MEDIMOVER: MOBILE MEDICAL ASSISTANT ROBOT

A PROJECT PHASE-II REPORT

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the APJ Abdul Kalam Technological University
in partial fulfillment of the requirements for the award of the Degree
of
Bachelor of Technology
In
Electronics & Communication Engineering

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

GOVERNMENT ENGINEERING COLLEGE THRISSUR

KERALA

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We undersigned hereby declare that the project report (MEDIMOVER: MOBILE MEDICAL ASSISTANT ROBOT), submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by us under supervision of Prof. Asha J, Assistant Professor, Government Engineering College, Thrissur. This submission represents our ideas in our own words and where ideas or words of others have been included; we have adequately and accurately cited and referenced the original sources. We also declare that we have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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Certificate

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Abstract

The Medimover project introduces a novel approach to mobile medical assistance through the development of a versatile robotic platform controlled via a mobile application. This prototype aims to enhance patient care by integrating sensor technology for real-time monitoring and medication delivery within healthcare facilities. The system, comprising of an Android mobile application, a Flask-based server, and an ESP32 microcontroller, enables remote control and monitoring of the robot's movements and functions. Equipped with sensors for patient vital signs monitoring and a built-in medication supply system, the robot offers healthcare professionals an innovative tool for efficient and accurate patient care management. The inclusion of a camera facilitates remote observation and control by medical staff, enhancing situational awareness and responsiveness. While the current implementation represents a functional prototype, further refinement and automation hold promise for future iterations. The Medimover project underscores the potential of mobile robotics in revolutionizing healthcare delivery, paving the way for enhanced patient outcomes and streamlined medical processes.

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Chapter 1

Introduction

In recent years, the field of healthcare has witnessed a transformative evolution through the integration of cutting-edge technology and robotics. Among the notable innovations in this realm, the emergence of medical assistance robots stands as a pivotal advancement in the provision of patient care and medical services.

The healthcare system is under pressure due to various factors, such as an increasing demand for medical services, especially in elderly care, and the COVID-19 pandemic. To address these challenges, there is a growing need for medical assistance robots that can perform a wide range of tasks in healthcare settings, including hospitals, nursing homes, and home care. These robots can provide support to healthcare professionals, assist patients with their daily routines, and help in the delivery of medical services.

1.1 Objectives

The primary objective of the Medimover project is to develop a mobile medical assistance robot capable of enhancing patient care within healthcare facilities. Specific objectives include:

1. Develop a mobile application capable of navigating robot and sending instructions, and collecting patient data.

2. Integrate sensors for monitoring patient vital signs, such as heart rate, blood pressure, and temperature, providing healthcare staff with timely and accurate patient health information.

3. Implement a reliable and accurate medication supply system within the robot, enabling healthcare professionals to dispense medications to patients as needed, thereby reducing manual workload and minimizing medication errors.

4. Incorporate a camera system into the robot to facilitate remote observation by medical staff, enhancing situational awareness and enabling swift responses to patient needs or emergencies.

1.2 Problem Definition

The healthcare industry faces numerous challenges in providing efficient and inclusive patient care, exacerbated by manual processes and resource constraints. Traditional methods of patient care management often rely on manual intervention, which can be particularly challenging for healthcare professionals with physical disabilities. In this context, the Medimover project addresses several key challenges:

1. **Manual Medication Administration:**Conventional medication delivery processes require healthcare professionals to manually transport medications to patients' bedsides, leading to delays and potential errors in medication administration. This manual approach is especially cumbersome for healthcare workers with physical disabilities, limiting their ability to provide timely and effective patient care.

2. **Limited Patient Monitoring:** Real-time monitoring of patient vital signs and health status is essential for proactive patient care. However, existing monitoring systems may be limited in scope or accessibility, hindering comprehensive surveillance. Healthcare professionals with physical disabilities may face additional challenges in accessing and interpreting patient data due to mobility limitations.

3. **Resource Constraints:** Healthcare facilities often face resource constraints, including shortages of healthcare staff and equipment. This can impact the quality and timeliness of patient care delivery, particularly in busy or understaffed environments. Healthcare professionals with physical disabilities may encounter additional barriers in navigating crowded or inaccessible spaces, further exacerbating resource limitations.

4. **Situational Awareness:** Timely access to patient information and situational awareness is critical for making informed decisions and responding effectively to changing patient needs or emergencies. Traditional communication channels and

observation methods may be inefficient or insufficient, particularly for healthcare professionals with physical disabilities who may face challenges in accessing and maneuvering within clinical environments.

Chapter 2

Literature Survey

1. **Mobile Robotics in Healthcare:** The integration of mobile robotics into healthcare environments has garnered increasing attention in recent years. Studies such as [1] have demonstrated the potential of mobile robots for tasks such as patient transportation, delivery of supplies, and remote monitoring. These robots offer flexibility and adaptability, allowing them to navigate dynamic healthcare settings and assist with various clinical tasks.

2. **Remote Control and Teleoperation:** Remote control and teleoperation technologies play a crucial role in enabling human-robot interaction in healthcare applications. Research by Smith et al. [2] explores the use of teleoperated robots for patient care tasks, highlighting the importance of intuitive user interfaces and real-time feedback for effective remote control. The Medimover project leverages similar principles to enable healthcare professionals to control the robot's movements and functions via a mobile application.

3. **Sensor Integration for Patient Monitoring:** Sensor technologies have revolutionized patient monitoring by providing real-time data on vital signs and health parameters. Studies such as [3] have investigated the use of wearable sensors, smart textiles, and ambient monitoring systems for continuous patient

surveillance. The Medimover project incorporates sensors for monitoring patient vital signs, enabling healthcare professionals to assess patient health status remotely and intervene as needed.

4. **Medication Delivery Systems:** Automated medication delivery systems offer numerous advantages, including improved medication adherence, reduced errors, and enhanced efficiency. Research by Jones et al. [4] discusses the design and implementation of automated medication dispensing systems in healthcare settings, emphasizing the importance of accuracy, reliability, and safety. The Medimover project integrates a medication supply system within the robot, enabling healthcare professionals to dispense medications to patients remotely and accurately.

5. **Human-Robot Interaction and Accessibility:** Ensuring inclusivity and accessibility in human-robot interaction is essential for accommodating diverse user needs and preferences. Studies such as [5] explore design considerations for accessible user interfaces and interaction modalities, particularly for users with physical disabilities. The Medimover project aims to address these considerations by developing a mobile-controlled robot that enables healthcare professionals, including those with physical disabilities, to provide efficient and effective patient care.

Chapter 3

General Architecture

The Chapter presents the General architecture of the project. It also includes the component selection and lists the hardwares and softwares chosen.

3.1 HARDWARE COMPONENTS

- Node MCU-ESP32
- L293D Motor driver IC
- Pulse sensor
- Dallas temperature sensor
- 7805(Voltage Regulator)
- OLED display
- 12V DC Motor
- stepper motor
- Resistor (470 Ω)
- Capacitor (470 μF)

- LED(5MM)
- Jumper Wires
- Battery
- Acrylic Sheet
- Robot-Chassis
- pill dispenser-3D printed parts

3.1.1 Node MCU-ESP32

The Node MCU-ESP32, central to the Medimover mobile medical assistant robot, embodies a potent combination of processing prowess, wireless connectivity, and GPIO pin versatility. Powered by a dual-core Tensilica LX6 microprocessor, it executes complex algorithms seamlessly, interfacing with an array of sensors and actuators. Its built-in Wi-Fi and Bluetooth capabilities enable remote control and monitoring via a mobile application, fostering seamless integration with other smart devices. With Arduino compatibility, it ensures ease of programming and rapid prototyping, while its low power consumption makes it suitable for battery-powered applications. Supported by a robust open-source community, the Node MCU-ESP32 stands as the intelligent core driving the Medimover's functionality in healthcare settings.

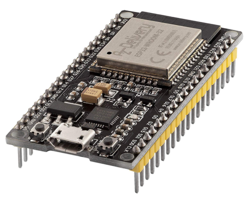


Figure 3.1: Nodemcu ESP32

3.1.2 L293D Motor Driver IC

The L293D Motor IC plays a pivotal role in the Medimover mobile medical assistant robot, serving as a motor driver to control the movement of its motors. This integrated circuit (IC) is specifically designed to drive small DC motors and stepper motors, offering bidirectional control for up to two motors simultaneously. Equipped with built-in protection diodes, the L293D ensures smooth and reliable motor operation while minimizing the risk of damage from back electromotive force (EMF). Its dual H-bridge configuration enables independent control of motor direction and speed, making it ideal for precise navigation and maneuverability of the robot. With its compact size and efficient design, the L293D Motor IC provides a robust and reliable solution for driving the motors of the Medimover robot, contributing to its mobility and functionality in healthcare environments.

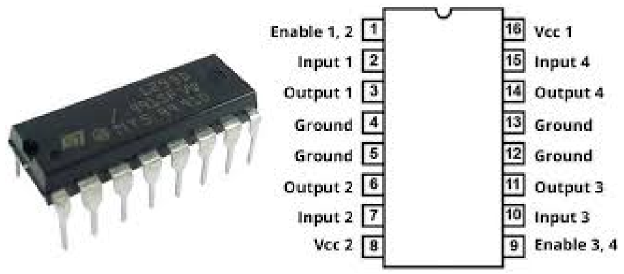


Figure 3.2: motor driver ic

3.1.3 Pulse sensor

The Pulse Sensor is a critical component of the Medimover mobile medical assistant robot, designed to monitor patients' heart rates in real-time. It consists of an optical sensor that detects variations in blood volume within the fingertip, translating these fluctuations into electrical signals proportional to the heartbeat. This sensor is integrated into the robot's system to provide continuous monitoring of patient vital signs, enabling healthcare professionals to assess cardiac activity remotely and intervene promptly if necessary. The Pulse Sensor's compact size, low power consumption, and high sensitivity make it an ideal choice for wearable and portable healthcare applications like the Medimover. Its seamless integration with the robot's control system enhances its capability to provide comprehensive patient care and monitoring within clinical settings.

Figure 3.3: pulse sensor

3.1.4 Dallas Temperature Sensor

The Dallas Temperature Sensor, often referred to as the DS18B20, is a popular digital temperature sensor known for its accuracy, simplicity, and versatility. This waterproof, sealed and pre-wired digital temperature sensor probe based on DS18B20 sensor is very handy for when you need to measure something far away, or in wet conditions. Because they are digital,signal degradation is negligible even over long distance. The DS18B20 sensor offers high precision temperature measurements with a resolution of up to 12 bits, providing temperature readings with an accuracy of ±0.5°C within the range of -10°C to +85°C. Additionally, it has a wide temperature range capability of -55°C to +125°C, making it suitable for aquiring body temperature of the patients.

Figure 3.4: Dallas temperature sensor

3.1.5 7805 Voltage regulator

A 7805 voltage regulator is an integrated circuit designed to maintain a constant output voltage despite changes in input voltage and load. Specifically, the 7805 is a positive voltage regulator that ensures a stable +5V output and can handle input voltages ranging from 7V to 35V. It uses an internal voltage reference, an error amplifier and a series pass transistor for maintaining a constant output voltage. It is a three-pin IC with an input pin for accepting incoming DC voltage, ground pin for establishing ground for the regulator, and output pin that supplies the positive 5 volts. It employs built-in current limiting, thermal shutdown, and safe operating area protection which makes them virtually immune to damage from output overloads.

Figure 3.5: 7805 Voltage Regulator

3.1.6 OLED Display

OLED is Organic Light Emitting Diode that emits light in response to an electric current. OLED display works with no backlight so it can display deep black levels. It is small in size and light in weight than Liquid Crystal Displays. 128x64 OLED display is simple dot matrix graphic display. It has 128 columns and 64 rows which make it display of total 128x64 = 8192 pixels. By just turning on/off these pixel's led we can display a graphical image of any shape on it. It has 4 pins, the serial data (SDA) pin, serial clock (SCL) pin, Vcc and ground. The SDA pin is used to send data and acknowledgements from the microcontroller. The SCL pin transmits clocks signals, data will be sent to devices on clock tick event.

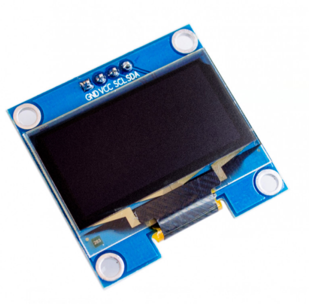


Figure 3.6: OLED Display

3.1.7 DC Motors

DC motors are electrical devices that convert electrical energy into mechanical rotational motion.They operate using direct current (DC) and consist of a rotor (the rotating part) and a stator (the stationary part).

A 12V 100 RPM DC motor is a compact yet powerful motor designed to operate on a 12-volt power supply, delivering a rotational speed of 100 revolutions per minute (RPM). Its versatility makes it a popular choice across various fields, including robotics and automation. With its moderate speed and torque output, it's well-suited for applications requiring precision and reliability.

Figure 3.7: DC Motor and wheel

3.1.8 Stepper Motor

The 28BYJ-48 is a 5-wire unipolar stepper motor that runs on 5V. It's perfect for projects that require precise positioning, like opening and closing a vent.Because the motor does not use contact brushes, it has a relatively precise movement and is quite reliable.Despite its small size, the motor delivers a decent torque of 34.3 mN.m at a speed of around 15 RPM. It provides good torque even at a standstill and maintains it as long as the motor receives power.

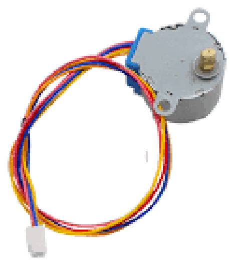


Figure 3.8: 28BYJ-48 Stepper Motor

3.1.9 Resistors

Resistors are fundamental electronic components within the Medimover mobile medical assistant robot, regulating the flow of electrical current and voltage across various circuits. These small yet essential devices help control the amount of current passing through sensitive components, ensuring their proper operation and preventing damage from excessive voltage. Resistor values are carefully selected to match specific requirements of the robot's electronic systems, providing stability and reliability in signal processing, voltage division, and current limiting. Despite their modest size, resistors play a crucial role in maintaining the integrity and efficiency of the robot's electrical infrastructure, contributing to its overall functionality and performance in healthcare settings.

Figure 3.9: Resistor

3.1.10 Capacitors

Capacitors are vital components within the Medimover mobile medical assistant robot, storing and releasing electrical energy to support various functions. These compact devices play a crucial role in smoothing voltage fluctuations, filtering noise, and stabilizing power supplies, ensuring reliable operation of the robot's electronic systems. Capacitors help maintain consistent voltage levels across critical components, minimizing the risk of voltage spikes and ensuring consistent performance. Their ability to store and discharge energy quickly enables rapid response to dynamic changes in power demands, enhancing the responsiveness and efficiency of the robot's operation. Despite their small size, capacitors are indispensable in optimizing the performance and reliability of the Medimover robot, contributing to its seamless functionality in healthcare environments.

Figure 3.10: capacitor

3.1.11 LED

LEDs (Light Emitting Diodes) are indispensable components integrated into the Medimover mobile medical assistant robot, serving various signaling and indication purposes. These small semiconductor devices emit light when current flows through them, providing visual feedback and status indication for different operational states of the robot. LEDs are strategically positioned throughout the robot's design to convey information such as power status, connectivity, and operational mode to users and healthcare professionals. Their low power consumption, long lifespan, and wide range of available colors make LEDs ideal for enhancing user interaction and facilitating clear communication within clinical settings. Despite their simple construction, LEDs play a crucial role in ensuring the Medimover robot's visibility, functionality, and user-friendliness in healthcare environments.

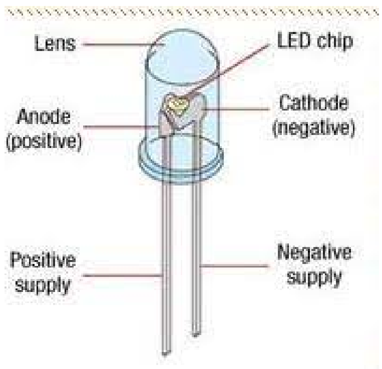


Figure 3.11: LED

3.1.12 Jumper wire

Jumper wires serve as essential conduits within the Medimover mobile medical assistant robot, facilitating electrical connections between various components. These flexible wires, typically made of copper with insulation, come in various lengths and colors to accommodate different circuit layouts and configurations. Jumper wires are utilized to establish both power and signal connections between components such as microcontrollers, sensors, actuators, and power sources. Their versatility and ease of use make them indispensable for prototyping, testing, and troubleshooting electrical circuits during the development phase. Jumper wires enable designers to quickly iterate and modify circuit layouts, facilitating the implementation of new functionalities and integration of additional components as needed. Despite their simplicity, jumper wires play a crucial role in ensuring the seamless operation and connectivity of the Medimover robot's electronic systems, contributing to its functionality and reliability in healthcare environments.

Figure 3.12: jumper wire

3.1.13 Batteries

Wheelchairs are typically powered by rechargeable batteries (Li-ion).These batteries provide the necessary electrical energy to operate the control system, motors, sensors, and other components.Power management systems may be incorporated to regulate the power supply, monitor battery levels, and optimize energy consumption.

Here we are using a 12V and a 9V battery.

Figure 3.13: Li-ion Battery

3.1.14 Acrylic Sheet

The acrylic sheet serves as the foundational material for the Medimover mobile medical assistant robot, offering a blend of durability, versatility, and transparency. Its lightweight yet sturdy construction provides structural support for internal components while allowing for easy customization to accommodate specific design requirements. The transparent nature of acrylic facilitates visual inspection of the robot's inner workings, while its sleek finish enhances the overall aesthetic appeal. With its protective properties and ease of maintenance, the acrylic sheet contributes to the functionality and professionalism of the robot in healthcare environments.

Figure 3.14: Acrylic sheet

3.1.15 Robot Chassis

The 2 motored body-chassis forms the structural backbone of the Medimover mobile medical assistant robot, facilitating its mobility and maneuverability within clinical environments. Consisting of a robust chassis and two independently controllable motors, this component enables omnidirectional movement, allowing the robot to navigate tight spaces and approach patients' bedsides with precision. Integrated with the overall control system, the body-chassis responds to commands from the mobile application, ensuring seamless coordination between movement and user inputs. Safety features are incorporated to prevent accidents and ensure the well-being of patients and healthcare professionals.

Figure 3.15: Chassis

3.1.16 Pill dispenser parts

The pill dispensing mechanism comprises a funnel for pill intake, a rotating cylindrical disk with pill compartments, a casing with attachment to the base, and supporting plates and pillars. Fabricated through precise 3D printing, it ensures consistent dimensions and optimal performance.

3.2 SOFTWARES USED

3.2.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) serves as the primary software tool for programming and developing the firmware for the Medimover mobile medical assistant robot's microcontroller, specifically the Node MCU-ESP32. With its user-friendly interface and extensive library of pre-written code (known as sketches), the Arduino IDE simplifies the process of writing, compiling, and uploading code to the microcontroller. Its compatibility with the Arduino programming language, based on Wiring and C/C++, allows developers to easily implement various functionalities, including motor control, sensor interfacing, and communication protocols. The Arduino IDE's versatility and accessibility make it an indispensable tool for prototyping and iterating software solutions for the Medimover robot.

3.2.2 Android Studio

Android Studio serves as the primary software environment for developing the mobile application interface used to control and monitor the Medimover mobile medical assistant robot. As the official Integrated Development Environment (IDE) for Android app development, Android Studio offers a comprehensive set of tools and features tailored specifically for building Android applications. Developers can leverage its intuitive user interface designer, code editor, and debugging tools to create visually appealing and functionally robust mobile interfaces. Integration with the Android Software Development Kit (SDK) and support for various programming languages such as Java and Kotlin enable developers to build powerful and responsive applications compatible with a wide range of Android devices. Android Studio's rich ecosystem of plugins and libraries further enhances its capabilities, facilitating the development of a seamless and intuitive user experience for controlling the Medimover robot remotely.

3.2.3 PyCharm

PyCharm serves as the primary Integrated Development Environment (IDE) for developing the server-side software component of the Medimover mobile medical assistant robot. Built specifically for Python development, PyCharm offers a feature-rich environment tailored to the needs of Python developers. Its intelligent code editor, debugger, and comprehensive set of tools streamline the development process, enabling developers to write, test, and debug server-side code efficiently. PyCharm's integration with popular frameworks such as Flask, used in the Medimover project, simplifies the implementation of web services and APIs required for communication between the robot and external devices. With its support for version control systems and collaborative development features, PyCharm facilitates teamwork and code management throughout the development lifecycle of the Medimover project.

3.2.4 SOLIDWORKS

SOLIDWORKS is a powerful computer-aided design (CAD) software utilized in the development of the Medimover mobile medical assistant robot. This comprehensive 3D modeling tool enables designers to create detailed and precise virtual representations of mechanical components, assemblies, and structures. With its intuitive user interface and robust set of features, SOLIDWORKS facilitates the visualization, design, and analysis of complex mechanical systems, ensuring optimal functionality and efficiency of the robot. Designers can leverage SOLIDWORKS' parametric modeling capabilities to iteratively refine and optimize the robot's geometry, ensuring compatibility and integration of various components within the system. Additionally, SOLIDWORKS' simulation tools allow for virtual testing of mechanical designs, enabling engineers to assess factors such as structural integrity, motion dynamics, and material properties prior to physical prototyping. By incorporating SOLIDWORKS into the development process, designers can accelerate the design cycle, minimize errors, and ultimately deliver a robust and reliable mobile medical assistant robot tailored to the specific needs of healthcare environments.

3.2.5 DipTrace

DipTrace is a robust software widely utilized for PCB (Printed Circuit Board) design, offering a user-friendly interface coupled with powerful features. Engineers and designers rely on DipTrace for its intuitive schematic capture module, which enables the creation of intricate circuit diagrams effortlessly. With its extensive component libraries, users can access a vast array of electronic components, streamlining the design process. DipTrace's PCB layout editor facilitates the translation of schematics into physical board designs, allowing for precise placement of components and routing of traces. Its advanced design rule checking ensures accuracy and helps avoid common errors, while 3D visualization capabilities provide insight into the final product. Overall, DipTrace stands as a versatile and efficient solution for professionals and hobbyists alike in the realm of PCB design.

3.3 Block Diagram

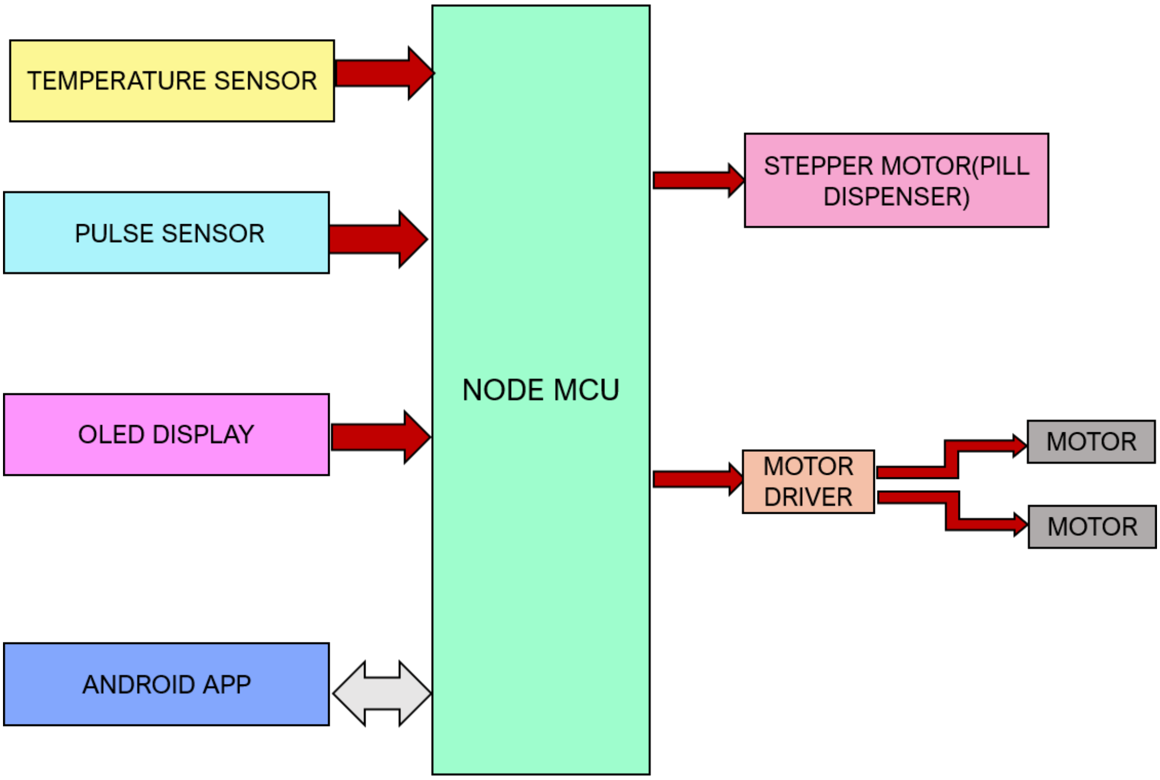


Figure 3.16: Block diagram

Chapter 4

Methodology & Working

This chapter provides an insight into the methodology and functioning of the Medical Assistance Robot. It includes an explanation of the system's design and development methodology and working.

4.1 Methodology

4.1.1 Working design and development

The methodology for the development of MediMover involved a comprehensive approach to integrate hardware and software components to create a functional mobile-controlled medical assistant robot. Beginning with the selection of appropriate hardware components, including NodeMCU-ESP32, motor drivers, sensors (such as pulse sensor and temperature sensor), and other necessary elements, careful consideration was given to their compatibility and suitability for the project requirements. The integration process focused on connecting and configuring each component to ensure seamless operation within the robot's framework.

4.1.2 Mobile Application Development

The mobile application development phase involved designing and implementing an intuitive interface for remote control and monitoring of the MediMover robot. Leveraging the Android framework, the application was crafted to provide users with easy navigation and precise control over the robot's movements. Features such as real-time data visualization, patient monitoring, and medication dispensation control were incorporated to enhance the user experience and facilitate efficient medical assistance.

4.1.3 Server Implementation

The server implementation was a crucial aspect of the project, serving as the communication hub between the robot, mobile application, and hospital infrastructure. Utilizing the Flask framework, a server was created to facilitate seamless data transmission and exchange between the various components of MediMover. Sensor data collected by the robot's NodeMCU was processed and distributed through the server to the designated mobile application interfaces, enabling healthcare professionals to monitor patient vitals and environmental conditions in real-time.

4.1.4 Database Integration

Database integration was essential for storing and managing patient data, sensor readings, and other relevant information collected by the robot. Firebase, a comprehensive backend infrastructure provided by Google, was utilized to establish a real-time database for efficient data storage and retrieval. This integration enabled seamless access to patient records and facilitated further analysis by medical experts, thereby enhancing the overall functionality and effectiveness of MediMover as a mobile medical assistant.

4.1.5 Pill Dispenser Integration

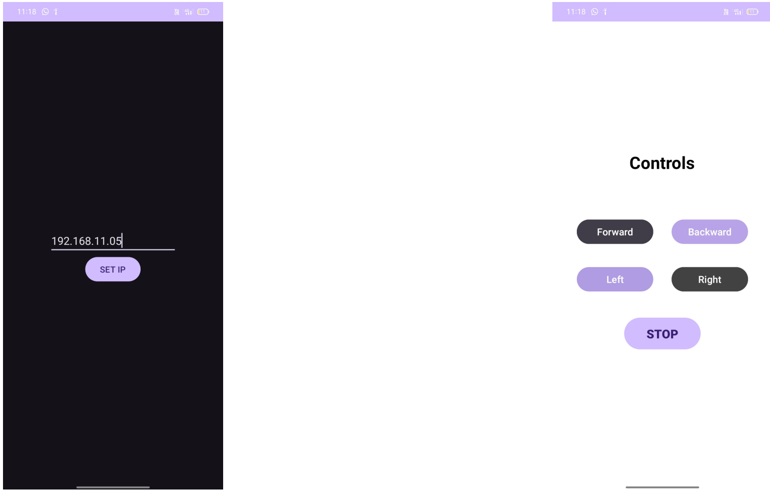
The integration of a pill dispenser mechanism within the medical assistance robot enhances its capabilities to provide accurate and timely medication administration for patients.Control and operation of the pill dispenser mechanism are seamlessly facilitated through the mobile application interface. Through precise motor control and synchronization mechanisms, the dispenser delivers medications with precision, minimizing the risk of dosage errors and ensuring optimal therapeutic outcomes for patients.

4.2 Working

The robotic system comprises a motor chassis affixed with two DC motors and a castor wheel, facilitating mobility between locations. Control over the motors is managed by the ESP32 microcontroller through the motor driver IC L293D. Additionally, a mobile application interface facilitates remote navigation of the robot via intuitive buttons, including forward, backward, left, right, and stop commands, thereby providing seamless control for the operator.

Furthermore, to monitor patients' vital signs, temperature and pulse sensors are integrated into the system. These sensors, connected to digital pins of the microcontroller, measure temperature and pulse values, which are then transmitted to the controller. Subsequently, the data is relayed to both the database and the application interface via a server, enabling remote monitoring by healthcare professionals. Additionally the system includes an OLED display to facilitate communication of any instructions.

Lastly, the mobile application houses a comprehensive repository of patient details, encompassing medical histories, prescribed medications, and vital sign records. This repository serves as a valuable resource for medical experts, facilitating detailed assessments of patient health and aiding in informed decision-making regarding patient care. The Pill dispenser comprises a funnel designed to facilitate easy pouring of



(a) IP page (b) Control Page

Figure 4.1: Application Interface

pills. The tail hole of the funnel is designed to pass exactly one pill, ensuring dosage accuracy. Directly beneath the funnel, a vertically aligned rotating disk features a compartment sized identically to the pill and alinged with the funnel's tail, enabling pills to descend directly into the compartment. This disk is linked to a stepper motor via a shaft mechanism. Upon receiving a prompt from the mobile application, the stepper motor initiates rotation along with the disk. After half a rotation, the pill compartment aligns with the lowermost position, enabling the pill to descend into the collection tray.

4.3 Connection Diagram

This connection diagram (Figure 4.1) illustrates the integration and interaction of hardware and software components within the MediMover system. This visual representation highlights the communication pathways between the mobile application, server, robot, and database, providing a clear overview of the system's architecture. By depicting the connections and data flow between each component, the connection diagram aids in understanding the functionality and operation of MediMover as a mobile-controlled medical assistant.

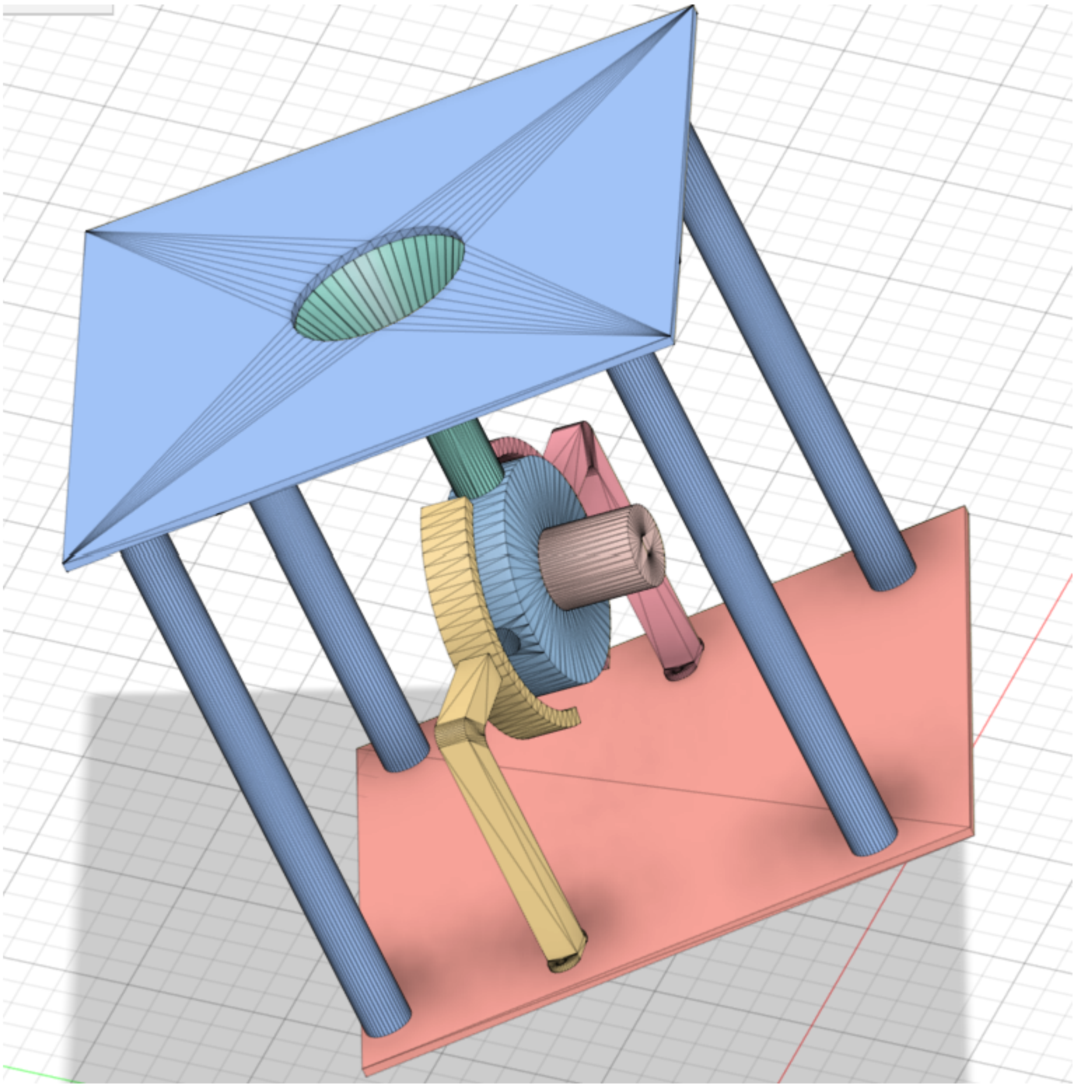


Figure 4.2: Pill Dispenser Assembly

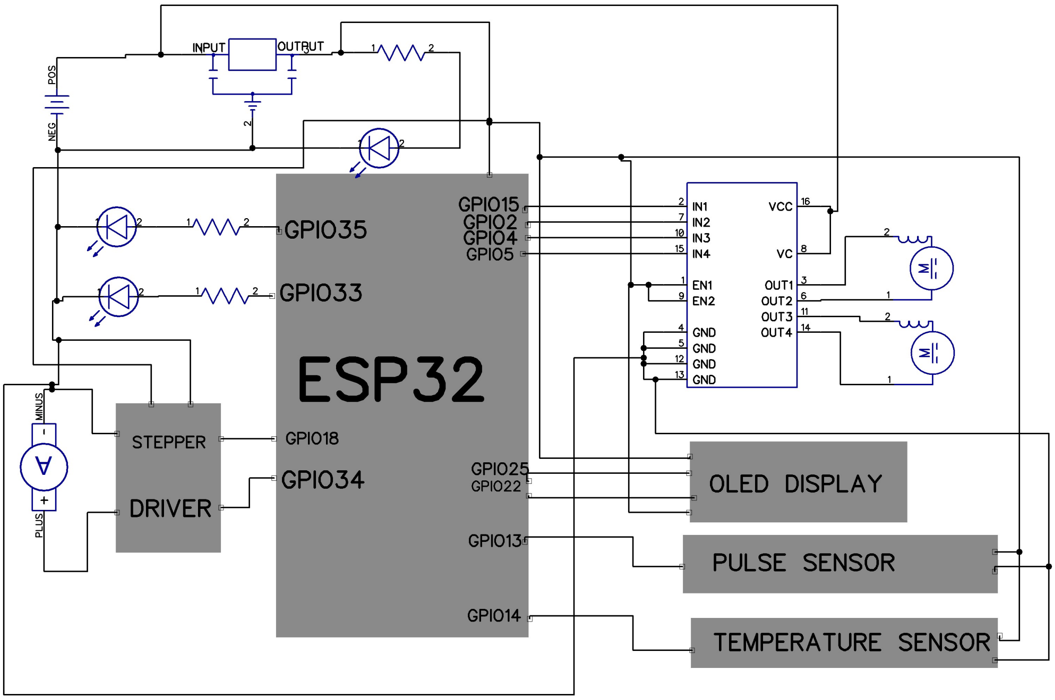


Figure 4.3: Connection Diagram

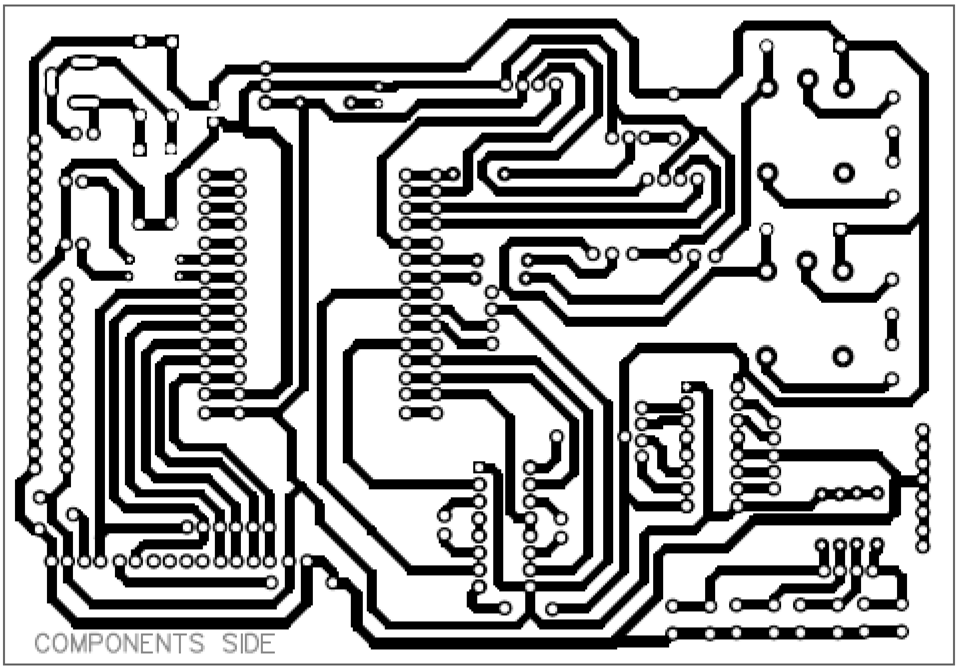


Figure 4.4: PCB design of Power Supply

Chapter 5

Code and explanation

5.0.1 ESP32

```
#include<ESP8266WiFi.h>
#include<ESP8266HTTPClient.h>
#include<HttpClient.h>
#include<WiFiClient.h>
#include <OneWire.h>
#include<DallasTemperature.h>

//initialising pins
int dallas = 19;
OneWire oneWire(dallas);
DallasTemperature sensors(&oneWire);
int pulseSensorPin = A0;
int p_pin = 32;
int pulseValue = 0;
int pvalue = 0;
bool flag1 = 0, flag2 = 0, flag3 = 0, flag4 = 0, flag5 = 0;
int m11 = 25;
```

```
int m12 = 26;
int m21 = 27;
int m22 = 14;

//wifi connection
WiFiClient wificlient;
HTTPClient http;
const char* ssid = "NEXUS_TECH";
const char* password = "nex@1234";
unsigned long int last_post = 0;
int post_interval = 1000;
int count = 0;

void setup_wifi()
{
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(1000);
    Serial.println("CONNECTING....");
  }
  Serial.println("CONNECTED");
}

//server communication
void send_data(String A)
{
  if (WiFi.status() == WL_CONNECTED && (millis() - last_post) >=
   ↪ post_interval)
  {
```

```
    http.begin(wificlient, "http://192.168.0.200:5000/test");
    http.addHeader("Content-Type",
     ↪  "application/x-www-form-urlencoded");
    String data = A;
    int httpcode = http.POST(data);
    String payload = http.getString();
    Serial.println(httpcode);
    last_post = millis();
    if (httpcode > 0)
    {
      String res = http.getString();
      Serial.println(res);
      if (res == "A") {
        flag1 = 1;
      }
      if (res == "B") {
        flag2 = 1;
      }
      if (res == "C") {
        flag3 = 1;
      }
      if (res == "D") {
        flag4 = 1;
      }
      if (res == "E") {
        flag5 = 1;
      }
    }
    http.end();
  }
```

```
}


void setup()
{
  pinMode(p_pin, OUTPUT);
  pinMode(pulseSensorPin, INPUT);
  Serial.begin(9600);
  pinMode(m11, OUTPUT);
  pinMode(m12, OUTPUT);
  pinMode(m21, OUTPUT);
  pinMode(m22, OUTPUT);
  setup_wifi();
}

void loop()
{
//motor control
  if (flag1 == 1)

  {
    digitalWrite(m11, HIGH);
    digitalWrite(m12, LOW);
    digitalWrite(m21, HIGH);
    digitalWrite(m22, LOW);
    flag1 = 0;
  }

  if (flag2 == 1) {
    digitalWrite(m11, LOW);
```

```
    digitalWrite(m12, HIGH);
    digitalWrite(m21, LOW);
    digitalWrite(m22, HIGH);
    flag2 = 0;
  }

  if (flag3 == 1)
  {
    digitalWrite(m11, HIGH);
    digitalWrite(m12, LOW);
    digitalWrite(m21, LOW);
    digitalWrite(m22, LOW);
    flag3 = 0;
  }

  if (flag4 == 1)
  {
    digitalWrite(m11, LOW);
    digitalWrite(m12, LOW);
    digitalWrite(m21, HIGH);
    digitalWrite(m22, LOW);
    flag4 = 0;
  }

  if (flag5 == 1) {
    digitalWrite(m11, LOW);
    digitalWrite(m12, LOW);
    digitalWrite(m21, LOW);
    digitalWrite(m22, LOW);
    flag5 = 0;
```

```
  }

//reading pulse sensor values
  digitalWrite(p_pin, HIGH);
  delay(3000);
  pulseValue = analogRead(pulseSensorPin);
  if (pulseValue >= 800 && pulseValue <= 1000)
  {
    pvalue = map(pulseValue, 0, 1024, 60, 90);
  }
  else
  {
    pvalue = 0;
  }
//reading temperature sensor values
  sensors.requestTemperatures();
  float var = sensors.getTempCByIndex(0);
  Serial.println("Temp is: ");
  Serial.println(sensors.getTempCByIndex(0));

  delay(1000);
  Serial.println("Pulse is :");
  Serial.println(pvalue);
  digitalWrite(p_pin, LOW);
  String temp = String(var);
  String pulse = String(pvalue);
  send_data(temp + "," + pvalue);

}

```

5.0.2 Server Realisation

```python

from flask import *

app = Flask(__name__)
dat = ""

@app.route('/test', methods=['POST'])
def test():
    global dat
    val = request.get_data().decode()
    print(val)
    result = "none"
    if dat:
        result = dat
        dat = ""
        print(result)
    return result

@app.route('/control', methods=['POST', 'GET'])
def control():
    try:
        global dat
        dat = request.form['data']
        print(dat)
        return jsonify({'result': "success"})
    except Exception as e:
        print(e)
        return jsonify({'result': "error"})

```

```
if __name__ == "__main__":
    app.run(host='0.0.0.0', port=5000)
```

5.0.3 Database Reading

```

from flask import *
import pymysql
con=pymysql.connect(host='localhost',port=3306,user='root',password='root',db='datas

cmd=con.cursor()

app=Flask(__name__)

@app.route('/test',methods=['get','post'])
def test():
    val=request.get_data().decode('utf-8')
    print(val)
    cmd.execute("insert into readings values (null,'"+val+"')")
    con.commit()
    return "ok"
app.run(port=5000,debug=True,host='0.0.0.0')

```

Chapter 6

Output

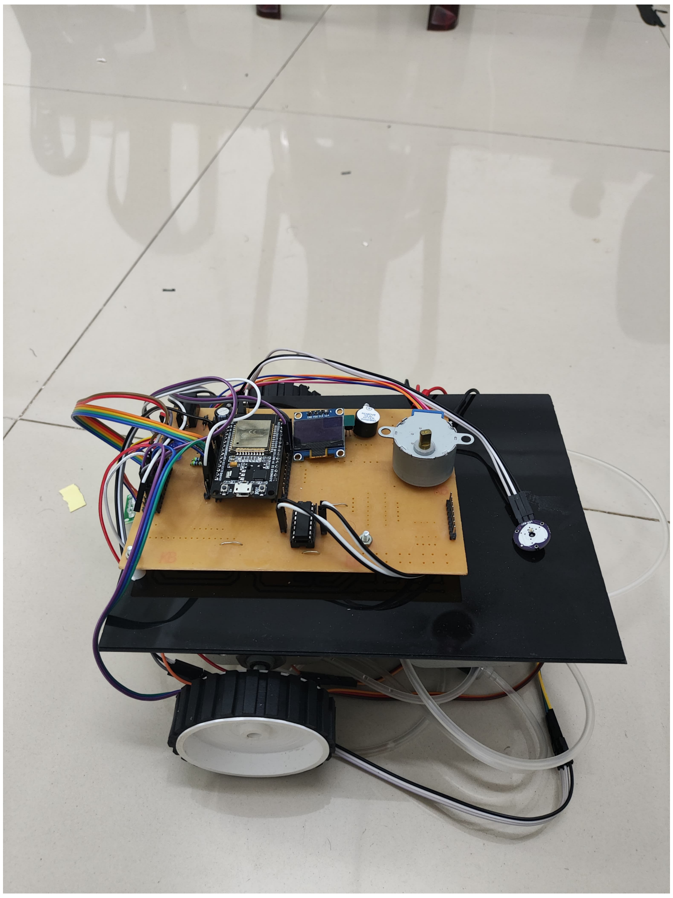


Figure 6.1: Robot Vehicle

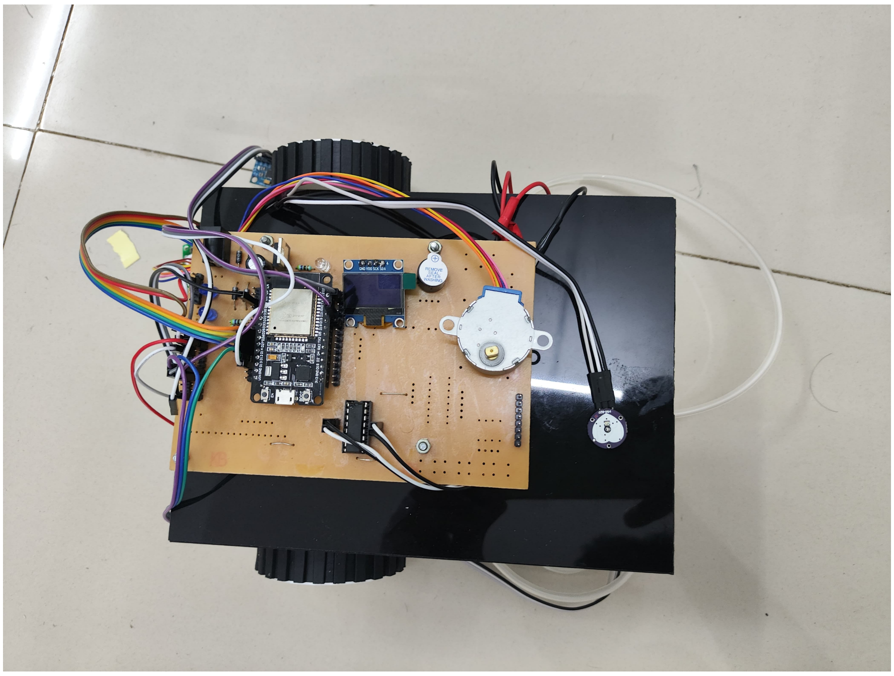


Figure 6.2: Robot Vehicle

Chapter 7

Conclusion

In conclusion, the development of our medical assistance robot represents a significant advancement in healthcare technology, offering a range of functions designed to improve patient care and streamline healthcare processes. By integrating capabilities such as checking vitals, medicine dispensing, and mobile application-controlled movement, the robot has demonstrated its potential to revolutionize healthcare delivery. Through our research and development efforts, we have shown that the robot can efficiently monitor patient vital signs, accurately dispense medications, and navigate hospital environments with ease, all while being remotely controlled via a user-friendly mobile application. These functionalities not only enhance the efficiency and productivity of healthcare professionals but also contribute to better patient outcomes and satisfaction. While our findings showcase the promising benefits of the medical assistance robot, we recognize the importance of addressing challenges such as technical limitations and regulatory requirements to ensure its successful integration into healthcare settings. Moving forward, continued refinement of the robot's design and functionality, along with further validation through clinical trials, will be essential steps toward realizing its full potential in transforming the delivery of healthcare services.

Expanding the scope of the project to include automated movement, broader implementation in hospitals, and multipatient compatibility opens up exciting opportunities for further innovation and impact in healthcare. By incorporating automated movement capabilities, the medical assistance robot can navigate complex hospital environments more efficiently, autonomously reaching patients in need and assisting healthcare providers with various tasks. This advancement not only increases the robot's versatility but also reduces the workload on hospital staff, allowing them to focus more on patient care.

Chapter 8

Bibliography

1 Hossain, Md & Zarif, Shahriar & Rahman, Md & Ahmed, Abir & Zishan, Md. (2021). Design and Implementation of Assistive Robot for The Elderly and Impaired Person. 10.1109/ICREST51555.2021.9331121.

2 Mireles, Caridad & Sanchez, Misael & Cruz-Ortiz, David & Salgado, Ivan & Chairez, Isaac. (2022). Home-care nursing controlled mobile robot with vital signal monitoring. Medical & Biological Engineering & Computing. 61. 10.1007/s11517-022-02712-y. and Dissertations. 829.

3 Haider, Iram & Khattak, Dr & Haider, Muhammad & Saeed, Arshad & Nisar, Kashif. (2020). Automated Robotic System for Assistance of Isolated Patients of Coronavirus (COVID-19). 1-6. 10.1109/INMIC50486.2020.9318124.

4 Hasan, Md & Ray, Saikat & Azad, Mehedi & Sarkar, Sujana. (2023). Design And Development Of Robo Medical Assistant. 10.1109/ICREST57604.2023.10070041.

5 Kyrarini, Maria & Lygerakis, Fotios & Rajavenkatanarayanan, Akilesh & Sevastopoulos, Christos & Nambiappan, Harish Ram & Kodur, Krishna & ramesh babu, Ashwin & Mathew, Joanne & Makedon, Fillia. (2021). A Survey of Robots in Healthcare. Technologies. 9. 8. 10.3390/technologies9010008.

6 Alvarez, Jesus & Campos, Guillermo & Enriquez, Valeria & Miranda, Alexis & Rodriguez, Francisco & Ponce, Hiram. (2018). Nurse-Bot: A Robot System Applied to Medical Assistance. 56-59. 10.1109/ICMEAE.2018.00017.