Patient Healthcare Monitoring system for Emergency Situations

Ashish Chauhan, Sanjeev Kumar Gupta, Rajendra Gupta

Abstract - System for real time patient monitoring, have attracted noteworthy consideration in the most recent two decades. An enormous number of economical forms of patient checking systems are accessible, which were being used by approved health care experts. Notwithstanding this there is a solid requirement for online patient observing system, when the patient isn't in the emergency clinic. The principle target of this paper is to structure and execute an economical, convenient powerful patient checking observing system that can transmit the essential indications of a patient in crisis /crucial circumstances constantly through a remote communication network. Different sensors, for example, pulse, temperature, blood pressure and fingerprint are inter-faced through the microcontroller for estimating the significant physical parameters of the patient. For remote transmission, these sensors are associated with a sensor node through GSM module. Raspberry-Pi is utilized as a sensor node as it has better highlights contrasted with different controllers. Subsequent to giving system access to the Raspberry Pix board, it goes about as a server. At that point the server routinely sends estimated information to the web-server, which are additionally checked by employing web page which can be recovered from anyplace on the planet using workstations, laptops, android advanced cell and so on. The deliberate constant parameters are refreshed at regular intervals. The information procured is first stored, analyzed and projected on a webserver. The framework is executed so that, when the deliberate physiological information surpasses the threshold value, the overseer is alarmed through SMS and a voice call. Also using the proposed system, real-time remote monitoring is also carried out on the patient. Additionally, positional data of the individual can be obtained from GPS receiver as shown on the digital map and sent to the related units. Thus, the system proposed in this paper makes the individual's day-to-day life relaxed and more comfortable.

Keywords: Raspberry Pie, GSM Module, LCD, Temperature Sensor, Fingerprint Sensor, Blood Pressure Sensor.

I. INTRODUCTION

With an increase in the number of elderly people throughout the world in many countries, there is a major concern about their health conditions. This has directed to a vital requisite for inventing inexpensive & smarter techniques to design health maintenance systems for elderly people suffering from a wide variety of diseases. In accordance with a health report from World Health Organization (WHO), the challenge of population aging is very crucial. Health situations of elderly individuals ought to be monitored more habitually, that poses a larger challenge to current medicinal systems. Consequently, to classify and categorize different infections in human body in time & precise way with less costs has been rewarded a growing care in the past decade[1]. Also, it perceived that at any time an individual is bare to longer working hours, it characteristically directs toward weakness. If this situation is left un-attended by the doctor, then this might directed to additional difficulties like heart infections, brain diseases & occasionally even lead to a foremost decrease in O2 oxygen levels in human body. Finally, the health situation eventually becomes a serious issue for that particular patient. So also, tremendous measure of people who are living in dangerous conditions bite the dust because of cardiovascular maladies consistently. The present total populace likewise has an expansion in the quantity of matured individuals who look for medicinal care system. Current developments in sensor fabrication, high speed communication systems and information technologies (IT) have facilitated improvement of innovative dynamic parameter observing systems that observed numerous important health factors may be monitored, such as body temp, electrocardiogram (ECG), heart rate, blood pressure (BP) & oxygen level [2]. Specifically, remote social health insurance associated programs utilizing remote sensor systems may bolster individuals & guardians by giving non-obtrusive & intrusive consistent wellbeing checking with a base connection of specialists and patients.

Wireless sensor network also known as WSN are finding a wide variety of applications in area such as health monitoring and controlling, emergency conditions, environment and agriculture security etc. WSN is a wireless network comprising of spatially distributed autonomous device using variable sensors for monitoring environmental conditions[3]. It includes a gateway mechanism that provides wireless connectivity to the distributed nodes. The data is sent via multiple nodes and it is also connected to another network such as ethernet through gateway mechanism. It comprises of base station and number of nodes (wireless sensors). A wireless network is made up of a large quantity of nodes, comprising a multi-hop network where surrounding nodes interact with each other. Development in wireless-communication & micro-electro-mechanical-system (MEMS) allows formation of a large scale, short power, multi-functional & low-cost network [4].

The primary point of this exertion is to measure numerous physiological imperatives of patient's body, for example, body temp, heart/pulse rate, breath rate and circulatory

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strain. The deliberate physiological information from different sensors are inter-faced to Raspberry-Pi sheets. The information from the Raspberry-Pi is attached to GSM module, then the information is conveyed to the specialist data so as to be in this manner dissected for diagnosis, using a user platform preferably android application and website page. This patient observing social insurance health monitoring system insists & give attentions continuously to the specialists/medicinal associates about the adjusting of essential constraints of the person & about urgent variations in encompassing natural constraints, so as to take defensive actions, spare lives in basic consideration & crisis circumstances [5].

II. DESIGN AND IMPLEMENTATION OF SYSTEM

A sensor is actually a system installed or interfaced in a system. Utilizing a remote (wireless) innovation, the deliberate physiological information is sent back to the system for understanding & investigation or even send its reaction to an actuator. Execution of a productive patient observing system relies upon different constraints, for example, heart-beat, pulse, body temp, saline level, person's position, wind current, and so on. Change to these constraints by human body responses coming about irregular working of the mindful organ may cause to genuine risks to soundness of a patient & consequently need ordinary checking to maintain a strategic distance from these lethal conditions. The proposed execution of an effective wellbeing observing system is appeared in figure 1. It comprises of a transmitter segment and the checking segment. The transmitter area comprises of a Raspberry Pi 3 B Model, different sensors, for example, pulse sensor, circulatory strain sensor, temperature sensor, unique finger impression sensor, GSM Module, Zigbee, Liquid precious stone showcase and camera. The checking area comprises of Zigbee recipient, PC or laptop, LED, signal and an android advanced cell [6].

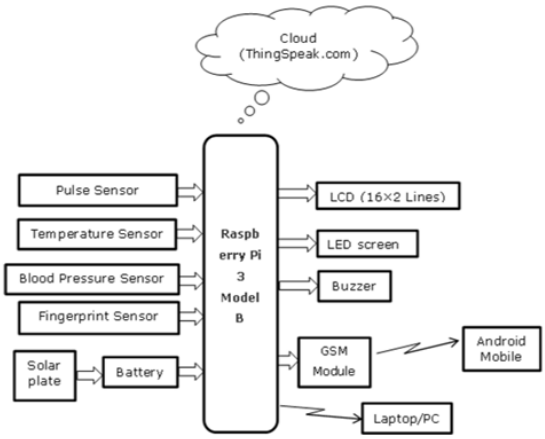

Figure 1: Block diagram of the Patient monitoring system

The proposed system can detect to parameters progressively and shows them on various indicating output system which empowers the specialist to screen the patient's wellbeing parameters, (for example, heart-beat, circulatory strain (blood pressure), temperature, and so forth.)

The proposed framework includes the accompanying primary parts:

1.1 Raspberry Pi 3 B model

The suggested Raspbian operative system for the proposed function is the Raspberry Pi 3 B Model. This is an opensource software created on Debian kernel, optimized for the Raspberry Pi hardware operations [7].

1.2 Pulse Sensor

A pulse sensor is designed to yield a digital output of the heart beat (which ranges between 60 to 100 BPM for adult and 80 to 100 BPM for children) after a finger is suitable placed on it. It works on the principle of light modulation (with the help of infrared rays) by blood flow through a finger for each pulse.

1.3 Blood Pressure Sensor

The proposed system employs a cuff-less blood pressure sensor which is based on transit time, interval time required for a pressure wave in the arterials to travel between two sites. It is a convenient, easy-to-use relatively cheap and fast for detecting blood pressure normally more than 120 over 80 and less than 140 over 90 (120/80 – 140/90).

1.4 Temperature Sensor

The normal human body temperature is about 37°C and it is very important as far as health monitoring is concerned. The LM35 Human Body Infrared Temperature sensor is used in this system which working. It is a precise temperature sensor IC and its output voltage and celsius temperature are linearly proportional with its operating range from -55°C to +120°C.

1.5 Fingerprint Sensor

Access to patient's database must be confidential and a fingerprint sensor/scanner may help to prevent unauthorized personnel from accessing the monitoring system. An ultrasonic pulse is transmitted against the placed finger on the scanner thereby accepting or denying access to the monitoring system. Hence, only the doctor and nurses working in the hospital should be granted access to the system.

1.6 GSM Unit (Module)

A GSM unit is employed to start a communication b/w the specialist's cell & persons constraints observed. This has a significant improvement to the previous implemented systems where the doctor needs to be physically present to monitor patients tied to their hospital beds. The GSM module is encoded to deliver the observed constraints to the doctor's android cell by a pre-configured SIM.

III. FLOWCHART AND ALGORITHM

The flowchart of the proposed system is illustrated in the Figure. 2. The entire process flow is explained below:

Step 1: Start

Step 2: Scan finger

Step 3: If the scanned finger is recognized, go to step 4; else go to step 2.

Step 4: Establish a connection between Microcontroller, GSM Module, network, and cloud server

Step 5: Continue to read sensor data from patient

Step 6: If the sensor data are greater than the sensor threshold limits, go to step 7 else go to step 5.

Step 7.1: Display the alert on an Alarm & LCD

Step 7.2: Notify the Doctor about the patient condition either by SMS or call to his Android mobile.

Step 7.3: Upload the data changes to the cloud server.

Step 8: Stop

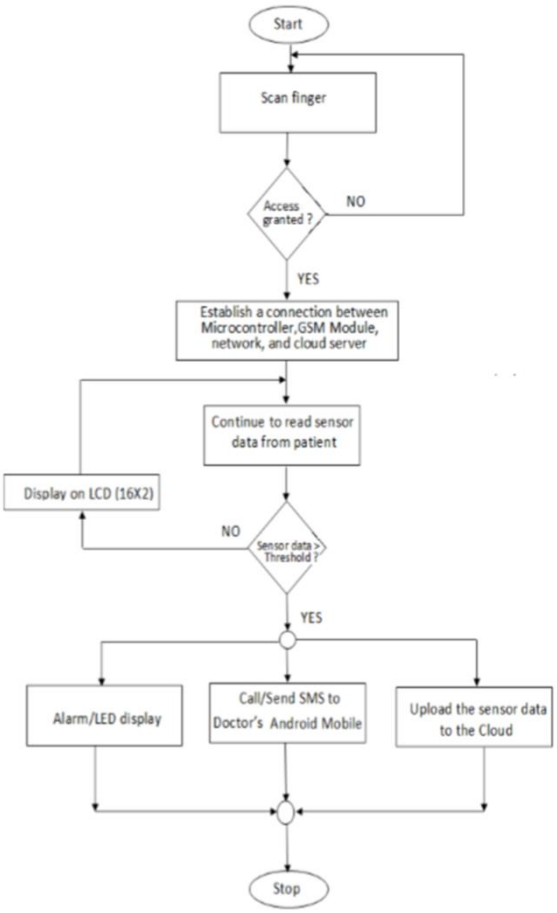

Figure 2. Flow chart of the entire process

IV. HARDWARE IMPLEMENTATION AND RESULT

The prime microcontroller employed in this proposed system is the model b version of Raspberry Pi 3. All the different sensors such as the pulse sensor, temperature sensor, fingerprint sensor and blood pressure sensor are interfaced with it. The GSM module and Zigbee are also interfaced with the Raspberry Pi 3 Model B by the wire inter-connections & programmed located on person's infirmary bed. The finger-print sensor is inter-faced through Raspberry Pi 3 B Model to give entree simply to the hospital's members & not give permission some other surgeon. This patient observing system may be proficiently executed remotely by surgeon by employing correct codes at the desktop/laptop end. When powered and programmed, independent and precise operations of reading the patient parameters such as blood pressure, patient heartbeat and patient temperature and sending the sensed data to the doctor's android phone, PC as well as making an alert like blinking an LED, sounding of a buzzer or displaying the abnormality on LCD will be taken by the system to call attention of the doctor. This will quickly call the attention of the assigned doctor/nurse thereby saving the patient's life. The concluding hardware model of smart patient monitoring for emergency situations is shown in figure 3.

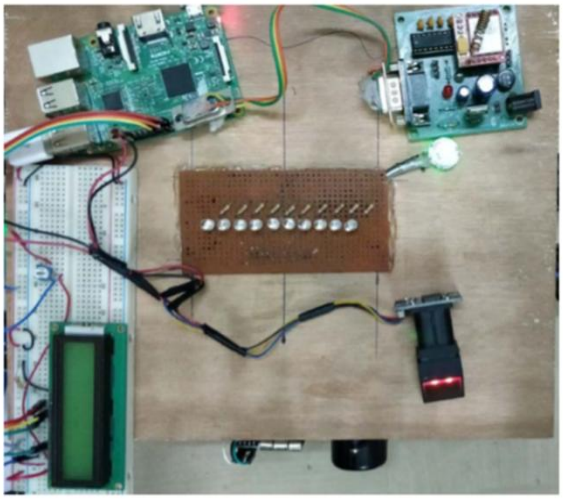

Figure 3. Prototype of the patient monitoring system

The glowing of LED lights in figure 4 designates the presence of high blood pressure. The threshold measurement for blood pressure measurement has been set at (130/88). On the off chance if all of the LEDs sparkle, at that point it shows the patient is experiencing hypertension, and in this way quick response should be done by the specialist. The measurement of various crucial parameters is shown in figure 4, while the figure 5 represent the screen shot of the message received by the specialist on his/her cell phone.

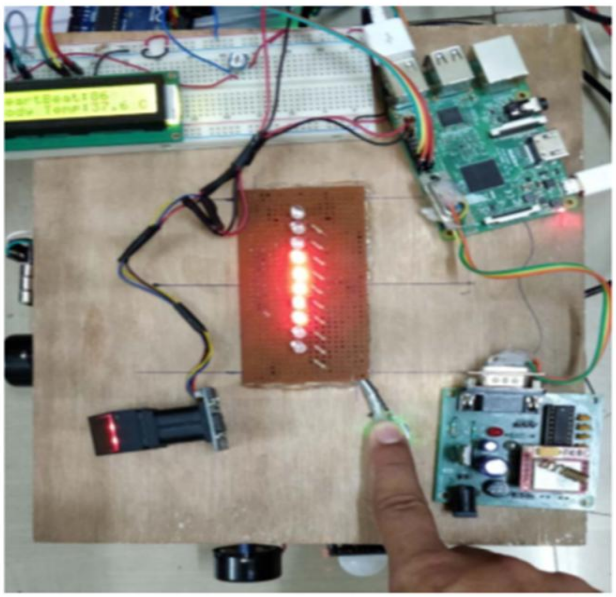

Figure 4. Measurement of temperature, heartbeat and blood pressure

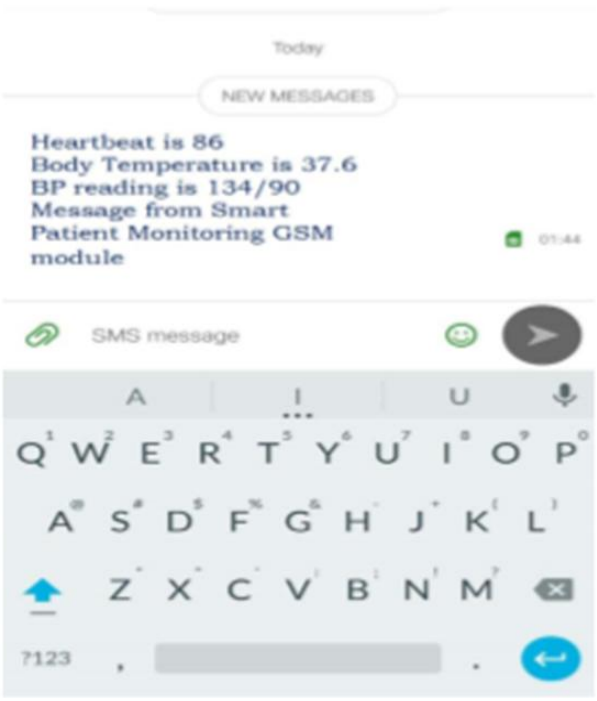

Figure 5. SMS message received on android mobile

V. CONCLUSIONS

In this paper, the design and implementation of smart patient monitoring system for emergency situations is presented. The primary goal of the projected work is to quantify diverse significant physiological constraints of patient, for example, body temp, pulse or heart-beat rate, breath rate & circulatory strain. This system encourages patients to counsel any specialists, and specialists to catch up patient's condition and information. Different sensors, for example, beat, temperature, pulse and finger mark are inter-faced to the micro controller for estimating the significant physical parameters of a patient. It utilizes remote sensor systems and data correspondence advances to give remotely clinical medicinal services. The deliberate constant physiological constraints are refreshed like clockwork. The information gained is first stored, investigated and envisioned on a webserver. The system has been planned so that, when the deliberate physiological information surpasses the specific limit (threshold limit), the doctor will alarmed through message & a phone call. The primary favorable position of the suggested system is the decrease of the intercession time of the patient in a crisis circumstance. In like manner, the proposed minimal effort system spares lives in basic consideration and crisis circumstances.

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