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Paralysis Patient Healthcare Monitoring System

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Abstract— Paralysis patients often face challenges in both movement and communication, which can make it difficult for them to get help when they need it. This project introduces an automated healthcare monitoring system designed specifically to support paralysis patients in their daily lives. The system allows a patient to send messages simply by moving a part of their body—such as tilting a small device using a hand or finger that still has some mobility. When the device is tilted in a certain direction, a message is displayed on an LCD screen, and an SMS alert can be sent through a GPRS module to notify a caregiver remotely.Along with messaging, the system also monitors the patient's vital signs in real time to ensure their health is constantly tracked. This can be especially useful when the patient is alone, as it provides a quick way to request help or report a problem without needing to speak or move significantly. The main goal of this system is to improve the safety and independence of paralysis patients by offering a simple, reliable way to communicate and monitor health conditions from a distance

I. INTRODUCTION

Microdrones—also referred to as mini or nano drones—are becoming increasingly popular due to their small size, maneuverability, and ability to operate effectively in tight or confined spaces [2]. These lightweight unmanned aerial vehicles (UAVs) are used across diverse applications such as surveillance, environmental monitoring, disaster response, and delivery services. Despite their versatility, ensuring safe and autonomous navigation remains a significant challenge, particularly in cluttered or unpredictable environments. Addressing this challenge requires the integration of advanced sensing and control technologies [5].

LiDAR (Light Detection and Ranging) has emerged as a highly effective solution for obstacle detection and navigation assistance in UAVs. This technology works by emitting laser pulses and measuring the time they take to reflect off objects, enabling it to generate highly accurate three-dimensional representations of the surroundings [1]. Compared to conventional sensors like ultrasonic or infrared, LiDAR offers superior range, precision, and performance under various lighting conditions, making it ideal for drone-based applications [2][3].

This project presents the design and implementation of a microdrone integrated with a LiDAR-based proximity alert system. The drone employs a LiDAR-Lite v3 sensor to detect nearby obstacles and activates a buzzer when objects are within a predefined threshold distance [6]. A NodeMCU microcontroller, equipped with Wi-Fi capabilities, is used to process the LiDAR data and communicate with the Pixhawk flight controller for real-time navigation and obstacle avoidance [4][5].

One such technology is LiDAR (Light Detection and Ranging), which uses laser pulses to measure distances with high precision. LiDAR can create accurate 3D maps of the environment, making it particularly effective for obstacle detection and avoidance. Compared to other common sensors, such as ultrasonic or infrared, LiDAR offers superior range, accuracy, and reliability, particularly in environments where lighting conditions are variable. These features make it an ideal choice for UAVs, especially those that operate in complex and cluttered environments [1][2][3].

II. BLOCK DIAGRAM

The proposed system is designed to improve accessibility for individuals who are blind, deaf, or mute by combining gesture detection with home automation in a smart glove. This innovative glove uses flex sensors to capture hand gestures and translate them into meaningful actions, such as voice output, text display, or controlling home appliances. An ESP32 microcontroller processes these gestures and communicates wirelessly via Bluetooth or XBee modules, allowing the user to interact with devices like lights, fans, and more, just through hand movements. By enabling gesture-based control, this system offers a hands-free way to interact with technology, empowering individuals with disabilities to achieve greater independence and ease in their daily lives.

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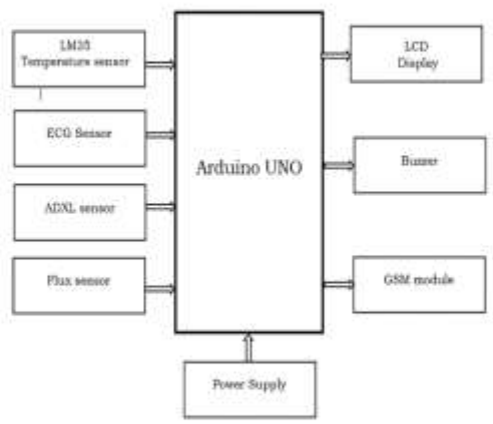


Fig.1: System block diagram

1.LM35 Temperature Sensor: This sensor is used to measure the body temperature of the patient. It provides an analog voltage output that is proportional to the temperature, which is then processed by the Arduino.

2. ECG Sensor: The ECG sensor captures the electrical activity of the heart, allowing for continuous heart monitoring. Abnormal heart patterns can trigger alerts.

3. ADXL Accelerometer Sensor: This sensor detects the movement or orientation of the patient. It is especially useful for fall detection or monitoring sudden motion
4.Flux Sensor: Used to detect changes in magnetic fields, this sensor can be employed for monitoring limb movement or other physical activities.

5. Arduino UNO: The Arduino UNO is the core of the system, responsible for processing the data received from all the connected sensors. It analyzes sensor data and uses predefined conditions to control the outputs, such as activating the alarm or sending SMS alerts. The versatility of the Arduino allows for easy integration of additional sensors and actuators, making the system highly customizable and scalable for different medical applications.

6. LCD Display (16x2): The 16x2 LCD Display provides real-time visualization of critical health parameters, such as body temperature, heart rate, and patient movement data. This display allows caregivers, medical staff, and patients to quickly assess the patient's status without needing to access complex data logs. The display provides a clear, user-friendly interface for monitoring the patient's condition.

7. Buzzer: The buzzer serves as an auditory alarm that activates whenever a sensor detects an abnormal condition. This alert mechanism is essential for immediate intervention, as it draws attention to the problem regardless of whether the monitoring system is being actively observed. For example, if the patient's heart rate falls outside a safe range, or if a temperature spike is detected, the buzzer will sound to alert caregivers.

8.GSM Module: The GSM Module is integrated into the system to send SMS alerts to registered phone numbers in case of an emergency. This feature ensures that caregivers, family members, or medical professionals can be notified promptly, even when they are not physically present near the patient. SMS alerts can include critical information such as the nature of the abnormal reading (e.g., high temperature, irregular ECG) and the specific sensor that triggered the alert.

III. IMPLEMENTATION:
Flow Chart:

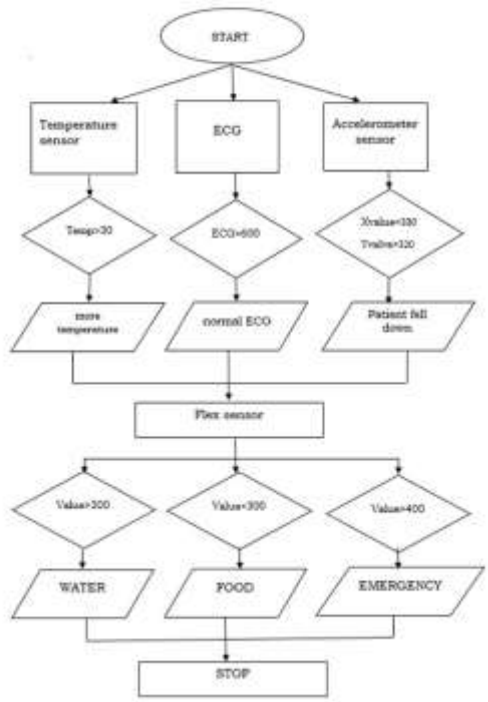


Fig. 2: Flow chart of Paralysis Patient Healthcare Monitoring System

1. Start: The system starts working automatically when powered on, or it can be manually triggered by a caretaker or nurse.
2. Sensor Initialization: The system gets all its parts ready. This includes: Temperature sensor to check body heat, ECG sensor to monitor heart activity, Accelerometer to detect movement or falls, and Flex sensors in the glove to recognize hand gestures.
3. Temperature Monitoring: If the temperature is higher than normal (e.g., over 30°C), it shows a message

like "High Temperature" — this could be a sign of fever or infection.

4. Heart Monitoring (ECG): If the heart signal is above a certain level (like 600), it's marked as "Abnormal ECG", If it's within a healthy range, it shows "Normal ECG".

5. Fall Detection with Accelerometer: The **ADXL accelerometer** watches for unusual movements, If it detects sudden changes — like the patient falling — it triggers an alert with a message such as "Patient Fell Down". Is Object within Threshold? (e.g., < 1 meter):

6. Gesture Detection with Flex Sensor (Smart Glove): The flex sensors in the glove let the patient "speak" using hand gestures, even if they can't talk or move much. The system reads the bending of fingers: Value > 300 → The patient is asking for WATER; Value < 300 → The patient needs FOOD; Value > 400 → This is an EMERGENCY — urgent help is needed.

7. Display and Alerts: All readings (like temperature, heart rate, movement, and gesture commands) are shown on an LCD screen for caregivers to see, If any serious issue is found (like a fall or emergency gesture), a buzzer alert goes off to get immediate attention.

8. Loop or Stop: he system keeps checking again and again — it doesn't stop unless turned off.

IV. RESULTS AND DISCUSSION

Fig 3: Implementation of Arduino UNO (ATMEGA 328p) with LCD background

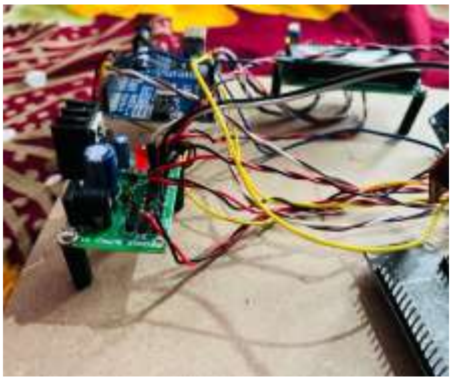
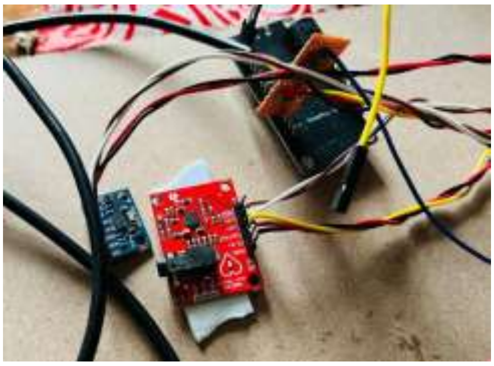


Fig 4: Implementation of power supply with



temperature sensor

Fig 5: Implementation of ADXL335 with Arduino UNO ATMEGA(328p)

Fig 6: Final Output

The system uses an Arduino UNO board (visible in blue) as the central controller to manage and process data. Connected to the Arduino is an LCD module (16x2 display) that shows real-time output, such as sensor readings or system status. The LCD is connected via jumper wires to the Arduino, utilizing digital pins, and a potentiometer (the blue knob) adjusts the contrast of the display. This setup allows users to monitor various sensor data in an easy-to-read format. Additionally, there is a power supply module (green PCB with large capacitors and a voltage regulator with a heatsink), which ensures stable voltage regulation, likely from a battery or adapter, to power the entire system at 5V or 3.3V.

The system also incorporates a temperature sensor module (likely BMP280 or DHT type, a small blue breakout board), which collects environmental data, such as temperature, and sends this information to the Arduino for processing and display. The ADXL335 accelerometer (red PCB) is another key component, which measures acceleration along the X, Y, and Z axes. It is connected to the Arduino, possibly via analog pins, as the ADXL335 outputs an analog voltage. This accelerometer could be used for detecting motion or changes in orientation, making it valuable for applications like fall detection or monitoring physical movement in your healthcare monitoring system.

V. CONCLUSION

The development of the Paralysis Patient Healthcare Monitoring System demonstrates the effective integration of biomedical sensing and assistive gesture-based technology to support differently-abled individuals. By combining vital sign monitoring with a smart glove equipped with flex sensors, the system enables real-time health tracking while allowing patients with limited mobility to communicate their basic needs and emergencies through simple hand gestures.

This paper highlights the potential of using Arduino-based systems for continuous patient care, offering a cost-effective and responsive solution compared to traditional monitoring methods. The inclusion of components like the ECG sensor, temperature sensor, accelerometer, and GSM module ensures timely alerts to caregivers, improving patient safety and response time.

Overall, the project presents a scalable and reliable healthcare solution that bridges the gap between patient limitations and caregiver communication, making it a meaningful step toward smarter, more inclusive medical assistance systems.

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