Motor Controller using Speech Commands: Harnessing the Power of Verbal Instructions for Enhanced Industrial Efficiency

Project Guide:

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Aim:

The aim of this project is to develop a Motor Controller system that operates through speech commands, leveraging the efficiency and convenience of verbal instructions in industrial settings.

Objectives:

- Designing a robust and responsive speech recognition system for industrial environments.
- Developing a motor control interface that seamlessly integrates with speech commands.
- Enhancing industrial efficiency by reducing the reliance on manual controls and streamlining operations through verbal instructions.

Abstract:

- This project aims to develop a voice-operated control system for motor components using embedded systems and Python programming.
- The system integrates a USB microphone, DC motor, LCD display, Arduino Uno microcontroller, and a motor driver module. The core concept involves implementing speech-to-text functionality using Python on a PC, which interprets spoken commands captured by the microphone.
- These commands are then transmitted to Arduino Uno microcontroller via serial communication.

- The Arduino Uno, equipped with motor driver capabilities, receives the commands and adjusts the motor's speed accordingly.
- The system offers three modes of operation for the motor: high speed, low speed, and medium speed, enabling versatile control based on the user's voice commands.
- By combining embedded systems with Python programming, this project provides an innovative solution for intuitive motor control, demonstrating the potential of voice recognition technology in automation and human-machine interaction.

Introduction:

- Voice Operated Control of Motor Components represents a significant advancement in human-machine interaction, offering a hands-free and intuitive method for controlling motorized devices.
- Traditional methods of motor control often rely on manual switches or complex programming interfaces, limiting accessibility and convenience.
- By leveraging the power of speech recognition technology and embedded systems, this project introduces a novel approach to motor control, allowing users to simply speak commands to adjust the motor's speed.

- The integration of a USB microphone, Arduino Uno microcontroller, motor driver module, and Python programming enables seamless communication between the user and the motorized system.
- This project addresses the growing demand for smart and user-friendly automation solutions by providing a versatile and efficient means of controlling motor components through voice commands.
- Through the implementation of speech-to-text functionality and real-time motor speed adjustments, this project showcases the potential of combining hardware and software to enhance human-machine interaction in various applications, from home automation to industrial control systems.

Problem Statement:

- Traditional interfaces may involve complex menu structures or multiple buttons, making it challenging to navigate and control motors efficiently.
- Manual control interfaces may result in delays in critical situations where rapid response is essential.
- Traditional interfaces may not be accessible for individuals with disabilities, such as those with mobility impairments or certain medical conditions.

Existing method:

- Existing methods for motor control typically rely on manual input devices such as switches, knobs, or touchscreens, requiring users to physically interact with the control interface to adjust motor parameters
- Some motor control systems incorporate remote controls or smartphone apps for wireless operation, providing greater flexibility but still requiring manual input from the user.

Drawbacks of Existing Method :

- Manual Input Limitations
- Limited Automation
- Wireless Control Challenges
- Accessibility Concerns
- Complexity of Control Interfaces
- Inefficiency in Streamlining Interaction

Proposed Method:

The proposed system aims to overcome the drawbacks of existing motor control methods by introducing a voice-operated control system. By integrating speech recognition technology with embedded systems, users will be able to control motor components through spoken commands, eliminating the need for manual input devices and providing a more intuitive and hands-free experience.

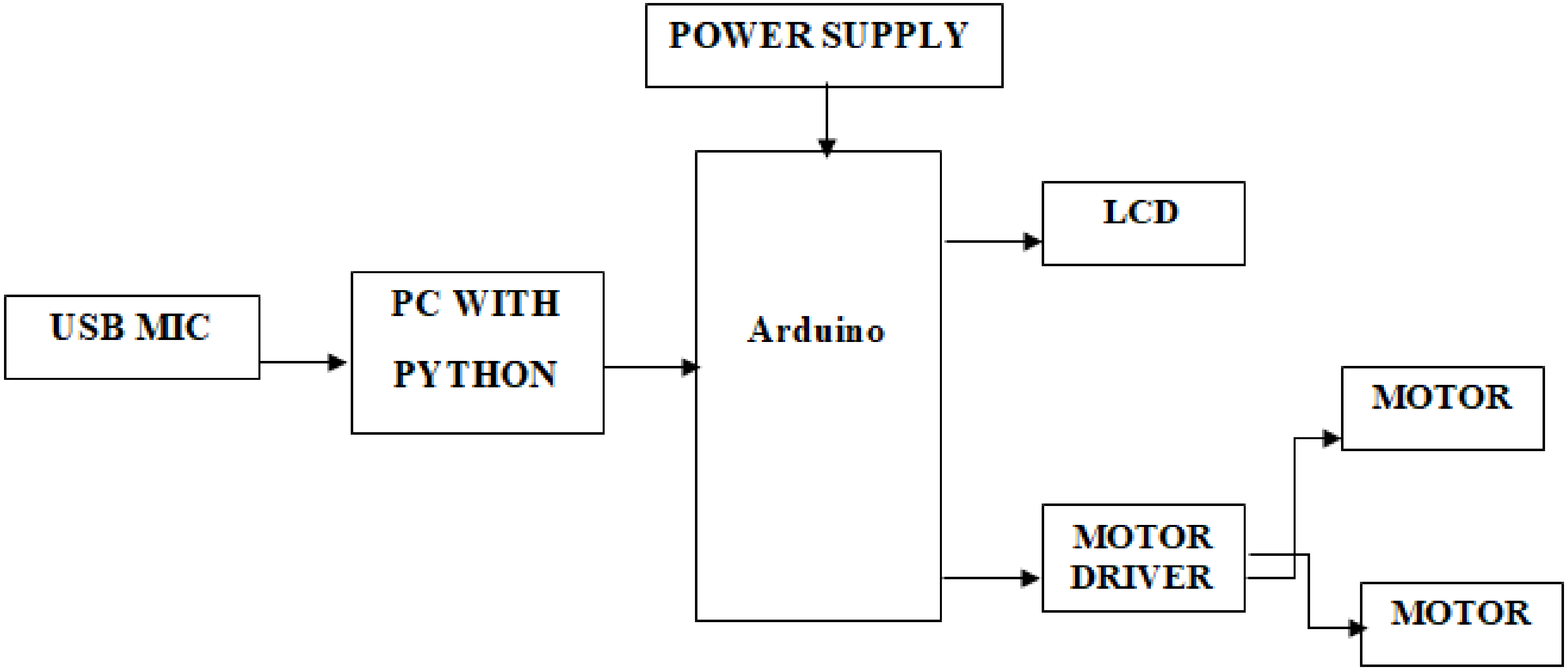
Advantages:

- Enhanced User Convenience
- Hands-Free Operation
- Intuitive Interaction
- Improved Accessibility
- Streamlined Control Experience
- Versatile Applications

Applications:

- Home Automation
- Industrial Control Systems
- Robotics
- Automotive Systems
- Assistive Technology
- Entertainment Systems

Block Diagram:



Components:

Hardware Requirements:

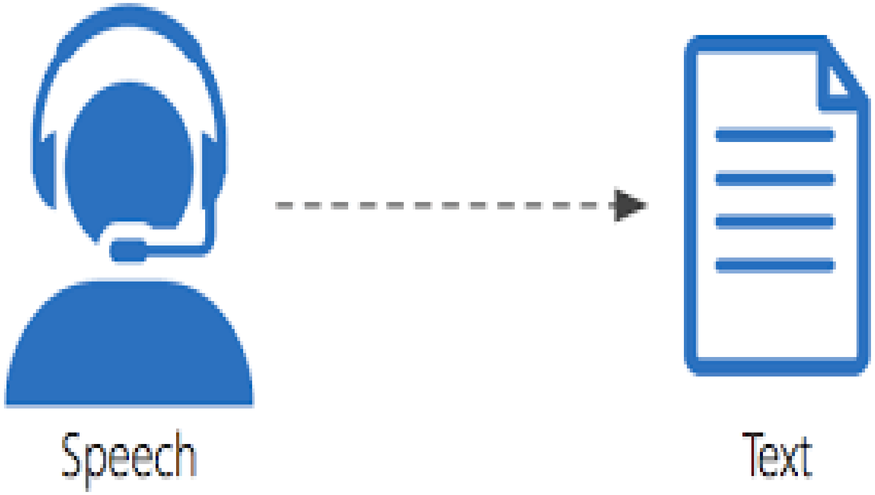
- Arduino UNO
- USB Mic
- Two DC Motors
- Motor Driver
- Power Supply
- LCD

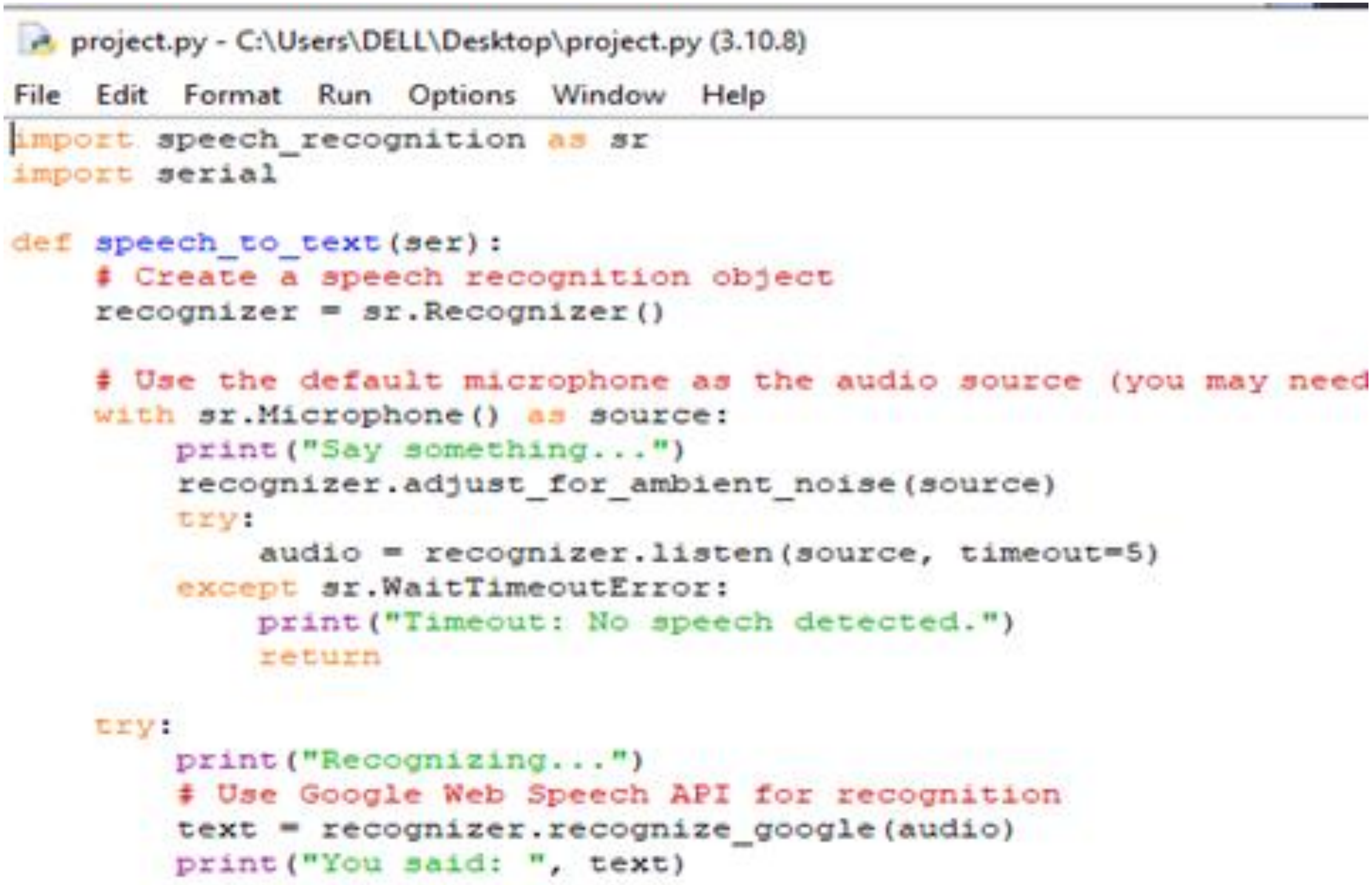
Software Requirements:

- python IDE
- Arduino IDE
- Embedded C

Work Done:

- Speech to text conversion using Python IDE.

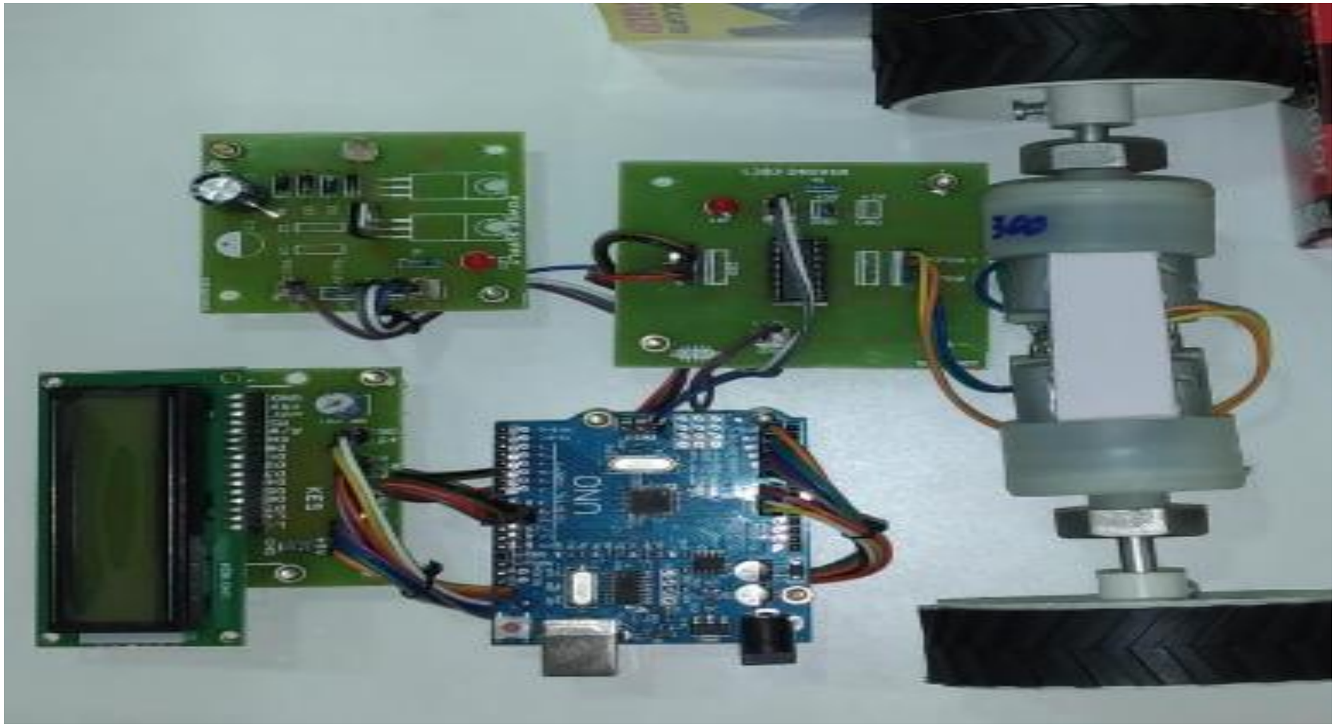


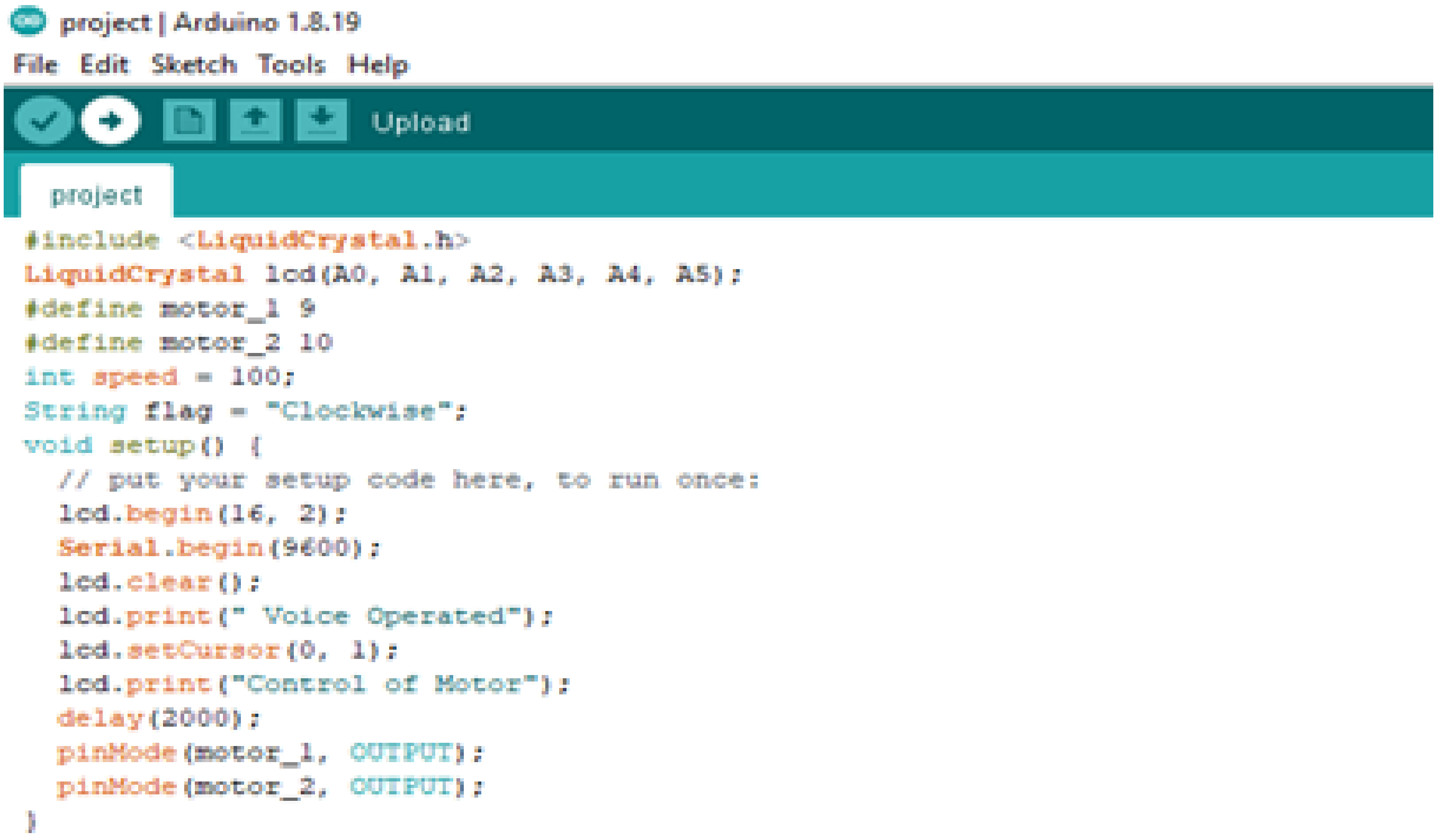


```
import speech_recognition as sr
import serial

def speech_to_text(ser):
    # Create a speech recognition object
    recognizer = sr.Recognizer()

    # Use the default microphone as the audio source (you may need
    with sr.Microphone() as source:
        print("Say something...")
        recognizer.adjust_for_ambient_noise(source)
        try:
            audio = recognizer.listen(source, timeout=5)
        except sr.WaitTimeoutError:
            print("Timeout: No speech detected.")
            return

    try:
        print("Recognizing...")
        # Use Google Web Speech API for recognition
        text = recognizer.recognize_google(audio)
        print("You said: ", text)
```

Python IDE

- Interfacing the two DC motors, LCD, motor driver module and power supply to the Arduino UNO.





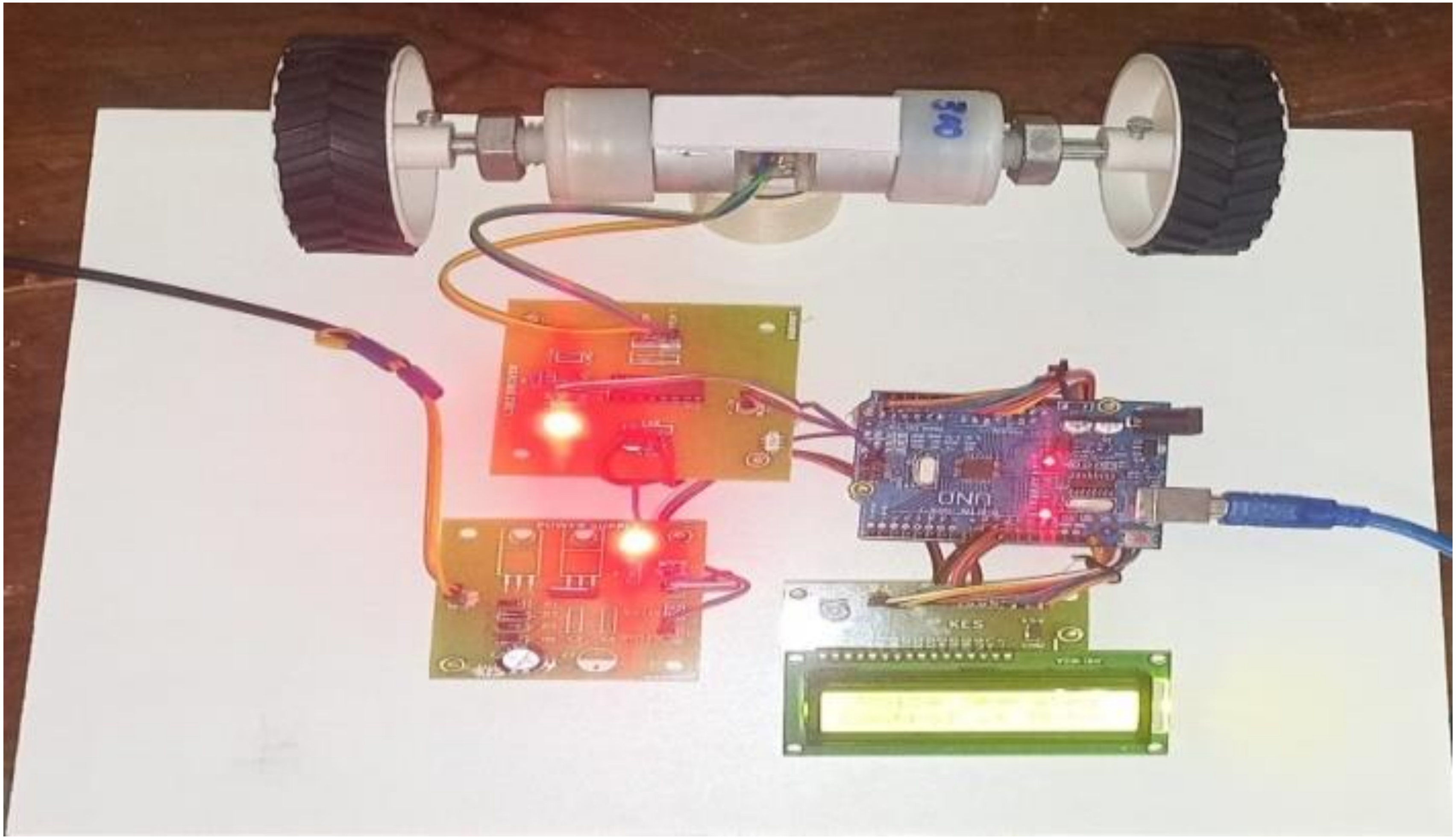
```
#include <LiquidCrystal.h>
LiquidCrystal lcd(A0, A1, A2, A3, A4, A5);
#define motor_1 9
#define motor_2 10
int speed = 100;
String flag = "Clockwise";
void setup() {
  // put your setup code here, to run once:
  lcd.begin(16, 2);
  Serial.begin(9600);
  lcd.clear();
  lcd.print(" Voice Operated");
  lcd.setCursor(0, 1);
  lcd.print("Control of Motor");
  delay(2000);
  pinMode(motor_1, OUTPUT);
  pinMode(motor_2, OUTPUT);
}
```

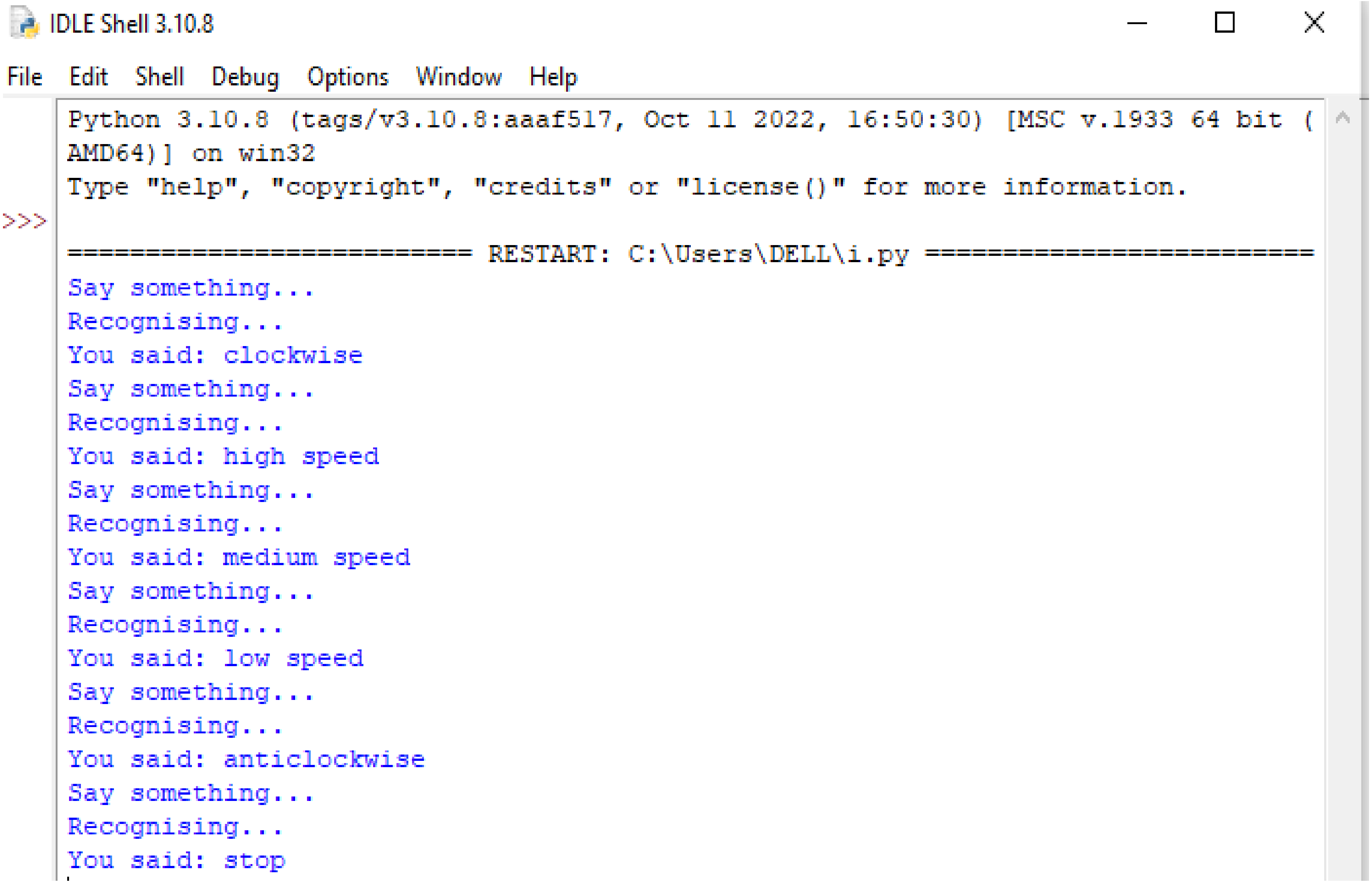
Arduino IDE

Algorithm:

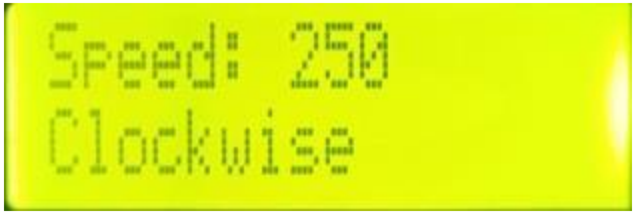
1. Connect USB cable of microphone to the laptop.
2. Then connect USB cable of Arduino UNO to Port COM14 and switch on the power supply.
3. Now speak any one command.
4. If that command is already declared in the python code it may print that command and send it to Arduino board.
5. Otherwise it may give ‘Speech Recognition could not understand audio’.
6. After sending the command to arduino board it will rotate the wheels interfaced to motors with specified speed.

Results:





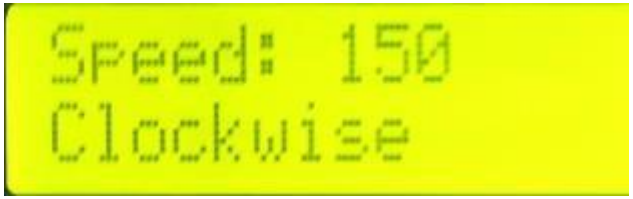
```
Python 3.10.8 (tags/v3.10.8:aaaf517, Oct 11 2022, 16:50:30) [MSC v.1933 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========================== RESTART: C:\Users\DELL\i.py =========================
Say something...
Recognising...
You said: clockwise
Say something...
Recognising...
You said: high speed
Say something...
Recognising...
You said: medium speed
Say something...
Recognising...
You said: low speed
Say something...
Recognising...
You said: anticlockwise
Say something...
Recognising...
You said: stop
```



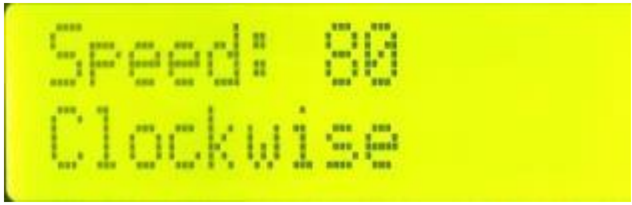
```
Speed: 250
Clockwise
```

1

2



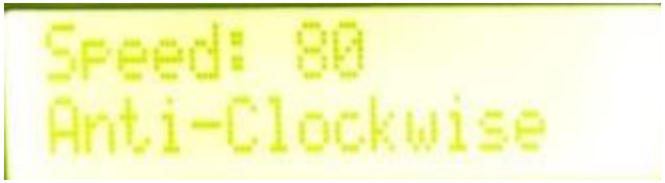
```
Speed: 150
Clockwise
```



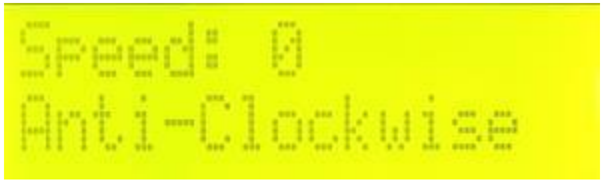
```
Speed: 80
Clockwise
```

3

4



```
Speed: 80
Anti-Clockwise
```



```
Speed: 0
Anti-Clockwise
```

5

Conclusion:

- The system's hands-free operation, enhanced user convenience, and streamlined control experience make it well-suited for a wide range of applications, including home automation, industrial control systems, robotics, automotive systems, assistive technology, and entertainment.
- Through the integration of a USB microphone, Arduino Uno microcontroller, motor driver module, and Python programming, the proposed system demonstrates the potential of combining hardware and software to create innovative solutions that improve accessibility, efficiency, and user experience.

- In conclusion, the development of a voice-operated control system for motor components represents a significant advancement in human-machine interaction. By leveraging speech recognition technology and embedded systems, this project offers a practical and intuitive solution for controlling motors through spoken commands.

THANK YOU