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Patient Health and Security Monitor

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ABSTRACT :

The Patient Health and Security Monitor is an advanced Arduino-based system designed to track vital health parameters such as body temperature, heart rate, and humidity levels in real time. It is highly useful in hospitals, elderly care centers, and home healthcare setups, ensuring continuous monitoring of patients or individuals who require supervision.

The system integrates multiple sensors, including a pulse sensor, temperature and humidity sensor (DHT11), and an ultrasonic sensor to detect movement within a defined range. If the monitored person moves beyond this boundary, a buzzer is triggered, alerting caregivers or medical staff to take action. The device also features a wireless connectivity module (ESP8266), allowing remote monitoring, while an LCD screen displays real-time data.

With its compact design, cost-effectiveness, and ease of use, this system enhances patient safety and security by reducing manual monitoring efforts. It plays a significant role in smart healthcare solutions, making health tracking more efficient and accessible in hospitals, nursing homes, and even residential setups.

Keywords :- IoT, Caregiver, wearable devices , vital signs, security, alerting, patient monitoring.

Introduction:

In today's world, real-time health monitoring and security systems are essential for ensuring the well-being of individuals, especially patients, elderly people, and those requiring continuous supervision. Traditional healthcare monitoring methods rely on manual checks, which can be time-consuming and prone to delays. To overcome these limitations, an automated wireless monitoring system is developed to provide real-time tracking of vital health parameters and movement. The Wireless Health and Security Monitor is an advanced system built using Arduino, designed to track body temperature, heart rate (BPM), and humidity levels while ensuring security through movement detection. The system incorporates an ultrasonic sensor to monitor a predefined area, and if a person moves beyond the set boundary, a buzzer is triggered to alert caregivers or medical staff.

This system features a Wi-Fi module, enabling remote monitoring by transmitting real-time data to an online platform or a mobile application. This allows caregivers and healthcare professionals to track patient status from a distance, reducing the need for constant physical supervision. Additionally, an LCD screen is integrated into the hardware to provide an instant on-device display of health parameters, ensuring quick access to essential information.

The Wireless Health and Security Monitor is particularly beneficial for hospitals, elderly care homes, and home healthcare setups, where continuous monitoring is crucial. By combining wireless technology, sensor-based automation, and real-time alerts, this system offers a cost-effective, efficient, and user- friendly solution for enhancing patient care and security. Its implementation contributes to the growing field of smart medical technology, making healthcare monitoring more accessible and reliable.

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1.1. Define User based problem

Especially in hospitals, elderly care facilities, and home environments, caregivers struggle to constantly track patients' vital signs and movement. Without quick detection, patients with mobility problems, dementia, or severe medical conditions could wander off or have health changes. No real-time alerts or automated monitoring raise the possibility of delayed medical responses, therefore rendering conventional systems ineffective and untrustworthy for guaranteeing patient safety.

1.2. Problem Definition

The absence of real-time tracking and automated alerts makes it difficult to monitor patients' vital signs and movement in hospitals, elderly care facilities, and homes. Caregivers sometimes find it difficult to constantly monitor movement, heart rate, and temperature, therefore raising the

possibility of delayed reactions in crisis situations. Patients, particularly those with mobility restrictions or cognitive disabilities, may unknowingly cross safe zones and cause accidents. Current systems are inefficient for remote healthcare monitoring since they lack instant alerts and need manual supervision..

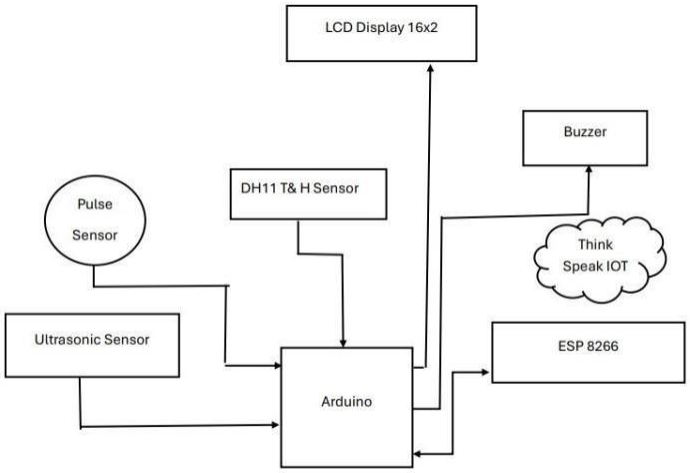
Literature survey :

Real-time monitoring in healthcare and security depends increasingly on wireless health and security monitoring systems. Often, ultrasonic sensors detect human presence and movement by means of ultrasonic wave emission and reflection time measurement. These sensors are good for tracking human activity in homes and healthcare environments, as well as for spotting illegal movement in security systems. They are reasonably priced, non-invasive, and perform well in many settings.

Temperature and humidity sensors are critical for ensuring optimal environmental conditions, particularly in healthcare, where they help maintain comfort and safety for patients, especially those with respiratory issues. Security applications also make use of these sensors to track sensitive locations including drug storage. When included into wireless systems for real-time monitoring, recent developments in sensor technology have made these sensors more accurate and dependable.

In these systems, buzzers are efficient alert systems that offer audible notifications when notable changes, including abnormal temperatures or movement, are found. Used in security systems to warn staff of possible breaches, they are also used in healthcare to notify carers. Buzzers can guarantee quick reactions to crises when combined with wireless communication protocols, therefore enhancing safety and efficiency in security and healthcare settings.

Block diagram:



Designed to track a patient's vital signs and movement in real-time, the Wireless Health and Security Monitor system guarantees safety and remote observation. The central processing unit is the Arduino microcontroller, which gathers and processes data from several sensors.
While the DHT11 temperature and humidity sensor records environmental conditions, the pulse sensor constantly tracks the patient's heart rate, so guaranteeing a safe and comfortable environment. Movement within a specified boundary is detected using an ultrasonic sensor. Should the patient exceed the set limit, the system activates a buzzer to immediately notify nearby carers.
A 16×2 LCD display shows real-time health parameters for local monitoring, so users can easily check the data at a glance. The system also includes an ESP8266 Wi-Fi module that sends the gathered data to the thing Speak IoT cloud platform, so enabling online remote tracking. This guarantees that even from a distance doctors or carers can track the patient's health status.

By combining multiple sensors, real-time alerts, and IoT-based remote access, the system enhances patient safety, reduces the need for constant physical supervision, and ensures immediate responses in case of emergencies.

Hardware Description:

Arduino Nano

Based on the ATmega328P microprocessor, the Arduino Nano is a small variant of the Arduino family. Its tiny size makes it perfect for portable and space-limited applications. The board supports communication protocols including I19C, SPI, and UART and is programmed using the Arduino IDE..

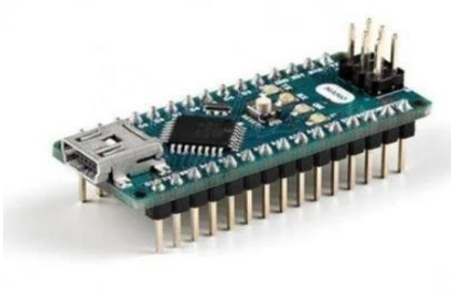


Figure 4.1 Arduino Nano Microcontroller Board

In the smart blind stick project, the Arduino Nano is the main control device. It is essential to coordinate the several functions and features of the smart stick. Processing data from sensors and modules, the Arduino Nano makes real-time decisions based on the input received and offers useful user feedback. The Arduino Nano communicates with the GSM module, interprets GPS data, and runs a programmed algorithm for obstacle detection using its microcontroller. It interacts with ultrasonic sensors to find obstacles in the user's path and activates suitable feedback systems, including beeping notifications. It also runs GPS coordinates to allow precise location tracking, therefore helping the visually impaired user to navigate.
Through its robust programming capabilities and versatility, the Arduino Nano ensures that the smart blind stick functions as an effective aid, enhancing the user's safety and independence while navigating through various environments

LCD Display (I2C Compatible)

Standard alphanumeric display, the 16x2 LCD has 16 columns and 2 rows. It allows simple integration with the Arduino Nano by using an I2C module to cut the number of needed connections.

4.2 Figure 16x2 LCD Display (I2C Compatible*)*

Commonly found in TVs, computer screens, and electronic devices, a flat-panel display technology called a Liquid Crystal Display (LCD) uses liquid crystals to modulate light, therefore generating images by manipulating the polarization of light.
A flat panel display called LCD (Liquid Crystal Display) runs mostly on liquid crystals. Because they are often found in smartphones, televisions, computer monitors, and instrument panels, LEDs have a large and varied range of applications for consumers and businesses.

Wi-Fi Module

The ESP8266 is a low-cost Wi-Fi module that can be configured as a standalone microcontroller or used with an Arduino. In this project, it transmits health data (BPM and temperature) to a cloud server or smartphone app for remote monitoring

Figure 4.3 ESP8266 Wi-Fi Module

The ESP8266 is a low-cost, versatile Wi-Fi module that allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections, often used in IoT applications

ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Ultrasonic Sensors

Using sound waves, an ultrasonic sensor is a device that can gauge the distance to an object. Its distance measurement is based on sending out a sound wave at a particular frequency and monitoring for that sound wave to reflect back..

Figure 4.4 HC-SR04 Ultrasonic Sensors

Primarily acting as the obstacle detection tool, the HC-SR04 ultrasonic sensor is a basic part of the smart blind stick project. Operating on the concept of sound wave reflection, this sensor is accurate and dependable in spotting obstacles in the user's path.

The smart blind stick's HC-SR04 sensor fires cone-shaped high-frequency ultrasonic waves. The sensor tracks the time it takes for the waves to return; these waves reflect off objects in the surroundings. The sensor can precisely identify the distance to the closest obstacle by computing the time of transmission and reception.

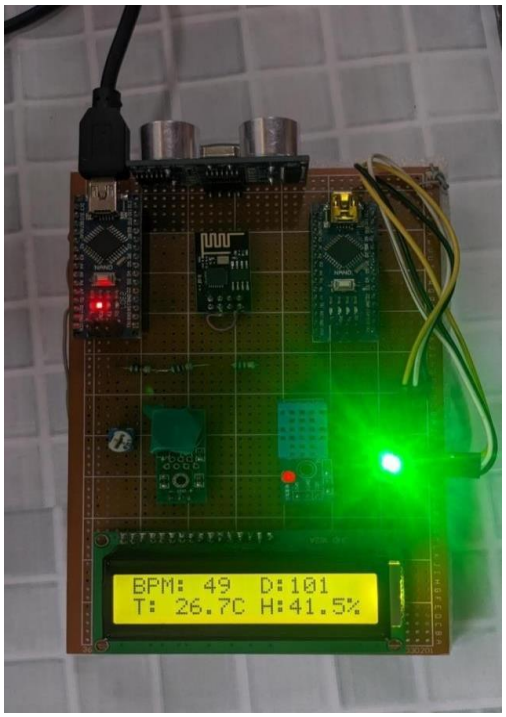
A wide field of view is covered by the HC-SR04, which is strategically positioned on the smart blind stick at several angles. The sensor notifies the Arduino Nano of an obstacle falling within a defined range. The Arduino Nano then activates the buzzer to help the visually impaired user to safely move and prevent object collisions in their path. Its accuracy and quick reaction make the HC-SR04 an essential tool for improving the user's mobility and safety when using the smart blind stick..

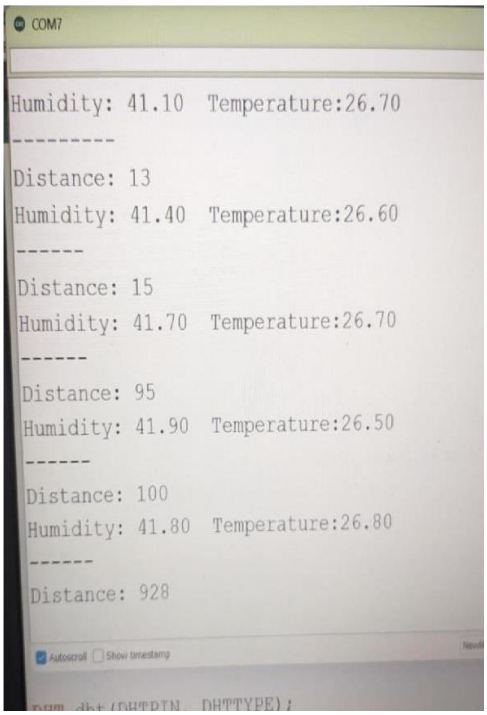
Future Directions :

- Advanced Sensor Integration – Adding ECG, SpO2, and blood pressure sensors for better health monitoring.
- AI-Based Alerts – Using machine learning to predict health issues and send early warnings.
- Mobile App Connectivity – Developing a smartphone app for real-time remote monitoring and alerts.

Real-time health tracking and movement monitoring by the Wireless Health and Security Monitor improve patient safety. Its accuracy and efficiency will be further enhanced by future developments in sensor technology, artificial intelligence, and remote access, therefore enabling a vital tool for quicker medical help and smarter healthcare..

Output:





Result:

we successfully perform Wireless Health and Security Monitor designed using Wi-Fi Module Which detects Heart rate(BPM), Humidity, and Distance of Patient.

Conclusion:

In conclusion, The Wireless Health and Security Monitor is an efficient and reliable system designed to enhance patient monitoring and security using Arduino, Wi-Fi, and multiple sensors. It effectively tracks body temperature, heart rate (BPM), and humidity levels, while the ultrasonic sensor ensures patient safety by detecting movement within a predefined range. The buzzer alert system provides immediate notifications if a patient moves beyond the set boundary, reducing risks and improving caregiver response time.

With Wi-Fi connectivity, the system enables remote monitoring, allowing healthcare providers or family members to track health data from any location. The LCD display ensures real-time data visualization, making it user-friendly. Its automation, cost-effectiveness, and scalability make it suitable for various applications, including hospitals, elderly care centers, and home healthcare.

Overall, this project contributes to smart healthcare solutions by integrating health monitoring with security features, providing a cost-efficient, real-time, and user-friendly approach to patient care. Future enhancements could include additional sensors for more health parameters, GPS tracking, or AI-based data analysis to further improve its functionality.

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