REAL-TIME SMART HEALTH ALERT SYSTEM

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ABSTRACT:

The Health Tracking System is developed to provide continuous real-time tracking of essential health metrics through multiple sensors and advanced technology. It incorporates a Heartbeat Sensor to record heart rate, a Pulse Oximeter to evaluate blood oxygen levels, and a MEMS sensor designed to recognize falls. These sensors are linked to an Arduino UNO, that processes the obtained data for precise and efficient monitoring. For remote accessibility, a NodeMCU module is utilized to transmit the recorded information to the ThingSpeak platform, allowing users and healthcare members to access health indicators from anywhere in the world. Beyond routine monitoring, this system includes essential safety mechanisms for emergency scenarios. If any unusual readings, such as irregular heart rate or low oxygen levels, are detected, an alert system is activated. A GSM module sends automatic notifications to pre-registered emergency numbers. Additionally, a manual emergency button permits users to request help, while a buzzer offers a hearable alert when needed. The objective of this system is to facilitate timely health tracking and ensure a swift response in critical situations, ultimately enhancing user safety and well-being.

Keywords: Security, Notification, Microcontroller, Intelligent Processing, Smart Connectivity.

I. 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 [1]. 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 [6]. 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 [1][2][3].

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 [4][5].

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 [5]. 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 [6]. 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 [7]. The amalgamation of predictive observation and instant treatment helps in not only ensuring safety but also preventive healthcare [1][2].

II. RELATED WORKS:

The Health Tracking System is a concept built to offer an easy and simpler method of monitoring human health for individuals that live in remote locations of the world where access to medical professionals is uncommon. This system enables real-time health tracking by transmitting collected data to a remote server, allowing healthcare professionals to assess a patient's condition from a distance. The measured values are displayed on a 16x2 LCD screen. Additionally, a pulse oximeter is integrated to monitor pulse rate and blood pressure. To facilitate remote access, an ESP8266 Wi-Fi module transmits the collected data to IoT platforms like Thing Speak or All Things Talk, where it is logged and available for analysis. The system is quite simple to use, requiring limited technical expertise. It can also accommodate multiple people under one account which means doctors, specialists or family can follow and monitor a person's health status over time without requiring

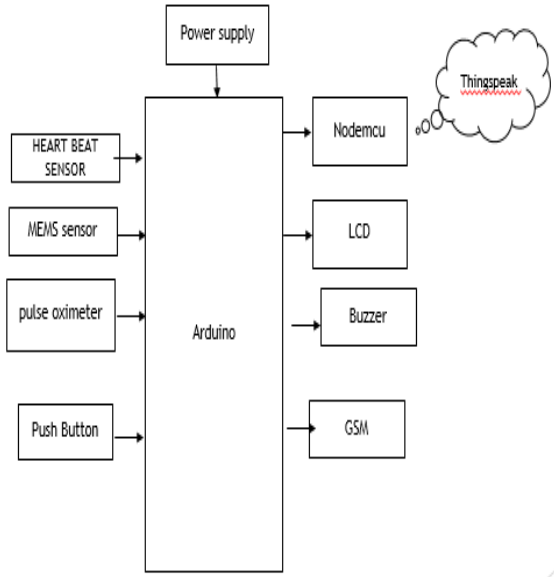
them to come in for repeated visits. It allows medical intervention to as possible and makes healthcare structures accessible to in fact those living in such remote locations.

The IoT-based Patient Health Tracking System aims to address the global challenge of healthcare as many remote and rural underdeveloped regions of the world lack access to medical resources for varied reasons such as finance and logistics. Our system employs Internet of Things (IoT) to make the patient health tracking system continuous just by integrating the required medical data gathering wearable sensors. By implementing a risk-based prioritization approach, the system ensures that physicians receive timely alerts and summaries, while detailed patient records remain accessible via cloud storage for further analysis. This technology enables medical professionals to monitor and manage patient health conditions effectively, even without direct physical consultations, thereby enhancing the overall quality of healthcare services in resource-limited settings.

III. PROPOSED METHOD

The main purpose of Health Tracking System is to continuously check essential health parameters using a combination of sensors and modern technology. It features a MEMS sensor to keep track of falls, Pulse Oximeter for observing oxygen saturation position, and a Heartbeat Sensor for checking heart rate. All the sensors are integrated with an Arduino microcontroller, which handle the gathered data for correct and proactive monitoring. To grant and telework, a Node MCU module transmits the collected data to the Thing Speak, allowing people to monitor real-time updates from any location via the internet. By using IoT technology, the system makes sure continuous tracking of physical condition and instant alerts, enhancing responsiveness to critical health conditions. The system comes with a host of added safety features to warn the user and their contacts in the event of an emergency. If any abnormal parameter is encountered the system automatically notifies pre-registered contacts using a GSM module. This ensures timely alerts, enabling quick medical intervention and enhancing patient safety. It has a manual emergency button to call for help, and a buzzer to alert you when that help is needed. So, by offering real- time health tracking combined with an efficient alert system provides safety and enhances the well-being.

Block Diagram:



Methodology

Hardware Requirements for the project:

Arduino Mega:

The Arduino UNO is primary microcontroller, which process data from multiple tracking sensors. Acting as a data-filtering and conversion center, the Arduino UNO stands out due to its ability to manage both digital and analog inputs and outputs, translating sensor readings into usable information and effectively controlling additional components. An LCD display is used to show real-time local output, while a GSM module sends emergency alerts when necessary. The Arduino UNO efficiently integrates and manages all hardware components, contributing compatibility with different types of sensors and ensuring easy plan for seamless operation. In addition to collecting and processing data, the Arduino UNO also helps communicate between various system components. Then it is combined with a small processing device can make it a seamless operate health tracking system with real time's tracking, and reliable communication.

Heartbeat Sensor:

The Heartbeat Sensor is essential for continuously tracking the heart rate, offering valuable insights into cardiovascular health. It operates by detecting

variations in blood rate with each heart stroke volume, typically measured at the fingertip or earlobe. Using infrared light, the sensor captures changes in light absorption caused by blood flow and converts them into electrical signals, which are then processed by using Arduino UNO.

Beyond basic heart rate tracking, the sensor plays a key role in identifying potential health concerns. If an irregular heart rate is detected—whether too high or too low—the system can automatically activate the GSM module to send alerts to designated contacts, such as healthcare providers or family members. By offering real-time monitoring and timely notifications, the Heartbeat Sensor enhances the system's ability to detect early warning signs and facilitate prompt medical intervention.

MEMS Sensor:

This sensor plays a vital role in this health tracking system by detecting falls and enhancing safety. This three-axis accelerometer measures dynamic acceleration, enabling it to track movement and orientation changes. When a sudden acceleration shift occurs, such as during a fall, the sensor records the data and alerts the system to respond accordingly. With its high accurate motion capture, it effectively monitors tasks like standing, walking, exercising and sudden movements, ensuring timely notifications when necessary.

Furthermore, the ADXL345 sensor continuously analyzes the user's movement patterns, playing a crucial role in fall detection. It communicates with the Arduino UNO, processing incoming data to decide if a fall has happened. When a fall is examined, the system activates an alarm and sends a notification to pre-registered contacts using the GSM. This feature is especially beneficial for individuals with medical conditions or those in high- risk environments, ensuring timely assistance when needed.

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.

Push Button:

The push button functions as a vital emergency tool, giving users the ability to request help when necessary. If sickness or any other health related condition is found or the user feels unwell, pressing the button offers a fast and simple way to get help. Designed for user- friendly operation, it ensures accessibility even for those with minimal technical experience. Once activated, the system promptly sends an alert to pre-registered contacts, such as family members, healthcare providers, or caregivers. This feature enhances safety by giving users control over emergency situations, particularly when verbal communication is not an option.

The system also senses abnormal health parameters automatically but having a push button is a significant combination that always ensures if the automated system doesn't send an alert. In general, the presence of this emergency function enhances the system's capabilities, to provide timely medical support and enhance user safety.

GSM:

The GSM module has a crucial role in having communication between the health tracking system and emergency contacts. If an abnormal heart rate or low oxygen level is found, the module automatically sends alert messages to predefined phone numbers, ensuring that caregivers and medical experts are informed in real- time. This allows users to receive timely medical attention without needing to make a call themselves, especially in situations where they may be unable to do so. The system mostly depends on IoT for transmitting health data to Thing Speak, the GSM ensures that essential information is still delivered via text messages. Whether used for emergency notifications or routine health updates, this module enhances system reliability, making it a vital component for health tracking and emergency reciprocation.

Nodemcu (ESP8266):

This health tracking system, Node MCU plays a vital role in obtain to health data accordingly. It is a medium between the Arduino UNO, which provides sensor readings, and the cloud-based Thing Speak

platform, allowing users and healthcare providers to monitor health metrics in real time. With built-in Wi-Fi capabilities, Node MCU connects the system to the internet and transmits key health data, including heart rate, oxygen levels, and fall detection results, for remote analysis. This ensures continuous monitoring, even in the absence of medical professionals. Beyond data transmission, Node MCU enhances system efficiency by enabling remote monitoring and control. Through IoT integration, users can securely access their health records from any location, allowing for timely intervention when needed. Designed to handle multiple sensor inputs at once, the module ensures seamless and reliable data transfer. By providing wireless connectivity and real-time updates, Node MCU significantly improves the system's functionality, making remote health monitoring more effective and accessible.

LCD:

In this project, an LCD screen works as a display interface to show the health parameters to the user in a real-time manner. The system features an LCD that provides clear and accurate health readings, allowing users to monitor their condition easily without the need for additional devices or software. This feature is particularly beneficial for individuals in home care settings or those who lack immediate access to medical professionals. Even more than just a simple screen usage, by providing the user with updates at all times, the LCD makes the entire system easier to use. It also reduces users' dependence on alerts or other notifications that external devices produce, letting them check their health whenever they want. When the LCD displays that the system is functioning properly, or potentially dangerous when the system detects a health problem.

Buzzer:

In this project, the buzzer functions as an audible alert system, ensuring users receive immediate notifications about potential health risks or system warnings. If an irregular heart rate, low SpO2 level, or any other abnormal condition is detected, the buzzer emits a loud sound to alert the user. This feature is particularly beneficial in high- stress or emergency situations where the user may not be monitoring the LCD screen or may miss a mobile notification.

This sound confirmation ensures that the distress signal has been successfully activated and that help is being summoned. By including a buzzer, the project enhances the system's effectiveness in emergency situations, ensuring that critical alerts are noticeable and prompt immediate action.

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

I. RESULTS

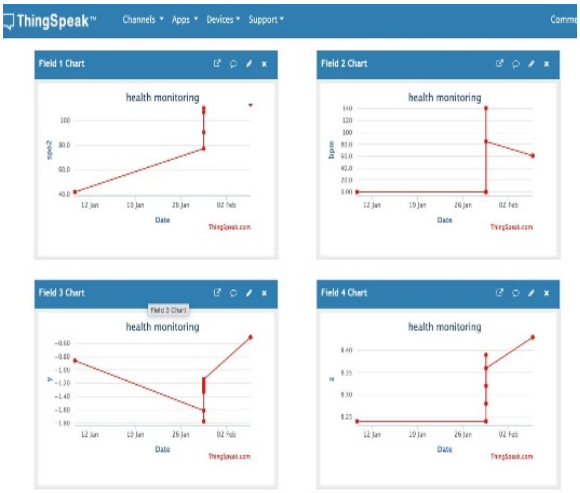


Fig1: ThingSpeak Health Monitoring Dashboard

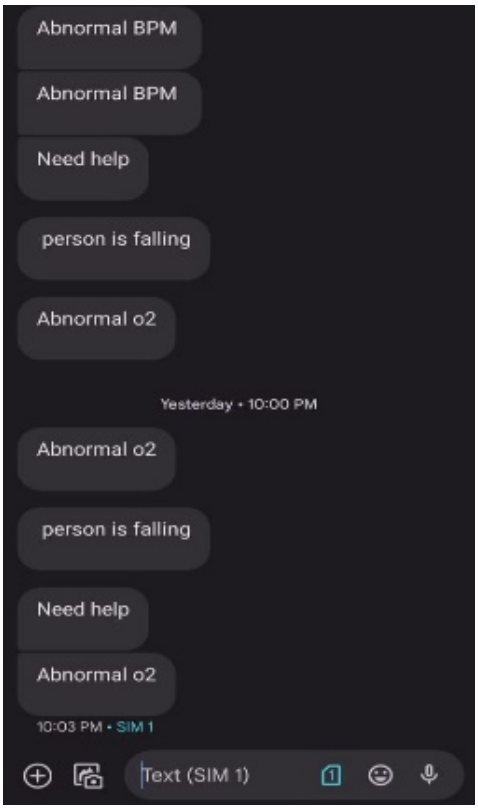


Fig2: Emergency Alerts received from user.

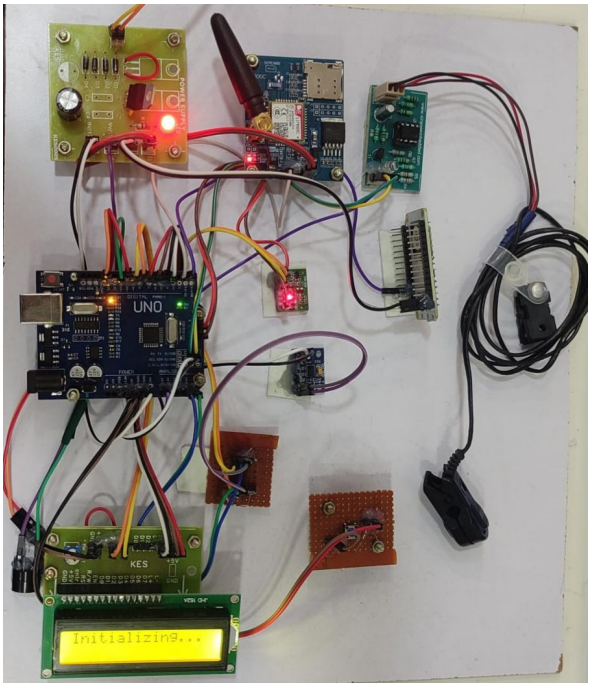


Fig3: Total KIT

IV. CONCLUSION

The proposed Health tracking System in this study utilized the state-of-the-art sensing and communication technologies to continuously monitor and show certain vital health elements. The system comprises several components as integrated so that physiological data (e.g., cardiovascular activity) and motion-related incidents can be monitored accurately. A microcontroller is responsible for processing the data from the sensors, and the harvested data is transferred to the computer server via an internet-enabled module; allowing the users and the medical practitioners to have access to real-time health information at any time and from anywhere through an online platform. This approach promotes proactive health management and ensures timely medical intervention

V. REFERENCES

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