# 📄 Project Summary

**Title:**

**Gesture-Controlled Light and Fan Automation System**

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## 🔍 Overview

This project presents a real-time gesture-based automation system for controlling the **brightness of an LED light** and the **speed of a DC fan** using simple finger gestures (1 to 5 fingers). The goal is to provide a **contactless, intuitive control interface** that can assist in smart home environments or support users with physical disabilities.

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## 🛠️ Core Technologies

- **MediaPipe & OpenCV (Python)**: For hand gesture detection via laptop webcam.

- **Arduino Uno**: Receives gesture data and generates PWM signals.

- **MOSFET IRFZ44N & 1N4007 Diode**: Used for safely switching the 12V DC fan.

- **PWM Control**: Adjusts LED brightness and fan speed based on finger count.

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## 🖐 Gesture-to-Action Mapping

| Fingers | LED Brightness | Fan Speed |
|---------|----------------|-----------|
| 1 | Low (Dim) | Off |
| 2 | Off | Low Speed |
| 3 | Full Brightness | Off |
| 4 | Off | Full Speed |
| 5 | Full Brightness | Full Speed |

## 💡 Features

- Real-time gesture detection with high accuracy.

- Touchless control of appliances.

- Modular design with breadboard hardware.

- Integrated protection using flyback diode for inductive load safety.

## ☑ Outcome

- Achieved >90% accuracy in gesture detection under varying lighting.

- Successfully demonstrated smooth PWM control of LED and fan.

- Latency remained below 500ms from gesture to output response.

- Replaced ESP32-CAM with laptop webcam for improved stability.

## 🌐 Applications

- Smart homes

- Assistive tech for physically challenged

- Touchless environments (clinics, labs, etc.)

- Future expansion: wireless control, machine learning gestures

## 📫 Contact

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