International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

Design and Implimentation of Multi Patient Health Monitering

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ABSTRACT:
In a hospital health care monitoring system it is necessary to constantly monitor the patient's physiological parameters. For example a pregnant woman parameters such as body temperature and heart rate of the woman and their health condition. This paper presents a monitoring system that has the capability to monitor physiological parameters from multiple patient bodies. In the proposed system, a coordinator node has attached on patient body to collect all the signals from the wireless sensors and sends them to the base station. The attached sensors on patient's body form a wireless body sensor network (WBSN) and they are able to sense the heart rate, temperature and so on. This system can detect the abnormal conditions, issue an alarm to the patient and send alert trough Zigbee to the physician or doctor. Also, the proposed system consists of several wireless relay nodes which are responsible for relaying the data sent by the coordinator node and forward them to the base station. The main advantage of this system in comparison to previous systems is to reduce the energy consumption to prolong the network lifetime, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life. We have developed this system in multi-patient architecture for hospital healthcare and compared it with the other existing networks based on multi-hop relay node in terms of coverage, energy consumption and speed.

I. INTRODUCTION

Health care monitoring system serves an important mean to monitor the patient continuously even at remote places. Also due to the changing life, living in the large area, lack of time etc. are the various reasons that cause difficulty in monitoring the patients' health. According to the latest research the lonely life of the adults is increasing day by day due to various reasons such as disappearance of multidimensional family structure and busy schedule of the people which makes it difficult to keep continuous eye on the family member. Also if a patient is discharged from a hospital, there are conditions when the patients still has to be monitor red either by caretaker or doctor. In such situation if the patients are called to the clinic them it increases the queue outside the clinic, causes inconvenience to patient as well as doctor. Health care monitoring system for measurement of health parameters such as temperature, heart rate. In this system the monitored sensor data of the patient is stored onto the server. These physiological conditions of the patients are forwarded using serial module and if there is any change occurs in this continuously monitored data then an alert sound is directly forwarded to the care taker. A survey of E- healthcare information focuses on the very significant issue in the healthcare monitoring system that is to monitor and optimize the data quality extracted from environment, which can improve the diagnostics and decision making. Real time Interactive medical consultation uses CARA (Context Aware Real Time Monitoring System) to continuously keep an eye on the physiological parameters of the patient and then either to store the data on server or stream the data to remote location in real-time. The system also uses webcam for real time monitoring of the patient. E- Healthcare information focuses on the very significant issue in the healthcare monitoring system that is to monitor and optimize the data quality extracted from environment, which can improve the diagnostics and decision making.

Block diagram

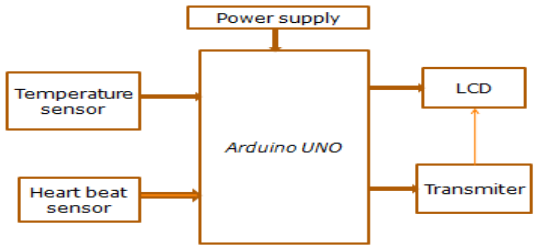

Fig: 1 NODE-1 & 2: Patient monitoring systems

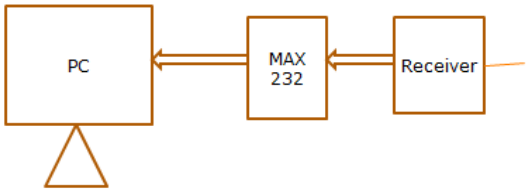

Fig 2: Doctor's mobile monitoring terminal

II. LITERATURE REVIEW

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a processor and software are involved in the preparation of their lunch or dinner. This is in direct contrast to the personal computer in the family room. It too is comprised of computer hardware and software and mechanical components (disk drives, for example). However, a personal computer is not designed to perform a specific function rather; it is able to do many different things. Many people use the term general purpose computer to make this distinction clear. As shipped, a general-purpose computer is a blank slate; the manufacturer does not know what the customer will do wish it. One customer may use it for a network file server another may use it exclusively for playing games, and a third may use it to write the next great American novel. Frequently, an embedded system is a component within some larger system. For example, modern cars and trucks contain many embedded systems. One embedded system controls the anti-lock brakes, other monitors and controls the vehicle's emissions, and a third displays information on the dashboard. In some cases, these embedded systems are connected by some sort of a communication network, but that is certainly not a requirement. At the possible risk of confusing you, it is important to point out that a general-purpose computer is itself made up of numerous embedded systems. For example, my computer consists of a keyboard, mouse, video card, modem, hard drive, floppy drive, and sound card-each of which is an embedded system. Each of these devices contains a processor and software and is designed to perform a specific function. For example, the modem is designed to send and receive digital data over analog telephone line. That's it and all of the other devices can be summarized in a single sentence as well. If an embedded system is designed well, the existence of the processor and software could be completely unnoticed by the user of the device. Such is the case for a microwave oven, VCR, or alarm clock. In some cases, it would even be possible to build an equivalent device that does not contain the processor and software. This could be done by replacing the combination with a custom integrated circuit that performs the same functions in hardware. However, a lot of flexibility is lost when a design is hard-cooled in this way. It is mush easier, and cheaper, to change a few lines of software than to redesign a piece of custom hardware.

III. DESIGN APPROACH

This proposed patient monitoring has 2 sensors. First one is a temperature sensor, second is Heartbeat sensor and This project is very useful since the doctor can monitor patient health parameters just by Doctor's Mobile monitoring Terminal .In a hospital health care monitoring system it is necessary to constantly monitor the patient's physiological parameters. For example a pregnant woman parameters such as body temperature and heart rate of the woman and their health condition. This paper presents a monitoring system that has the capability to monitor physiological parameters from multiple patient bodies. In the proposed system, a coordinator

node has attached on patient body to collect all the signals from the wireless sensors and sends them to the base station. The attached sensors on patient's body form a wireless body sensor network (WBSN) and they are able to sense the heart rate, temperature and so on. This system can detect the abnormal conditions, issue an alarm to the patient and send a SMS/E-mail to the physician. Also, the proposed system consists of several wireless relay nodes which are responsible for relaying the data sent by the coordinator node and forward them to the base station. The main advantage of this system in comparison to previous systems is to reduce the energy consumption to prolong the network lifetime, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life. We have developed this system in multi-patient architecture for hospital healthcare and compared it with the other existing networks based on multi-hop relay node in terms of coverage, energy consumption and speed. The Arduino UNO board continuously reads input from these 2 sensors. Then it sends this data to the cloud by sending this data to particular base systems. Then this action of sending data to Zigbee is repeated after a particular interval of time. For example in this project, we have sent data after every 30 seconds.

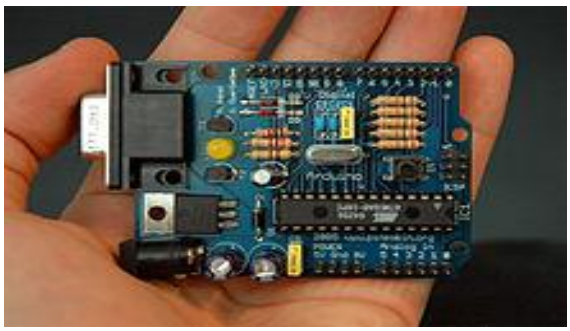

Fig 3(a): Arduino board

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila,[a] Duemilanove,[b] and current Uno[c] provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins.

Fig 3(b): Arduino board pins

These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board[15] and Boarduino[16] boards may provide male header pins on the underside of the board that can plug into solderless breadboards. Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

Heart beat sensor

Fig 4: Heart beat sensor

This heart beat sensor is designed to give digital output of heat beat when a finger is placed inside it .When the heart detector is working, the top-most LED flashes in unison with each heart beat. This

digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

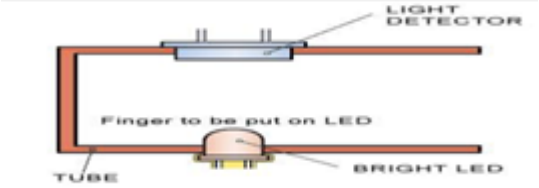

Fig 5: Heart beat sensor construction

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the light must pass through finger and detected at other end. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated on top by a LED which blinks on each heart beat. The pulse signal is applied to the input of Arduino uno which is monitored by the program whenever this input goes high. Internally to Arduino uno , there is a counter which counts how many 1ms intervals there are between two high going heart beat pulses. This number is then divided by 60,000 and the result is the pulse rate. For example, if the pulse rate is 60 BPM (beats per minute) there will be a pulse every second. The duration of one heart beat will be one seconds or 1000 x 1ms. Dividing 60,000 by 1000 will give the correct result of 60 which is shown on the display. If there is invalid result (BPM>200) it is invalid and waits for next cycle. The code does not average reading, but shows instantly. To steady reading averaging of 10 past values can be implemented.

Temperature Sensor (LM 358)

These devices consist of two independent, high-gain, frequency-compensated Operational Amplifiers designed to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 32 V (3 V to 26 V for the LM2904 , and VCC is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage. Applications include transducer Amplifiers dc amplification blocks, and all the conventional Operational Amplifier circuits that now CAN be implemented more easily in single-supply-voltage systems. For example, these devices CAN be operated directly from the standard 5-V supply used in digital systems and easily provide the required Interface electronics without additional 5-V supplies. Complete LM358 datasheet specifications. The LM358 series consists of two independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

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Application areas include transducer amplifier, DC gain blocks and all the conventional OP-AMP circuits which now can be easily implemented in single power supply systems.

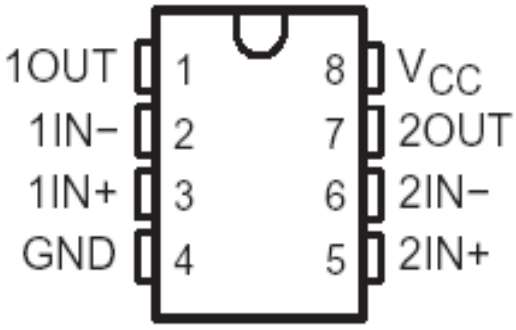

Fig 6: Pin diagram

ZIGBEE Module

Fig 7: Zigbee module

Several standards currently exist for wireless networks, including Bluetooth, WiFi, and WiMax. Zigbee is a new standard for wireless sensor and control networks. It has the following characteristics:

- Low battery consumption. A Zigbee end device should operate for months or even years without needing its battery replaced.
- Low cost.
- Low data rate. The maximum data rate for a Zigbee device is 250Kbps.
- Easy to implement.
- Supports up to 65,000 nodes connected in a network.
- Zigbee can automatically establish its network.
- Zigbee uses small packets compared with Wife and Bluetooth.

Shows a comparison of Zigbee characteristics with those of WiFi and Bluetooth.shows that Bluetooth, while similar in functionality to Zigbee, does not offer the range of topologies, and its standby current is nearly 70 times more than ZigBee. Of the three wireless networks under comparison, ZigBee is the only one that offers mesh topology. In addition, a ZigBee end device can be in sleep mode and still keep its association with its network. Zigbee is considered a more sophisticated network when compared to either Bluetooth or Wifi. the needs of communication of data with simple structure like the data from the sensors. The explosion in wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. There have been a multitude of proprietary protocols for control applications, which bottlenecked interfacing. Need for a widely accepted standard for communication between sensors in low data rate wireless networks was felt. As an answer to this dilemma, many companies forged an alliance to create a standard which would be accepted worldwide. It was this Zigbee Alliance that created Zigbee. Bluetooth and Wi-Fi should not be confused with Zigbee. Both Bluetooth and Wi-Fi have been developed for communication of large amount of data with complex structure like the media files, software etc.

ZigBee offers basically four kinds of different services:

•Extra Encryption services (application and network keys implement extra 128b AES encryption)

•Association and authentication(only valid nodes can join to the network).

•Routing protocol: AODV, a reactive ad hoc protocol.

•Application Services: An abstract concept called "cluster" is introduced. Each node belongs to a predefined cluster and can take a predefined number of actions. Example: the "house light system cluster" can perform two actions: "turn the lights on", and "turn the lights off

Security in Zigbee:

Triple Security in ZigBee: Link, Network and Application layer Encryptions

XBee ZigBee networks may use three different keys:

Link Key: it is used to send the 'Network Key' cyphered. If this key is set to zero, then the key will be sent without cyphering to the joining nodes. Setting this key using Waspmote API is as simple as:

xbeeZB.setLinkKey("link_key_secret_");

Network Key: it is used to cypher all the data sent within the network. Setting this key using Waspmote API is as simple as:

xbeeZB.setNetworkKey("network_key_encr");

Application Key: it is used to cypher the data at the application layer. It is unique between each pair of nodes. This key is not configurable, though we must

specify if it is going to be used or not with the following function:

xbeeZB.setAPSencryption(XBEE_ON);

IV. RESULT

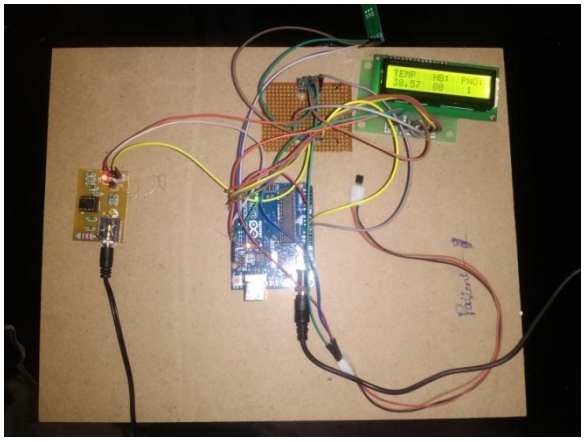

Fig 8(a): Readings of patient 1

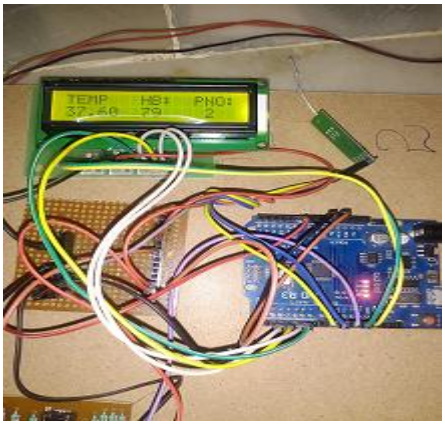

Fig 8(b): Readings of patient 2

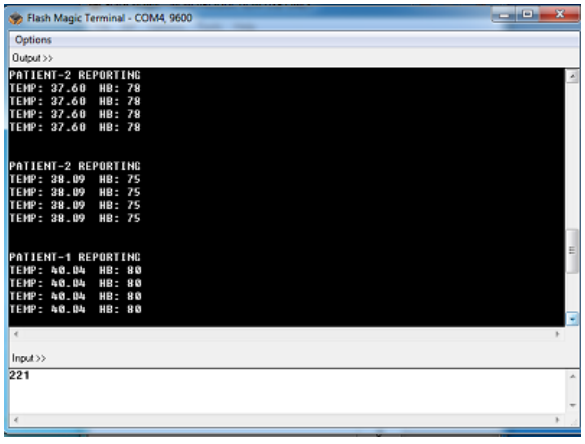

Fig 8(c): Readings in doctors terminal

V. ADVANTAGES

1) Monitoring proves really helpful when we need to monitor & record and keep track of changes in the health parameters of the patient over the period of time. So with the IOT health monitoring, we can have the database of these changes in the health parameters. Doctors can take the reference of these changes or the history of the patient while suggesting the treatment or the medicines to the patient.

2) Hospital stays are minimized due to Remote Patient Monitoring.

3) Hospital visits for normal routine checkups are minimized.

4) Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files. Or even the digital records which are kept in a particular computer or laptop or memory device like pen- drive. Because there are chances that thesse devices can get corrupt and data might be lost. Whereas, in case of IOT, the cloud storage is more reliable and does have minimal chances of data loss.

VI. FUTURE DEVELOPMENT

We can add a GPS module in patient health care monitoring using Arduino Uno and wife module project. This GPS module will find out the position or the location of the patient using the longitude and latitude received. Then it will send this location to the cloud that is the IOT using the Wi-Fi module. Then doctors can find out the position of the patient in case they have to take some preventive action

VII. CONCLUSION

The developed system in the presented work is low cost, and light weight. It consists of sensing nodes. These nodes can be strategically placed on the human body and capable of creating a wireless sensor network (WSN) to monitor various physiological parameters. These parameters can be monitored for a long period of time and provide real-time feedback to the user and medical staff. The

system is also capable of providing reliable and secure communication. A successful interaction among the Arduino UNO microcontroller and the different sensors fitted on the kit is achieved. The system further promises to revolutionize the health care monitoring approach. In this work temperature sensors are used to collect physiological data from patients. This healthcare monitoring sends an emergency notification message to the friends or relatives if any patient's health condition is critical.

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