



AMERICAN  
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## HCI Project Report

Title: Face Recognition Door Lock System

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Section:C

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## **Part 1 - Understanding the Problem:**

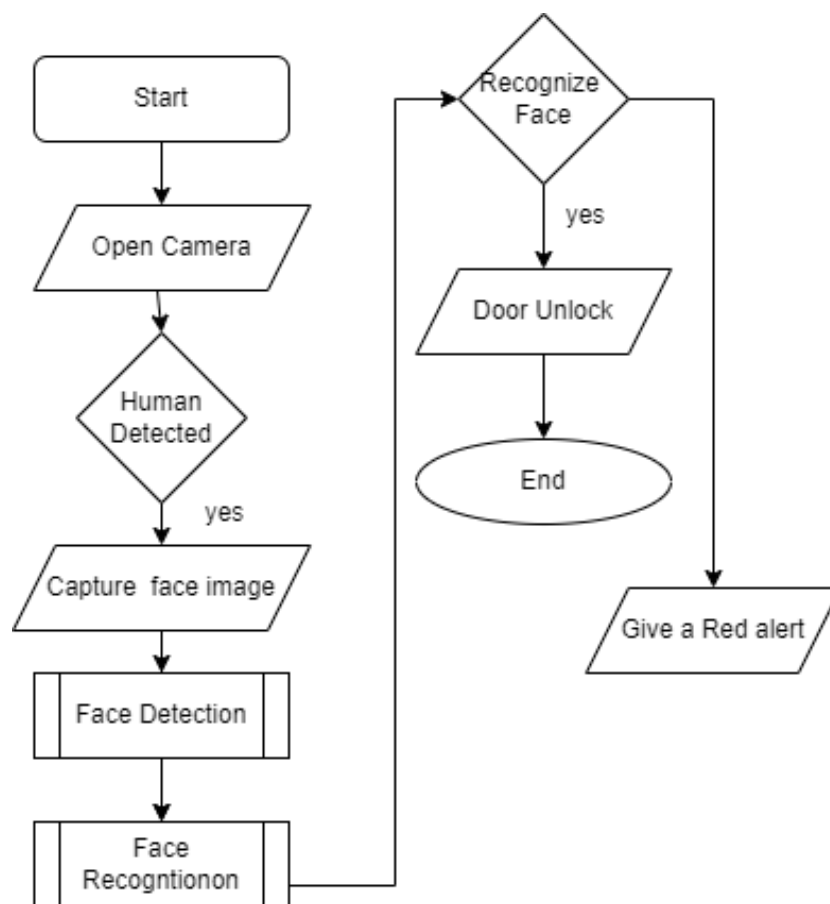
In our project we made a 'Face Recognition Door lock System'. The design of this system using electronic door locks, open source OpenCV and webcam as a unit component. In the last two decades face recognition has received significant attention and an important issue in many applications such as access control, security systems, credit card verification and criminal identification. This paper proposes three main sub systems namely face recognition, face detection and automatic door access control. A face recognition door lock is a type of security system that uses facial recognition software to identify authorized users. These locks are becoming increasingly popular as they offer high security and convenience. Several options are available on the market, so deciding which is right for you can be difficult. Let's show some point that is reflect that why this system is necessary, the problem statement:

- Increased security – A face recognition door lock offers a high level of security, as authorized users can only open it. This is a great option for businesses or homes that want to ensure their property is protected.
- Convenience – Face recognition door locks are very convenient, allowing you to easily access your property without fumbling with keys.
- Customizable settings – Face recognition door locks offer several customizable settings, so you can choose the level of security that best suits your needs. You can also set up different profiles for different users, making managing access rights easy.
- Health Issues: In our present situation covid-19 is also spread over touch. So. If we use face recognition door lock, we can also avoid the other people touch like finger print, key lock or password.
- Others: It can use as attendance sheet like university, office, college etc. Employee or students can give their attendance without using any physical touch or ordinary pen paper system

Many methods are available in biometric identifications like fingerprint, eye iris, retina, voice, face etc. These different methods have certain advantages and disadvantages which must be

considered in developing biometric systems, such as system reliability, price, flexibility, necessity of physical contact with the scanning device and many other parameters. Security system plays an important role of providing an extra layer of security through user authentication by which illegal intrusions can be easily tracked at the entry itself.

In this system the house member or like home owner give some photos while the door is making. This picture was saved in database. When someone want to enter house, he/she show her face Infront of camera sensor. Then the Adriano board match the previous loaded input and create a loop. If the new face matches any previous face then the door will be opened. And if there is no match then crate a red signal.



## Part-2: Design Alternatives

**Project Description:** We have made a face detection lock system. We made this system to protect our society from crime and our vision and mission is to make a smart society with smart door lock system with security. Mainly, our system is for the house doors. In our society there are a lot of complains about the entrance of unknown people at home and sometimes crime happens very badly just for the security issues. To prevent this kind of issues we dedicatedly made our system to protect our society and make our home smart.

**Requirement Summary:** Making our society smart and secure we tried to made a smart door lock system. To make the system we have chosen some components. Those are listed below:

1. Arduino Uno
2. A few jumper wires
3. LED's (Green & Red)
4. A Servo Motor
5. Face detection camera (From Laptop)

By these components our system is primarily ready to work as a prototype and we can test our project as it is ready to work or not.

The Arduino Uno will be used to control the system. The control system means it will take the input from the camera and process as the result is Ture or False. We used jumper wires to give the connections between Arduino Uno and other components. The LED's (Green and Red) shows that the final result of the face detection system. If the LED become RED, it means it commands the servo motor and make it locked. On the other hand if the LED become Green, it means it commands the servo motor and make it unlocked. We used a servo motor to process the lock system. It takes the command from the Arduino Uno and do its rotation. For the final touch we used a laptop webcam as default to recognize a person face to give command to Arduino Uno board.

### **Design Space:**

On the time of doing this project we have faced a question that is, what requirements may be difficult to realize? To find the answer of this question we started making our system. When we started making the system, we faced that we cannot making a decision that how we make it and we did not make any design before. Mainly, design makes a system easy and shows the possibilities

of working. So, we have decided to make a prototype system first and start making our face recognized door lock system.

When we finally made our prototype designing, we started to put connections into the Arduino Uno control board. All the process we are following are from the design which we made before. The connection between the control board and servo meter are simply easy. But the main problem we are facing is that the RED LED cannot taking the 5V power. 3 of our RED LED's are got damaged. So we decided to make a decision and joint a 1K resistor with the RED LED and it works perfectly. The other problem which we facing that is related to our Python code. The path we selected into the code it shows an error. The error was,

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**SyntaxError: (unicode error) 'unicodeescape' codec can't decode bytes in position 2-3: truncated \UXXXXXXXX escape**

When we google it, we found a result and it shows us, **“This error occurs, because you are using a normal string as a path”**.

This problem takes a lot of our time to continue our work and finally we partition a drive and put our project into that path and it started working.

Requirements changes:

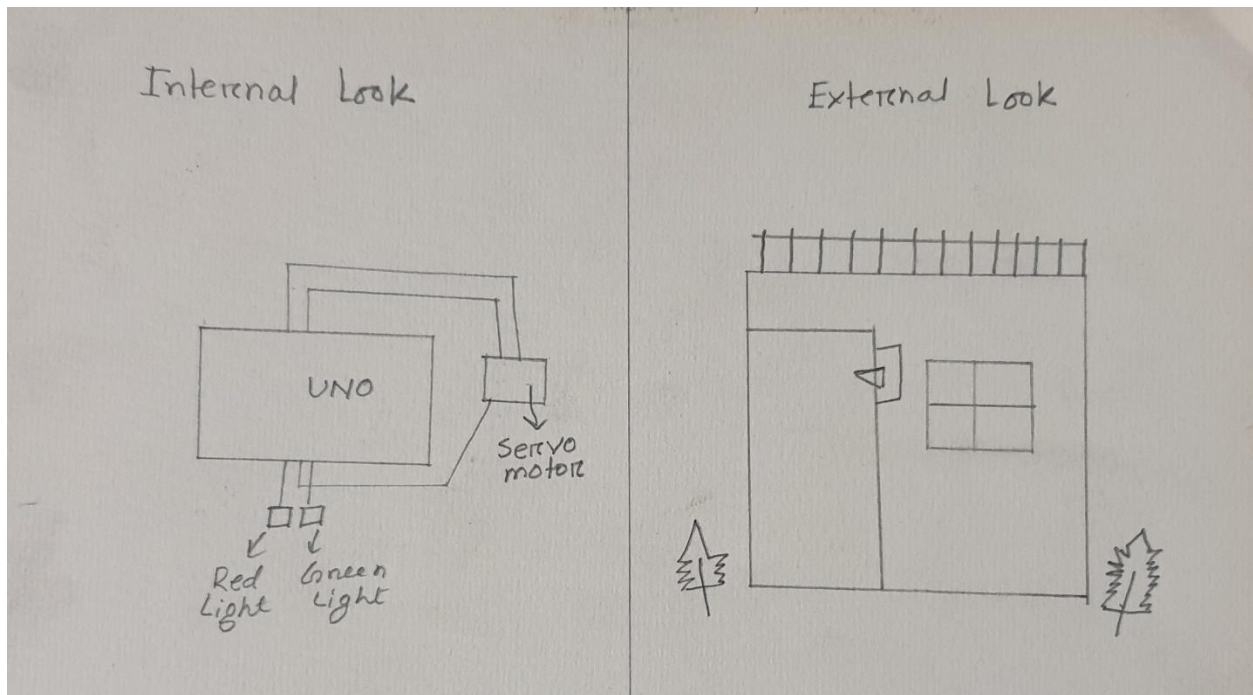
We want to make our system small and easy to use. For that reason firstly we have chosen a control board which was Arduino Uno NANO. Unfortunately, we did not find the way how to give connection on that board. So we decided to change our control board and move to Arduino Uno. We found the correct pins and put our design on that and our system works perfectly.

## **Part 3 – System Prototype and Evaluation Plan**

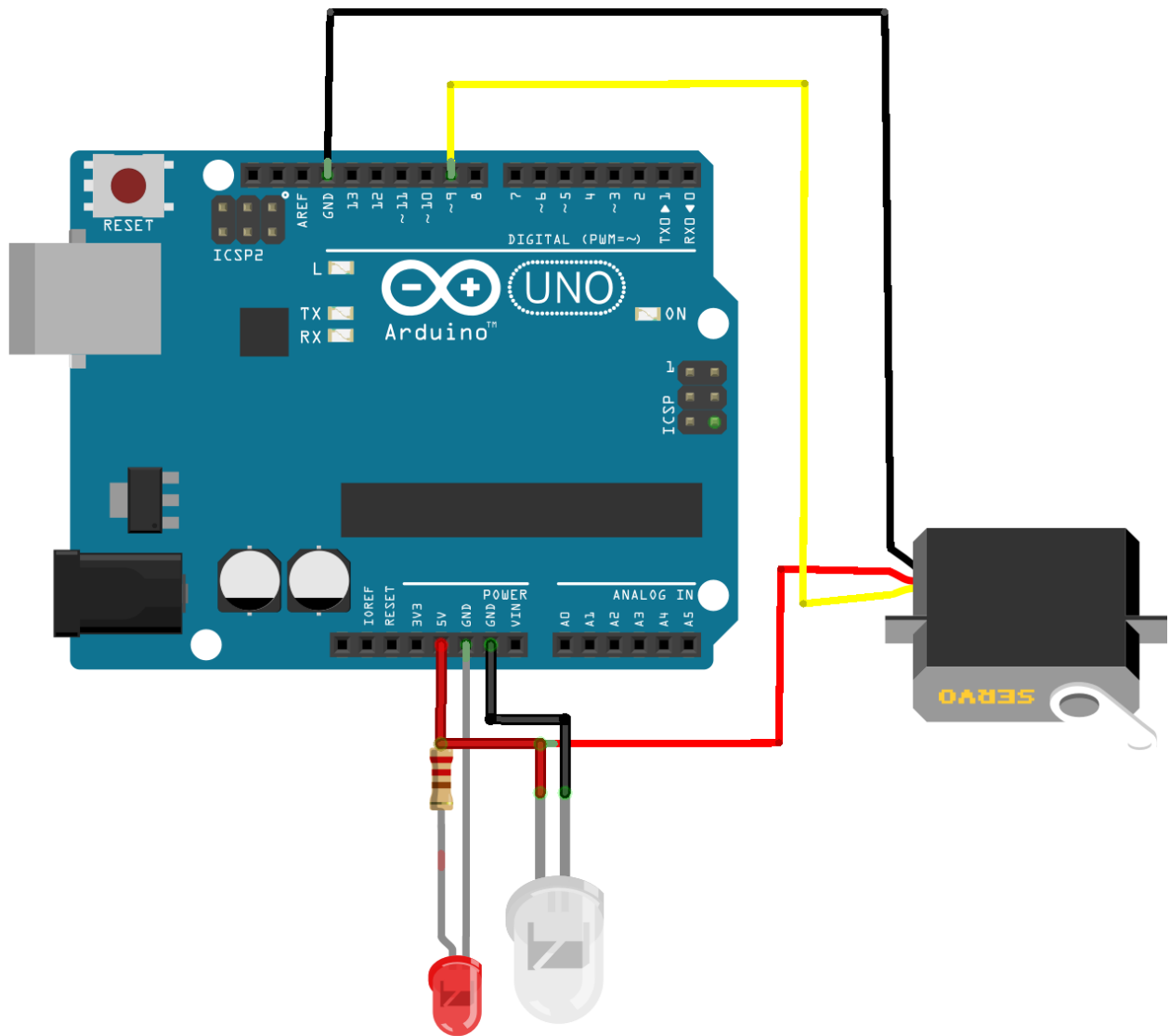
### **Prototype Description:**

As we are going to build Face Recognition Door Lock System. So, we have selected some components which will be relatable, User friendly and cost effective. Our First Plan is our design

should be more user friendly and easy to use. So initially we made a Prototype which can be understandable to us to make our first step to this project.



Then we made a UI Design –



fritzing

So, our design is now ready and everything was like we planned how'll be we make our project.

Now the question is how a user can lock and open a door? Right?

So, the answer is so simple.

We have a camera sensor in the gate. When a user will show his/her face in the camera then the door will open with a green light and when an unknown face will be detected then the door will be closed with a red light.

As The camera is expensive so we have used our laptop camera to demonstrate our project.

Now the question arises why did we choose this prototype?

Because this is the simplest user-friendly design we have made.

We have changed our requirements too many times.

Then finally we made this.

We have to use some components which can not be suit in this project. Like we've used Nano first. But that's not working. Then we've used UNO. And That's working well. Finally, we've made a house to look familiar to door lock System.

## **Part -4 – Evaluation**

**Overview :** It works by identifying and measuring facial features in an image. Facial recognition can identify human faces in images or videos, determine if the face in two images belongs to the same person, or search for a face among a large collection of existing images. Biometric security systems use facial recognition to uniquely identify individuals during user onboarding or logins as well as strengthen user authentication activity. Mobile and personal devices also commonly use face analyzer technology for device security.

**Data Presentation -** The technique of identifying a face in a picture is called detection. Face detection and identification from an image including one or more people's faces is made possible by computer vision. It can detect facial data in both front and side face profiles . So We collect some picture and store it . Then we give the location of every pictures in our python code . Then we try to analyze it



## Analysis

The facial recognition system then analyzes the image of the face. It maps and reads face geometry and facial expressions. It identifies facial landmarks that are key to distinguishing a face from other objects. The facial recognition technology typically looks for the following:

- Distance between the eyes
- Distance from the forehead to the chin
- Distance between the nose and mouth
- Depth of the eye sockets
- Shape of the cheekbones
- Contour of the lips, ears, and chin

The system then converts the face recognition data into a string of numbers or points called a faceprint. Each person has a unique faceprint, similar to a fingerprint. The information used by facial recognition can also be used in reverse to digitally reconstruct a person's face.

## Conclusion

Smart locks enable a homeowner to enter their home or grant access to others without the need for a standard key in a smart home. Instead, the user wirelessly verifies and mechanically unlocks the door with a smartphone or a key. Smart locks bring home automation and security together. So, We are try to build face recognition system has been developed in order to study the potential application for automated door access control. Among the other bio-metric techniques, face recognition approach posses one great advantage which is user friendliness. The technique of Eigen faces has been applied into the system which makes the system more secure

