A New Paradigm in an Intelligent Patient Monitoring System in Hospital

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Abstract— An Intelligent Patient monitoring system will monitor the patient health condition especially in rural areas where there is lack of health care facilities. In this article, the important health parameters of the patient like body temperature, pulse rate and patient location are measured using smart wearable temperature sensor, pulse rate sensor and GPS sensor. The measured health data was processed using Arduino board by some intelligent logic to compare the patient health data with threshold to detect any abnormality in health condition of patient in order to alert doctor immediately. The patient data was sent over the GSM as SMS, in order to maintain the history of the patient health. The main aim of this article is to provide health care facilities in rural areas where the doctors were not available continuously but patient needs the health monitoring.

Keywords: ARDUINO UNO, GPS Sensor, GSM, LM35, Pulse rate sensor.

I. INTRODUCTION

Now days with the use of GSM technology the data can be transmitted to any other place for remote monitoring. The patient was located at one place and the doctor was located at some other place. The patient health data was captured using sensors and this data were sent to Arduino board for processing. The processing data sent over GSM to the place where the doctor was located for remote monitoring of patient.

II. LITERATURE REVIEW

Srushti jagtap et al [1] explained in his paper about health monitoring by using various sensors such that pressure, temperature etc. by integrating with LPC2148 micro controller and finally the output will be displayed on liquid crystal display.

Md julhas Hossain et al [2] discussed patient monitoring using IOT and described important health parameters such as heart rate, blood glucose level etc. and validate data to figure out any sort of medical emergency. From diagnosing heart disease to know ICU bed availability in the nearest hospitals, digital technology is all to assist.

Rishi Kumar et al [3] narrated that how the sensor information will be read and processed by Arduino supported Wi-Fi enable node MCU controller, Thus, IOT based patient monitoring system will monitor patient's health status and save life on time.

Bhashipangu.Tejaswi and Dasari.Ramesh [4] were realized that patient parameters were captured from various sensors and transmitted to some other place using IOT and display it on Liquid crystal display and UART.

Priyanka A J and Dr. N Manja Naik [5] explained that sensors data was given to LPC2148 micro controller for processing and finally the data will be transmitted to remote location using GSM modem.

Asha G Hagargund et al [6] discussed that patient data from various sensors were processed using Arduino and transmit to remote location using wireless sensor network.

Mohammad salah Uddin and Jannat Binta Alam [7] worked on how to get patient data from sensors and process it then finally transmit to remote location using sensor networks.

Umera banu et al [8] discussed that the patient data can be transmitted after processing by micro controller using power line communication.

Shailesh V et al [9] worked on patient data and location were tracked and recorded at some other location using ZigBee.

Mr. Khyamling A. Parane et al [10] proposed that patient data acquired through various types of sensors and how to process it and transmit using IOT Cloud.

Rishikesh D. borse et al [11] explained that continuously monitor patient using smart wearable sensors and to provide early warnings based on patient data for alerting doctors in advance.

Nikhil Nair and Kiran K A [12] realized that patient data acquired using various sensors and processed by raspberry pi and processed data sent over an IOT cloud.

Ning Hu et al [13] worked on how to encode the patient data which was obtained from smart wearable sensors and store for long time and transmit to some other location using IOT cloud.

Jaishankar et al [14] realized that sensor data collected and sent using IOT cloud in order to alert doctor immediately.

Imen Ben Ida et al[15] proposed that early warnings based on sensors data so that doctor can alert in advance to save the patient life.

Section [1] gives the introduction and clear idea about topic. Section [2] covers literature survey. Section [3] covers basic block diagram. Section [4] covers methodology followed here to generate messages to alert the doctor and and tables related to software logic. Section [5] covers results and analysis. Section [6] references.

III. BLOCK DIAGRAM
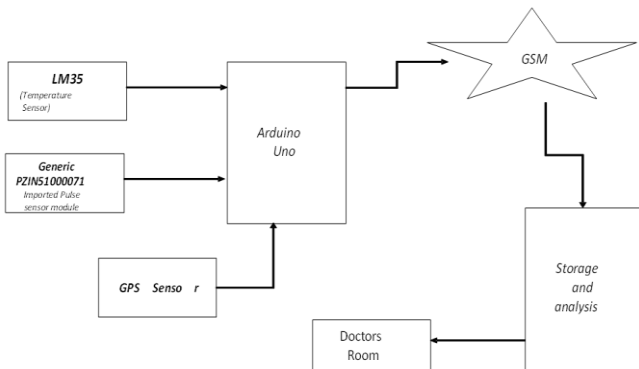
FIG-I: Block diagram

It acquires patient health data using smart wearable sensors like temperature sensor (LM35) and pulse rate sensor (Generic PZIN51000071 Imported pulse sensor module). This was processed using Arduino board. This board perform threshold level fixation for health data by that it can give various alerts to doctors which are located at faraway from patient via GSM network. The data will be processed and filtered by intelligent logic in software viz data compared with threshold, if any abnormality found a message will be sent over GSM. This GSM network will store the patient health data for long time and it helps to track patient record and while treating the patient also effectively.

IV. METHODOLOGY

LM35 Sensor is used to measure the temperature levels. It has three terminals namely power, data and ground. Generic PZIN51000071 Imported Pulse sensor module is used to measure the heart rate. Arduino Uno board is a microcontroller device which are used to process the sensor data and generates alert, so that doctor can alert immediately.

Table-I: Threshold Levels for patient monitoring

Range	Temperature	Heart Rate
LOW	< 95F (35 deg)	< 50 bpm
NORMAL	> 95F (35 deg) and < 100.4 F (38 deg)	>50 bpm and <100 bpm
HIGH	> 100.4 F (38 deg)	> 100 bpm

Table-II: Intelligent logic in Arduino

| Temperature	Heart Rate	Display
< 95 F (35 deg)	< 50 bpm]	Low Temperature Low Heart rate
< 95 F (35 deg)	> 100 bpm]	Low Temperature: High Heart rate
> 100.4 F (38 deg)	< 50 bpm]	High Temperature Low Heart rate
>100.4 F (38 deg)	> 100 bpm]	High Temperature High Heart rate
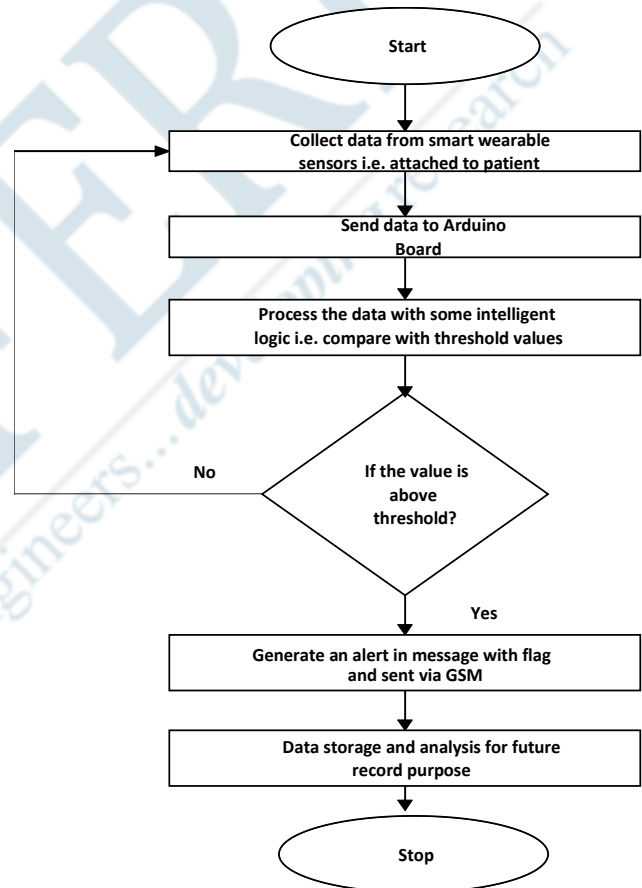
FIG-II Patient monitoring flow diagram

The patient data contain temperature, heart rate and GPS location. This information was given to Arduino for processing. Here the processing is done based on threshold comparison with patient data. If the patient data is above or below the threshold value, that abnormality was denoted by micro controller and generates and alert message which was transmitted using GSM network so that the doctor will alert immediately to provide better service to the patient and it helps to protect the patient life.

V. RESULT AND ANALYSIS
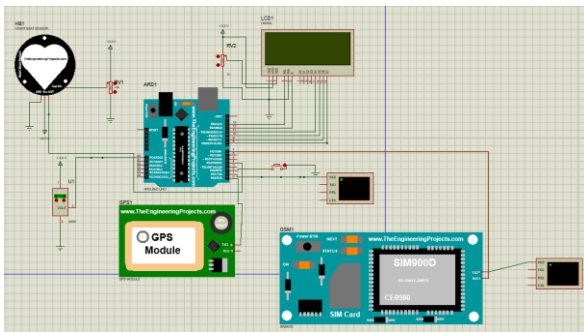
Fig III: Pre layout Simulation skeleton diagram
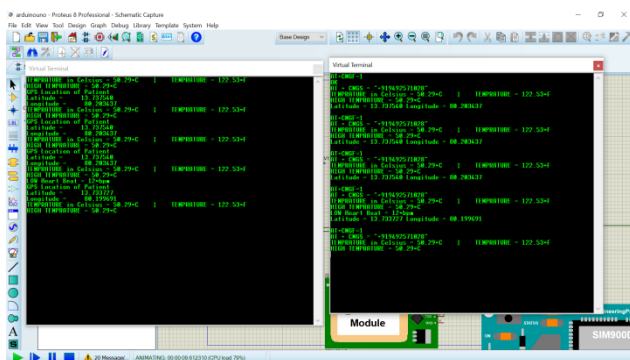
Fig IV: Simulation Output on Virtual Terminal (Arduino Output) and Virtual Terminal (GSM Output)

VI. CONCLUSION

The Intelligent patient monitoring system was realized using various smart wearable sensors like temperature sensor, pulse rate sensor with Arduino board. The Arduino board was processing data using software written in embedded C language. The processed data sent Over GSM network for storage and analysis of patient data monitored by doctor located faraway from patient. This type of health care facilities requires in now a day due to increase number of patients and due to lack of health care facilities at rural areas.

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