Project Proposal: AI-Powered Door Security System

# 1. Introduction

In the current age of technological advancements and rising security concerns, an intelligent and automated solution for door access control is essential. This proposal outlines the design and implementation of an AI-powered door security system that integrates computer vision, speech recognition, IoT, and defensive mechanisms to ensure secure, smart access control.

# 2. Objectives

- Detect approaching individuals using ultrasonic sensors and a camera.  
- Recognize known faces using AI (face recognition).  
- Authenticate unknown visitors through voice-based password verification.  
- Allow remote control actions through a custom-built Python GUI (using customtkinter).  
- Activate alarms or defense mechanisms in case of authentication failure.

# 3. System Components

- Raspberry Pi or PC (Processing Unit)  
- Ultrasonic Sensor (Distance Detection)  
- ESP8266 (Wi-Fi Communication)  
- Camera Module (Face Recognition)  
- Servo Motor (Door Mechanism)  
- Buzzer or Alarm (Intruder Alert)  
- CustomTkinter GUI Application (Operator Dashboard)  
- Microphone (Speech Recognition)  
- Python Libraries: OpenCV, face\_recognition, speech\_recognition, multiprocessing

# 4. System Workflow

1. The ultrasonic sensor detects motion near the door.  
2. The camera captures the image and checks for face recognition.  
3. If unknown, the system prompts the visitor to speak a password (3 attempts).  
4. On three failed attempts, a buzzer rings and GUI notifies the operator.  
5. If recognized or authenticated, the servo opens the door.  
6. The operator can take further actions using the GUI.

# 5. Key Features

- Smart and secure entry system.  
- AI-based face recognition and speech authentication.  
- Real-time monitoring and control via GUI.  
- Configurable defense mechanism for intruder alerts.  
- Low-cost hardware setup using basic components.

# 6. Future Enhancements

- Cloud logging and remote access.  
- SMS or app-based notifications.  
- Night vision and weatherproof enclosures.  
- Integration with home automation systems.

# 7. Conclusion

This AI-powered door security system will offer an intelligent, interactive, and secure way to manage entry access, especially in sensitive or high-security environments. It is cost-effective, easy to deploy, and highly scalable for future upgrades.