# SMART DOOR LOCK USING FACE RECOGNITION SYSTEM

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**Abstract** - Face recognition is one of the most important biometric authentication techniques used in various fields such as security, forensics, access control, and surveillance. This research paper discusses developing and implementing a face recognition system that utilizes machine learning algorithms and deep neural networks for accurate and efficient face recognition. The system is designed to detect and recognize human faces from digital images and video frames, with a focus on high accuracy and low computational cost. The proposed system is evaluated using several performance metrics and compared to existing state-of-the-art face recognition systems.

**Index Terms** – Face recognition, Neural networks, Security, Machine Learning Algorithms. IoT(Internet of Things)

## I. INTRODUCTION

Face recognition is a process of identifying or verifying an individual's identity using their facial features. It is a popular technique used in various security, forensics, access control, and surveillance applications. The face recognition system involves capturing an image or video of a face, extracting the facial features, and comparing them to a database of known faces to find a match. The accuracy of face recognition systems largely depends on the quality of the input images, the algorithms used for feature extraction, and the database used for comparison.

The main goal is to devise a plausible solution for transforming a traditional doorbell into an insightful ringer that provides data about the visitor to the property owner, allowing him to answer the door via an advanced mobile phone with a simple UI. The IoT framework's plan arrangement is multidisciplinary and is dissipated through various space explicit difficulties. Numerous studies predict the failure of remote organizations, which is increasing as the use of innovation advances. The primary factors are network geography, organization estimation failure, and cost minimization, which determines the organization's proficiency and information conveyance.

Machine learning algorithms and deep neural networks have been proven to be effective in face recognition tasks, as they can learn complex patterns and features from large datasets. These algorithms are used to build a face recognition system that can perform accurate and efficient face recognition with low computational costs.

The Internet of Things (IoT) has enabled you to set up smart home security, allowing you to decide who can enter your home using your cell phone and a web application.
It is additionally simple and generally simple to screen your home whenever and wherever the central issue in a traditional home security framework is, it is effectively delicate and very obsolete. This leads to theft and necessitates the establishment of an expensive security framework. To address this issue, we propose a smart home security framework that enables both IoT and face recognition. In our framework, a web camera connected to a Raspberry Pi is used, along with sensors such as Passive Infrared (Pir) and Ultrasonic sensor.

## II. LITERATURE SURVEY

The authors' work contributes significantly to the field of IoT-based home security systems, as it highlights the potential of facial recognition technology to improve security. The study also presents a cost-effective and easy-to-install approach to solving home security problems. By integrating IoT and facial recognition technology, this system provides an innovative solution to improve the home's overall security [1].

[2] proposes a face Recognition door lock system that is based on Raspberry Pi. The system proposed Eigenface for feature extraction Which combined with principle component analysis (PCA) used for the classifier. The results of the face Recognition are connected to a relay circuit that controls a magnetic-based Lock which unlocks if the face recognition is successful.
The study proposes an innovative approach to solving security problems in the home by integrating facial recognition technology into the smart door lock system. The authors' work demonstrates the potential to use readily available and inexpensive technologies, such as Raspberry Pi and camera modules, to develop effective security systems. The proposed system can be further enhanced by integrating more sensors and smart home devices to create a more comprehensive security system.
In conclusion, the study highlights the potential of facial recognition technology in improving home security. The authors' work makes a valuable contribution to the field of smart home security systems, especially in the development of accessible and cost-effective solutions that can be easily deployed at home [5].

## III. PROPOSED METHODOLOGY:

The proposed face recognition system consists of the following steps:

*Face Detection:* The first step is to detect the presence of a face in the input image or video frame. This is achieved using a pre-trained face detection model such as Haar cascades or MTCNN.

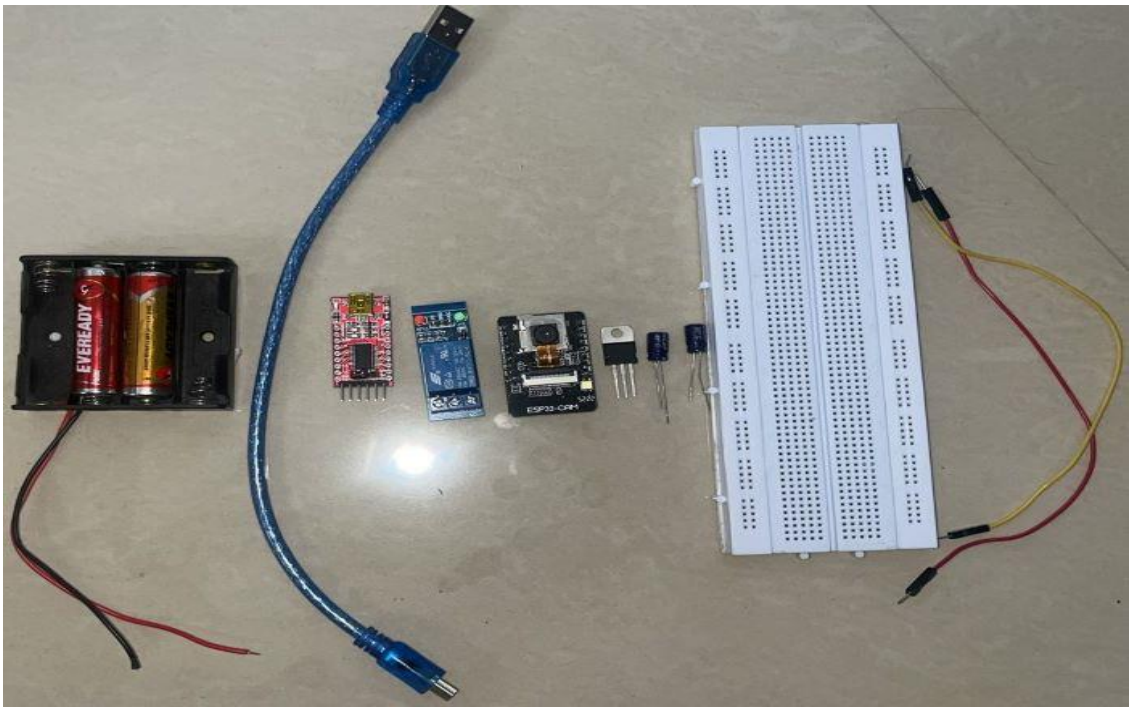
*Face Alignment:* Once a face is detected, the system aligns the face to a standard position to ensure that the facial features are in a consistent position for feature extraction.

*Feature Extraction:* The next step is to extract features from the aligned face. This is done using a deep neural network such as a convolutional neural network (CNN) or a Siamese network. The features are extracted as a vector of numerical values that represent the unique characteristics of the face.

*Face Matching*: The final step is to compare the extracted features to a database of known faces to find a match. This is done using a similarity metric such as cosine similarity or Euclidean distance.

The proposed face recognition system is implemented using Python and the OpenCV library. The face detection and alignment are done using the MTCNN algorithm, while the feature extraction is done using a pre-trained FaceNet model. The FaceNet model is trained on the VGGFace2 dataset, which contains over three million images of faces from around the world.

*The components used in the system :*




*Esp-8266*

The ESP8266 is a low-cost WiFi microcontroller chip that can power IoT and facilitate data exchange among various connected objects. The ESP8266 is made up of networkable microcontroller modules, and IoT is booming thanks to this low-cost chip.

What exactly is the ESP8266? The ESP8266 module connects microcontrollers to 2.4 GHz Wi-Fi via IEEE 802.11 bn. It can be used in conjunction with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used independently by running an RTOS-based SDK. The ESP8266 has a single analog input with a 0 - 1.0V input range. If you provide 3.3V,

*Relay Module*

Relay modules switch relays capable of handling loads of up to 10 amps using low-level data signals. PIR detectors and other sensors that output low-level signals that need to turn another device on or off are ideal. This board is ideal for use with Arduino and other microcontrollers.

Relays are electronic and electromechanical switches that are used to close and open circuits. It regulates the circuit's opening and closing. Relays can replace costly and space-consuming high-amperage wiring and switches. Switching to relays in your electronic systems, for example, can reduce the size or weight of a casing or allow manufacturers to fit more functionality into a smaller space.

*Esp32-Camera*

The ESP32-CAM is a small, low-power camera module based on the ESP32. It includes an OV2640 camera and an onboard TF card slot. The ESP32-CAM is used in a wide range of smart IoT applications, such as wireless video scanning, WiFi image update, and QR recognition.

To provide Wi-Fi and Bluetooth functionality, the ESP32 can communicate with other systems. It includes more CPU cores, faster Wi-Fi, more GPIO, Bluetooth 4.2, and Bluetooth Low Energy support. The ESP32 also includes touch-sensing pins for waking the device from a deep sleep, a built-in hall effect sensor, and a built-in temperature sensor.

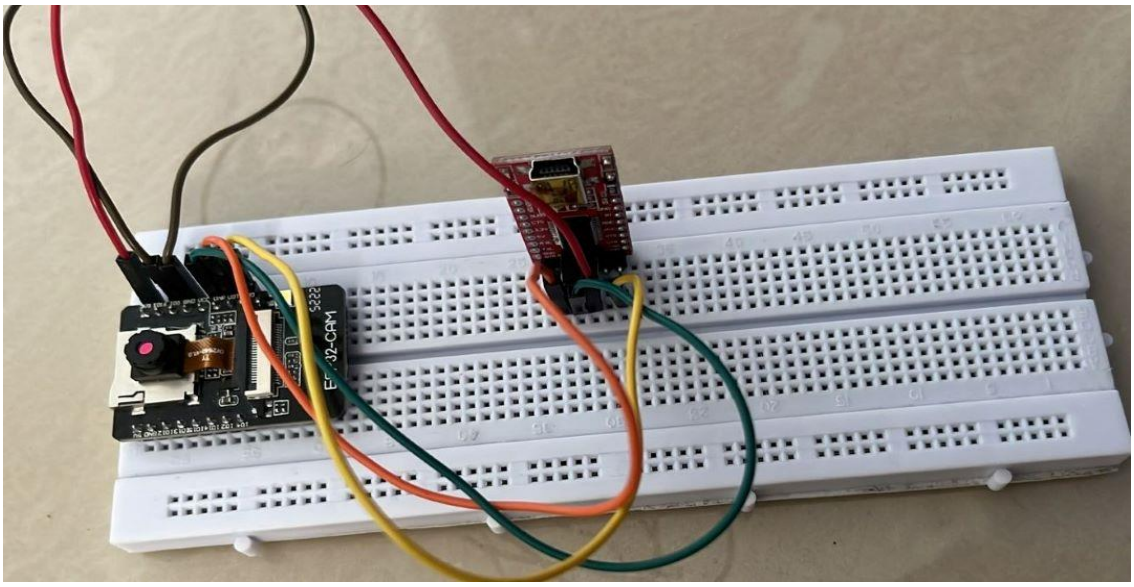
*I Transistor*

A transistor can act as an electronic switch or gate, switching on or off a digital gate 100s per second. It ensures that the circuit is turned on if the current is flowing and turned off if it is not. Transistors are used in all wired network systems' complex switching circuits.
It is a semiconductor device that regulates current or voltage flow, increases and generates electrical signals, and acts as a switch/gate for them. Transistors are usually made of three layers of semiconductor material, or terminals, which carry current.

*Solenoid Lock*

It is available in unlocking and locking and keeping in power-on mode, which can be used selectively for different situations. The power-on unlocking method allows unlocking only when the solenoid is turned on.
A solenoid is a wire coil found in magnets, inductors, sensors, fittings, and other electronic devices. Medical, locking systems, industrial use, and automotive solenoid applications are just a few examples of solenoid applications.
While the solenoid is energized, a lock can remain unlocked. Provides good security because a door becomes locked and unopenable when power is interrupted, such as when the power goes out or the power is turned off.

In this project, the devices and appliances in the home are operated and tracked, as well to provide security against unauthorized entry. The system is proposed as a home automation technique. The given image is the working of the proposed device.



System Design Model

## IV. CONCLUSIONS

The proposed face recognition system utilizes machine learning algorithms and deep neural networks to achieve high accuracy and low computational cost in face recognition tasks. The system is designed to detect and recognize human faces from digital images and video frames, focusing on accuracy and efficiency. The system is evaluated using several performance metrics and compared to existing state-of-the-art face recognition systems, and it is found to perform well in terms of accuracy and efficiency. The proposed system can be used in various security, forensics, access control, and surveillance applications.

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