

CUTTING-EDGE HUMAN HEALTH SURVEILLANCE DEVICE AND COMMUNICATION INTERFACE THROUGH IOT INTEGRATION IN EMBEDDED SYSTEM

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Abstract: This paper is present an advancement of human health tracking system or the device which have been used by the people who have working towards the screen and also used for elderly people to monitor their health conditions at any time. This is a IoT-based wearable device empowers individuals to take control of their health, promoting proactive wellness and disease prevention through real-time vital sign tracking and accurate health insights. An advanced technologies like Arduino, sensors like MLX90614 temperature, AD8232 ECG, and MAX30100 oximeter sensors, GSM module connectivity for seamless data transmission, GPS module for location tracking. This device will perform a real time monitoring of vital signs of body temperature, oxygen saturation, heart rate of health conditions and provide real time notifications

Index terms: *Healthcare, IoT, Real time monitoring, sensors, remote, patient monitoring, wearable device.*

I. INTRODUCTION

The increasing complexity and busyness of modern life have led to neglect of health and for the elderly people, resulting in poor adherence to health monitoring and delayed detection of health issues. Current health monitoring systems are often cumbersome, inconvenient, and reactive, rather than proactive. A Cutting-Edge Human Health Surveillance Device and Communication Interface through IoT Integration in Embedded System is helping to surveying heart rate, oxygen rate, and temperature. It has been proposed to track user's health conditions and provide real-time notifications. An advanced sensor technologies like MLX90614, AD8232 ECG, and MAX30100 oximeter sensors, Arduino technology and Bluetooth connectivity for seamless data transmission, GPS sensor for location tracking, real-time monitoring of vital signs of temperature, oxygen saturation, and heart rate.

Improved health insights through continuous tracking, proactive health monitoring and informed lifestyle decisions, timely detection of health issues. This IoT-based wearable device empowers individuals to take control of their health, promoting proactive wellness and disease prevention through real-time vital sign tracking and accurate health insights.

According to WHO, around two billion individuals, or one out of every four people, will be over 60 years old by 2050. So, there is a lot of interest in finding efficient and reliable ways to keep track of patients' well-being and care for them at home. Constant patient health monitoring has been shown to lead to a 50 percent reduction in hospitalizations, a 73 percent reduction in emergency department visits, and a 51 percent reduction in inpatient costs.

In the age of modern science and technology, the Internet of Things (IoT) has become a flourishing research topic. The interconnections between objects and devices have reached a tipping point, bridging the gap between humans and machines. Remote healthcare monitoring is becoming popular day by day. It's considered the most standard way of healthcare. As the observation of remote patients has become more popular and standard health care, how to provide high-quality patient care outside the hospital setting has become a worrying but complex problem in reducing ineligible premature deaths.

Every year, many people die as a result of delayed treatment. If the time to late treatment can be decreased and prompt medical care can be ensured, it will be able to lower the death rate to a great amount. In this research,

an IoT-based system is proposed for providing timely medical treatment even from the comfort of one's own home (i.e. away from the hospital). One of the most important features of this system is that the doctor and the patient will be connected 24 hours a day, seven days a week, so that the patient may be watched at all times. Our major goal is to ensure that late medical care does not result in a patient's death.

The internet of things is improving technology in modern life, which give the concept of enabling to use the various electronic devices and sensors to connect over the internet to improve our lives. This IOT could be used in various sector such us private and government places including hospital. This system uses the IOT for the configuration of electronic devices (like microcontroller, GSM module, GPS module and Wi-Fi module) and various sensors (i.e. body temperature, oximeter, electrocardiogram). Overall, this device uses the concept of IOT, wearable devices, real-time notification, cloud database, web application. The following are the primary contributions of the work:

- Initially, sensors like MLX90614 temperature sensor, AD8232 ECG Sensor, and MAX30100 oximeter sensor are equipped in this device which collects health details like ECG, body temperature, and oxygen rate from the user.
- Then using Arduino with GSM connectivity, the collected sensor data is given to the respective monitoring person as real-time notification and mobile application.
- Finally, all the data are given to the mobile application which shows the heartbeat rate, body temperature, and oxygen rate, and it notifies the user that their health condition is normal or abnormal with the location of the user using the GPS-sensor equipped in this device.

The proposed system aims to bridge the gap in existing health monitoring solutions by offering a seamless and user-friendly approach to continuous health tracking. It not only addresses the limitations of current systems but also empowers individuals to take control of their well-being through proactive monitoring.

II. LITERATU REREVIEW

In the last few years, several studies have used wearable technology to monitor health. A number of the contemporary evaluation techniques are discussed in the part that follows, along with some of their drawbacks:

In 2021, Mohd. Hamim, Sumit Paul suggested a IOT based remote health monitoring system for patients and elderly people[1]. In this prototype they used sensors like heart pulse, body temperature, galvanic skin response sensors for collecting data of patient. The collected data are sent to cloud storage and can be accessed by android app. In our system use different sensors including oximeter sensor for better accuracy of patient health care which can be delivered the data by real time notification.

In 2020, Carmela comito, Deborah falcone proposes a paper about integrating IOT and social media for smart health monitoring[2]. They expressed the method of tracking patient health by using various sensor and which processed by microcontroller. Then the data sent to cloud-based storage. Mainly they focus on social media users health conditions for being over face screening. In our system which take care of all people including elderly people.

In 2022, Punit Gupta, Deepika Agrawal have developed a IOT based smart healthcare kit[3]. This kit has used the IOT technology for better efficiency of transmitting data of patient health conditions. They use temperature, blood pressure, heart rate sensors for analyzing the health conditions of patients. The collected data are sent web application. In our system, we use real time notification via SMS.

In 2021, Salma sultana, Sadia Rahman suggested an IOT based integrated health monitoring system[4]. This paper proposes a smart healthcare monitoring system based on IoT, enabling 24/7 patient monitoring by doctors. Health data is collected via sensors and stored in the cloud, accessible through a mobile app.

In 2020, bong jia. Radzi Ambar presented a elderly care monitoring system with IOT application[5]. This paper aims to develop an IoT-based wearable device for elderly fall detection using an accelerometer. The system connects to the Thing Speak IoT platform, allowing remote monitoring by care providers. They use accelerometer sensor and used the Wi-Fi module for data transmission. In our system, we use GPS module for live location tracking of patient.

In 2020, Dev Gupta, Swarnaltha has proposed a paper on basis of integrated healthcare monitoring devices for obese adults using internet of things[6]. This paper aims to implement IoT technology for continuous real-time monitoring and evaluation of health conditions in obese adults. The device developed measures key physiological parameters such as SpO₂, blood pressure, body temperature, and pulse rate, transmitting the data to an IoT dashboard for remote monitoring by healthcare professionals.

In 2021, E.N. Ganesh has developed a health monitoring system using raspberry pi and Iot[7]. This proposed idea will help doctors to know about the state of patient health and monitor anywhere in the world. In this proposed idea the sensors gather the medical information of the patient that include patient's heart rate, blood pressure, and pulse rate then using camera the patient is lively monitored through the raspberry kit and this information is sent to the internet and stored in a medical server.

In 2022, G. Karthick , P. Pankajavalli has proposed a paper about A Review on Human Healthcare Internet of Things: A Technical Perspective[8]. This survey paper explores the advances in Human Healthcare Internet of Things (H2 IoT) and analyses the present-day networks, architectures, topologies, platforms, services and applications in healthcare. This paper also surveys the challenges in H2 IoT design, privacy, security, threats and attack classification. In our system, we resolve all the problem faced by this paper.

In 2021, Mohd Javid has present paper on basis of Internet of Things (IoT) enabled healthcare helps to take the challenges of COVID-19 Pandemic[9]. The application of IoT helps for the better care of the patient during COVID-19 Pandemic. Real-time monitoring is successfully done with IoT and saves lives from different problems like diabetes, heart failure, asthma attack, blood pressure, etc. Smart medical devices are connected via a smartphone to transfer the required health data to the physician smoothly. These devices also collect data on oxygen, blood pressure, weight, sugar level etc.

In 2021, Ali I. Siam, Mohd. Almaiah developed a Secure Health Monitoring Communication Systems Based on IoT and Cloud Computing for Medical Emergency Applications[10]. This paper presents a secure smart monitoring portable system based on Internet-of-things (IoT) technology. The implemented system is designed to measure the health parameters: heart rate (HR), blood oxygen saturation (SpO₂), and body temperature, simultaneously. An ESP8266 integrated unit is used for processing, encryption, and providing connectivity to the cloud over Wi-Fi.

III. REASON BEHIND USING IOT TO MAKE THE MEDICAL SYSTEM EASIER AND APPLICATION OF IOT IN HEALTHCARE

The medical system is gradually improving as a result of the use of IoT devices. IoT is currently influencing the medical research sector in a big way, making it possible to start a better medical system. IoT not only saves time but also money that may be put into research. Real-time monitoring is simple with IoT devices. The importance of real-time, on-time alerts in crucial situations cannot be overstated. For example, if a patient's heart rate, blood pressure, pulse, blood sugar, or other vital signs indicate that they are in a severe situation, automatic alerts will be sent to doctors or hospitals. One of the main reasons for incorporating IoT devices into the medical system is to make it more efficient. IoT can help with the development of healthcare components such as medical equipment and facilities. It's used in healthcare applications like telemedicine, drug management, patient tracking, imaging, and overall hospital workflow. It has the potential to lead to the creation of novel medicines to treat a wide range of illnesses.

IV. DISCUSSION ABOUT SENSOR WHICH WE USED IN OUR PROJECT

The sensors that were used in this experiment are detailed below.

A. Microcontroller

Choose a microcontroller that meets the system's requirements in terms of processing power, memory and input or output capabilities. Popular choices include Arduino, Raspberry Pi, or microcontrollers specifically designed for automotive applications.

B. Temperature sensor

The 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.

C. Heart Rate Sensor

The MAX30100 is an integrated pulse oximetry and heartrate 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.

D. ECG Sensor

The AD8232 ECG sensor is a commercial board used to calculate the electrical movement of the human heart.

E. GPS Module

It can track up to 22 satellites over 50 channels and achieve the industry's highest level of tracking sensitivity i.e. -161 dB, while consuming only 45 mA current.

G. GSM Module

SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls.

F. Wi-Fi Module

The ESP8266WiFi Module is a self-contained SoC with integrated TCP/IP protocol stack that can give access to your Wi-Fi network (or the device can act as an access point).

V. PROPOSED METHOD AND BLOCK DIAGRAM

An Arduino uno board was used in this system with a connection of Wi-Fi module to perform the IOT functions and android application based remote healthcare system. The sensor that used in this system to measure the parameters of body conditions like heart rate, oxygen saturation and body temperature from the following patient.

When the sensor measures the respective parameters will be calculated with the preset of dataset to monitor that the parameter reading is under the normal range. If it exceeds the limit range from any one of the parameters, it will send a SMS message via GSM module to the particular person who monitor the patient along with the patient exact location. The respective data will be also store in cloud base storage. That data can be accessed by doctors through web applications from anywhere.

In this system, the power supply was applied to the Arduino board with the value of 3v - 5v to the Vcc pin. The sensors take the power supply from the microcontroller itself. Only the GSM module and GPS module uses relay to power up its activity. The sensors output data will be given to the analog pins in microcontroller board. The GPS is also sent the input data of location through the digital pin. After all process the output data was sent the GSM module via digital pin of microcontroller. With the help of wifi module the final output data are sent to cloud base storage. The AWS cloud storage is used for cloud storage of patient data and also with web application these data can be retrieved and view by the medical officials or doctors.

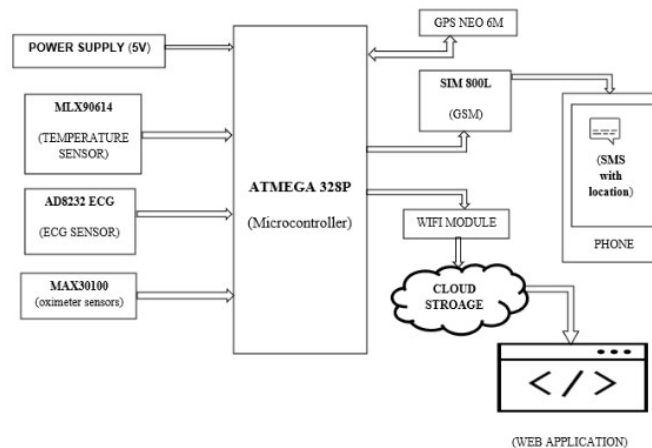


Figure 1: proposed block diagram

VI. RESULT

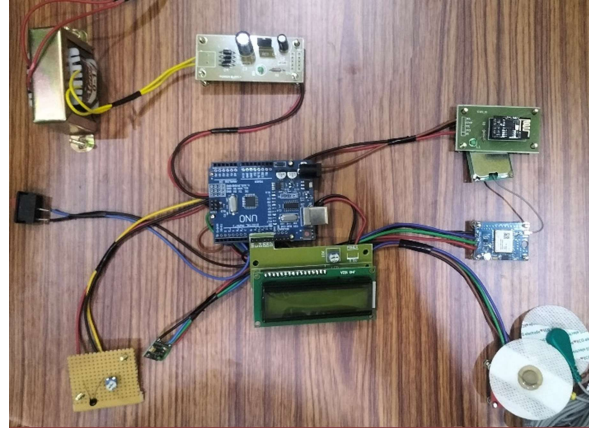


Figure 2: Prototype of system

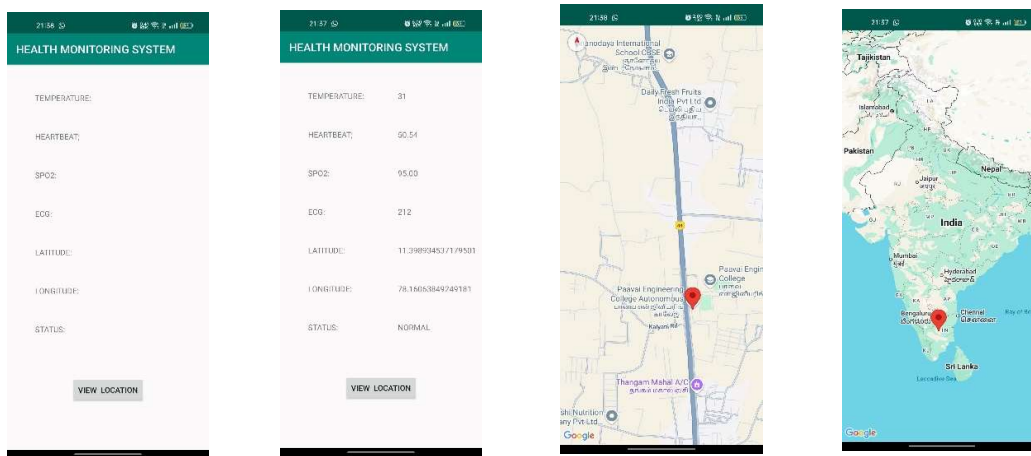


Figure 3: Input and Output

VII. CONCLUSION

It has been proposed to implement a real time health care monitoring system to detect the abnormal conditions of a patient as was described. Temperature and pulse parameters were acquired by the patient and processed with microcontroller to monitor the patient. Its purpose is to assist both the patient and the physician at any time and from any location. We can avoid a critical crisis by using this system. The number of patients is currently so large that doctors are having difficulty keeping track of them. Our system uses real-time data, so if an irregularity happens, a notification will be sent to the doctor right away, and the doctor will be able to take the appropriate steps personally or through the nurse.

VIII. FUTURE WORK

This project was developed with extra another sensor which is called oximetry sensors to monitor the oxygen level of patient. The features of obtaining the patients location with GPS module and transmitting the data over network using GSM module which has sim card within it. If any of one sensors parameter is beyond its limit, then it performs real time notification sender, all corresponding data will be stored in IOT platform for medical official's purpose.

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