Biometric Authentication Smart Door Lock System

Dr. L. Ganesh[1], M. S. Subrahmanyeswari[2], K. Pravallika[3], Ch. Gyanamruta[4], G. Prasuna Sai[5]

[1]Associate Professor, Department of ECE, GVP College of Engineering, for Women, Visakhapatnam, India

[2,3,4,5]Student, Department of ECE, GVP College of Engineering, for Women, Visakhapatnam, India

Abstract- Digital technologies for smart home have improved, through Wi-fi and connectivity, video surveillance, voice control etc. Biometric Authentication for Door Lock System backed up with 24-hour support guarantees the safety of homes and workspaces. The project focuses in developing a door lock authentication system that uses multiple biometric devices and smart technology. This project can be implemented in two phases. In the first phase, the door access is given to the owner and in the second phase the owner gives access to the outsiders. In the first phase, the door can be accessed by the owner using either fingerprint module(R307) or by reading the facial features using ESP32 Camera. The second phase is through the ESP32 Camera module, which can be fixed near the doorbell. The owner can see the outsiders at their door and give access through mobile from anywhere. There exists a communication between mobile and door lock using Blynk app. Once the owner grants access the door lock opens. Smart security devices are now more reliable. It is safer than a lock and key.

Keywords- ESP32 Camera, Face recognition, Fingerprint sensor, Blynk cloud

1 INTRODUCTION

This project is about the secure home entry along with video surveillance and an advanced technology of door locking system which prevents from the unexpected and unknown entries. The main theme of this project is to develop the automatic door locking system which unlocks using the fingerprint and the facial features. It starts from scanning the fingerprint of the house owner to unlock the door automatically. It can be accessed by either fingerprint or the facial features of the house owner parallelly. When the owner accesses the fingerprint or cam, then the solenoid lock which is connected to the fingerprint sensor opens and gives access to get in. If the fingerprint or image is not matched with the fingerprint or image which is stored in the database, then there will be no access. If any unknown person is in front of the door, then the esp32 cam which was fixed to the lock system, captures the image of that person, and sends the notification or alert message to the owner mobile. Then the owner will choose whether the access should be given or not through his mobile.

2 LITERATURE SURVEY

Our project discusses about the smart door lock system which is authenticated with the multiple biometric access. The door is accessed with both the fingerprint and face recognition. The outsiders are detected with the ESP32 Camera and blynk helps to send the notification to the mobile.

This system is to develop an application for the Smart Automation System playing a major role which helps in reducing a work done manually by using some embedded hardware and technologies that come with it. The anticipated effort is to send a signal to locker door from a Tablet or mobile devices by using wireless system through the web page we can see the details of locker status. This permits the user to lock and unlock a locker through fingerprint and WIFI authentication. The idyllic resolution of the work is that, if the locker is not locked and its status, the user will have the authenticated entry through the locker door from fingerprint or Laptop via webpage authentication and entry times are noted in the database located in the secured cloud. [1]

Digital door locks have grown quite prevalent in recent years as technology has advanced and the use of IoT has increased. A digital lock does not require a physical key to operate, instead relying on Radio-Frequency Identification (RFID), fingerprint, Face ID, pins, passwords, and other methods to do so. Using these diverse technologies, we have previously built several digital door lock applications. In this article, we will use the Espressif Systems' Camera (ESP32 CAM) to create an IoT-based Wi-Fi Door Lock system. [2]

The creation of a door lock system is accomplished using facial recognition in conjunction with the ESP32 CAM for more accurate face detection. The ESP32 CAM is powered by battery that acts because it is the

system's backbone, and it controls the door locks and unlocks systems. This door lock system works on facial recognition. Here, the door lock system is controlled by face recognition of a private. A door is one of the defence features to take care of physical security of the house. [3]

With the advancement of technology and the increasing use of IOT, digital door locks have become very common these days. Digital lock doesn't require any physical key, but it uses RFID, fingerprint, Face ID, pin, passwords, etc. to control the door lock. In past, we have developed many digital door locks applications using these various technologies. In this project we will build a Face reorganization system using ESP32-CAM. The AI-Thinker ESP32-CAM module is a low-cost development board with a very small size OV2640 camera and a micro-SD card slot. That it can be monitored by the mobile and can grant the permission to access the door. It also enabled with notification when someone is detected by the system and alerts to the owner.[4]

3 PROPOSED SYSTEM

3.1 FLOW CHART:

This flow chart explains about the two main phases of the project. In that, the first phase explains about the access of the owner. The access can be given through either detecting the fingerprint or by facial features. If the fingerprint is matched, then the door will be opened automatically.
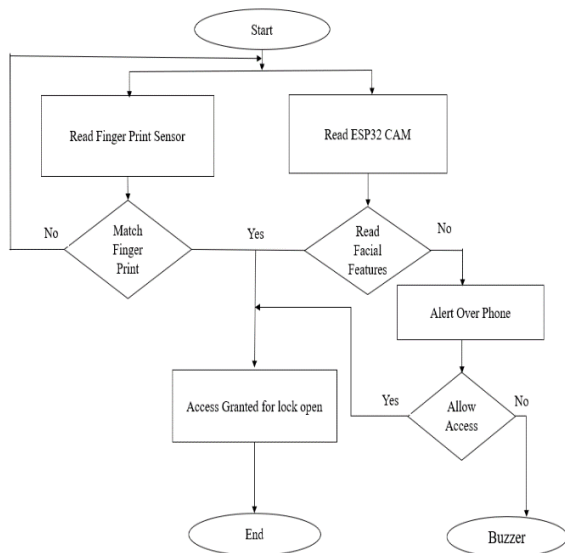

Figure 1 Flow chart of Biometric smart door lock system

Otherwise, the fingerprint sensor asks for access continuously. The owner can also be accessed with

camera by detecting the facial features. In this case also, If the facial features are matched, then the door is opened automatically.

The second phase is about accessing the outsiders. In this phase, if any unknown person is detected in front of the camera, then it takes the picture of that person and sends it to the owner.
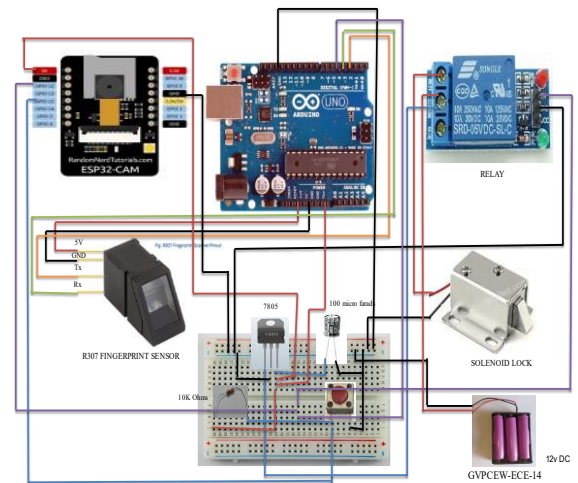
3.2 CIRCUIT DIAGRAM:

Figure 2 Circuit diagram of Biometric smart door lock system

In this circuit diagram, the red colour depicts the power supply connections as well as black colour represents the ground connections. The controlling connections are represented by the purple colour. Interconnections are represented by the blue colour. Transmission connections are done with yellow colour and receiver connections are done with green colour.

3.3 Hardware and software requirements:

Hardware components
- ESP 32 CAM
- R307 Fingerprint sensor
- 12v Solenoid lock
- Arduino Uno
- 12v Relay
- 7805 Voltage regulator (5v)
- 10K Resistor (1 no.)
- Capacitor 100uF
- 12v DC Adaptor
- Breadboard
- Push button

Software requirements
- Arduino IDE
- Blynk App

4 METHODOLOGY

This project makes use of three modules of authentication to grant access. These three authentications are divided into two phases. Phase-1 grants access to the owner and phase-2 grants access to the outsiders.

Phase-1: Enabling ESP32 Camera module. Connecting ESP32 Camera with Wi-fi and enabling face recognition. Interfacing of fingerprint module (R307) with Arduino Uno. Creating of authenticated fingerprint data set.

Phase-2: Interfacing of ESP32 Camera module with Blynk app. Interfacing mobile with Blynk app. Establish communication between mobile and ESP32 module through Blynk.

5 OUTPUT

FACIAL FEATURE ENROLLMENT:
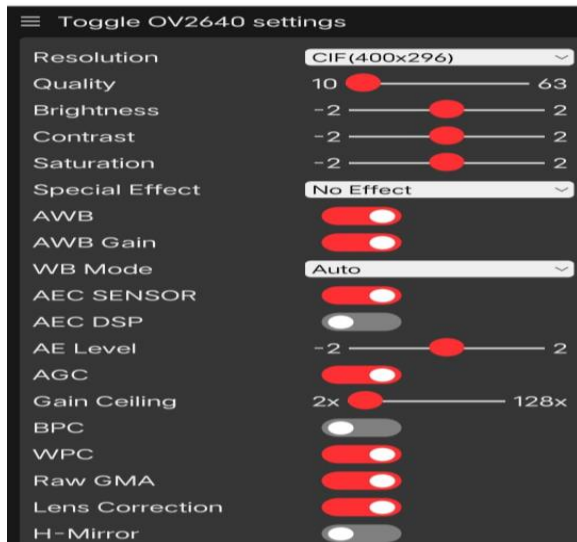
Figure 3 Enrolment of facial features.
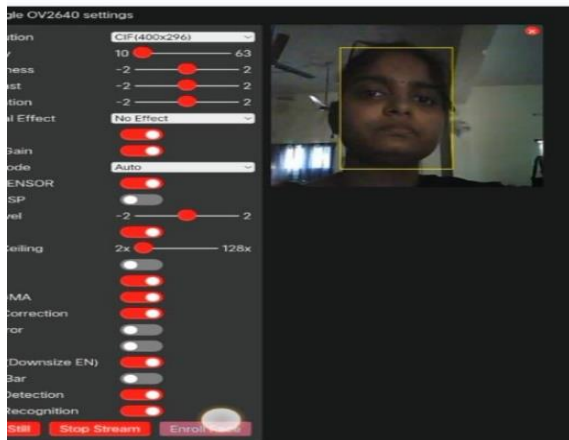
Figure 4 Enrolment of face.

Match Found:
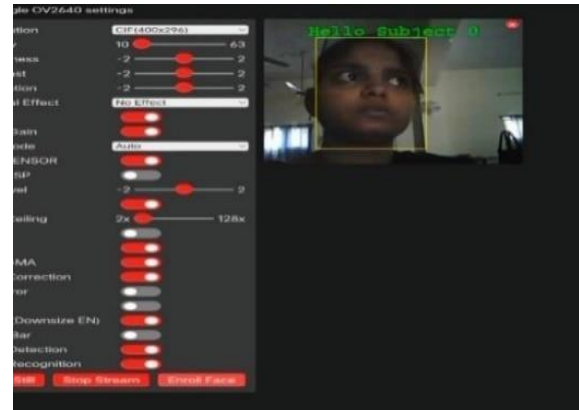
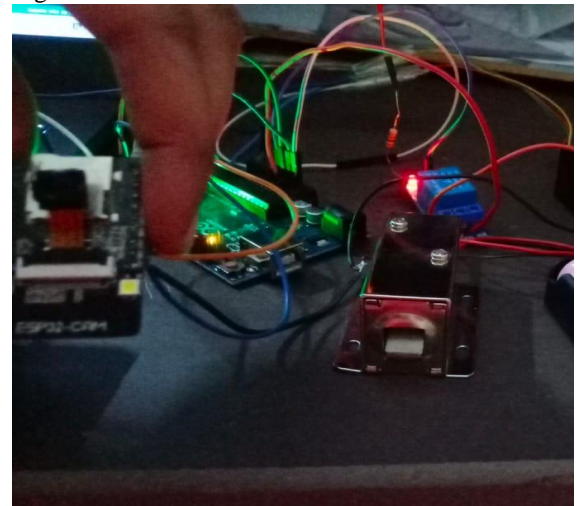Figure 5 Matched facial features.

Figure 6 Result for matched facial features.
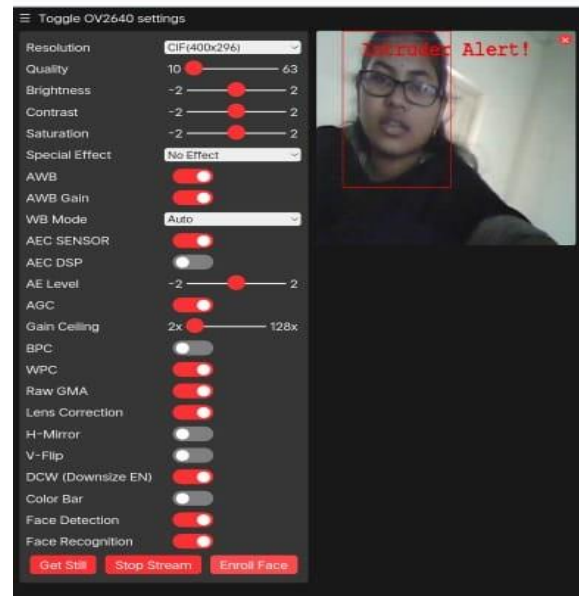
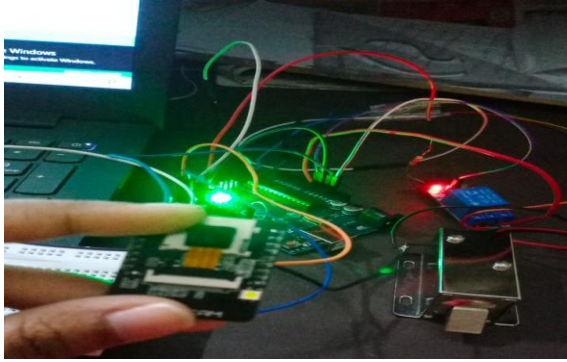Mismatched Image:

Figure 7 Mismatched facial features.

Figure 8 Result for mismatched facial features.

ACCESS THROUGH FINGERPRINT: LOCK OPEN
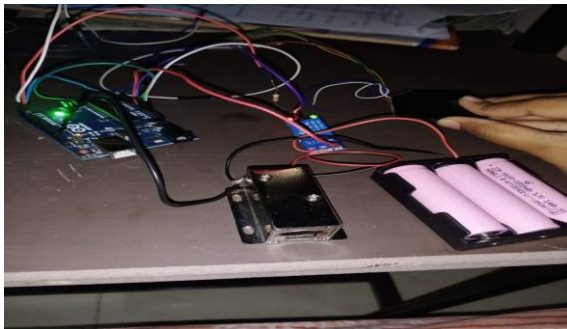WHEN FINGERPRINT MATCHES

Figure 9 Lock opens when fingerprint is matched.
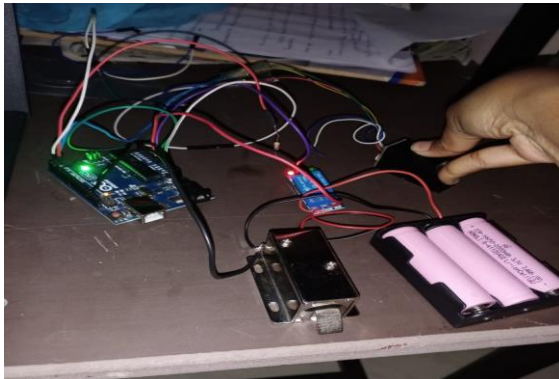
LOCK CLOSED WHEN FINGERPRINT NOT
MATCHES

Figure 10 Lock closes when fingerprint is mismatched.
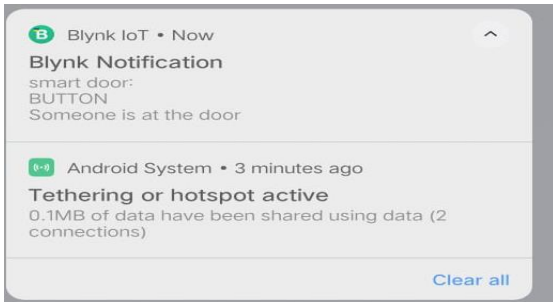
NOTIFICATION USING BLYNK:

Figure 11 Notification is received by mobile through blynk.

Figure 12 Owner gets the notification.
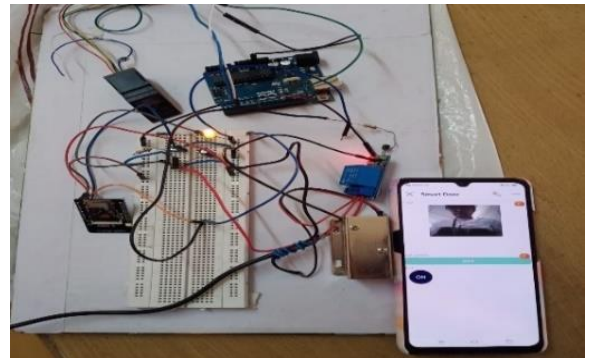
DOOR ACCESS USING BLYNK:

Figure 13 Access is given by the owner.
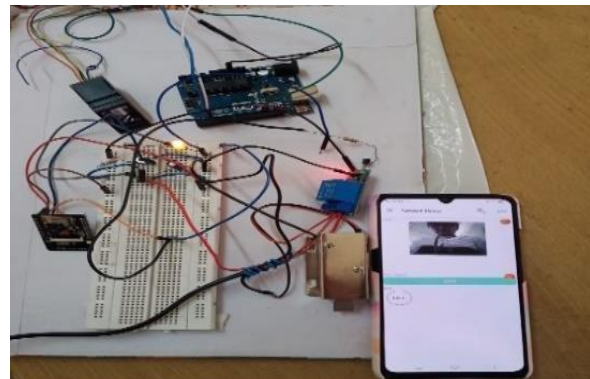
ACCESS GIVEN

Figure 14 Access is denied by the owner.
ACCESS DENIED

CONCLUSION:

Our project is about mainly accessing the door by fingerprint or by facial features. The owner can unlock the door through either fingerprint or facial features. If any outsider is detected by the camera, then the message will be sent to the owner. The option of

unlocking the door is given by the owner. The biometric access to owner through both face recognition and fingerprint is done and the locking-unlocking of the door is done using solenoid lock. The dataset of both facial features and fingerprints are created. The interfacing of ESP-32 Camera with Blynk app is done using mobile phone. The blynk app is accessing the outsider images using ESP-32 cam is done and the notification is sent to the owner. The door access for the outsiders is given using solenoid lock through Blynk.

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