Appendix-1

Para Connect

IoT-Enabled Healthcare System for Paralysis patients and Bedridden Elders

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MALLA REDDY UNIVERSITY

(Telangana State Private Universities Act No.13 of 2020 and G.O.Ms.No.14, Higher Education (UE) Department)

CERTIFICATE

This is to certify that this is the Application development lab record entitled "**Para Connect IoT Enabled Healthcare System for Paralysis Patients and Bedridden Elders**", submitted by **ADDULA JAIDEEP REDDY 2011CS010022, CHELLA SAI SREENIVAS 2011CS010055, ARELLY SAIRAM 2011CS010005, MANI KUMAR BODDUPALLI 2011CS010046** B. Tech **IV** year **I** semester, Department of CSE during the year 2023-24. The results embodied in this report have not been submitted to any other university or institute for the award of any degree or diploma.

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External Examiner

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DECLARATION

I declare that this project report titled **PARA CONNECT IOT ENABLED HEALTH CARE SYSTEM FOR PARALYSIS PATIENTS AND BEDRIDDEN ELDERS** submitted in partial fulfillment of the degree of B. Tech in CSE is a record of original work carried out by me under the supervision of Mr. D.I.P Mani Kumar, and has not formed the basis for the award of any other degree or diploma, in this or any other Institution or University. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

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We sincerely thank our HOD Dr. Shaik Meeravali for his constant support and motivation all the time. A special acknowledgement goes to a friend who enthused us from the back stage. Last but not the least our sincere appreciation goes to our family who has been tolerant understanding our moods, and extending timely support.

ABSTRACT

Para Connect is a special healthcare system designed for people who are affected with paralysis or for the bedridden elders who are confined to bed by sickness or old age. This project uses smart technology like sensors and wearable gadgets that give message to the persons who take care of the patients.

The main goal of this project is to help the patients by keeping an eye on their daily needs, like water, food and other necessary things. This device lets them easily communicate to their caregivers and doctors. This device is easy to use and can get the things done in time.

This device is a groundbreaking leap in healthcare technology, offering a comprehensive, accessible, and responsive support system to empower and uplift those with limited mobility. The system incorporates a variety of IoT components, including sensors, wearable devices, batteries, and a centralized control hub, interconnected through a circuit. Para Connect is a helpful friend, always there to watch over and support these individuals, making their lives easier and safer.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The electronic document contains details on a device termed Gesture based monitoring system for partially paralyzed patients. The concept of paralysis is explained initially, this is followed by the technical explanation of the device created, the electronic components and the physics of the Monitoring system.

The main aim of the project is to design a smart glove which can be used for paralyzed persons to express Wi-Fi and dual-mode Bluetooth. The ESP32 series employs a Ten silica Xtensa LX6 microprocessor in both dual-core and single-core variations and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules.

The main controlling device of the project is ESP32 MODULE. MPU6050 GYROSCOPE, BUZZER, LCD display is interfaced to the ESP32 module. Here we are fixing the mpu6050 gyroscope to the glove. When the user tilts the sensor, it will display the appropriate message on lcd along with buzzer. To achieve this task esp32 loaded program written in embedded C language.

Para Connect represents a groundbreaking initiative in the realm of healthcare, aiming to enhance the quality of life for paralysis patients and bedridden elders through the integration of Internet of Things (IoT) technology. This innovative healthcare system leverages the power of connectivity to address the unique challenges faced by individuals coping with paralysis and those confined to their beds due to age-related issues.

By seamlessly merging healthcare with IoT, Para Connect seeks to provide a comprehensive and adaptive solution that not only monitors but actively contributes to the well-being of its users. Para Connect creates a future where healthcare transcends traditional boundaries. The integration of IoT empowers healthcare professionals, caregivers, and patients alike by fostering real-time communication, data-driven insights, and responsive care.

1.1 Problem Statement

Paralysis patients and bedridden elders often encounter significant challenges in managing their health and well-being, exhausted by limitations in mobility and accessibility to timely healthcare. Traditional healthcare systems may struggle to address the unique needs of this demographic due to a lack of continuous monitoring and proactive intervention. The absence of a structured solution leads to a gap in personalized care, hindering the overall quality of life for these individuals.

Para Connect aims to bridge this gap by addressing the limitations of current healthcare models, introducing an IoT-enabled system that offers real-time monitoring and personalized interventions to enhance the health and independence of paralysis patients and bedridden elders.

1.2 Objective

The objective of Para Connect, an IoT-enabled healthcare system for paralysis patients and bedridden elders, is to enhance the quality of life and provide comprehensive healthcare support for individuals facing mobility challenges. The system aims to address the unique needs and requirements of paralysis patients and bedridden elders by leveraging the capabilities of the Internet of Things (IoT) technology.

- Gyroscope based gesture detection.
- Automatic Display the message on LCD display.
- Audible alert using Buzzer.
- To achieve this task using esp32 microcontroller.

1.3 Goal of the Project

The overarching goal of the Para Connect project, an IoT-enabled healthcare system for paralysis patients and bedridden elders, is to significantly enhance the quality of life for individuals facing mobility challenges while providing efficient and effective healthcare support.

- Enhanced Healthcare Monitoring.
- Improved Independence and Daily Living.
- Reduced Risks and Improved Safety.

Chapter 2

PROBLEM IDENTIFICATION

2.1 Existing System

The Existing consists home healthcare agencies provide a range of services to patients at home. These services may include regular check-ups by healthcare professionals, assistance with daily activities, and monitoring of vital signs. Support networks for caregivers, which may include educational resources, counseling, and community-based organizations that offer assistance and guidance to those caring for paralysis patients and bedridden elders.

Non-technical solutions such as specialized beds, mattresses, and lifts designed to enhance comfort and assist with mobility challenges. These could include manual or hydraulic systems for adjusting bed positions. Physical and occupational therapy programs designed to help individuals regain or maintain their independence. These programs often involve non-technical exercises and activities.

Services that focus on medication management, including organizing and administering medications according to prescribed schedules. These services may involve trained healthcare professionals or caregivers. Telephone-based support services that provide information, guidance, and emotional support for patients and caregivers. These services can be critical for addressing immediate concerns and queries. Community-based programs that aim to engage bedridden elders and paralysis patients through social activities, companionship, and involvement in community events.

2.2 Proposed System

The proposed system "Para Connect IoT Enabled System for Paralysis Patients and Bedridden Elders" developed IoT enabled device consists of gyro sensor and USB Module. include accelerometers and gyroscopes for activity tracking, allowing for the detection of changes in movement patterns. By using this gyro sensor, it will capture the patient movements and alert to the buzzer and display the need of the patient. By these the care taker of the patient will see the message or respond to the buzzer and fulfill the need of the patient.

Design an intuitive and accessible user interface for both patients and caregivers, allowing easy monitoring of health data and control of IoT devices. Ensure compatibility with various devices, including smartphones, tablets, and computers. Implement robust security protocols and encryption to safeguard patient data. Adhere to healthcare data regulations and standards to ensure privacy and compliance.

The proposed Para Connect system aims to provide a technologically advanced and interconnected healthcare solution that enhances the quality of life for paralysis patients and bedridden elders. Through IoT integration, the system seeks to improve monitoring, communication, and personalized care, ultimately contributing to a more comprehensive and effective healthcare experience.

CHAPTER 3

REQUIREMENTS

3.1 Software Requirements

Programming Language	C
IDE	Arduino
Operating System	Windows 10 or Windows 11
Simulator	Wokwi

Table 1.1

3.2 Hardware Requirements

Micro controller	ESP32
Sensor	Gyro sensor
Board	Printed circuit board
Display	Liquid crystal display (LCD)
Device	Buzzer

Table 1.2

Hardware Components

Gyroscope sensor (MPU6050)

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers.

It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc.

If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9- axis Motion Fusion output.

Let’s see MPU6050 inside sensors.

3-Axis Gyroscope

The MPU6050 consist of 3-axis Gyroscope with Micro Electro Mechanical System (MEMS) technology. It is used to detect rotational velocity along the X, Y, Z axes as shown in below figure.

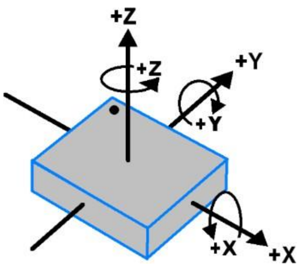
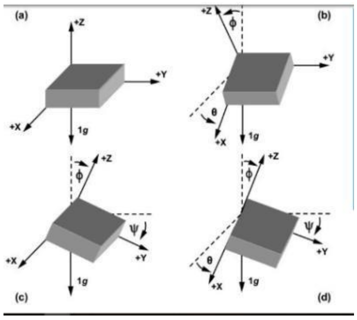


Fig 1.1

- When the gyros are rotated about any of the sense axes, the Coriolis Effect causes a vibration that is detected by a MEM inside MPU6050.
- The resulting signal is amplified, demodulated, and filtered to produce a voltage that is proportional to the angular rate.
- This voltage is digitized using 16-bit ADC to sample each axis.
- The full-scale range of output are +/- 250, +/- 500, +/- 1000, +/- 2000.
- It measures the angular velocity along each axis in degree per second unit.

3-Axis Accelerometer

The MPU6050 consist 3-axis Accelerometer with Micro Electro Mechanical (MEMs) technology. It used to detect angle of tilt or inclination along the X, Y and Z axes as shown in below figure.



- Acceleration along the axes deflects the movable mass.
- This displacement of moving plate (mass) unbalances the differential capacitor which results in sensor output. Output amplitude is proportional to acceleration.
- 16-bit ADC is used to get digitized output.
- The full-scale range of acceleration are +/- 2g, +/- 4g, +/- 8g, +/- 16g.
- It measured in g (gravity force) unit.
- When device placed on flat surface it will measure 0g on X and Y axis and +1g on Z axis.

DMP (Digital Motion Processor)

The embedded Digital Motion Processor (DMP) is used to compute motion processing algorithms. It takes data from gyroscope, accelerometer and additional 3rd party sensor such as magnetometer and processes the data. It provides motion data like roll, pitch, yaw angles, landscape and portrait sense etc. It minimizes the processes of host in computing motion data. The resulting data can be read from DMP registers.

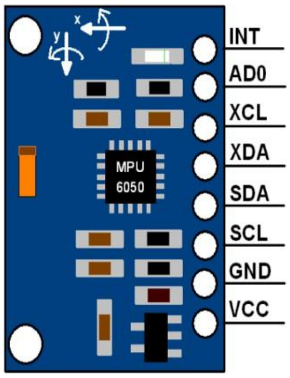
MPU-6050 Module

The MPU-6050 module has 8 pins, INT: Interrupt digital output pin.

AD0: I2C Slave Address LSB pin. This is 0th bit in 7-bit slave address of device. If connected to VCC then it is read as logic one and slave address changes.

XCL: Auxiliary Serial Clock pin. This pin is used to connect other I2C interface enabled sensors SCL pin to MPU-6050.

XDA: Auxiliary Serial Data pin. This pin is used to connect other I2C interface enabled sensors SDA pin to MPU-6050.



SCL: Serial Clock pin. Connect this pin to microcontrollers SCL pin. SDA: Serial Data pin. Connect this pin to microcontrollers SDA pin. GND: Ground pin. Connect this pin to ground connection.

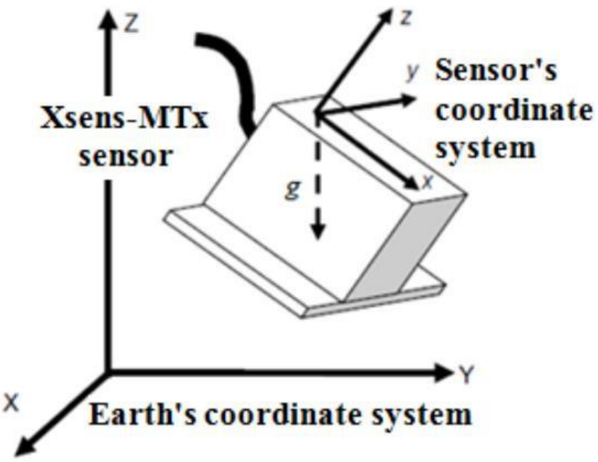
VCC: Power supply pin. Connect this pin to +5V DC supply.

MPU-6050 module has Slave address (When AD0 = 0, i.e. it is not connected to Vcc) as, Slave Write address(SLA+W): 0xD0

Slave Read address(SLA+R): 0xD1

MPU-6050 has various registers to control and configure its mode of operation. So, kindly go through MPU-6050 datasheet and MPU-6050 Register Map.

A 3-axis accelerometer is a sensor that returns a real-valued estimate of the acceleration along the x, y and z axes from which velocity and orientation angle can also be estimated. Accelerometers measure the acceleration and output the projections of the acceleration vector represented in a three dimensional coordinate system. Each accelerometer has its own coordinate system and gives the relative vector projections. Because of the Earth's gravity, all objects experience a gravitational pull towards the Earth's centre. The acceleration unit of the pull is referred to as g or g force. Consequently all objects are subject to 1 g acceleration (Figure 1). When the accelerometer is at rest, only Earth's gravity is measured. Accelerometers can be used as motion detectors as well as for body-posture recognition and fall detection.



A gyroscope or gyro is a device for measuring or maintaining orientation, based on the principles of conservation of angular momentum. It will keep the original direction of its rotation axis no matter which way the sensor is turned. The data received from this module is useful in activity/posture recognition process because of the estimation of the sensor orientation and rotation. The advantage compared to accelerometers orientation estimation is in dynamic activities/postures. During these activities/postures the user individual acceleration affects the estimation of the orientation using only acceleration data, which corrupts the final estimation. In these situations the gyroscope and magnetometer data are used as addition in orientation estimation.

LCD DISPLAY

LCD Background:

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

Basic 16x 2 Characters LCD

LCD Pin diagram

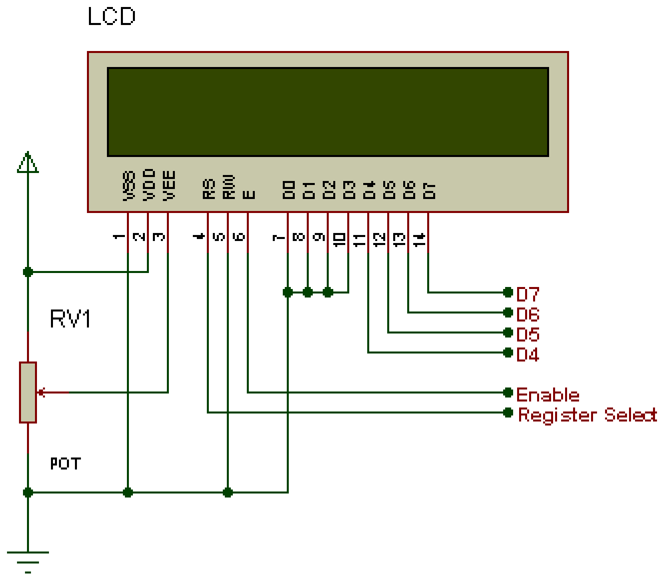


Fig 1.2

Pin Description

Pin No.	Name	Description
Pin no. 1	**VSS**	Power supply (GND)
Pin no. 2	**VCC**	Power supply (+5V)
Pin no. 3	**VEE**	Contrast adjust
Pin no. 4	**RS**	0 = Instruction input 1 = Data input
Pin no. 5	**R/W**	0 = Write to LCD module 1 = Read from LCD module
Pin no. 6	**EN**	Enable signal
Pin no. 7	**D0**	Data bus line 0 (LSB)
Pin no. 8	**D1**	Data bus line 1
Pin no. 9	**D2**	Data bus line 2
Pin no. 10	**D3**	Data bus line 3
Pin no. 11	**D4**	Data bus line 4
Pin no. 12	**D5**	Data bus line 5
Pin no. 13	**D6**	Data bus line 6
Pin no. 14	**D7**	Data bus line 7 (MSB)

Buzzer

Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.

To interface a buzzer the standard transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.

If a battery is used as the power supply, it is worth remembering that piezo sounders draw much less current than buzzers. Buzzers also just have one 'tone', whereas a piezo sounder is able to create sounds of many different tones.

To switch on buzzer
-high 1 To switch
off buzzer -low 1

Fig 1.3

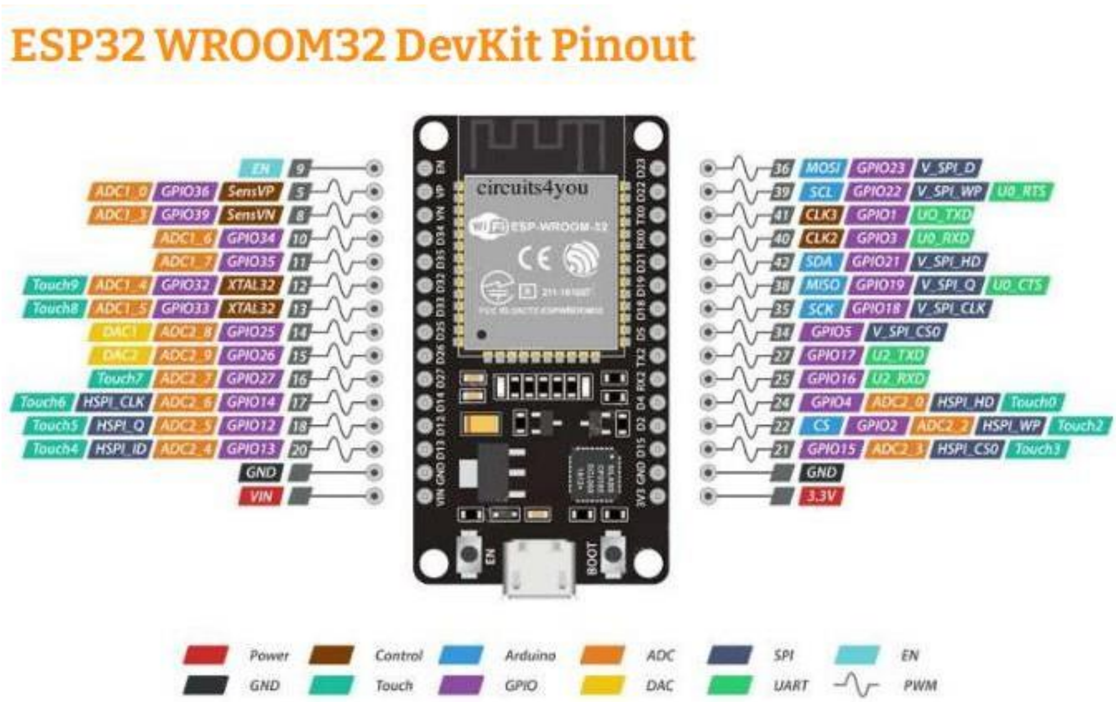
ESP32

ESP32-WROOM-32 is a powerful, generic Wi-Fi+BT+BLE MCU module that targets a wide variety of applications, ranging from low-power sensor networks to the most demanding tasks, such as voice encoding, music streaming and MP3 decoding.

Fig 1.4

At the core of this module is the ESP32-D0WDQ6 chip*. The chip embedded is designed to be scalable and adaptive. There are two CPU cores that can be individually controlled, and the CPU clock frequency is adjustable from 80 MHz to 240 MHz. The user may also power off the CPU and make use of the low-power co-processor to constantly monitor the peripherals for changes or crossing of thresholds. ESP32 integrates a rich set of peripherals, ranging from capacitive touch sensors, Hall sensors, SD card interface, Ethernet, high-speed SPI, UART, I2S and I2C.

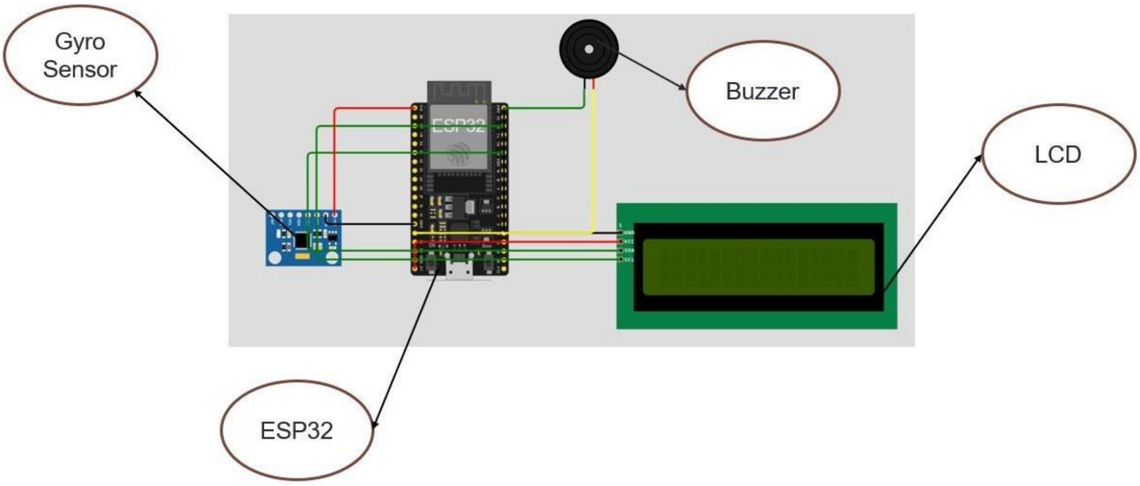
The integration of Bluetooth, Bluetooth LE and Wi-Fi ensures that a wide range of applications can be targeted, and that the module is future proof: using Wi-Fi allows a large physical range and direct connection to the internet through a Wi-Fi router, while using Bluetooth allows the user to conveniently connect to the phone or broadcast low energy beacons for its detection. The sleep current of the ESP32 chip is less than 5 µA, making it suitable for battery powered and wearable electronics applications. ESP32 supports a data rate of up to 150 Mbps, and 20.5 dBm output power at the antenna to ensure the widest physical range. As such the chip does offer industry-leading specifications and the best performance for electronic integration, range, power consumption, and connectivity. The operating system chosen for ESP32 is freeRTOS with LwIP; TLS 1.2 with hardware acceleration is built in as well. Secure (encrypted) over the air (OTA) upgrade is also supported, so that developers can continually upgrade their products even after their release.



CHAPTER – 4

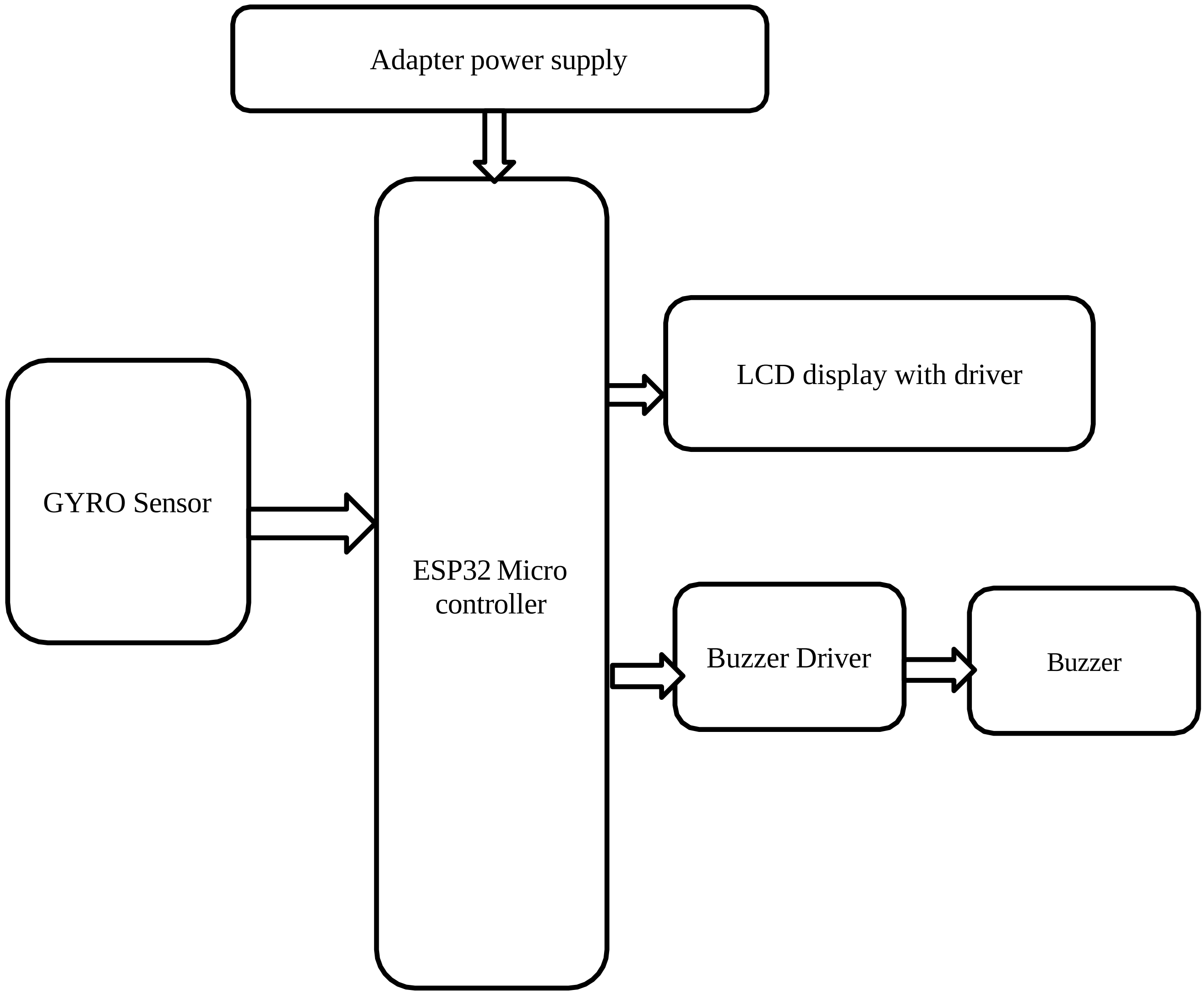
DESIGN AND IMPLEMENTATION

4.1 Design



The circuit design is developed in the wokwi simulation software for testing the project

Block Diagram



4.1 Implementation

The “para connect” project is developed by using the Arduino board and other hardware components like ESP 32, Gyro sensor, Lcd Display, Buzzer components used in this project.

- The power supply is connected to the PCB to share the power equally to all the components in the system.
- The Buzzer is connected to the PCB and the D22 pin of ESP32 Micro controller.
- The LCD display is connected to the PCB for power and D21 pin of ESP32 Micro controller.
- The Gyro sensor is connected to the ESP32 Micro controller and to the LCD display.
- The Embedded code is deployed into the ESP32 Micro controller.

CHAPTER 5

CODE

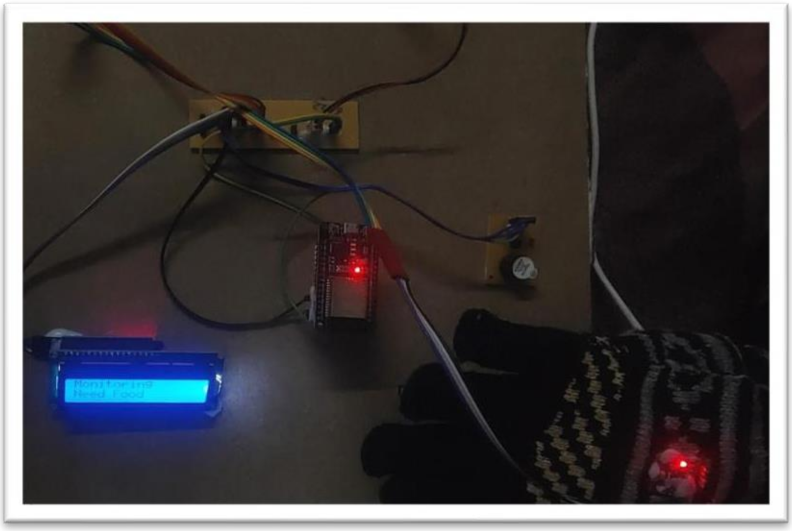
5.1 Source Code

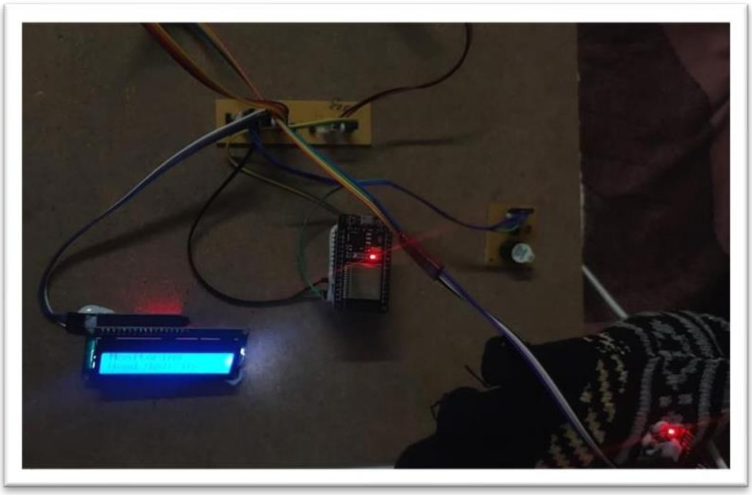
```
#include <LiquidCrystal_I2C.h>
#include <Adafruit_MPU6050.h>
#include <Adafruit_Sensor.h>
#include <Wire.h>

Adafruit_MPU6050 mpu;
LiquidCrystal_I2C lcd(0x27, 16, 2);
#include <stdio.h>
#include <string.h>

int buz = 23;

void setup()
{
  // put your setup code here, to run once:
  Serial.begin(9600);

  pinMode(buz, OUTPUT);

  lcd.init();
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print("  Welcome ");
  lcd.setCursor(0, 1);
  lcd.print("To The Project");
  delay(1000);



 digitalWrite(buz,1);
 delay(700);
 digitalWrite(buz,0);
```

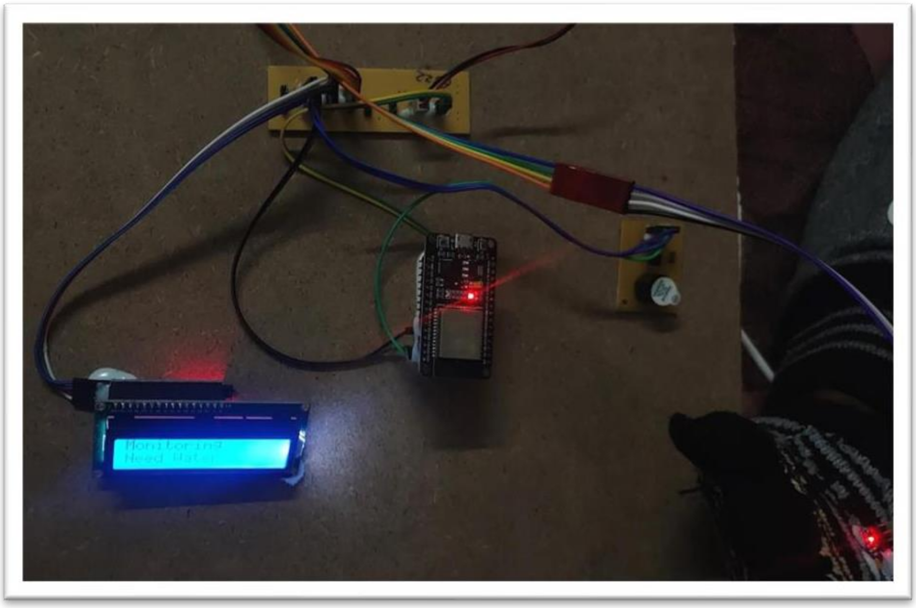
```
  delay(700);
  digitalWrite(buz,1);
  delay(700);
  digitalWrite(buz,0);

}
void loop()
{

  sensors_event_t a, g, temp;
  mpu.getEvent(&a, &g, &temp);

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Monitoring ");
  digitalWrite(buz,0);

  if(a.acceleration.x > 4)
  {
    lcd.setCursor(0, 1);
    lcd.print("Need Water ");
  digitalWrite(buz,1);
  }

  if(a.acceleration.x < -4)
  {
    lcd.setCursor(0, 1);
    lcd.print("Need Food ");
  digitalWrite(buz,1);
  }

  if(a.acceleration.y < -4)
  {
    lcd.setCursor(0, 1);
    lcd.print("Need Medicine ");
  digitalWrite(buz,1);
  }
```

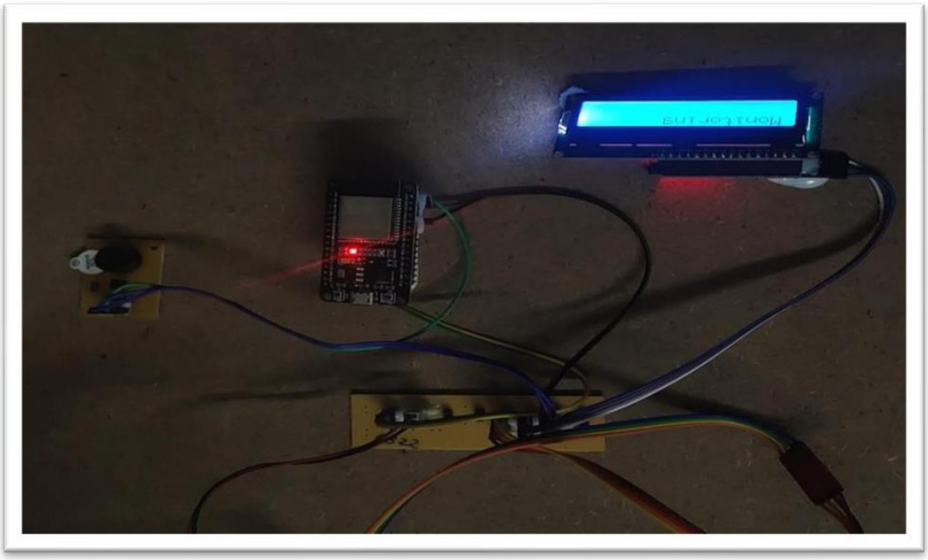
```
 if(a.acceleration.y > 4)
 {
  lcd.setCursor(0, 1);
  lcd.print("  Emergency ");
 digitalWrite(buz,1);
 }
 delay(500);

}
```

5.2 Screenshot of project






Monitoring



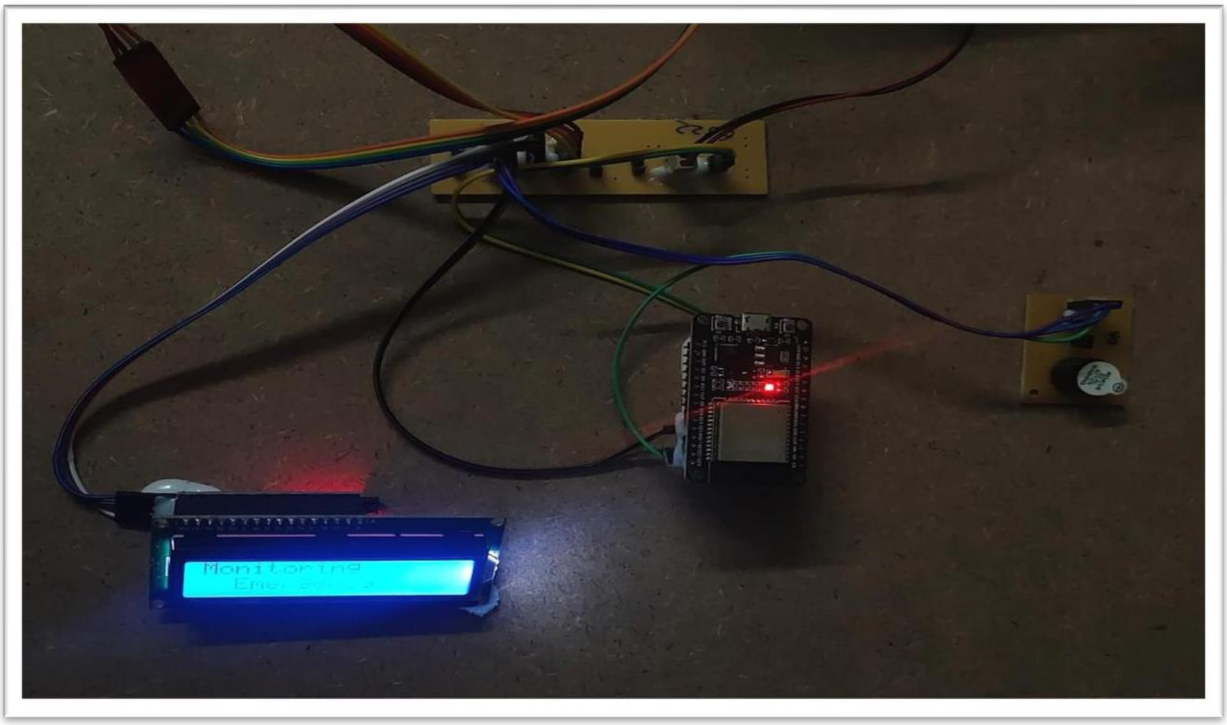
CHAPTER 6

RESULTS AND CONCLUSION

6.1 Results

The project **“Para physical disabled person using esp32 and gyroscope”** was designed a smart glove which can be used for paralyzed persons to express their needs. The main controlling device of the project is ESP32 MODULE. MPU6050 GYROSCOPE, BUZZER, LCD display is interfaced to the ESP32 module.

Here we are fixing the mpu6050 gyroscope to the glove. When the user tilts the sensor, it will display the appropriate message on lcd along with buzzer. To achieve this task esp32 loaded program written in embedded C language.




I need water


Emergency


I need food


Monitoring

6.2 Conclusion

In conclusion, the Para Connect IoT-Enabled Healthcare System represents a cutting-edge solution designed to address the unique healthcare challenges faced by paralysis patients and bedridden elders. By leveraging advanced IoT technology, the system aims to significantly enhance the quality of life for these individuals and provide comprehensive support for both patients and caregivers. The integration of wearable devices equipped with sensors allows for continuous monitoring of vital signs, ensuring prompt detection of any anomalies.

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced ICs with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

CHAPTER 7

References

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[8] https://www.webmd.com/brain/paralysis-types.