SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, Dharwad-580002

An autonomous Institution affiliated to

Visvesvaraya Technological University, Belgaum – 590018

Department of Electronics and Communication Engineering

Report on Minor Project-1

Entitled

"Voice Activated Home Automation for Elderly and Physically Challenged Individuals"

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CERTIFICATE

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has satisfactorily completed the **Minor Project - 1 [22UECL505]** entitled **"Voice Activation Home Automation for elderly and physically challenged individuals"** for the partial fulfillment of the requirements for the completion of **5th semester** of Bachelor of Engineering in Electronics and Communication during academic year 2024-25.

Prof. Vyas Murnal Project Guide Dept. of E&CE.	**Dr. Shreedhar A Joshi,** Head of the Department, Dept. of E&CE.	**Dr. Ramesh L. Chakrasali**, Principal, SDMCET, Dharwad.

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Name:

Designation:

Department:

Examiner -1 **Examiner -2**

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ABSTRACT:

Advancements in the technologies are higher, especially for IoT, this can be integrated well with home automation to enhance daily lifestyle. Remote controlled automation systems are very helpful for bedridden patients and physically handicapped persons. Gesture controlled systems are being developed nowadays. These need more memory and processing speed. As the Wi-Fi connectivity is provided, the system can be controlled even from a large distance. Use of the latest technology and low cost, easy to operate system will make it accessible for every household. The use of home automation is now extended even to factories, various industries for the automatic ON/OFF of various machineries and electronic appliances. This system can efficiently monitor the power consumption of building automation systems like HVAC.

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Chapter -1

Conception of the project

1.1 INTRODUCTION:

The voice-based home automation system for physically challenged and elderly individuals is designed to provide an accessible and efficient solution for managing household appliances.

This innovative system leverages voice recognition technology to allow users to control various devices through simple voice commands, significantly enhancing their independence and quality of life. By integrating a microcontroller, Bluetooth communication, and relay modules, the system ensures seamless operation and ease of use.

The primary objective is to create a user-friendly, cost-effective, and secure home automation solution that reduces the need for physical interaction with switches and remotes, thereby improving safety and convenience.

This project not only demonstrates the potential of modern technology to transform daily living but also highlights its importance in supporting the needs of physically challenged and elderly individuals.

1.2 Motive of the Project:

As the global population ages and the number of individuals with physical disabilities increases, there is a growing need for solutions that promote independent living and enhance the quality of life for elderly and physically challenged people. Many of these individuals face physical or cognitive challenges that make daily tasks difficult.

1.3 Background:

Home automation systems have become an integral part of modern living, aiming to increase comfort, convenience, and energy efficiency. These systems are particularly beneficial for elderly and physically challenged individuals, offering them a safer and more independent living environment. The integration of voice-activated control in home automation systems marks a significant advancement, providing a hands-free method for managing household tasks.

1.4 Literature Survey

The literature survey underscores the transformative potential of voice-activated home automation systems for elderly and physically challenged individuals. While significant progress has been made, ongoing research and development are essential to address existing challenges and further enhance the functionality and user experience of these systems.

1.5 Problem Statement

1. Elderly and disabled individuals often face difficulties with daily tasks due to physical or cognitive limitations.
2. Traditional home automation systems can be daunting for them, given the complexity of interfaces and the need for precise commands. Simple tasks like turning on lights, adjusting thermostats, or operating household appliances can become frustrating.
3. This challenge is compounded by the need for reliable internet connections and the learning curve associated with new technologies. Voice-activated home automation systems hold the promise of simplifying these tasks by providing intuitive, hands-free control, but they must be designed with accessibility and ease of use at their core to truly benefit these users.

1.6 Objectives

1. 1.Enhance Independence: Enable physically challenged and elderly individuals to control household appliances without physical effort.
2. 2.Improve Quality of Life: Provide a convenient and efficient way to manage home environments, enhancing overall quality of life.
3. 3.Ensure Safety: Reduce the risk of accidents by allowing users to control appliances from a distance.
4. 4.User-Friendly Interface: Develop an intuitive and easy-to-use system operated through simple voice commands.
5. 5.Cost-Effective Solution: Utilize readily available and affordable components to keep the system cost-effective.
6. 6.Real-Time Responsiveness: Provide immediate feedback and control, ensuring the system responds promptly to voice commands.

1.7 Working

This system improves the lives of elderly and physically challenged individuals by offering an intuitive and efficient voice-activated solution for home automation. It allows users to easily manage appliances, enhancing accessibility and independence, while customizable features cater to individual needs and preferences.

1.8 Features

1.Voice Command Recognition

- Intuitive Voice Interface: Users can control home appliances using simple voice commands without the need for physical interaction.
- High Accuracy: Advanced voice recognition technology ensures precise command interpretation, even in noisy environments.

2.Appliance Control

- Lights: Turn on/off and adjust brightness based on voice commands and ambient light conditions.
- Fans: Control fan speed automatically based on room temperature using DHT11 sensors.
- Smart Plugs: Control power to various appliances, providing flexibility in managing electronic devices.

3.Customizable Settings

- Personalized Routines: Users can create and schedule routines tailored to their daily needs, such as turning on lights at specific times.
- Preference Adaptation: System learns and adapts to user preferences over time, enhancing user experience.

4.Accessibility and Independence

- Hands-Free Operation: Eliminates the need for physical controls, making it ideal for individuals with mobility impairments.
- Enhanced Independence: Allows users to perform daily tasks independently, reducing the need for caregiver assistance.

5.Safety Features

- Emergency Commands: Users can issue voice commands to trigger emergency responses, such as sending alerts to caregivers or turning on all lights.
- Energy Management: Automatically adjusts appliance settings to conserve energy, promoting safe and efficient use of resources.

1.9 Areas of Application

1. **Residential Homes**

1. Elderly Care: Enhances the quality of life by providing hands-free control over household appliances, ensuring comfort and safety for elderly residents.

2. Physically Challenged Individuals: Facilitates independence by allowing them to manage their environment without needing physical interaction.

3. **Assisted Living Facilities**

4. Increased Autonomy: Residents can control their own living spaces, promoting a sense of independence.

5. Improved Safety: Quick response to emergencies and convenient control of lighting and appliances enhance safety.

2. **Hospitals and Rehabilitation Centers**

6. Patient Comfort: Patients can control room settings such as lighting, temperature, and entertainment systems with voice commands.

7. Staff Assistance: Reduces the workload on healthcare staff by allowing patients to manage their own environments.

1.10 Benefits

- **Accessibility**: Provides an easy-to-use interface for physically challenged and elderly individuals, allowing them to control home appliances without physical effort.

- **Independence**: Enhances the independence of users by enabling them to manage their home environment without assistance.

- **Convenience**: Voice commands are a convenient way to control multiple devices, reducing the need for physical interaction with switches and remotes.

- **Safety**: Reduces the risk of accidents, such as falls, by allowing users to control appliances from a distance.

Chapter-2

Design of project

2.1Circuit Diagram

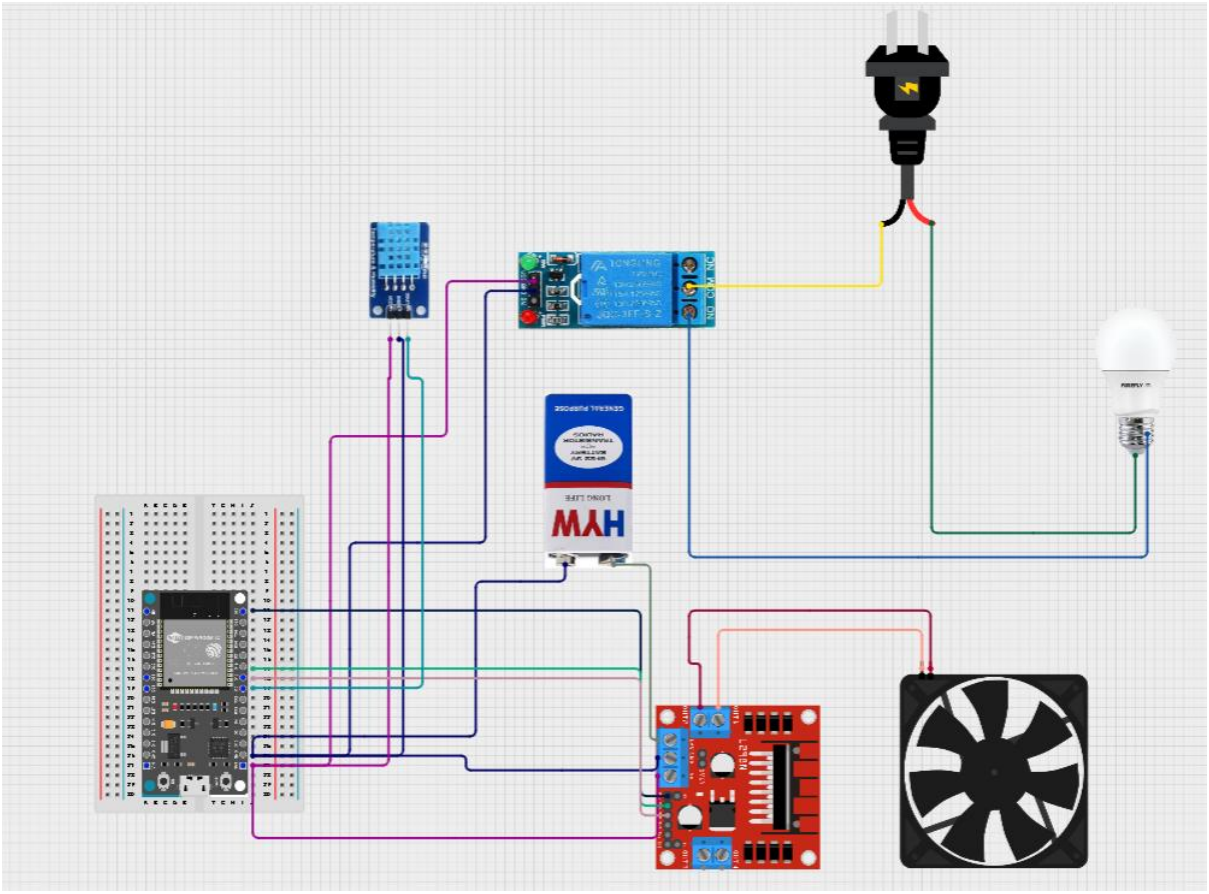

Figure 2.1(Circuit design for voice activated home automation.)

Chapter-3

Implementation of the Project

3.1 Components List and Specifications

- Microcontroller (ESP32): It is a low-cost microcontroller with Wi-Fi, Bluetooth, and IoT applications.
- Relay Module: Controls the switching of home appliances.
- Smartphone with Bluetooth connectivity: Converts voice commands to text and sends them to the microcontroller via Bluetooth.
- LED Bulb.
- LM289 Motor Driver: This is a component which helps run the fan.
- DC Fan.
- 9V Battery.
- DHT11 Temperature and Humidity Sensor: This component senses the external temperature and humidity.

3.2 Project related code:

```
#include <BluetoothSerial.h>
#include "DHT.h"

// DHT11 Sensor Setup
#define DHTPIN 4      // GPIO pin connected to the DHT11
#define DHTTYPE DHT11 // Specify sensor type
DHT dht(DHTPIN, DHTTYPE);

// Relay Pin for Light Control
#define RELAY 2       // GPIO pin connected to the relay for light control

// Motor Driver Pins for Fan Control
#define ENA 23        // PWM pin for fan speed control
#define IN1 18        // Motor direction control pin 1
#define IN2 19        // Motor direction control pin 2

BluetoothSerial SerialBT; // Bluetooth Serial communication

// Fan Speed Adjustment Variables
int fanSpeed = 0;            // Current fan speed (0-255)
bool autoFanControl = true;  // Toggle automatic fan speed control

void setup() {
  Serial.begin(115200);
  SerialBT.begin("ESP32_Device_Control");
  Serial.println("Bluetooth device started, now you can pair it with your phone!");

  // Initialize DHT sensor
  dht.begin();
```

```
30
31    // Initialize Light Control
32    pinMode(RELAY, OUTPUT);
33    digitalWrite(RELAY, HIGH); // Start with the light off
34
35    // Initialize Fan Control
36    pinMode(IN1, OUTPUT);
37    pinMode(IN2, OUTPUT);
38    pinMode(ENA, OUTPUT);
39    digitalWrite(IN1, LOW);
40    digitalWrite(IN2, LOW);
41    analogWrite(ENA, 0); // Start with fan off
42  }
43
44  void loop() {
45    // Read DHT11 Sensor Data
46    float temperature = dht.readTemperature(); // Celsius
47    float humidity = dht.readHumidity();
48
49    // Check if the sensor reading is valid
50    if (isnan(temperature) || isnan(humidity)) {
51      Serial.println("Failed to read from DHT sensor!");
52    } else {
53      Serial.print("Temperature: ");
54      Serial.print(temperature);
55      Serial.println("°C");
56      Serial.print("Humidity: ");
57      Serial.print(humidity);
58      Serial.println("%");
59
```

```
60      // Adjust fan speed automatically based on temperature if autoFanControl is enabled
61      if (autoFanControl) {
62        if (temperature < 25) {
63          fanSpeed = 0; // Turn fan off for low temperatures
64        } else if (temperature >= 25 && temperature < 30) {
65          fanSpeed = 128; // Medium speed for moderate temperatures
66        } else {
67          fanSpeed = 255; // Full speed for high temperatures
68        }
69        // Set fan direction and speed
70        digitalWrite(IN1, HIGH);
71        digitalWrite(IN2, LOW);
72        analogWrite(ENA, fanSpeed);
73      }
74    }
75
76    // Bluetooth Command Handling
77    if (SerialBT.available()) {
78      String command = SerialBT.readStringUntil('\n');
79      Serial.println("Received command: " + command);
80
81      // Light Control
82      if (command == "turn on the light") {
83        digitalWrite(RELAY, LOW); // Relay active-low
84        SerialBT.println("Light turned on");
85      } else if (command == "turn off the light") {
86        digitalWrite(RELAY, HIGH);
87        SerialBT.println("Light turned off");
88      }
```

```
    // Fan Manual Control
    else if (command == "turn on the fan") {
      autoFanControl = false; // Disable automatic control
      digitalWrite(IN1, HIGH);
      digitalWrite(IN2, LOW);
      analogWrite(ENA, 255); // Full speed
      SerialBT.println("Fan turned on manually at full speed");
    } else if (command == "turn off the fan") {
      autoFanControl = false; // Disable automatic control
      digitalWrite(IN1, LOW);
      digitalWrite(IN2, LOW);
      analogWrite(ENA, 0); // Stop fan
      SerialBT.println("Fan turned off manually");
    }
    // Fan Speed Adjustment
    else if (command.startsWith("set fan speed ")) {
      autoFanControl = false; // Disable automatic control
      int speed = command.substring(14).toInt();
      if (speed >= 0 && speed <= 255) {
        fanSpeed = speed;
        digitalWrite(IN1, HIGH);
        digitalWrite(IN2, LOW);
        analogWrite(ENA, fanSpeed);
        SerialBT.println("Fan speed set to " + String(fanSpeed));
      } else {
        SerialBT.println("Invalid speed. Use a value between 0 and 255.");
      }
    }
    // Enable Automatic Fan Control
    else if (command == "auto fan control") {
      autoFanControl = true;
      SerialBT.println("Automatic fan control enabled");
    }
```

```
    // Invalid Command
    else {
      SerialBT.println("Invalid command");
    }
  }

  delay(2000); // Adjust the delay based on your requirements
}
```

Chapter-4

Results of the project

4.1 Progress till now

This project successfully demonstrates a voice-activated home automation system that can control two components: a light and a fan. When the command 'Turn on the light' is given, the light turns on, and when 'Turn off the light' is said, the light switches off. Similarly, the fan can be controlled with commands like 'Turn on the fan' to switch it on and 'Turn off the fan' to switch it off. Additionally, the system includes an 'Autofan control' feature, which automatically adjusts the fan's speed based on the current temperature. This makes the system user-friendly, efficient, and responsive to voice commands, providing a smart solution for home automation.

4.2Future Scope

- The future of voice-activated home automation looks promising and is expected to bring even more convenience, efficiency, and integration into our daily lives. Here are some key areas where we can expect advancements:
- **Enhanced Natural Language Processing**: Future systems will likely have improved natural language processing capabilities, allowing them to understand and respond to more complex and varied commands.
- **Contextual Understanding:** Voice assistants will become better at understanding the context of commands, making interactions more intuitive and seamless.
- **Broader Device Integration**: We can expect voice-activated systems to integrate with an even wider range of smart home devices, from kitchen appliances to security systems.

4.3 Limitations

- **Accuracy Issues**: Voice recognition technology may struggle with accents, dialects, or background noise, leading to misinterpretation of commands.
- **Privacy Concerns**: These devices are always listening, which raises concerns about data privacy and potential misuse of recorded conversations.
- **Dependency on Internet**: Voice-activated devices often require a stable internet connection to function effectively.
- **Complexity of Commands**: Elderly users might have difficulty recalling specific commands or navigating through multiple steps to achieve a task.
- **Lack of Training**: Many users, especially the elderly, may need structured training to effectively use these devices.

- **Social Isolation**: While these devices can reduce loneliness by providing companionship, they can also contribute to social isolation if users rely too heavily on them instead of human interaction.
- **Cost**: The initial setup and ongoing costs of maintaining and updating these systems can be prohibitive for some users.

Conclusion

Voice-activated home automation has the potential to significantly enhance the quality of life for elderly and physically challenged individuals. These systems can offer increased independence, convenience, and safety by allowing users to control their home environment using simple voice commands. However, they come with challenges such as accuracy issues, privacy concerns, dependency on the internet, and potential complexity for some users.

By addressing these limitations through user-friendly design, robust privacy measures, and adequate training, voice-activated home automation can be a valuable tool in promoting autonomy and improving the daily lives of those who need it most. The ongoing development and refinement of these technologies will be crucial in ensuring they meet the diverse needs of their users.

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