & accurate delivery of the information to the monitoring system is achieved. So that doctor will come & see the patient. Thus the necessary health aid can be provided and once the doctor arrives the results of concerned patients can be checked. This project proposes a system that provides a continuous health monitoring service for people.

The monitoring health system of temperature and pulse of humans based on Zigbee, GSM, and SMS is mainly composed of the patient section and the Signal conditioning, the communication unit, and the expert software. The software which is used for programming is Micro Pro for PIC & information is sending on display terminal. Temperature and pulse signals are measured from the temperature and heart beat sensors and are processed by a built-in microcontroller. The processed data are then transmitted by Zigbee wireless transmission [09]. Finally the received data is sent to the PC & through a GSM modem to the doctor mobile.

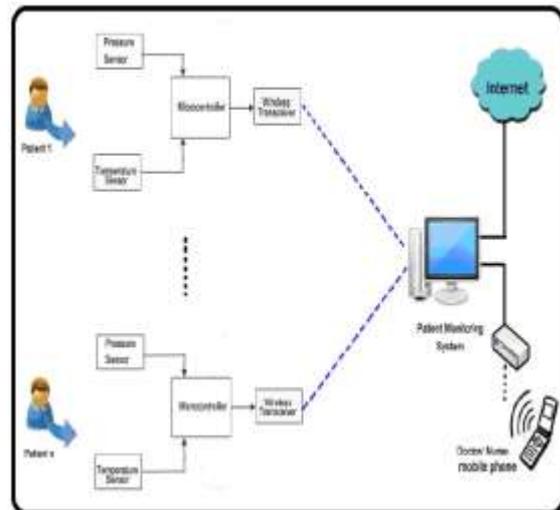


Figure 1: Basic architecture of patient monitoring system

It can facilitate doctors in diagnosis and improve the efficiency and quality of medical administration. Using GSM modem message is transmitted to the programmed mobile number to the doctor in charge [10]. When the measured temperature exceeds the allowable value or if the pulse measured is abnormal, then buzzer will turn on & message send through GSM to the doctors in charge. Performance of sensor can be evaluated by certain factor.

V. FLOWCHART

Different sensors are connected to the patient's body at appropriate positions to collect data about the health

- Firstly initialize inbuilt 10 bit ADC & RFID Tag can read the 12 digit data. Accordingly Name of the patient is search.
- Sensors like LM 34, Thermister, Heart beat sensor 1 & Heart beat sensor 2 are attached to the body of patient can read the data.
- These data are then compared to standard threshold values to check if the patient is in normal condition.
- Accordingly, the information about the patient is updated in the database on doctor's PC .
- Continuous monitoring of health parameters of the patient is being achieved by wireless transmission of sensors output through Zigbee technology.

In case if it exceed the threshold, and Buzzer will turn ON & information is sent to the doctor's mobile in the form of a SMS, through GSM modem describing that immediate visit is required by the doctor.

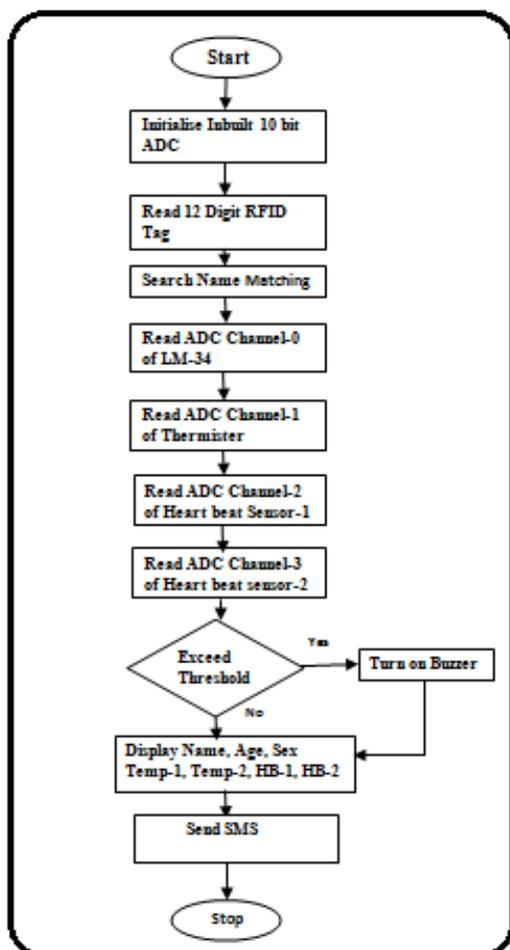


Figure 2: Flow chart

VI. EXPERIMENTAL SETUP

The building blocks for Zigbee based patient monitoring system for different health parameters like temperature & heart beat of multiple patients is shown in figure 3. The main components for the proposed system are the sensors used to monitor temperature i.e. LM34 and thermister , and for monitoring heartbeat i.e. HBS1 and HBS2, RFID reader, PIC microcontroller. RFID reader read the information of patients by their unique identification & data sent to Micro controller. As the patients are identified using their unique IDs these wireless sensors sense the data which then process it further and compare it with the threshold limit. After comparing the data is then transmitted to the patient monitoring system situated in doctor's cabin with the help of Zigbee module. The real time data (current status) regarding patients health gets recorded at the main server. Thus in the absence of doctors the recorded data helps to track the performance of the patient and to take the necessary measures by sending the data to doctors phone whenever needed.

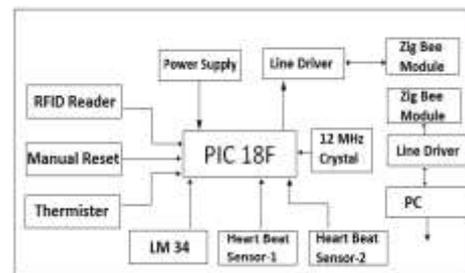


Figure 3: Patient Monitoring System

VII. IMPLEMENTATION AND RESULTS

In this paper the patient monitoring system for monitoring the health parameters of multiple patients simultaneously in indoor scenario is proposed. The parameters considered for the

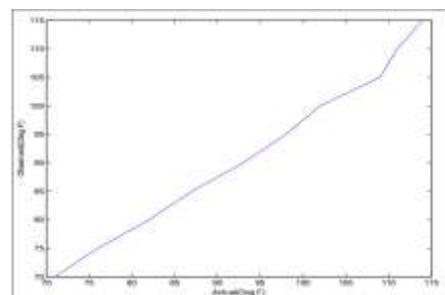


Figure 4: Graphical Result of performance evaluation of LM 34

experiments are temperature and heartbeat. The two sensors used for temperature monitoring are LM34 and Thermister. The results of performance evaluation of sensor LM34 and thermister for the patient monitoring system is represented graphically in Fig4, Fig5, Fig6 & Fig7 The experimental results shows that the performance results of LM34 sensor is more accurate and has better performance than thermister, as LM34 has the difference of only ± 1 or 2 F when compared with actual input temperature to observed output temperature while in case of thermister that difference goes upto ± 5 F.

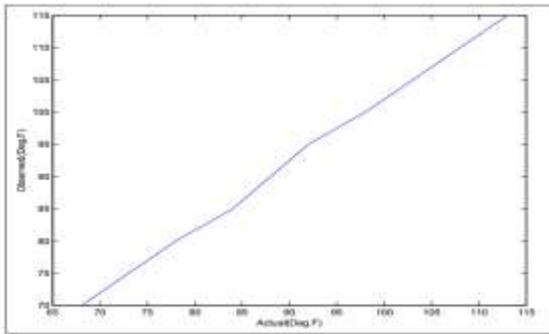


Figure 5: Graphical Result of performance evaluation of Thermister

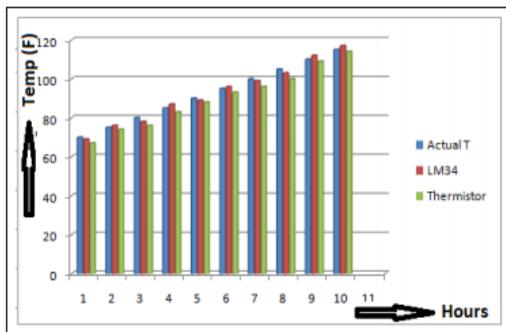


Figure 6: Graphical Representation of Comparison between LM 34 & Thermister.

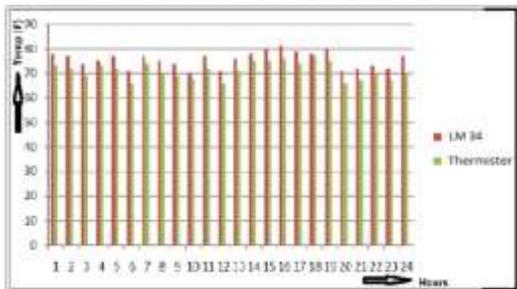


Figure 7: Graphical Result of performance evaluation between LM 34 & Thermister

Thus proving LM34 is more efficient and reliable than thermister. Where as Fig8, Fig9, Fig10 & Fig11 shows the graphical representation of performance evaluation of two heartbeat sensors HBS1 and HBS2. HBS1 is 1157 sensor which is readily available in market and HBS2 is prepared in order to compare the characteristics of both sensors.

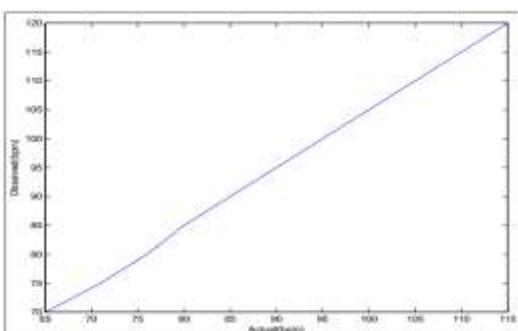


Figure 8: Graphical Result of performance evaluation of Heart beat sensor 1

Thus performance of sensor HBS1 is better than HBS2 as the observed measurements of HBS1 sensor has more accuracy in reading as compared to HBS2.

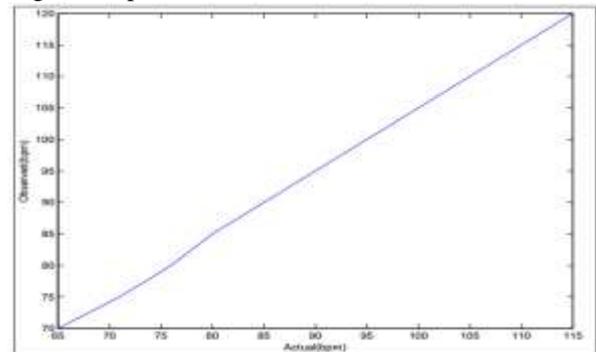


Figure 9: Graphical Result of performance evaluation of Heart beat sensor 2

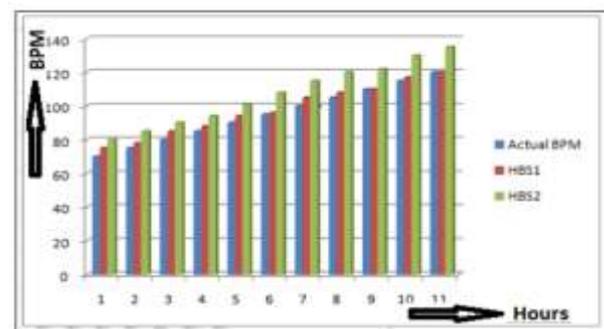


Figure 10: Graphical Representation of Comparison between HBS1 & HBS2.

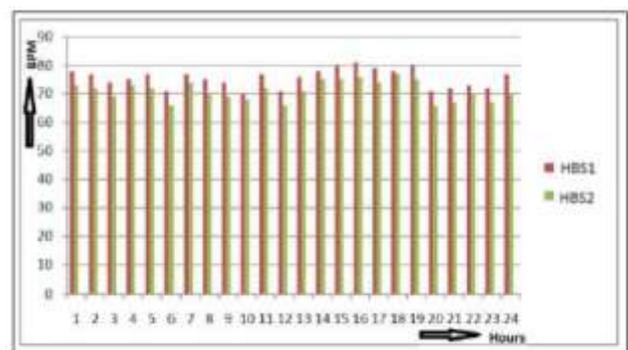


Figure 11: Graphical Result of performance evaluation between HBS1 & HBS2

Hours	Temperature(°F)		
	Actual	LM 34	Thermister
1	70	69	67
2	75	76	74
3	80	78	76
4	85	87	83
5	90	89	88
6	95	96	93
7	100	99	96
8	105	103	100
9	110	112	109
10	115	117	114

Table 1: Recorded Temperature (°F) per hour for LM 34 & Thermister

Hours	Heart Rate (BPM)		
	Actual	HBS1	HBS2
1	70	75	80
2	75	78	85
3	80	85	90
4	85	88	94
5	90	94	101
6	95	96	108
7	100	105	115
8	105	108	120
9	110	110	122
10	115	117	130
11	120	120	135

Table 2: Recorded Heart rate (BPM) per hour for HBS 1 & HBS 2

Temperature and Heartbeat readings from multiple patients are wirelessly transmitted to a central monitoring system using Zigbee technology. At the server each patient is identified using the Unique ID and thus doctors will get a detailed report of patient’s current status and state. Following graph shows the performance results of the experimental setup.

```

Name:David Patil
Age:20
Gender:M
Temp(LM34)F= 90
Temp(Therm)F= 94
BPM1= 60
BPM2= 64
AT
ATEO
AT+CMGF=1
AT+CMGS="+918446113306"
Temp1(F): 90 Temp2(C): 94 BPM1= 60 BPM2= 64

Name:Monali Patil
Age:32
Gender:F
Temp(LM34)F= 85
Temp(Therm)F= 84
BPM1= 95
BPM2= 90
AT
ATEO
AT+CMGF=1
AT+CMGS="+918446113306"
Temp1(F): 85 Temp2(C): 84 BPM1= 95 BPM2= 90
    
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Figure 12: Final output window obtained at the server end.

VIII. FUTURE WORK & CONCLUSION

In this paper, we conclude that we are able to transmit the data which is sensed from remote patient to the doctor’s PC by using wireless transmission technology, Zigbee. Experimentation was carried out by taking Temperature & Heart beat readings of multiple patients. Wireless biometric

System gives monitored patient’s health Status so that doctor will diagnose the patient & data can be store in the system. The performances of temperature and heartbeat sensors are measured and evaluated. Thus from the results temperature sensor LM 34 and the heartbeat sensor HBS1 appeared to have better performance over Thermister and HBS2 resp.

Wireless communication employed also enables rapid data transfer offering immediate results in a critical situation for multiple patients. Such a system developed successfully, promises to reduce the cost, effort and time put in traditional health visits to hospitals.

In future, this system can also be used for more health parameters with slight development along with help of new sensors for more efficient and accurate performance.

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