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IoT based Smart Healthcare Monitoring System

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Abstract: **The paper presents the design and implementation of an IoT based Health Monitoring System for emergency medical services using the android technology. The project can demonstrate collection and integration of IoT data which offers adaptable operation and cost sparing alternatives to both medicinal services experts and patients. Here, a patient can be examined utilizing a collection of lightweight sensor nodes for real time sensing and analysis of different fundamental parameters of patients. The proposed result of the project is to provide accurate and efficient clinical services to patients by associating and gathering information data through health status monitors which would comprise the patient's temperature, blood pressure, oxygen saturation and keeps the patient updated with his present status and full medical data. Therefore, patients will have high quality services on the grounds that the system supports medical staff by providing the current status of patients health by eliminating the manual data collection.**

Keywords : IoT, Alert system, Emergency app, Sensors, Temperature, Blood Pressure, Pulse Oximeter

I. Introduction

IoT could be an arrangement of reticulated computing gadgets, mechanical and computerized machines, objects, animals or the individuals who are provided with particular images and therefore the capacity to transfer knowledge over a system while not expecting human to human or human to pc interaction. Associate degree IoT framework comprises web empowered sensible gadgets that are implanted processors, sensors and communication hardware to accumulate, send and follow up on information they procure from their surroundings. A thing in the Internet of things can be an individual with a heart monitor implant, an animal with a biochip transponder, a car that has built-in sensors to alert the driver when tire pressure is low or some other characteristic or man-made item that can be assigned an Internet Protocol (IP) address and can transfer information over a system. In the care stream, sensible system technology brings about higher diagnostic tools to higher treatment and personal satisfaction for patients by simultaneously diminishing costs of public care systems. An indicator could be a gadget that recognizes and responds to some style of input from the physical environmental factors. This

particular input can be lightweight, heat, movement, moisture, pressure or anyone of a good range of various natural phenomena. The output is generally a symptom that is born-again to human legible show at the detector location or transmitted electronically over a system for reading or any procedure. Sensors are around for various types like LDR, Temperature indicator, inaudibility identifier, moisture sensor, vibration detector, gas detector and others. Emergency application is a mobile application that indicates doctors and members from the family with respect to the emergency state of the patient.

II. Literature Survey

This section reviews the existing recent literature work and provides insights in understanding the challenges and tries to find the gaps in existing approaches. Various computing techniques are applied in the Healthcare domain. The focus of the literature survey here is on the use of Internet of Things and Android systems in the healthcare domain. Health- care domain challenges are in improving research phases.

Internet of things (IoT) based smart health care system [1]

A BSN (Body Sensor Network) is a system intended to operate autonomously to associate various medical sensors and implants situated inside and/or potentially outside of the human body; which offers adaptable operation and cost sparing alternatives to both healthcare professionals and patients. This work illustrates the structure and implementation of a smart health monitoring framework. Here, a patient can be monitored using a collection of lightweight wearable sensor nodes for real time detecting and analysis of various indispensable parameters of patients. The devices seamlessly assemble and share the information with each other and furthermore store the information, making it possible to gather records and analyze data. The different sensors are placed at the respective locations on the human body and are connected to the Arduino board. The temperature sensor output from LM35 is converted to digital form with the assistance of ADC pins of the Arduino board. For the pulse rate sensor when the heart pumps blood through the blood vessels, the finger turns out to be marginally opaque and so less light arrives at the detector. With each heart beat the detector signal differs and this variation is converted into an electrical pulse. The pulse is also indicated by an LED which blinks on every heartbeat.

Body Temperature Measurement for Remote Health Monitoring System [2]

The goal of this project is to structure and develop a body temperature estimation gadget framework that can be monitored by the specialists in real time as well as history data via the web with an alarm/indication in occurrence of abnormalities. In the proposed health monitoring system, pulse rate and body temperature wireless remote sensors were developed, however this paper only focuses on body temperature wireless monitoring framework. The temperature sensors will send the sensed readings to a microcontroller using Xbee wireless correspondence. In order to transmit the continuous sensed information to the health monitoring database, wireless local area network (WLAN) has been utilized. An Arduino with Ethernet shield dependent on IEEE 802.11 standard has been used for this purpose. Test results from a group of volunteers shows the real-time temperature reading successfully monitored locally (at home) and remotely (at doctor's computer) and the readings are comparable to commercial thermometers.

IOT BASED PATIENT HEALTH MONITORING SYSTEM [3]

The fundamental thought of the designed framework is to persistently monitor the patients over the internet. The model comprises 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 gathers the information from the sensors and sends the information through GPRS Protocol. The Protected information sent can be accessed anytime by the doctors by typing the corresponding unique IP address in any of the Internet Browsers at the end user device(ex: Laptop, Desktop, Tablet, Mobile phone). The Microcontroller is associated with GPRS Modem which provides information to doctor/caretaker when the heart rate goes irregular. During this time the buzzer turns on and alerts the caretaker. The user interface html webpage will automatically refresh for every 15 seconds subsequently patient health status is persistently sent to the specialist.

III. Proposed System

A. Proposed Architecture of Smart Healthcare Monitoring Systems

This can be contributed essentially to the improvement in the classification and recognition frameworks utilized in disease diagnosis which is able to provide information that guides medical specialists in early detection of lethal diseases and therefore, increment the survival rate of patients altogether. The application of android frameworks in the field of medical diagnosis is expanding gradually. The consequences of the study reinforce the idea of the application of IoT and android systems in early detection and outcome of diseases. Medicinal services and health of individuals is an important necessity of the human population. Heart Rate and body temperature are two significant vitals associated with the health of an individual. The ability to screen these two vital signs is key to guarantee legitimate healthcare is delivered early. In this paper, a system to monitor heart rate, body temperature and blood pressure of a user and alert the user when these values are anomalous is proposed. Patient Medical Emergency Alert System (PMEAS) essentially comprises two components, a wearable hardware unit and an android application. The wearable unit contains sensors to monitor the heart rate and body temperature of the user, which are displayed on an LCD screen.

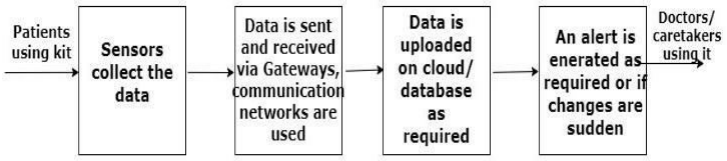


Fig. 1

B. Flowchart

The flow of the system is being specified as the detection is being performed by the sensors and the alert system eventually works as per the threshold value.

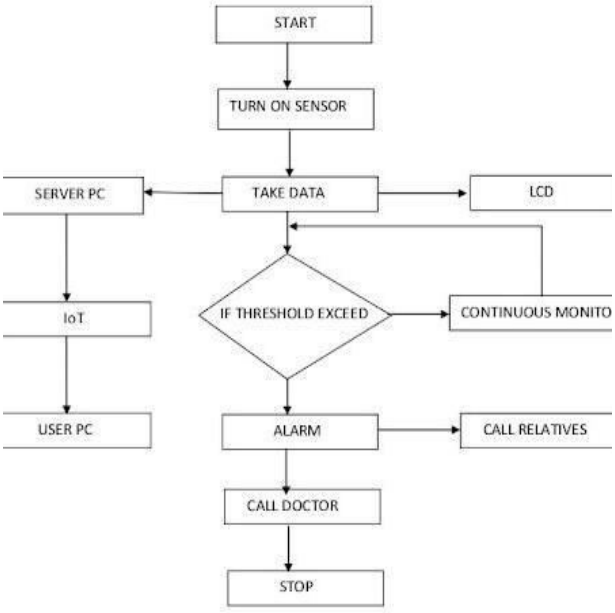


Fig.2

IV. Materials and Methods

A. Body Temperature

Body temperature (BT) is a consequence of the harmony between heat production and heat loss in the body, being its estimation crucial to avoid many elements defunctionalization because of high temperatures (e.g., proteins denature and lose function above certain temperatures)

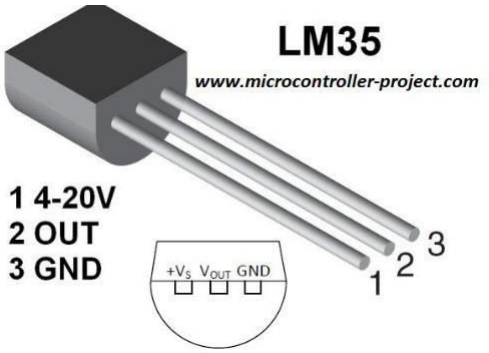


Fig. 3

Lm35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius.

B. Blood Pressure Measurement

Blood pressure (BP) is considered as a crucial cardiopulmonary parameter, demonstrating the pressure exerted by blood against the arterial wall. BP provides roundabout information about the blood flow when the heart is contracting (systole) and relaxing (diastole) and can likewise demonstrate cellular oxygen conveyance. Ambulatory BP

Fig. 4

monitoring permits getting BP readings several times a day, which is ideal to monitoring high blood pressure (hypertension), probably one of the greatest threats to the global burden of illnesses, improving cardiovascular disease prediction. The gadget which quantifies this is called Sphygmomanometer. Here we use a wrist blood circulatory pressure monitor as shown in Fig 2.

C. NodeMCU

The NodeMcu is an open-source firmware and development kit that helps you to prototype your IoT product with a couple Lua script lines.The Development Kit as appeared in Fig. 3 is depends on ESP8266, integates GPIO, PWM, IIC, 1- Wire and ADC across the board. ESP8266EX (potentially referred to as ESP8266) is a framework on-chip (SoC) which incorporates a 32-bit Tensilica microcontroller, standard advanced digital peripheral interfaces, antenna switches, RF balun, power amplifier, low noise receive amplifier, channels, filters and power management and execution modules into a small package.

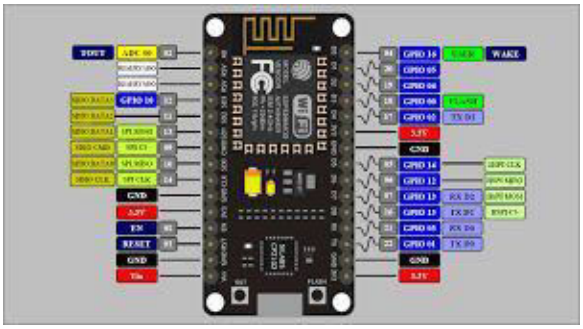


Fig. 5

D. Pulse Oximeter Sensor

Hardware Description Pulse oximetry is a basic technique to discover the proportion of haemoglobin. Oximeter quantifies the number of hearts beat per unit of time which is usually conveyed in bits per minute (Bpm). In the undertaking MCP6004 based pulse oximeter

is designed and TCRT1000 reflective IR optical sensor is utilized for photo plethysmography(PPG). UsingTCRT1000 improves the strategy since both emitter and detector are arranged side by side. This technique is used to evaluate heart rate since change in blood volume is synchronous to heart beat.

V. Implementation Algorithm of the proposed system

A. WiFi Connections

In this project, we are going to utilize ESP 12 as a WiFI module to create association with the internet. The ESP8266 WiFi Module is an independent SOC with integrated TCP/IP protocol convention stack that can provide any microcontroller access to your WiFi network. The ESP8266 is capable of either facilitating an application or offloading all Wi-Fi networking capacities from another application processor.

B. Working

Correspondence between ATMEGA 328 and Node MCU is done over the sequential serial port. ATMEGA328 sends information on the transmit pin and Node MCU receives it on the receive pin. The majority of the computation part is dealt by the ATMEGA 328 and then data is sent to the web server using the Node MCU. Node MCU is Wifi empowered which can communicate with the Wi-Fi Source for the connection and then provides the information to the web servers via the Get requests. Also, for the correspondence between them both should have the same Baud rates.

The values accepted by the server are then stored in the database. The values in the database are analysed thoroughly and are provided with ideal thresholds. These thresholds provide a basis to determine anomalies in readings. If the values of a particular health parameter exceed the threshold, which means a potential threat, an alert SMS is sent to the individuals on the priority list of the patient's contacts including the assigned doctor through the SMS Gateway. All the sensors are connected to the printed circuit board. The values stored in the database are displayed in the emergency app continuously between time intervals. The picture depicting the constant readings displayed in the app are shown in Fig. 7

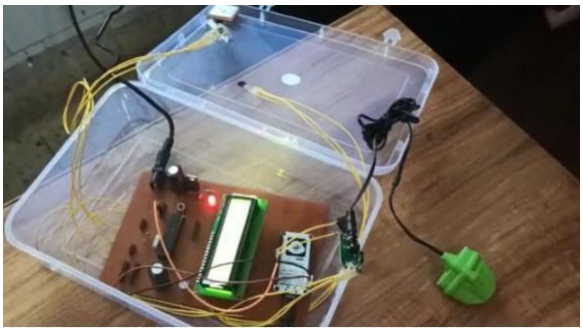
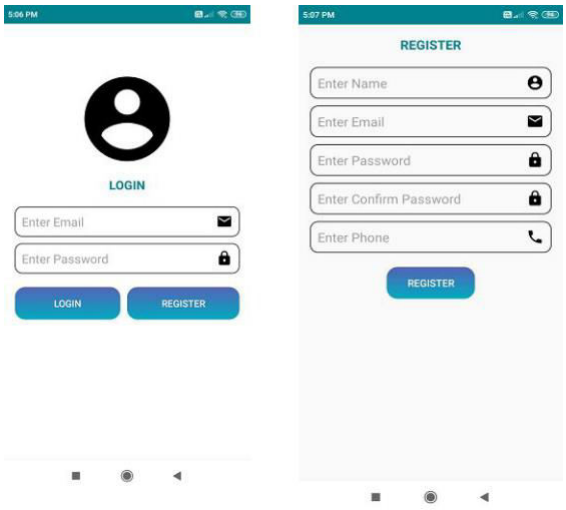


Fig. 6

C. Alert system.

The wireless monitoring of patients has an incredible effect in the field of medicine. With the assistance of micro sensors which are integrated into wireless communication networks, the physiological parameters of the patient can be remotely accumulated and observed utilizing traditional medical instruments can be avoided. In this project the monitoring of the patient is undertaken by the doctor consistently without actually visiting the patient. Here, we make use of various IoT sensors that detect like pulse rate, temperature, blood pressure of the patient. These detected signals are transmitted to update the data constantly. The readings are sent to the individual on the priority list wirelessly. Consequently, the specialist can monitor the patient from anywhere. This framework has the capability of providing real time monitoring and also improvements of SMS. It sends the data to the control unit for additional processing and estimations are displayed on the application. It then proceeds to alert by sending SMS, SMS will be sent to the cell phone of the individuals in the priority list, if and only if the threshold value is maximally surpassed.

D. Emergency App



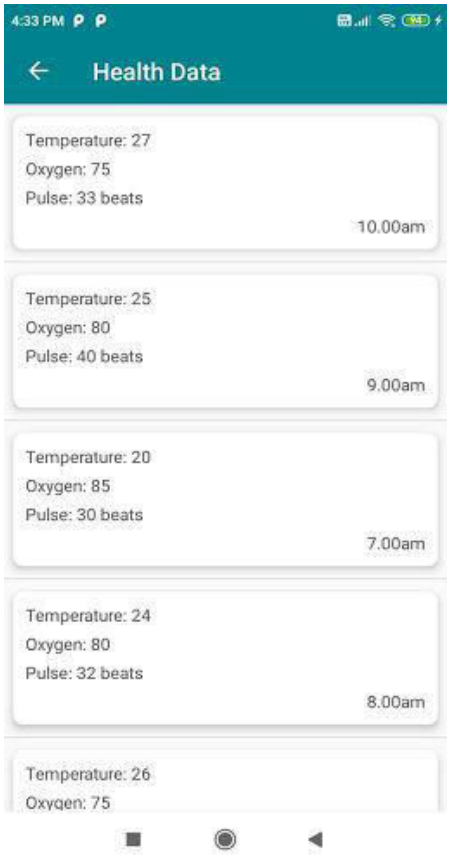


Fig. 7

VI. Conclusion and Future Scope

The objective of this project has been successfully achieved. Body temperature, oxygen saturation and blood pressure measurements for remote health monitoring have been designed and developed. The system provides reliable measurements and is very user friendly. The system successfully alerts the guardians in case of abnormal readings.

The device and the system can be improved in terms of sizing and integration between more measurement devices with the existing set-up, for example electrocardiography (ECG).

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