# Real-Time Smart Health Alert System

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Abstract: This Health Tracking System is designed to perform continuous real-time tracking of some critical health parameters using various sensors and cutting-edge technology. It features a Heartbeat Sensor to measure heart rate, a Pulse Oximeter to assess blood oxygen levels, and a MEMS sensor intended to detect falls. The obtained data is processed by the sensors, linked to an Arduino UNO for clear and efficient monitoring. A NodeMCU module is used for remote accessibility and transferring the recorded information to the ThingSpeak platform, enabling both users and healthcare members to check health indicators from anywhere in the world. In addition to basic monitoring, this system adds critical safety features for fault-tolerance. If the readings are unusual, such as showing an irregular heart rate or low levels of oxygen, an alert system activates. Automatic messages are sent through a GSM module to numbers that have already been saved. There's also a buzzer that provides audio feedback when it's needed, and a manual emergency button that allows the user to request assistance. This system aims to provide timely health tracking, and response to critical situations, thereby ensuring user safety and good health.

## 1 INTRODUCTION

The Health Tracking System is a futuristic solution to track significant health parameters in real-time which helps in early intervention, especially in conditions that demand immediate medical intervention (Azimi, et al. 2017). It uses different sensors Heartbeat, Mems sensor, Pulse oximeter and so on and it can monitor heart rate, oxygen and body movements all the time (Parekh, et al.2017). Development of immersive experiences and enabling technology-driven methodologies for early health condition screening, useful in early diagnosis and helping to mitigate critical health risks (Azimi, et al. 2017)(Pardeshi, et al. 2017)(Lavanya G, et al. 2017).

An Arduino UNO lies at the heart of the system, which processes the data collected, ensuring necessary and efficient management. To expand its features, a Node MCU module is added which helps to send the data to Thing Speak platform so that doctors or family members can access it remotely (Lokeswari, et al. )(Abdul, et al. ).

The Health Tacking System is designed for monitoring important health parameters, while being able to enable a fast response in an emergency. This allows for real-time health data reading coupled with remote access to this information, facilitating continuous monitoring of the patient's health (Abdul, et al. ). The system is powered by intelligent sensors including the Pulse Oximeter and Heartbeat Sensor that measure vital parameters accurately, every time, enabling you to detect any anomaly in the earliest stage (Parekh, et al.2017 ). Additionally, the MEMS sensor also improves safety, as it can detect falls, making it particularly advantageous for older women or those with a higher risk. With GSM-based alert notifications and a manual emergency button, the system is designed to improve its emergency response capabilities, enabling users to get help rapidly whenever possible (Hu Y, et al.). The amalgamation of predictive observation and instant treatment helps in not only ensuring safety but also preventive healthcare (Azimi, et al. 2017)(Pardeshi, et al. 2017).

## 2 RELATED WORKS

The Health Tracking System is an concept created to facilitate an easy and simpler way of tracking human



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health for people living in the remote corners of the globe where finding a medical professional is not possible. Recent developments in Machine Learning and Internet of Things (IoT) technologies have the potential to open up new opportunities for continuous health monitoring and real-time analysis. The LCD used is a 16x2 LCD which shows the measure values. It is also containing a pulse oximeter for pulse rate and blood pressure measurement. In order to access the data remotely, an ESP8266 Wi-Fi module is used to send the captured data towards IoT platforms such as Thing Speak or All Things Talk, where it is logged and provides us with the analysis. It is a very simple system to use and does not require much technical knowledge. Because it can host multiple people under one account, doctors, specialists or family can track a person's health status over time without having to schedule each individual's visits. It brings medical assistance as close as possible and opens up medical facilities to really residents of these very remote industries.

Healthcare has become a global problem because, for one reason or another, many remote and rural underdeveloped areas of the world still do not have access to these resources (including medical). The use of Internet of Things (IoT) in our system makes the patient health tracking mechanism continuous just by adding the appropriate medical data collection wearable sensors. The system prioritizes relevant information for prompt notification of physicians by monitoring which patients suffer from urgent need for treatment and only writing summaries of relevant patient records, which are stored in the cloud for in-depth review when necessary. These systems allow health workers to monitor and treat patient illnesses remotely without needing to see patients in person, all while improving the quality of care in resource-poor settings.

# 3 PROPOSED METHOD

Health Tracking System can be described as constant monitoring of health parameters using sensors and modern technology. It has a MEMS sensor to detect fell, Pulse Oximeter for monitoring oxygen saturation level, and Heartbeat Sensor for measuring heart rate. The microcontroller obtains the data from all the sensors via Arduino and takes care of the data for the proper and timely monitoring. A Node MCU module sends the collected data to the Thing Speak to allow a people, who can observer the real time data from any place through Internet. The system ensures the continuous monitoring of the physical condition and also provides instant alerts by employing the technology of IoT, thus improving the responsiveness of the critical health condition. The system is packed with extra safety mechanisms to alert the user and their contacts if there's a problem. Now what if he encountered any abnormal parameter then with the help of GSM module system automatically send a notification to pre-registered contacts. This helps to set off timely alerts for medical professionals which can speed up emergency treatments and secure the safety of patients. It also has a manual emergency button to summon help, and a buzzer to tell you when thathelp is needed. So, it combines real- time health tracking with an effective alert system, ensuring safety and improves the quality of life.

## 3.1 Block Diagram

Figure 1 shows the block diagram of an Arduino-based health monitoring system integrated with IoT. The system consists of various sensors such as a heartbeat sensor, MEMS sensor, pulse oximeter, and a push button, all connected to the Arduino. The Arduino communicates with external modules including a NodeMCU (for ThingSpeak cloud connectivity), an LCD for display, a buzzer for alerts, and a GSM module for messaging. The entire system is powered by a power supply.

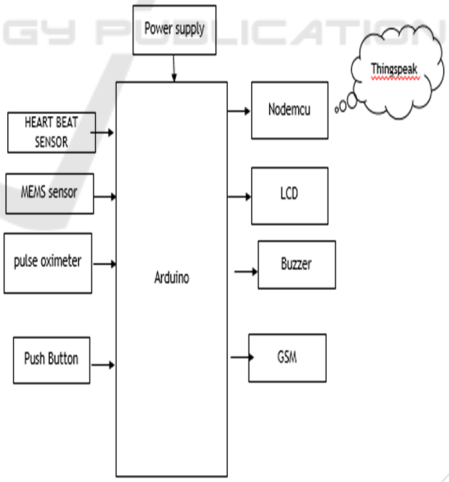


Figure 1: Block Diagram of Arduino-Based Health Monitoring System with IoT Integration.

# 4 METHODOLOGY

Hardware Requirements for the project:

## 4.1 Arduino Mega

The data collected from two or more tracking sensors is processed by the primary microcontroller, which is an Arduino UNO. The Arduino UNO is the data-filtering and conversion center that really made the project effective due to its versatility in managing digital and analog inputs and outputs converting sensor readings into meaningful information and controlling additional components. The real-time data local output is displayed using an LCD, and an emergency GSM module is added. The Arduino UNO is used to integrate and manage all physical components effectively and is compatible with different types of sensors so it is designed to work smoothly as well. The Arduino UNO not only collects data and processes it but also plays an important role in communication between components of your system, too. Finally, a small processing device make it a fluid operate health tracking system with real time's tracking, and reliable communication.

## 4.2 Heartbeat Sensor

The Heartbeat Sensor is prominent and tracks the heart rate continuously, providing continuous values for heart data and useful health information with respect to heart. It works by sensing changes in blood frequency with every stroke volume of the heart, usually at the fingertip or earlobe. The sensor works by using infrared light to detect changes in light absorption due to blood flow; these are then converted into electrical signals, which are processed with the help of Arduino UNO.

The sensor does more than simply track heart rate; it is also integral to tracking potential health concerns. If the heart rate is detected to be not normal (too high or too low), the system can automatically trigger the GSM module and send the alerts to the predefined contacts like healthcaring unit or family. The Heartbeat sensors increases the system's capability to sense early warning signs and enable timely medical assistance by providing real time monitoring and alerts.

## 4.3 MEMS Sensor

Such a sensor is an integral part of this health tracking system in detecting falls and improving safety. This measures dynamic acceleration along three axes, an indication of changes in movement and orientation. Something into sudden acceleration, a shift like, a fall, then the sensor stores the data and tells the system to react appropriately. It accurately tracks standing, walking, exercise and movements enabling timely notifications when required.

The ADXL345 sensor, on the other hand, constantly analyzes the user's movements and plays a vital role in fall detection. Communicates with the Arduino UNO and processes incoming data, constantly checking to see if a fall has occurred. In case a fall is detected, it raises an alarm and sends a notification to a pre-registered contact via GSM. This can be a great help for users with medical conditions or for high- risk environments, where help is needed sooner rather than later.

## 4.4 SPO2 Sensor

This sensor is a vital part of this health tracking system, designed to measure blood oxygen saturation (SpO2), a crucial role for health management. This real-time monitoring helps assess oxygen circulation in the body, enabling early detection of potential respiratory concerns.

In the event that the oxygen saturation falls below an acceptable level, the GSM module alerts the nominated contact or medical service. This is especially helpful for those who have respiratory issues, to ensure they are immediately attended to in the event their oxygen levels fluctuate. The Pulse Oximeter sensor's capability to offer continuous and reliable SpO2 data complements the system's ability to facilitate proactive healthcare and timely interventions.

## 4.5 Push Button

The push button is an important emergency tool that allows users to call for help when needed. When the user becomes sick or faces a health-related crisis, the push of a button, is a simple and quick method to summon assistance. Built with user- friendly in mind, it is easy to use, even for those with little technical experience. When activated, the system immediately sends an alert to contacts previously entered into the system, including family members, healthcare providers, or caregivers. This allows users to take charge in emergencies where talking is not an option, thereby improving safety.

Along with the automatic sensing of abnormal health parameters, having a push button is an essential combo of the system that never fails to detect if the automated system fails to send an alert. Overall, the inclusion of such emergency features serves to bolster the system's potential, offering prompt medical intervention and improved security for users.

## 4.6 GSM

The GSM module is vital to the communication between health tracking system and emergency contacts. If an abnormal HR or SpO2 is detected, the module will automatically send warning messages to the predefined phone numbers to notify the caregivers and medical specialists in real time. This means that users can get medical attention in a timely manner, and without needing to make a phone call themselves, in cases where they might not be able to do so. Although the system uses IoT to send health data to Thing Speak, the GSM ensures that the required information will still be sent through text messages. This becomes a vital module for health tracking and emergency reciprocation, as it improves the reliability of the health systems, be it used for emergency notifications or routine updates.

## 4.7 Nodemcu (ESP8266)

Node MCU, especially in obtain to health data is an essential part of this health tracking system. It is an intermediary link between Arduino UNO which sends the sensor readings to Thing Speak based on cloud where the users and health-care professionals can monitor health parameters in real time. An internal Wi-Fi module (Node MCU) allows the system to connect to the internet and forward key health information (heart rate, oxygen levels and fall detection results,) for remote analysis. This allows for constantly monitoring the patients, even if there are no doctors around. Apart from data transmission, Node MCU also help increase system efficiency through remote monitoring and control features. With IoT integration, users can securely access their health records from anywhere, enabling timely intervention when needed. The module is capable of interfacing with multiple sensors simultaneously, making it an ideal choice for applications that involve real-time sensor data processing. The versatility and simplicity of wireless technology and influencers on project contributions comes to setup the system in more operational and feasible machine as this can improve and enhance the health data which is useful to patients through continuous, real-time information.

## 4.8 LCD

In this project, LCD screen is used as display interface to visualise the health parameters to the user in real-time. The system's screen uses LCD technology, which only displays accurate health readings, enabling users to track their health effortlessly without any need to rely on other devices or different software. This becomes especially useful for someone who lives in a home care setting or who stays far away from medical professionals. More than just using the screen, by constantly providing the user updates, the LCD greatly makes the system easier to use as a whole. It also decreases users' reliance on alerts or other communications sound by external devices, allowing them to check their health as needed. When LCD headlights indicate the system is working or when potentially hazardous LCDs indicate a health issue detected by the system.

## 4.9 Buzzer

Here comes the buzzer, which in this project is the alarm that plays a significant role in alerting users with sound notifications whenever there is any health risk or system interaction. It Buzzer emits loud sound when it finds Irregular Heart rate, Low SpO2 or any abnormal body condition. This is particularly helpful in high- stress or emergency situations where the user may be unable to even glance at the LCD screen or misses a mobile notification.

These reassuring sounds confirm that the distress signal has been triggered, and that assistance is on the way. The addition of a buzzer elevates the project's effectiveness in emergencies, assuring that critical alerts stand out and lead to quick action being taken.

### 4.9.1 Advantages and Applications

**Advantages**

- Real-time
- Affordability
- Performance
- Cost-Effectiveness
- Ease of Access
- User-Friendliness
- Expandability
- Smart Automation
- Mobility
- Live Tracking

**Applications**

- Virtual Healthcare
- Connected Health
- Wellness Monitoring
- Smart Wearables

- Distant Patient Care
- Health Status Tracking
- Accident Detection
- Urgent Medical Alert
- Life Sign Monitoring

- Rapid Emergency Assistance

## 5 RESULTS

Figure 2 illustrates the Thing Speak Health Monitoring Dashboard where real-time sensor data is displayed. Figure 3 shows the emergency alerts received from the user in critical situations. Figure 4 presents the complete view of the assembled health monitoring kit.

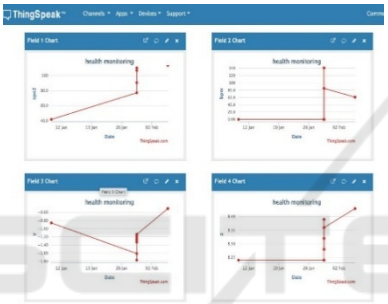

Figure 2: ThingSpeak Health Monitoring Dashboard.

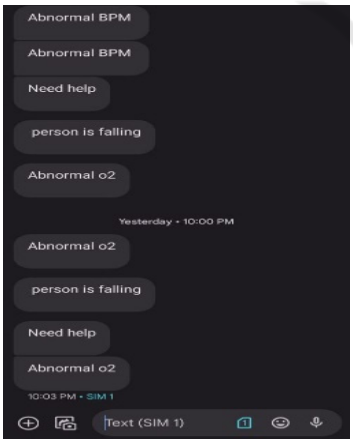


Figure 3: Emergency Alerts Received from User.

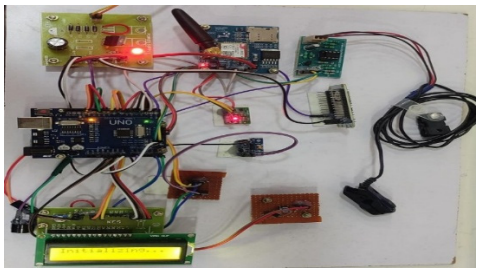

Figure 4: Total Kit.

## 6 CONCLUSIONS

The system proposed so far in this paper is an effective Health tracking System which makes use of the high-end sensing and communication technologies to monitor and display the certain important health parameters continuously. The system includes several components as integrated so that physiological data (e.g., cardiovascular activity) and motion-related events can be monitored with precision. The microcontroller processes the data acquired from the sensors and the accessed data is sent to the computer server through an internet-enabled module; enabling the users and the medical practitioners to gain access to real-time health data at any moment and from anywhere via an associated online portal. It encourages preventive care, requiring early medical treatment

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