Gesture Control & Voice Command Integration for Servo Motors and LEDs

This is my presentation on gesture control and voice command integration for servo motors and LEDs. We'll explore a comprehensive approach for home automation, using the power of computer vision, speech recognition, and hardware interfacing.

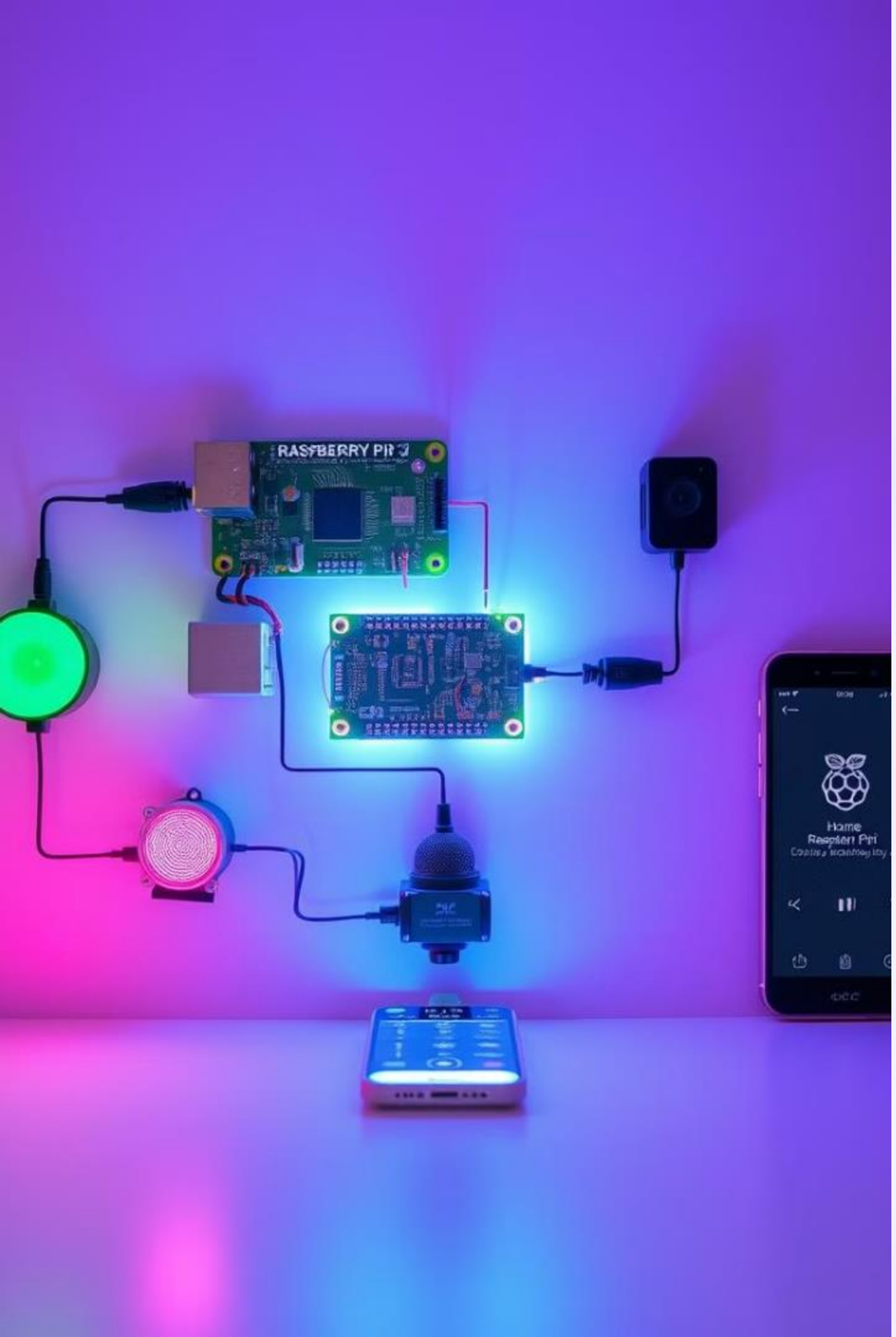
Introduction

Objective

Demonstrate gesture control and voice commands for physical devices like servo motors and LEDs.

Scope

Hand gesture tracking with OpenCV and MediaPipe, voice command recognition with SpeechRecognition, and control of hardware components like servo motors and LEDs.



Technology Stack

Hardware

Servo Motor

LED

Microcontroller

Software

OpenCV & MediaPipe (gesture control)

Speech Recognition (voice command recognition)

Flask (web interface).

Gesture Control with OpenCV & MediaPipe

MediaPipe

A hand gesture recognition library that detects key hand landmarks and tracks movements in real-time.

Implementation Flow

1. Capture video feed.
2. Process frames to detect hand landmarks.
3. Control servo motor position based on hand gesture.

Voice Command Integration

1 Speech Recognition

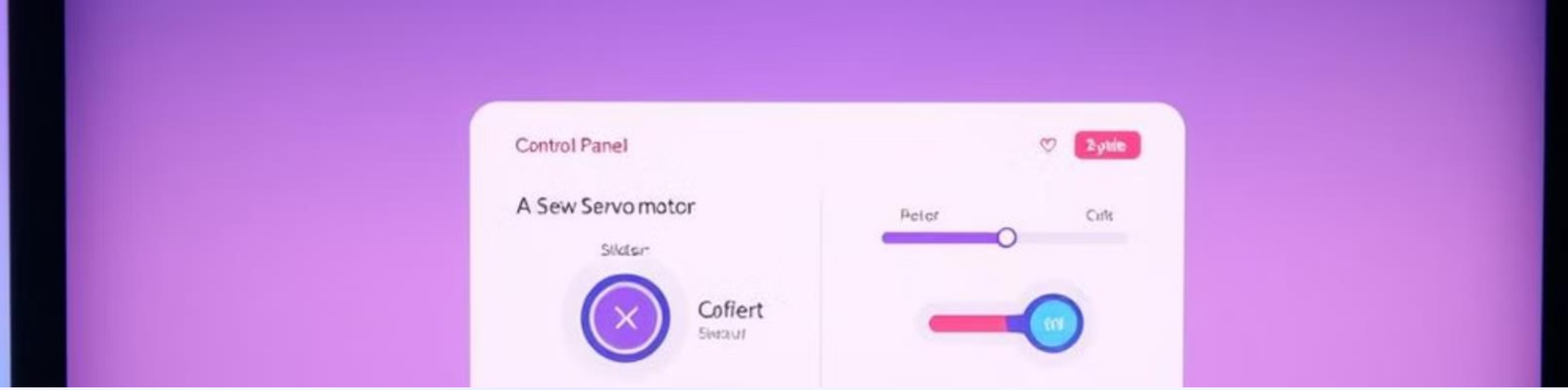
Captures audio and converts speech to text. Recognizes commands like "Turn on LED" or "Move servo."

2 Control Actions

Maps voice commands to hardware actions, controlling LEDs and servo motors.

3 Libraries Used

SpeechRecognition for text-to-speech feedback.



Web Interface with Flask

Flask Backend

Displays real-time control status on a webpage, including servo position and LED status.

Live Feedback

The webpage auto-updates to reflect changes at the same rate as the camera frame.

System Architecture

1. Input (gesture/voice)
2. Gesture Recognition (OpenCV/MediaPipe)
3. Command Execution (Servo/LED control)
4. Web Interface (Flask)

Challenges and Solutions

1

Challenges

Gesture detection accuracy in varying lighting conditions.

Delay in voice command recognition and action.

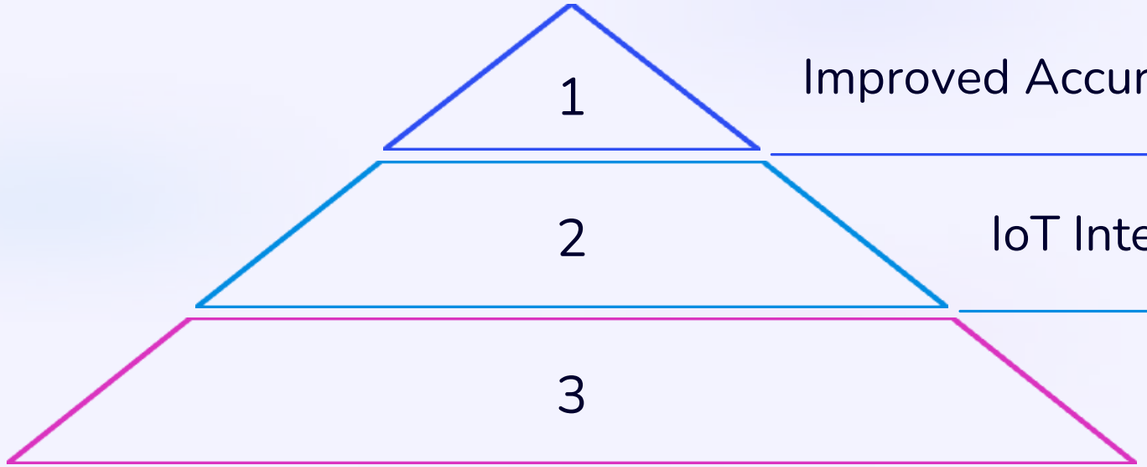
2

Solutions

Enhanced hand tracking with MediaPipe.

Integrated low-latency voice recognition.

Future Enhancements



Improved Accuracy for the gestures and audio commands

IoT Integration : Will try to implement this on a larger scale

Mobile App: for proper home automation

Conclusion

This project demonstrates a promising approach to home automation using gesture control and voice commands. By integrating computer vision, speech recognition, and hardware interfacing, we can create a more intuitive and user-friendly way to interact with smart home devices.

Reference

1. MediaPipe Documentation: MediaPipe GitHub
2. SpeechRecognition Library: SpeechRecognition Documentation
3. Flask Documentation: Flask Documentation

Flask