IOT BASED PATIENT HEALTH MONITORING SYSTEM

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ABSTRACT

Technology plays the major role in healthcare not only for sensory devices but also in communication, recording and display device. It is very important to monitor various medical parameters and post operational days. Hence the latest trend in Healthcare communication method using IOT is adapted. Internet of things serves as a catalyst for the healthcare and plays prominent role in wide range of healthcare applications. In this project the LPC2148 microcontroller is used as a gateway to communicate to the various sensors such as temperature sensor and Heart Beat sensor. The microcontroller picks up the sensor data and sends it to the network through GSM/GPRS and hence provides real time monitoring of the health care parameters for doctors. The data can be accessed anytime by the doctor. The controller is also connected with buzzer to alert the caretaker about variation in sensor output. But the major issue in remote patient monitoring system is that the data as to be securely transmitted to the destination end and provision is made to allow only authorized user to access the data. The security issue has been addressed by transmitting the data through password protected with GPRS and the users/doctor can access the data by logging to the html webpage. At the time of extremity situation alert message is sent to the doctor through GSM/GPRS module connected to the controller. Hence quick provisional medication can be easily done by this system. This system is efficient with low power consumption capability, easy setup, high performance and time to time response.

Keywords

LPC2148 controller, Temperature sensor, GPRS Module, LCD Display, Buzzer, Heart Beat Sensor.

I. INTRODUCTION

Today Internet has become one of the important part of our daily life. It has changed how people live, work, play and learn. Internet serves for many purpose educations, finance, Business, Industries, Entertainment, Social Networking, Shopping, E-Commerce etc. The next new mega trend of Internet is Internet of Things (IOT). Visualizing a world where several objects can sense, communicate and share information over a Private Internet Protocol (IP) or Public Networks. The interconnected objects collect the data at regular intervals, analyse and used to initiate required action, providing an intelligent network for analyzing, planning and decision making. This is the world of the Internet of Things (IOT).The IOT is generally considered as connecting objects to the Internet and using that connection for control of those objects or remote monitoring. But this definition was referred only to part of IOT evolution considering the machine to machine market today. But actual definition of IOT is creating a brilliant, invisible network which can be sensed, controlled and programmed. The products developed based on IOT include embedded technology which allows them to exchange information, with each other or the Internet and it is assessed that about 8 to 50 billion devices will be connected by 2020. Since these devices come online, they provide better life style, create safer and more engaged communities and revolutionized healthcare. The entire concept of IOT stands on sensors, gateway and wireless network which enable users to communicate and access the application/information. Be that as it may, among all the regions no place does the IOT offer more prominent guarantee than in the field of health awareness. As a saying goes "Health is wealth" it is exceptionally crucial to make utilization of the innovation for better wellbeing. Consequently it is obliged to add to an IOT framework which gives secure health awareness checking. So outlining a savvy medicinal services framework where client information is gotten by the sensor and sent to the cloud through GPRS and permitting just approved clients to get to the information.

II. LITERATURE SURVEY

In previous days especially in medical field wireless sensors are not available these are with wires and their power consumption is more therefore they getting more costly . Every time the doctors or nurse should have to keep the record of patient's parameters manually. Therefore there is no allowance to patients to move freely etc. these things are very tedious.

Also at earlier stages a real-time patient monitoring system prototypes have been designed to obtain various physical parameters. But there were several constraints like security of the patient, Interference due to mass deployment. Also added to these were design constraints like battery power consumption and sensor calibration to different working conditions and controllers. The above survey is taken from Wikipedia.

In [1] Kesavarapu et al. proposed a portable human health monitoring system for analysing the basic physical parameter. In this the communication is via SMS in the critical case of patient. This project used the GSM module for the purposed of sending SMS.

In [2] Moeen et al.reviews on opportunities and challenges in Health Monitoring and Management using IoT sensing with cloud based processing. They reviewed the current state and projected future directions for integration of remote health monitoring technologies into the clinical practice of medicine.

In [3] Alok et.al reviews healthcare applications of the internet of things. The IoT based heath care systems are clinical care, which provides continuous automated flow of information about patients and remote monitoring which enables wirelessly monitoring patients.

The question of how the combination of BP meter, Pulse oximator and temperature sensor with raspberry pi becomes the part of health monitoring based on the IoT is addressed in[4]

In [5] Prabhakaran R.et. al describes the monitoring human health using Internet Of Things (IOT) from a remote location. It includes Zigbee modules which collect the measured parameters from Sensor node. The data should be processed and uploaded to the internet world using web interface. Also the GSM module is connected to send the critical condition to the doctor.

III. PROPOSED SYSTEM

The main idea of the designed system is to continuous monitoring of the patients over internet. The Proposed System architecture for IOT Healthcare is as shown in the Figure. The model consists of LPC2148 Microcontroller, Temperature sensor(LM35), Heart Beat Sensor, Liquid Crystal Display(16x2), GPRS Modem, Piezo Electric Buzzer, Max232, Regulated Power Supply. In this system LPC2148 Microcontroller collects the data from the sensors and sends the data through GPRS Protocol. The Protected data sent can be accessed anytime by the doctors by typing the corresponding unique IP address in any of the Internet Browser at the end user device(ex: Laptop, Desktop, Tablet, Mobile phone). The Microcontroller is connected to GPRS Modem which provides information to doctor/caretaker when the heart rate is greater than100 or less than 60 and when the temperature is greater than 40. During this time the buzzer turns on and alerts the caretaker. LCD is connected to microcontroller to display the transaction process and healthcare data. And the user interface html webpage will automatically refresh for every 15 seconds hence patient health status is continuously sent to the doctor. Hence continuous monitoring of patient data is achieved.

IV. DESIGN

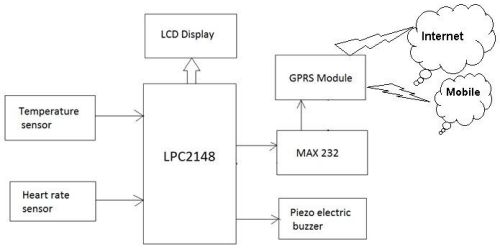

Fig: Block Diagram

System structure and working principle:

The system is composed of two main sections. The first section is to measure the parameters such as temperature and heart beat. And second section is to send all the data to LPC2148 microcontroller for displaying it on LCD display. And if any of the data falls under critical category then the microcontroller with the help of GPRS module sends a message to the concerned person, Also the user interface html webpage will automatically refresh for every 15 seconds hence patient health status is continuously sent to the doctor.

Temperature sensor:

LM35 is an integrated circuit whose output value is directly proportional to the temperature (in oC).It does not need any external calibration for maintain an accuracy at room temperature because it is internally calibrated.

LM35 doesn't required any output voltage be amplified. LM35 produce low output impedance, linear output. Parameter values commonly used in this system:

- Voltage ranges from 4 to 30v
- 5v or 12 v are generally used.
- scale factor of LM35 is .01V/oC

Heart rate sensor:

The heart rate is the one of the important parameter in the health assessment. The adult healthy human has a heart rate between 60and 100 beats per minute. Basically, the heart rate measurement is an indirect method. The heart rate sensor used in this proto type is smart Q heart rate sensor. It consist of easy sense unit present in it. Heart beat can be measured manually by checking one's pulses at two locations- wrist (the radial pulse) and the neck (carotid pulse). By using a sensor Heart Beat can be checked based on optical power variation as light is absorbed during its path through the blood as the heart beat changes. The heart rate sensor is based on the principle of photo plethysmography. It calculate the change in volume of blood that flow from any organ of the body which causes a change in the light intensity through that organ (a vascular region). It consists of two regions one is Transmission and reflection. Light passes from the light emitting device is transmitted through any vascular region of the body and received by the

detector. Light emitted from the light emitting device is reflected by the regions. Basically heartbeat sensor consists of a light emitting diode and a detector. It monitors the light level travel through the vascular tissue of the fingertip and the corresponding variations in light intensities that occurs as the blood volume will changes in the tissue. The Easy Sense unit can detect that the Smart Q Heart Rate Sensor light and produces the result accordingly. Procedure to use this sensor first keep the finger infront of the LED so that light will pass from vascular tissue of the fingertip to easy sense unit and it compared with each heart pulse so easy sense unit detect that signal and gives result in LCD display.

Microcontroller and GPRS module:

The LPC2148 receives the data from the heart rate sensor and the temperature sensor, the output of temperature sensor is in analog form. So the microcontroller converts the analog data into the digital one by using the inbuilt ADC. After the conversion the microcontroller sends the data to LCD to display the temperature and heart rate of patient, which is visual to patient and its caretaker. For every patient its maximum and minimum body temperature and heart rate will be stored in the microcontroller. So when sensors gives the input to the microcontroller it compares with the threshold values which was decided by the doctor. If the values exceeds the threshold values or lower than the threshold value then buzzer is ON.
And microcontroller sends the data to GPRS Module at this critical condition. And the SMS is send to doctor in which critical heart rate or temperature will be mention. Also through GPRS module the patient data will be uploaded to the webpage. The doctor, patient caretaker and the patient relative will be accessed the data through any place and any device.

MAX 232:

Max232 is a dual driver/receiver which converts TTL level to RS232 level. These receivers usually as the threshold of 1.3v and can accept +/- 30v of supply. When Max-232 IC receives the TTL level it converts it in to voltage levels i.e. logic0 changes to voltage between +3 and +15v and logic1 changes to voltages between -3 and -15v.

Buzzer:

Buzzer is an electronic device used to produce sound. In the project the buzzer is used to alert the caretaker during extreme condition. This sound indicates that the patient health is in risk.

Flowchart of temperature sensing:

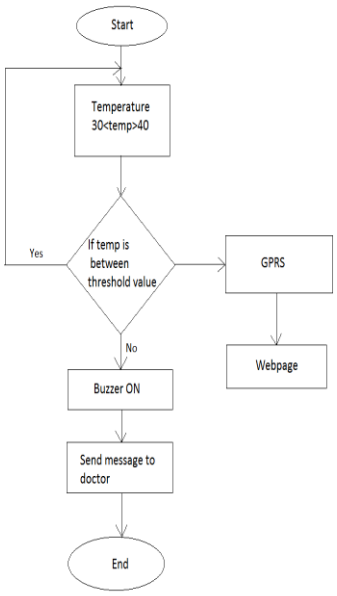

Fig: Flowchart for temperature detection

Flowchart of heart beat detection:

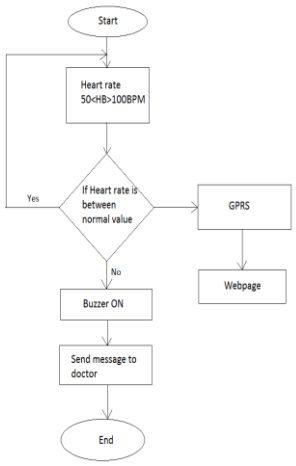

Fig: Flowchart for heart beat monitoring.

HARDWARE DESIGN

Circuit Diagram:

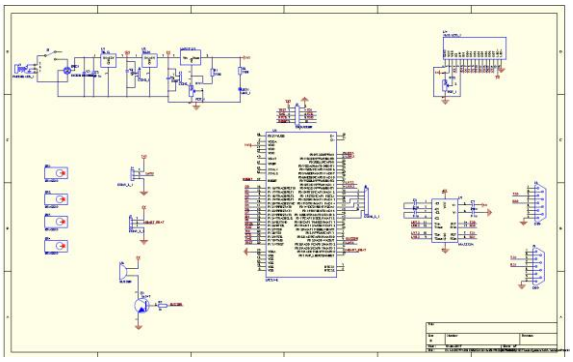

Fig. Circuit diagram

PCB layout:

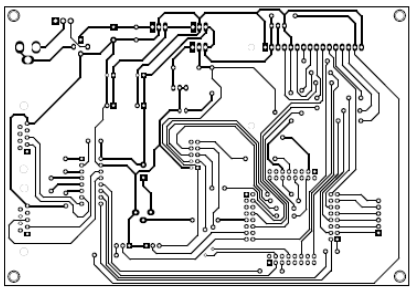

Fig. PCB layout

System hardware:

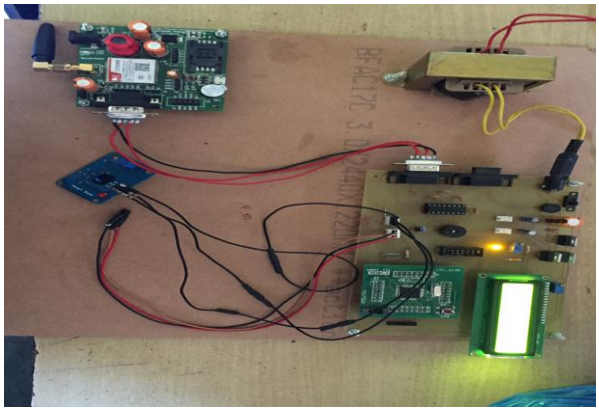

Fig. Hardware designed

SOFTWARE DESIGN

Software Use:

1) Microvision Kill.5: uvision kill 5 is used for the ARM 7 programming.

2) Flash Magic: Used for programming.

3) Protel: This software is used for circuit designing and PCB layout.

4) Proteus: This is used for simulation purpose.

Power supply simulation:

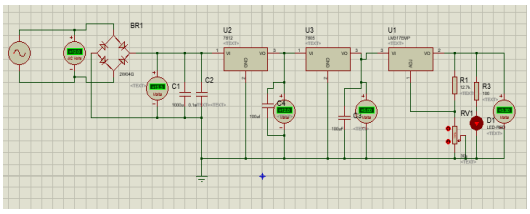

Fig. Simulation of power supply.

Simulation of System circuit:

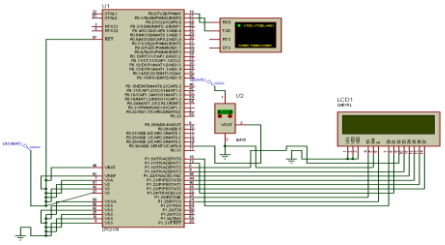

Fig. Circuit simulation of system.

V. RESULTS

Result for Heart Beat measurement and displayed:

Fig. Heart Beat displayed.

Result for temperature measurement and displayed:

Fig. Temperature measurement.

Result for message received at mobile:

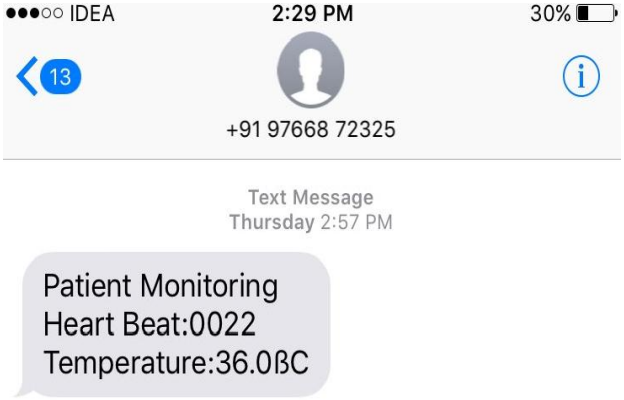

Fig. Received message on mobile

Result for website:

Fig. Web login page.

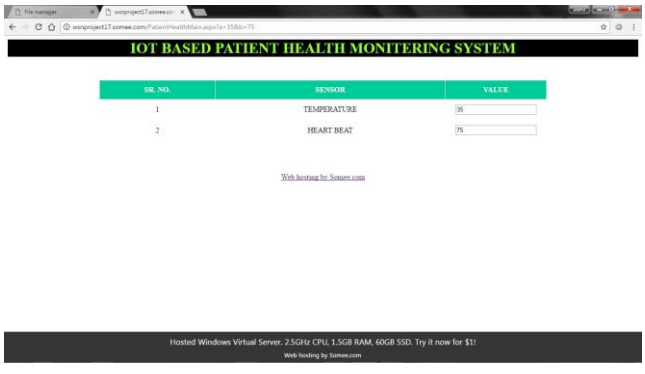

Fig. Data uploaded at web.

VI. ADVANTAGES

1. Bridging the gap between doctor and patients.
2. Best to be used in rural areas.
3. Compare with compact sensors it gives better performance.
4. Easy to operate.
5. Even when patient is in unconscious condition, all the parameters will be sensed and doctor will be cautioned, thus it reduces doctor's workload and also gives more accurate results.
6. Decreased Costs–When healthcare providers take advantage of the connectivity of the healthcare solutions, patient monitoring can be done on a real time basis, thus significantly cutting down on unnecessary visits by doctors. In particular, home care facilities that are advanced are guaranteed to cut down on hospital stays and re-admissions.
7. Improved Disease Management – When patients are monitored on a continuous basis and health care providers are able to access real time data, diseases are treated before they get out of hand.

VII. CONCLUSION

With the wide use of internet this work is focused to implement the internet technology to establish a system which would communicate through internet for better health. Internet of things is expected to rule the world in various fields but more benefit would be in the field of healthcare. The proposed IoT based patient health monitoring system is integration of embedded and IoT application, provides platform in cost efficient manner, solution for patient and doctor located at remote location. The key objective of developing patient monitoring system is to reduce health care cost by reducing emergency room, physician office visits, hospitalization and diagnostic testing procedures.

In this project work is done to design an IoT based patient monitoring system using LPC2148 microcontroller. In this work LM35 temperature sensor and heartbeat sensor is used to read the temperature and heart rate of patient and microcontroller picks up the data and send it through GSM commands. The data is also sent to the LCD for display so patient or healthcare can know his health status. During extreme conditions to alert the doctor message is sent to doctor's cell phone through GSM modem connected and at the same time the buzzer turns on to alert caretaker. The doctors can view the sent data by logging to html webpage using unique logging ID and page refreshing option is given so continuously data reception is achieved. Hence continuous patient monitoring system is achieved.

VIII. FUTURE SCOPE

1. Multiple parameters like blood pressure, retinal size, age and weight can be included as controlling parameters in the future.
2. The whole health monitoring system which we have proposed can be integrated into small compact unit as cell phone or wrist watch.
3. EEG, ECG and other health parameters can be also monitored.

IX. REFERENCES

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