Healthcare Monitoring System for Smart Campus

Assistant Professor. Rupali Satpute[1], Swati Naik[2], Komal Patil[3], Shruthi Muthuraman[4], Janhavi Kulkarni[5]

[1,5]Department of Electronics and Telecommunication Engineering, K.J Somaiya Institute of Engineering and Information Technology, Mumbai

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Abstract: Healthcare system is becoming a new trend to solve the existing healthcare system limitations. High flexibility and accessibility are the main advantages of wireless and contactless measurements. In order to improve the way of data collection and workflow of vital signs measurement, this paper proposed a IOT based vital signs data collection and information system. This paper demonstrates a model which uses sensors for body temperature, blood pressure, pulse oximeter in one system. All of the devices can communicate with the microcontroller and Tablet PC via wifi module. Moreover, the designed user interface on Tablet PC can inspect patients' information and upload the collected vital signs data to an excel-sheet/ database server via wireless local area network (WLAN). We propose to build the prototype of the above system which will be powered using solar.

Keywords: IOT based, vital signs measurement, wifi module, database, solar, high accessibility

I. Introduction

During COVID pandemic, the mismanagement among the healthcare providers, poor communication and limited number of resources leads to inefficiency in providing quality care. Now after unlocking, there will be a need for a real-time, non-invasive, compact healthcare monitoring system for colleges/institutes to monitor students/employee's health on a daily basis. In general the way to record vital signs data is recording vital signs data and noting it down in handwritten format, and then as per requirement transcribe vital signs data to an information system by typing on a computer. But this is definitely a tedious and time-consuming process. Furthermore, it may cause recording error during handwritten and could also cause error by typing vital signs on the computer.

IoT is defined as the interconnection of sensors, devices, applications, and network connectivity whose purpose is to control the physical world using the internet. When it comes to standard practices of health monitoring in hospitals, vital signs measurement is at the heart of every patient care.

So here we will make an IoT based Health Monitoring System which records the vital signs mentioned above. To store the data uniquely along with the student's name details we will also make use of RFID. The system proposed also sends an email/SMS alert whenever those readings go beyond critical values. Pulse rate and body temperature readings are recorded over ThingSpeak and Google sheets so that patient health can be monitored from anywhere in the world over the internet.

In this paper, we are using MLX90614 as an infrared thermometer for non-contact temperature measurements, MAX30100 an integrated pulse oximeter and heart rate monitor sensor. It measures Oxygen Saturation of the blood. Here AP3 / AG3 dedicated low noise noninvasive blood pressure sensor is used to measure blood pressure. If these vital signs data can directly input from a measuring device to the cloud through wifi module, then it can reduce the error rate and delay time. A widely used WIFI module ESP8266 is also used. Here we will use AT commands to send data from Arduino to ESP.

II. Literature survey

2.1 Contactless Vital Signs Measurement for Self-Service Healthcare Kiosk in Intelligent Building

In this paper, a contactless healthcare kiosk for intelligent building application is built.

The Remote Imaging

Photoplethysmography (rIPPG) based framework to measure multiple human's vital signs, including pulse rate (PR), respiratory rate (RR), and systolic blood pressure (SBP) was developed to fulfill the performance requirement with a personal Computer. A consumer-grade RGB camera to record the video of the user. The Intel Realsense camera is adopted and set in capturing format of 640x480 resolutions. To obtain the clean signal, the spatial-temporal processing method is employed after the video is recorded.

2.2 Using Wireless Measuring Devices and Tablet PC to Improve the Efficiency of Vital Signs Data Collection in Hospital

This paper proposed a Tablet PC based vital signs data collection and information system. This system comprises a database server, Tablet PC, and wireless devices such as blood pressure monitor, infrared thermometer and barcode scanner. The Tablet PC and wireless devices are put on a cart to serve as a mobile nursing information system unit. All of the devices have Bluetooth interface, therefore they can communicate with the Tablet PC via Bluetooth. Moreover, the designed user interface on Tablet PC can inspect patients'

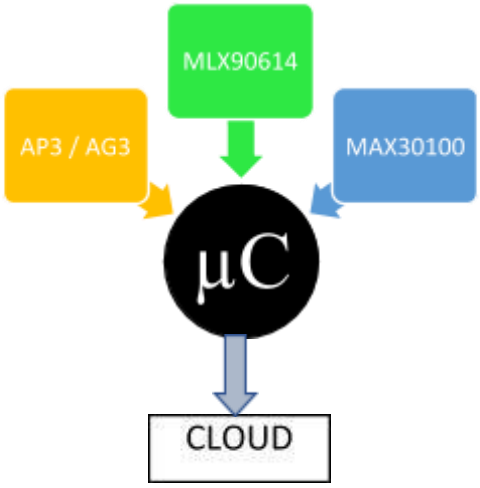
2.3 Design of a Non-Contact Body Temperature Measurement System for Smart Campus

Outbreaks of influenza in Hong Kong was the main reason behind this paper presentation. Some schools were in need of measuring the students' forehead temperature when they arrived at the school. The repetitive tasks of attendance taking and temperature logging consumes a considerable amount of manpower, time and administrative resources. To facilitate such daily operations at the school entrances, an automated system with the integrated functions of attendance taking and temperature measurement is being developed in collaboration with an access control company in Hong Kong. This paper presents our prototype system, which consists of non-contact temperature sensor, embedded system, and database.

III. Proposed system

Hardware setup and working :

When students/employees enter the college then at the entrance itself their vital signs will be measured within 5-8 mins. When students scan the RFID card, we will measure the body temperature contactlessly and blood pressure, oxygen saturation, pulse rate, etc wirelessly. Arduino or NodeMCU collects the data from the various sensors mentioned.



Entire prototype will be powered using a battery which will be charged using solar energy through solar panels of required size.

Here we use **EM18 RFID Reader** which features a transceiver that transmits a radio signal. When the RFID tag comes in the transmitter signal range, this signal hits the transponder that is inside the card. The tag draws power from the reader module-generated electromagnetic field. The transponder then transforms the radio signal into the usable form of power. Upon getting power, the transponder transfers all the information, such as a specific ID, in the form of an RF signal to the RFID Module. Then this data is sent to the microcontroller using UART communication.

Here **MLX90614** is an infrared thermometer for non-contact temperature measurements. Both the IR sensitive thermopile detector chip and the signal conditioning ASIC are integrated in the same TO-39 can. Integrated into the MLX90614 are a low noise amplifier, 17-bit ADC and powerful DSP unit thus achieving high accuracy and resolution of the thermometer.

As shown in the above block diagram, **MAX30100** is an integrated pulse oximetry and heart rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

Also **AP3xx-044KG-NIBP /**

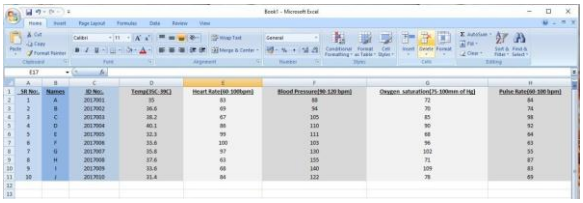
AG3xx-044KG-NIBP is used as a

Non-Invasive Blood Pressure Monitoring sensor. It is composed of a silicon piezoresistive pressure sensing chip

and a signal conditioning integrated circuit. The low-level signal from the sensing chip is amplified, temperature compensated, calibrated, and finally converted to a high-level output signal that is proportional to the applied pressure.

The collected data is then sent to the cloud and to Excel sheet/database. For sending the data to the Excel sheet, we are going to use **PLX-DAQ**. It is an Excel Plug-in software that helps you to write values from Arduino to directly into an Excel sheet on your Laptop or PC. Here we will log the Name and health details of that student. We will use **ThingSpeak** to monitor online data uploaded on the cloud. ThingSpeak 'Collects' the data from the sensors, 'Analyze and Visualize' the data and 'Acts' by triggering a reaction. By using ThingSpeak site, we can monitor our data and control o`ur system over the Internet, using the Channels and webpages provided by ThingSpeak. Afterwards the required processing is done on this cloud stored data. We will also use **IFTTT** platform to connect ThingSpeak to email/message service so that alert messages can be sent whenever the patient is in critical state.

RESULTS:



The above mentioned table is our expected result of our project .Each subject's body temperature, pulse rate, heart rate, oxygen saturation, blood pressure are measured and saved in excel format and also stored in the cloud for future use.

Vital parameters	Standard ranges
Temperature	35C-39C
Pulse rate	60-100bpm
Oxygen saturation	75-100mm
Blood pressure	90-120bpm
Heart rate	60-100bpm

Conclusion:

Our proposed system may definitely prove very useful in measuring vital signs body temperature, blood pressure, oxygen saturation, pulse rate, heart rate of the student non-invasively in real time. Also data recording and access becomes easy. Thus we analyze the health of the student daily or over the week or over the month through various graphs etc. Also we can send alerts if the readings cross the standard limits. Our system can also be used to mark attendance since it also uses RFID. So it becomes a time-saving and efficient system.

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