HUMAN HEALTH MONITORING SYSTEM USING WIRELESS SENSOR NETWORK

[1]Bala Nagendran A G, [2]Pradeep B, [3]Ashokkumar S, [4]Shanmuga Priya L,
[4]Assistant Professor,
[1,2,3,4] Department of Computer Science and Engineering,
Kamaraj College of Engineering and Technology, Virudhunagar, India.
[3]sak073243@gmail.com

Abstract

Wireless devices have invaded the medical area with a wide range of capability. To monitor the patient details in periodic interval is on overhead using existing technologies. To overcome this wireless sensor technology is needed. Sensors are used to gather patient's medical information without being injecting inside the body. By this remote monitoring, patient's data are collected. This adds the advantages of mobility. There is no need for a doctor to visit the patient periodically. This system can be implemented in hospitals as well as in residency of patient. The objective of this project is to design and implement a reliable, cheap, low powered, non-intrusive, and accurate system that can be worn on a regular basis and monitors the vital signs and send the parameters to the concerned doctor, if the threshold values set are crossed out. This data is also easily accessible by the physician through wireless network. The system measures various critical parameters such as temperature, blood pressure of patients. If abnormalities in the recorded parameters, then SMS will be sent to the medical authorities and the relatives concerned.

Index Terms—Patient Monitoring System, Temperature, Pulse Fall detection, IV flow.

I.INTRODUCTION

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices that use sensors to monitor physical or environmental conditions. In recent years, wireless sensor networks are used to structure home-care system in many researches.

Home health care is a wide range of health care services that can be given in your home for an illness or injury. Home health care is usually less expensive, more convenient, and just as effective as care you get in a hospital or skilled nursing facility (SNF).Healthcare is the maintenance or improvement of health via the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in human beings. Health care is conventionally regarded as an important determinant in promoting the general physical and mental health and well-being of people around the world. The role and the importance of health care systems in the quality of life and social welfare in modern society, have been broadly well recognized. Wireless based technology has shown to improve the lifestyle of people by providing early detection, convenience and flexibility. Hence people who live far from hospitals, immediate and quick treatment during an emergency can be obtained.

II.PROBLEM STATEMENT

In this project, one of the tasks is to design and implement a device that will measure the ECG. Appropriate electrodes have to be chosen and placed at correct locations on the body. A signal conditioning block is to be designed to filter out noise and amplification is added to increase the signal to distinguishable levels. The second task is to design and implement a system that will measure blood pressure. Pulse oximeter will be designed to measure the volume changes in the

blood. The PPG and ECG will then be combined to give a blood pressure reading. The accuracy of acquiring blood pressure using this method has to be determined. The final task of this project is to design and implement a temperature measurement system that will measure the ear's temperature. This has to be accurate to within ±0.2°C to have a reliable monitor.

III.OBJECTIVE

The objective of this project is to design and implement a reliable, cheap, low powered, non-intrusive, and accurate system that can be worn on a regular basis and monitors the vital signs and send the parameters to the concerned doctor, if the threshold value set are crossed out. This data is also easily accessible by the physician through wireless network. Here we develop affordable Low cost Wireless Human Health Monitoring System for rural area Hospital. The main objectives are: To provide assistance to patients at home when there is no one beside them. The entire system cost is very much less compared to others. To reduce the carrying load of treatment details and records. To also intimate the relative of the patient and also to the nearest hospital, when they are needed. To enable smooth integration of wireless body sensors and web/grid/cloud service architectures. To support the provisioning of quality and cost-effective healthcare service ubiquitously. To allow real-time diagnosis of patients healthcare conditions irrespective of time and locations.

IV.CHALLENGES

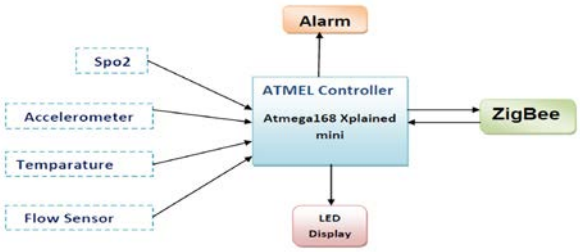
- Tamper proof control unit
- Power supply to unit / Battery backup
- Government initiative & approval
- User acceptance

V.SOCIAL IMPACT

The social conditions in which people live powerfully influence their chances to be healthy. Indeed factors such as poverty, food insecurity, social exclusion and discrimination, poor housing, unhealthy early childhood conditions and low occupational status are important determinants of most diseases, deaths and health inequalities between and within countries (WHO 2004). A range of factors has been identified as of health and these generally include: the wider socioeconomic context; inequality; poverty; social exclusion; socio-economic position; income; public policies; health services; employment; education; housing; transport; the built environment; health behaviors or lifestyles; social and community support networks and stress. A life course perspective provides a framework for understanding how these social determinants of health shape and influence an individual's health from birth to old age. Some of the social impacts are Society, Reduces the gap between poor people and high-level sophisticated medical facilities, Provides access for everyone to get modern medical facilities.

VI.SYSTEM DESIGN

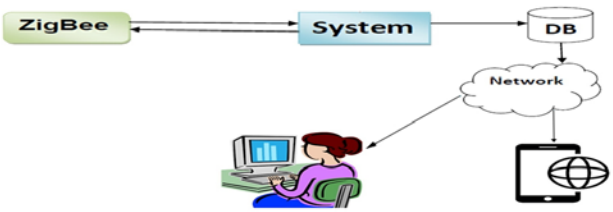
The proposed system overcomes the limitation of the existing system in the following manner. The proposed system architecture consists of three tiers. Tier-1 consists of sensor nodes wired to intermediate control unit. The data acquired through the sensors are transmitted through this control unit. Also the unit serves as power source to the sensor nodes. Tier-2 is the intermediate receiving unit which acquires the forwarded data. It is also responsible for storage, processing and displaying the data. Tier-3 is concerned with alert systems and data transmission to longer distances



through appropriate internet services.

Transmitter side

Receiver side



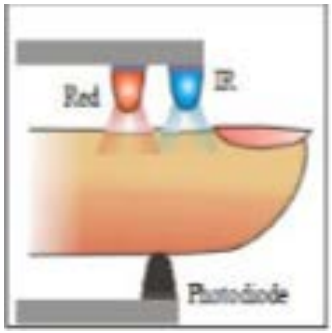
Working

Step 1: Attach the sensory device to the body of the patient and turn it on.
Step 2: The sensors, namely temperature sensor, Pulse rate sensor, accelerometer sensor and IV flow sensor will collect the data and transmit it through the ZigBee module attached on the ATmega microcontroller board.
Step 3: The sensed data will transferred to the online cloud storage for storing, analyzing and processing the data.
Step 4: The received data will be processed according to the specific channels which will be provided by IOT platform.
Step 5: All the parameters of the patient would be displayed to the corresponding person (Doctor).
Step 6: If the received values exceed the medically predefined thresholds, alerts will be sent to the corresponding members.

VII.METHODOLOGY

Pulse oximeter

To build a pulse oximeter selection of appropriate LED's and photodiodes are essential to obtaining a good signal.



(Figure 1: Transmission PPG)

A Red LED and an Infrared LED are normally used in a pulse oximeter to measure the blood volume changes that are used to determine the content of oxygenated and deoxygenated hemoglobin in the blood. For This project, the transmission technique is used on the finger to obtain the signal. Instead of using two LEDs.

The Red LED chosen for this project is 5mm, 2800 MCD, SSL-LX5093SRC/E that generates light with wavelengths of 660 nm. A light-to-voltage optical sensor, TSL250R- LF is chosen to measure the light transmitted through the finger. This sensor combines a photodiode and a trans impedance amplifier, producing a voltage output. It has peak spectral responsively at 750 nm; however, it also produces 100% responsively at 660 nm.

Thermistor

Thermistors are temperature sensitive resistors. All resistors vary with temperature, but thermistors are constructed of semiconductor material with a resistivity that is especially sensitive to temperature. However, unlike most other resistive devices, the resistance of a thermistor decreases with increasing temperature. That's due to the properties of the semiconductor material that the thermistor is made from.

(Figure 2: Temperature Sensor)

Thermistors are inexpensive, easily-obtainable temperature sensors. They are easy to use and adaptable. Circuits with thermistors can have reasonable output voltages - not the millivolt outputs thermocouples have. Because of these qualities, thermistors are widely used for simple temperature measurements. They're not used for high temperatures, but in the temperature ranges where they work they are widely used. Normal temperature ranges vary from 36.5°C to 37.5°C (97.7F to 99.5F).

Accelerometer

Automatic fall detection technology is a newcomer to the medical alert monitoring industry and it's not without some controversy, since they can't detect 100% of all falls. Read our most frequently asked questions in regards to medical alert devices with fall detection to learn more. The purpose of the system is Falls are a major problem for the elderly people leading to injury, disability, and even death. An unobtrusive, in-home sensor system that continuously monitors older adults for fall risk and detects falls could revolutionize fall prevention and care.

(Figure 3: Accelerometer)

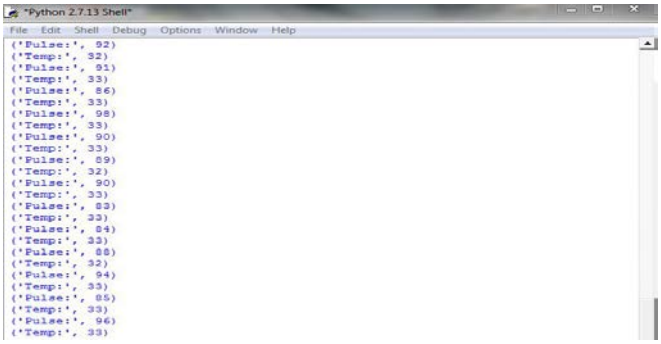
IV Flow Sensor

It indicates the amount of Intravenous fluid using IR Led light mechanism. It will alarm if any variation in the set parameters thus prevent air embolism that cause heart attack.Used to set fluid flow. Some errors do not have serious consequences, but others cause major harm, including deaths, and health professionals are always looking for ways to improve dispensing workflows.

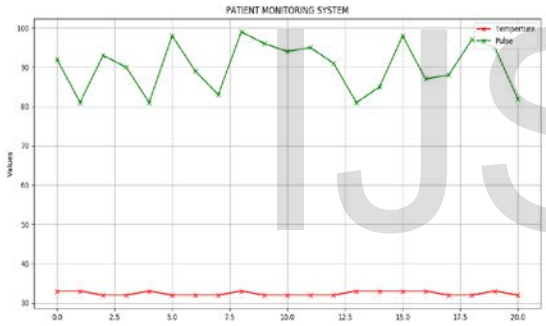
During intravenous (IV) infusion of fluid, the flow rate is obtained as the product of the drip rate (fluid drops per minute) and the drip factor of the tubing (number of drops / ml). The drip rate is set by regulator on the tubing, and it is monitored by visually counting the drops over 15 or 30 seconds to work out the rate per minute the rate set by the nurse may change due to several reasons. Every 15 to 20 minutes, a drip has to be checked to make sure it is flowing at the correct rate. The drip chamber is generally transparent and a photo-sensor assembly clipped around it can sense the drops falling in it.

An **IR sensor** is a device which detects IR radiation falling on it. There are numerous types of IR sensors that are built and can be built depending on the application. Proximity sensors (Used in Touch Screen phones and Edge Avoiding Robots), contrast sensors (Used in Line Following Robots) and obstruction counters/sensors (Used for counting goods and in Burglar Alarms) are some examples, which use IR sensors. An IR sensor is basically a device which consists of a pair of an IR LED and a photodiode which are collectively called a photo-coupler or an opto-coupler. The IR LED emits IR radiation, reception and/or intensity of reception of which by the photodiode dictates the output of the sensor. Now, there are so many ways by which the radiation may or may not be able to reach the photodiode.

III. OUTPUT



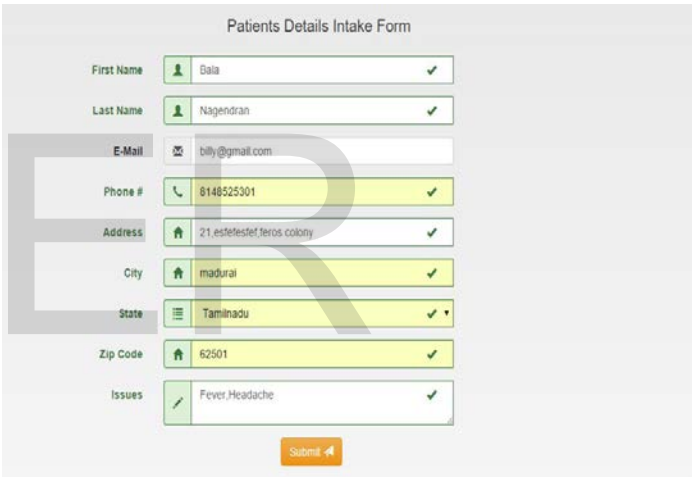
(Figure 4: Wirelessly received Patient data captured using pyserial port)



(Figure 5: Data plotted using Pyserial Graph)

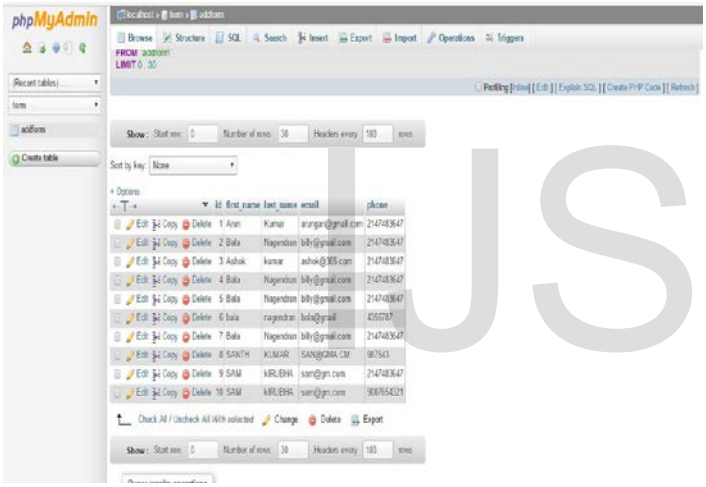
DATE	TIME	DESCRIPTIOI	VALUE
17-Mar-17	3:55:50 PM	Flow	0
17-Mar-17	3:55:50 PM	Flow	0
17-Mar-17	3:55:55 PM	Flow	0
17-Mar-17	3:56:00 PM	Flow	0
17-Mar-17	3:56:02 PM	Flow	1
17-Mar-17	3:56:02 PM	Flow	1
17-Mar-17	3:56:03 PM	Flow	1
17-Mar-17	3:56:28 PM	Pulse	77
17-Mar-17	3:56:32 PM	Pulse	81
17-Mar-17	3:56:50 PM	Alarm	0
17-Mar-17	3:57:16 PM	Temp	36
17-Mar-17	3:57:22 PM	Temp	36
17-Mar-17	3:57:33 PM	Pulse	92
17-Mar-17	3:57:51 PM	Flow	0
17-Mar-17	3:57:53 PM	Flow	0
17-Mar-17	3:58:03 PM	Flow	7
17-Mar-17	3:58:54 PM	Flow	3
17-Mar-17	3:58:55 PM	Flow	3
17-Mar-17	3:58:56 PM	Flow	3
17-Mar-17	3:59:12 PM	Temp	36

(Figure 6: Output of sensors data in VB)

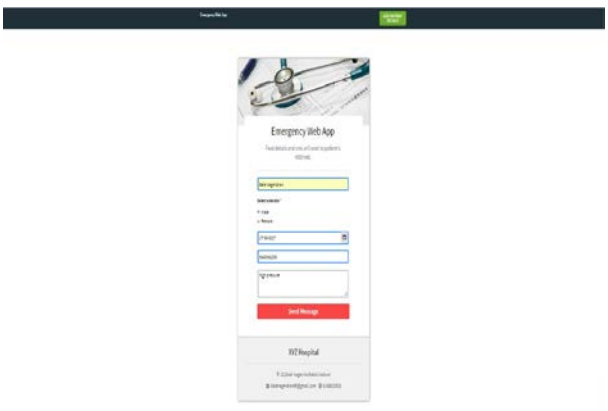


(Figure 7: Patient information feed through web app)

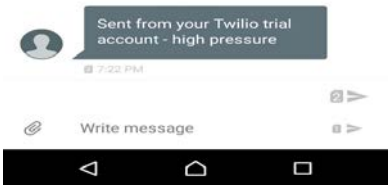
(Figure 8: Patient data viewed through browser)



(Figure 9: Patient data stored in mysql database)



(Figure 10: Emergency message sending web app)



(Figure 11: Emergency message to patient's relatives through Twillio sms service)

IX.CONCLUSION

The main aim of this project is to monitor the patient's wirelessly. The functionality of the kit gave satisfactory result with expected output. We also record the patient data in database that can be viewed from anywhere. Also incorporated emergency SMS alert using Twillio sms service. Our project helps to achieve triple aim of health care by improving patient's outcomes, access to care, and to make more cost effective.

Future work

Future work may include more number of sensors in a single system to provide flexibility. It can be enhanced by using different parameters such as retinal size, BP, weight and age can be included to control the parameters in the future. The system can also be used for neonatal infant monitoring with slight modification. Miniaturization of entire module that can fit into a bag pack - easily wearable. Battery powered with large Backup. GPS

tracking system to identify the location of the patient useful for emergency help. Patient activity measures through GAIT analysis – helpful to monitor their daily activities – walking, sleeping, etc.

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