



SECURE DOOR ACCESS SYSTEM WITH FACE RECOGNITION AND WEAPON DETECTION

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Abstract: Physical door lock systems are not much secure when compared with digital locks. Physical door locks can be damaged hence provides lesser security. The current paper provides secured lock system to prevent unwanted access using face recognition and weapon detection. When a person visits, the person's face is captured by the camera and also the same will be verified with the images which are previously stored in the dataset. If the visitor is detected as known and labeled with name the lock opens and person can enter in. If it doesn't match it is labeled as 0 detecting it as unknown by locking the door. If the person is detected as known and holding harmful weapon then the weapon detector present in the system will detect the weapon thus producing buzzer to signal the visitor holding weapon. The design of this device is dependent on Arduino and Python using OpenCV. This device helps in providing security by restricting unwanted and harmful access.

Index Terms – Face Recognition, Weapon detecting sensor, Haar Cascades classifier, Arduino, Motor Driver, Battery

I. INTRODUCTION

Home automation is a technological solution that enables automating household appliances. Smart and secure door locking system is one such home automation application. Security is the biggest need for every house. There is a high chance of damaging the physical door locks. When we use password based locking system there is chance of forgetting the password. Detecting the visitors face and allowing them to enter is the solution for this. As a result, this project is an attempt to make the houses more secure by adding the feature of weapon detection to face recognition door lock system. The main objective of the project is to provide security. This can be done in 2 phases. The first phase is where the visitors face is recognized and the same is used to unlock the door. The second phase is where the weapon detection comes in. Here if the visitor is carrying a weapon it can be detected by the weapon detecting sensor, it signals by producing buzz sound. Hence the visitors allowance can be denied.

Various concepts of Internet of Things (IoT) and Machine learning are used here for Image pre-processing, feature extraction and feature comparison. The main objective of the project is to provide smart allowance in to home where no intruders are allowed.

II. EXISTING SYSTEM

The existing system is a password authentication door lock system. The password based door lock system makes the user to memorize the password all the time where there are high chances of forgetting the password. This password authentication is also known as single-factor login system. Security experts call the use of a single-factor login system as a sign of poor cyber security "hygiene".



Fig: Password authentication door lock system

III. PROPOSED SYSTEM

In the proposed system we are designing an application with the help of the face recognition module which also includes weapon detection. In this system we are using Arduino Nano to send signals from the system to the motor driver where locking and unlocking operation is performed. We are using computer vision techniques for detecting the face and the sensor placed inside the system detects the weapons which are held by the visitors. It portrays machine learning approach for face recognition to accomplish this process very quickly with high identification rates using Haar Cascades classifier algorithm in OpenCV library.

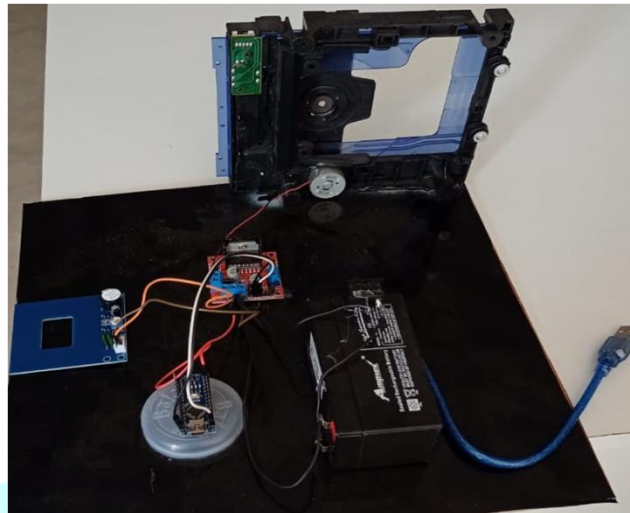


Fig: Smart door lock system (Device should be connected to webcam)

IV. IMPLEMENTATION

Web camera is connected to the OpenCV and the USB C port plug is connected to both the Arduino and OpenCV. Power Supply is generated to Motor Driver to run the Disc Driver and these are presented in the Lock Module. Weapon detection Sensor is connected to the Motor Driver and it acts as an interface between the motors and the control circuits. Arduino is connected with 11, 12, and 13 numbered ports. If the battery is on then the LED will be in ON mode. After the connection of USB C port to the system if the face of the person is detected as a stored image then the door will open and if there exists a weapon(hidden or exposed), weapon detecting sensor will capture it then the buzzer sound will be heard.

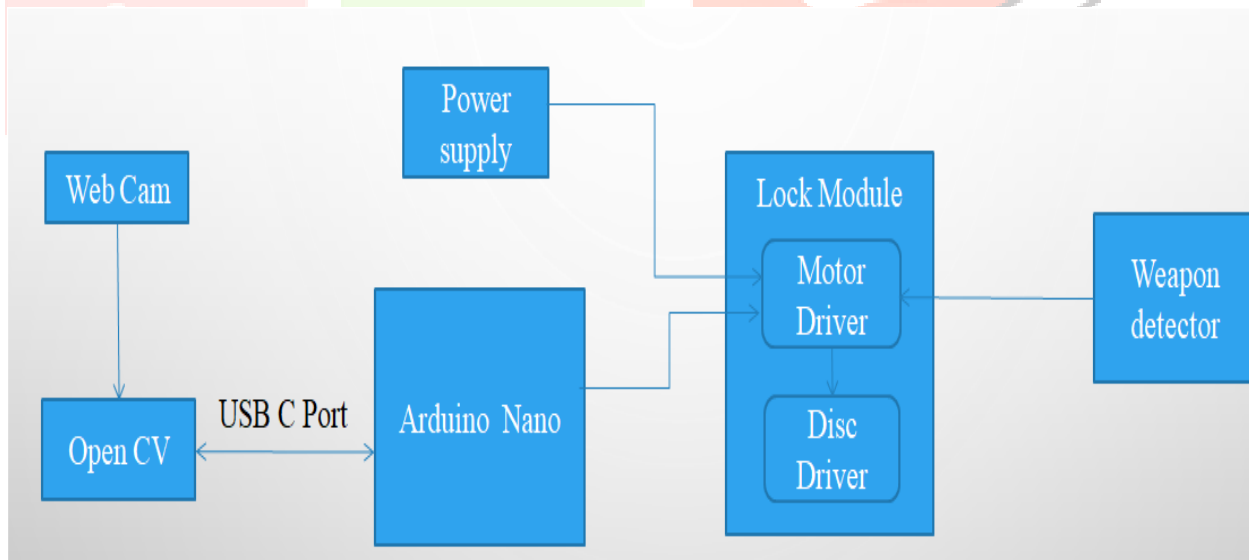
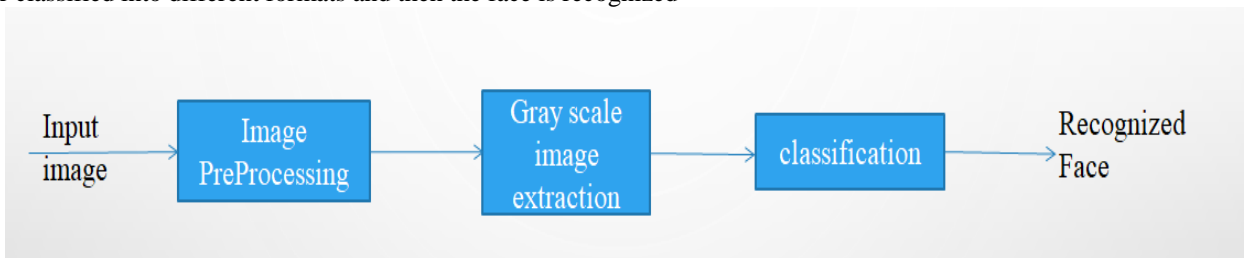


Fig: Modular organization of the system

For the face recognition, when an image is captured by the web camera it undergoes pre-processing, later it will be converted into gray scale image extraction. In this application we are capturing 20 images of the person to store in the dataset. These are further classified into different formats and then the face is recognized



V. HARDWARE REQUIREMENTS

a. ARDUINO NANO BOARD

Arduino is a single board micro controller, intended to make the application of interactive objects or environments more accessible. Arduino Nano is a small, complete and breadboard-friendly board based on the ATmega328 (Arduino Nano 3x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.



Fig: Arduino Nano

b. WEAPON DETECTING SENSOR

When the electricity flows through the transmitter coil, it creates a magnetic field all around it. If you sweep the weapon above the detector (such as this old gray spanner), the magnetic field penetrates right the weapon and hence it can be detected by producing buzz sound.

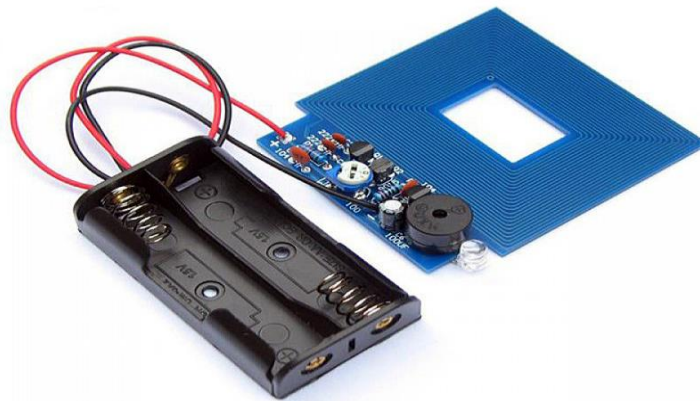


Fig: Weapon detecting sensor

c. BATTERY

A battery is a power source consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of external electric circuit to the positive terminal.

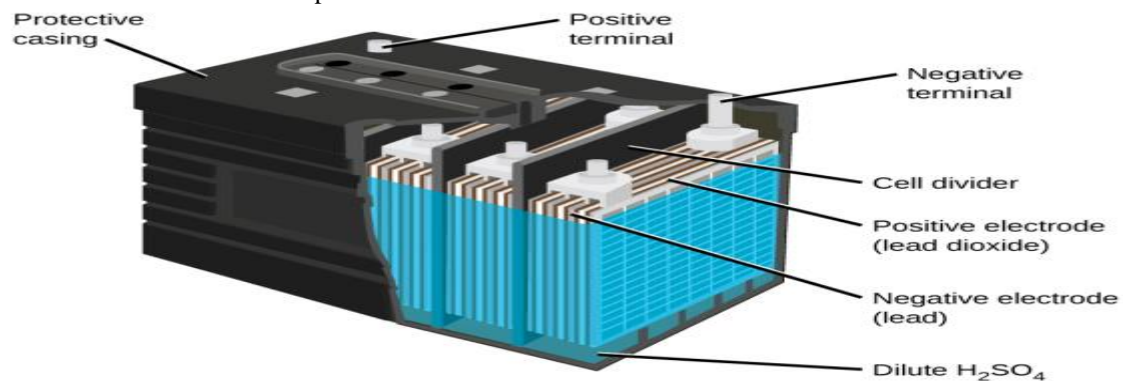


Fig: Battery (6V)

d. MOTOR DRIVER:

Motor Driver acts as an interface between the motors and the control circuits. Motor require high amount of current where as the controller circuit works on low current signals. So the function of Motor Driver is to take a low-current signal and then turn it in to higher current signal that can drive a motor.

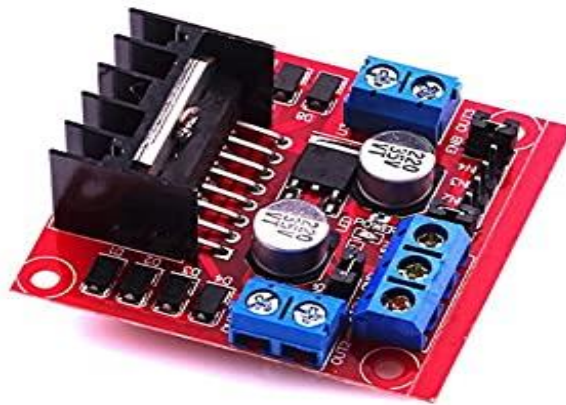


Fig: Motor Driver

e. JUMPER WIRES

A jump wire (also known as **jumper**, **jumper wire**, **jumper cable**, **DuPont Wire** or cable) is an electrical wire, or group of them in a cable with a connector or pin at each end (or sometimes without them- simply “tinned”), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

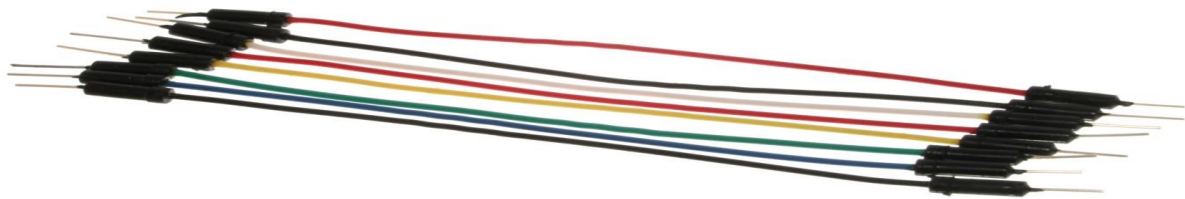


Fig: Jumper Wires

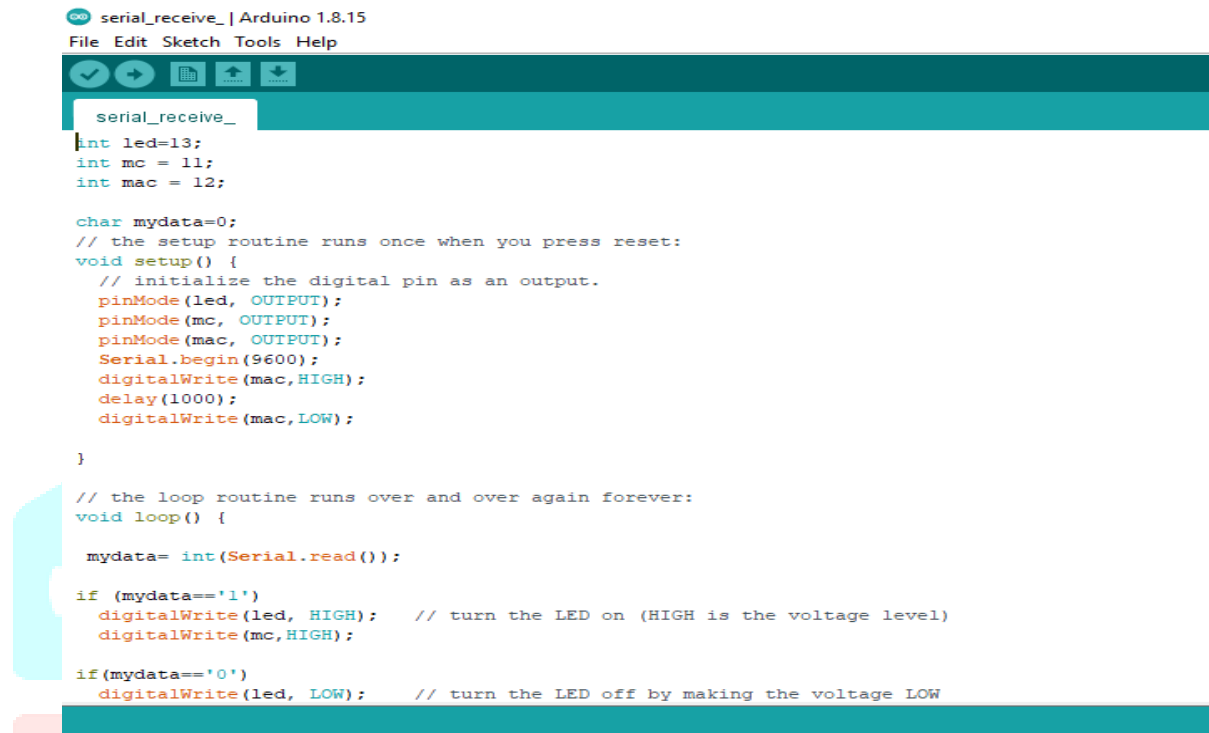
VI. SOFTWARE REQUIREMENTS**a) OPENCV**

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for business to utilize and modify the code.



b) **ARDUINO IDE:**

The Arduino Integrated Development Environment - or **Arduino IDE** (1.8.15) – is a cross platform IDE that helps developer write code and upload it to a board (Here we are using Nano), where the code can be easily tested. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. The Arduino IDE platform lets you even test your simulations on a variety of Arduino devices as well as third-party hardware. You can write code on computer as you launch unbelievable home robotics projects. It is said to be the best software to accompany the Arduino technology. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .in. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (1.8.15), including complete error messages and other information



```

serial_receive_ | Arduino 1.8.15
File Edit Sketch Tools Help

serial_receive_
int led=13;
int mc = 11;
int mac = 12;

char mydata=0;
// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
  pinMode(mc, OUTPUT);
  pinMode(mac, OUTPUT);
  Serial.begin(9600);
  digitalWrite(mac,HIGH);
  delay(1000);
  digitalWrite(mac,LOW);
}

// the loop routine runs over and over again forever:
void loop() {

  mydata= int(Serial.read());

  if (mydata=='1')
    digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage level)
    digitalWrite(mc,HIGH);

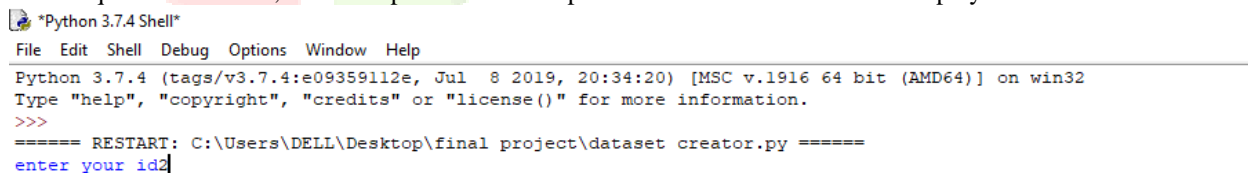
  if(mydata=='0')
    digitalWrite(led, LOW); // turn the LED off by making the voltage LOW
}

```

Fig: Arduino IDE (1.8.15)

VII. RESULTS

First we need to take the input as a person's face. The system asks for ID and when a particular ID is entered, system the person face is captured it will store 20 pictures of the person and in this case grey scale extraction is included. Each and Every person has a unique ID and name, when the person face is captured based on ID the name is displayed.



```

*Python 3.7.4 Shell*
File Edit Shell Debug Options Window Help
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul 8 2019, 20:34:20) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: C:\Users\DELL\Desktop\final project\dataset creator.py =====
enter your id2

```

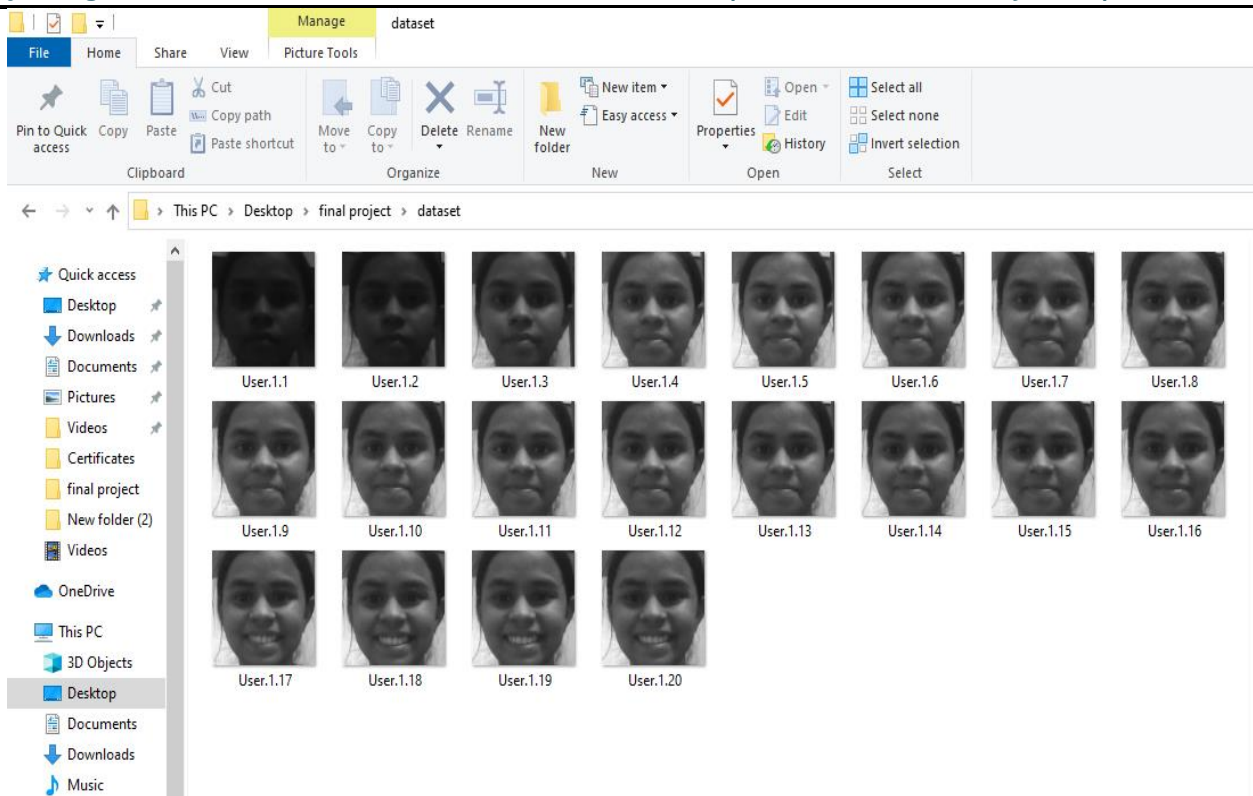


Fig: Interface asking for ID and storing images.

CASE 1:

If the visitor is detected as known and carrying no weapons the lock will be opened by labelling the face with the name stored with particular ID.

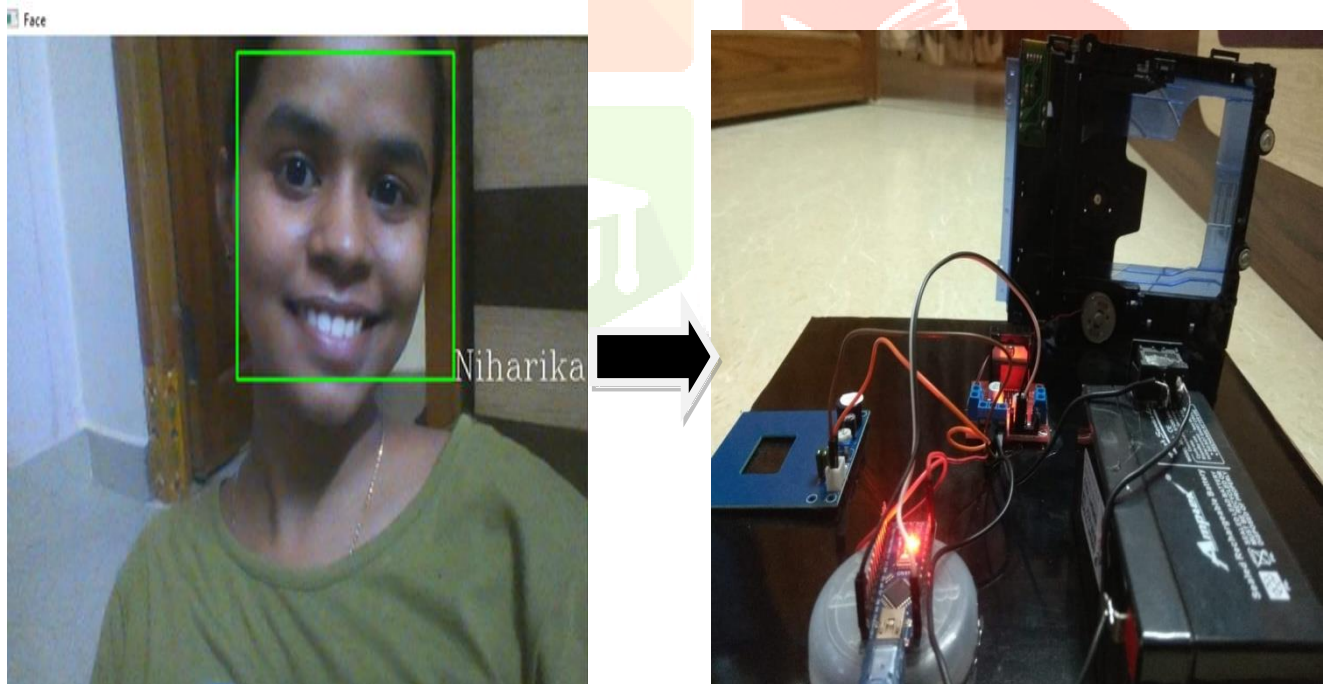


Fig: Opening lock when face recognized.

CASE 2:

If the visitor is not known locking the door by labeling with 0 and detecting face as unknown.

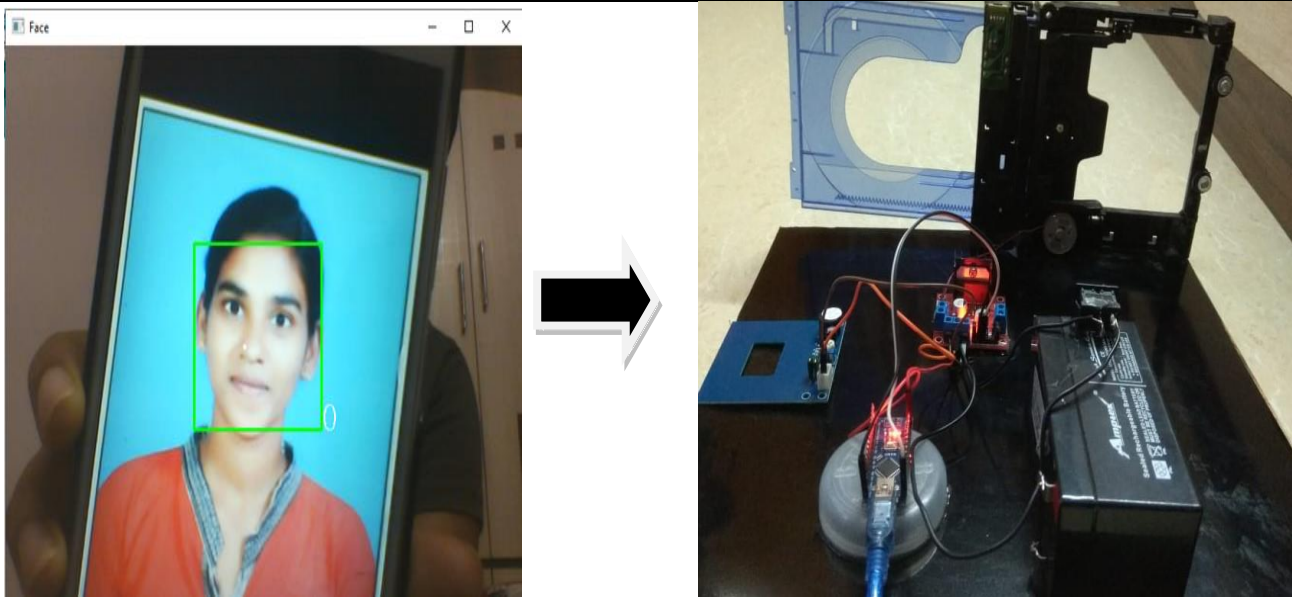
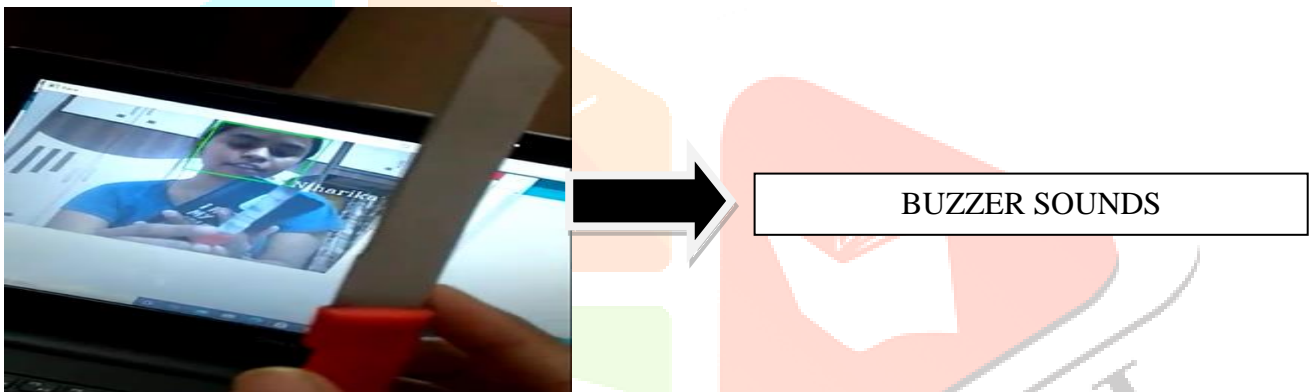


Fig: Locking the door when face detected as unknown.

CASE 3:

If the visitor is holding a weapon.



VIII. CONCLUSION

This paper provides the secure door locking system with affordable price. In this proposed door access system by using face recognition the images are stored which are helpful in comparing the visitors. This system also includes weapon detection which adds more security.

Even the known persons cannot enter the home if he /she are carrying a weapon. Here we are designing a highly secured door locking system by using Arduino Nano and OpenCV

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