



Known and Unknown Face Smart Home Door Lock System using AI and Edge Computing

Sabarinathan .D

Hindusthan College of Arts and Science

Coimbatore

Abstract

Security is at most concern for anyone nowadays, whether it's data security or security of their own home. With the advancement of technology and the increasing use of IoT and AI, digital door locks have become very common these days. Face recognition system is broadly used for human identification because of its capacity to measure the facial points and recognize the identity in an unobtrusive way. The application of face recognition systems can be applied to surveillance at home, workplaces, and campuses, accordingly. The problem with existing face recognition systems is that they either rely on the facial key points and landmarks or the face embeddings from FaceNet for the recognition process. Deep convolutional neural networks have been successfully applied to face detection recently. Despite making remarkable progress, most of the existing detection methods only localize each face using a bounding box, which cannot segment each face from the background image simultaneously. To overcome this drawback, this project present a face detection and identification method based on improved Mask R-CNN, named G-Mask, which incorporates face detection and recognition into one framework aiming to obtain more fine-grained information of face. This paper also investigates the robustness of the face recognition system when an unknown person is being detected, wherein the system will send an SMS Web link to the owner of the house through edge computing. The door lock can also be accessed remotely from any part of the world by using a door lock integrated server account.

CHAPTER-1

INTRODUCTION

1.1 Overview

Locks have been around for thousands of years. Probably as long as there have been valuables that people wanted to protect, locks — in some form — have been there to keep things secure. One can probably encounter all sorts of locks every day. From combination locks on school lockers to deadbolt locks on front doors, locks are all around us. Today there are many different kinds of locks. Some are very simple locks that open with a key or a combination of numbers. Others are extremely complicated locks that open with fingerprints or special electronic key cards. Today's locks feature many different types of mechanical and technological systems to increase security.

Effects of Traditional door locks

We were all familiar with traditional door locks on our front door. And we surely cannot forget the most frustrating thing come across in our life is practically walking out the front door suddenly recognized that you've locked the door and left your keys on the kitchen table. However, it could pose a serious security risk if your kids or pets are locked inside. Pin-and-tumbler locks are different, because they require a key to unlock them. Basic pin-and-tumbler locks have several spring-loaded pins inside a series of small cylinders. If you don't have the right key, one or more of the pins will remain in the way of the shear line. This will prevent the cylinder from turning and the lock will remain closed. Designed to ensure privacy and securing access, nowadays you'd find a lock on almost everything - from home's front door to your smartphone. This goes to show how we, as a society, have come to value privacy and safety more and more over time. Choosing the right kind of door lock for yourself is, in our view, more important than ever. Let's first clarify the distinction between 'smart' and 'traditional' locks. Most people are not used to the term 'traditional' locks - we simply call them 'locks', essentially referring to the average door lock that is non-automated and has to be manually engaged. You rotate the key and a deadbolt locks your door - easy! On the other hand smart locks (in their simplest form) are automated versions of traditional locks or retrofitting accessories, which can be integrated into smart home systems. They too usually operate a traditional deadbolt - but the mechanism can be engaged and controlled remotely, which can bring many improvements to the overall home security experience. Just like traditional locks, smart locks come in different shapes and forms. Some are enhanced by security cameras, keypads, touchpads, others may simply be remotely controlled directly from a mobile app. So, people gets move from traditional door lock systems to electronic door lock systems. Smart locks (like all smart-home devices), in order to exchange data between other smart home electronic devices, commonly use protocols such as Bluetooth, ZigBee, LoRa, NBIoT, and WiFi. Therefore anyone with a smart lock should definitely keep their apps and system updated and phone and passwords secured (I think we'd agree that a screen lock is pretty much a must these days). The electronic locks do not eliminate the risk of someone sweeping the key from under your doormat, picking your lock, or smashing their way in through your door Traditional locks - not as safe as we think. Despite what all of us would like to believe, most common locks are highly vulnerable to picking - an experienced burglar could snap a deadbolt and

stage a break-in in only a matter of seconds. Unfortunately, your front door is not as secure as you'd think - it will, pretty much, only keep out the 'honest' criminals who are either not quite willing to push their luck or simply inexperienced beginners.

Effects of technological door locks systems

Forgetful - You may be the one to forget your keys now and then, and it can be easy to forget your PIN code for the lock and when you're in a rush to get into the room or building or it is night time and dark, you don't want to be changing the code in the middle of the night or when it's raining!

Keep the PIN code safe and the lock clean: Only tell the code to people who you trust, as you don't want a code to your property to be local news. When the lock has been used a few too many times, the coating may start to come away or mucky fingerprints may start to occur on the buttons. Keep the lock maintained and clean to stop unwanted people finding out the code! Some digital door locks have a PIN code length up to 10 digits - this is not what you want!

1.2 Problem Identified

The history of locks dates back 4,000 years. Even now, there's still no such thing as a perfect traditional lock. Smart locks, which have only been around about ten years, naturally have some technological limitations.

The key is stuck or broken inside the lock

Your key may be stuck due to misaligned door latch or that some components of the lock are not properly lubricated. If the key is stuck, forcing it to turn may lead to breaking the key inside the locks.

Understand that you are low on time and in a hurry to meet up with an appointment. However, if you notice that the key is stuck on the lock, do not force it to open or close; you may end up aggravating the problem.

Slow door locks

Stiffened or slow door locks may occur as a result of the accumulation of dirt or grime in your locks. If you notice that the handle of your lock is slow or it is difficult inserting the key into the lock.

Misaligned door latch

In case the door latch does not catch the strike plate, you will find it difficult shutting or locking your door properly. This problem can creep up from time to time, and it can be caused by improper installed or screwed hinges, damp weather condition, or heat

Effects of smart locks

Smart locks can also control the locks of one door. It's one thing to try out new technology on a phone or computer, but this is the key to your house and technological issues can set you back. When you look at the simplest smart locks, they are just an automated version of a traditional lock. The locking mechanism might

even be the same, but it's capable of being engaged remotely and electronically. What makes smart locks different is the type of interaction necessary compared to traditional locks.

While smart locks offer ease of access and they can be locked from anywhere, if you forget to lock up, they are very similar to traditional locks when it comes to security. Since most smart locks work with a traditional deadbolt, they are just as secure as traditional locks.

The one downfall you will find when comparing smart locks to traditional locks is the accessories you can use to make them more secure. Some smart locks cannot be used with certain additional features due to the way they are designed. Sometimes fingerprint scanners can have problems reading fingerprints due to various reasons such as sensitivity to moisture, lotions, oils, sweat and dry skin. Activities such as swimming, showering or exercising can also temporarily affect the proper scanning of fingerprints hence security is low. So it must need to take some actions to avoid from these door lock issues. However, with the right smart lock and the right features, people might be able to gain a very secure lock.

1.3 Artificial Intelligence

Artificial Intelligence (AI) is the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving, and pattern recognition. Artificial Intelligence, often abbreviated as "AI", may connote robotics or futuristic scenes, AI goes well beyond the automatons of science fiction, into the non-fiction of modern-day advanced computer science. Professor Pedro Domingo's, a prominent researcher in this field, describes "five tribes" of machine learning, comprised of symbolists, with origins in logic and philosophy; connectionists, stemming from neuroscience; revolutionaries, relating to evolutionary biology; Bayesians, engaged with statistics and probability; and analogizes with origins in psychology. Recently, advances in the efficiency of statistical computation have led to Bayesians being successful at furthering the field in a number of areas, under the name "machine learning". Similarly, advances in network computation have led to connectionists furthering a subfield under the name "deep learning". Machine learning (ML) and deep learning (DL) are both computer science fields derived from the discipline of Artificial Intelligence.

Broadly, these techniques are separated into "supervised" and "unsupervised" learning techniques, where "supervised" uses training data that includes the desired output, and "unsupervised" uses training data without the desired output.

AI becomes "smarter" and learns faster with more data, and every day, businesses are generating this fuel for running machine learning and deep learning solutions, whether collected and extracted from a data warehouse like Amazon Redshift, ground-trothed through the power of "the crowd" with Mechanical Turk, or dynamically mined through Kinesis Streams. Further, with the advent of IoT, sensor technology exponentially adds to the amount of data to be analysed -- data from sources and places and objects and events that have previously been nearly untouched.

1.3.1 AI in everyday life

Below are some AI applications that you may not realize are AI-powered:

Online shopping and advertising

Artificial intelligence is widely used to provide personalized recommendations to people, based for example on their previous searches and purchases or other online behaviour. AI is hugely important in commerce: optimizing products, planning inventory, logistics etc.

Smart homes, cities and infrastructure

Smart thermostats learn from our behaviour to save energy, while developers of smart cities hope to regulate traffic to improve connectivity and reduce traffic jams.

Cars

While self-driving vehicles are not yet standard, cars already use AI-powered safety functions. The EU has for example helped to fund VI-DAS, automated sensors that detect possible dangerous situations and accidents.

Navigation is largely AI-powered.

Cybersecurity

AI systems can help recognize and fight cyberattacks and other cyber threats based on the continuous input of data, recognizing patterns and backtracking the attacks.

Artificial intelligence against Covid-19

In the case of Covid-19, AI has been used in thermal imaging in airports and elsewhere. In medicine it can help recognize infection from computerized tomography lung scans. It has also been used to provide data to track the spread of the disease.

Fighting disinformation

Certain AI applications can detect fake news and disinformation by mining social media information, looking for words that are sensational or alarming and identifying which online sources are deemed authoritative.

1.3.2 Deep Learning

Deep Learning is a branch of machine learning that involves layering algorithms in an effort to gain greater understanding of the data. The algorithms are no longer limited to create an explainable set of relationships as would a more basic regression. Instead, deep learning relies on these layers of non-linear algorithms to create distributed representations that interact based on a series of factors. Given large sets of training data, deep learning algorithms begin to be able to identify the relationships between elements. These relationships may be between shapes, colours, words, and more. From this, the system can then be used to create predictions. Within machine learning and artificial intelligence, the power of deep learning stems from the system being able to identify more relationships than humans could practically code in software, or relationships that humans may not even be able to perceive. After sufficient training, this allows the network of algorithms to begin to make predictions or interpretations of very complex data.

1.4 Scope of the project

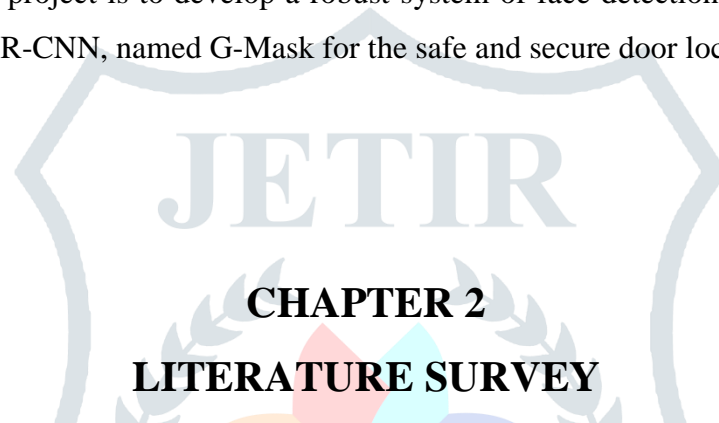
When you think of locks, traditional door locks are probably what comes to mind. These locks have a keyhole and a manual latch. Traditional locks have some issues like forgot their keys, door lock get stuck, easily break the lock etc. People feel that traditional lock is not safe so people gets move to smart locks

system but even smart lock systems also have some issues like forgot their codes, fingerprint can't get access etc.

The features of this system include it use face detection system for the safe and secure door lock system. So if the unauthorized person or relatives gets enter into the house they will only get enter into the house after getting permission from the family head or authorized users who gets SMS link of the unauthorized person or relatives face. If that authorized users gives approval then only the door gets open otherwise not open the door. So using this method people feel safe and secure home door lock systems because no one can enter into the house without the authorized user permission.

1.5 Objective

The key objective of this project is to develop a robust system of face detection and identification method based on improved Mask R-CNN, named G-Mask for the safe and secure door lock system.



1. Smart Door Locking Mechanism

Authors: Janhavi Baikerikar; Vaishali Kavathekar; Nilesh Ghavate; Ronit Sawant; Kharansu Madan

Year: 2021

Link: <https://ieeexplore.ieee.org/document/9487704>

Objective:

The aim of this project is designing and implementing a Smart door lock system which can be deployed in rented premises/households/bank lockers so that only authorized personnel can gain access to it.

Methodology:

Our daily life revolves around the concept of automation and the things that are automated are said to be of benefit because they reduce the intervention of human beings. Short-term renting of spaces and household currently involves exchange of keys between the tenant and owner of the place. This not only results in wastage of time for both the parties but also results in high security risk as the keys may get misplaced or the copies of the keys can be made by the guest. In the recent times, security has become a serious threat and people are opting for more secured resources. Many cases involving burglary at premises have been registered. This article idea revolves around designing and implementing a Smart door lock system which can be deployed in rented premises/households/bank lockers so that only authorized personnel can gain access to it. As security is a major concern nowadays, existing technology as simple keys are not fool proof any more. This system of smart door lock system requires owners to

set a pin every time the premises are rented to a new guest. The guest is required to simply unlock a door using the One-time password (OTP) which is convenient for both owner of the place and guest renting the place. The use of the Onetime password (OTP) and SMS processing is used for creating a secure and easy to use smart door lock in a hotel like premises.

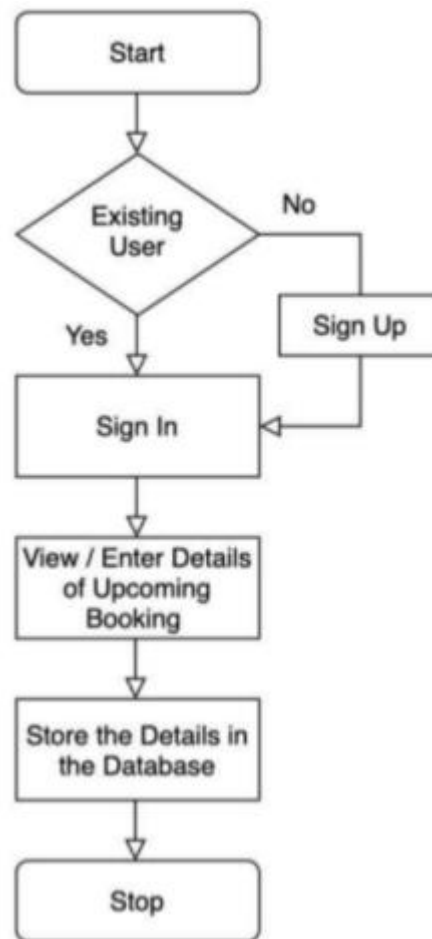


Figure 2.1- Owner side App Flow diagram.

Merits:

- It is secure and easy to use.
- It increases the system usability.
- It increases the security.

Demerits:

- Power failure.
- High cost.
- Time consumption process.

2. IoT based Door open or close monitoring for home security with emergency notification system using LoRa Technology

Authors: Santhi Venkatraman; R R Varshaa; P Vigneshwary

Year: 2021

Link: <https://ieeexplore.ieee.org/document/9441890>

Objective:

The aim of this project is door monitoring system which is designed to monitor the status of a single door only using LoRa technology.

Methodology:

The basis of installing a door monitoring system is to create and accentuate the home and bank locker safety. Indeed, home safety is a major concern for citizens as well as for police and authorities. Therefore, to encourage people to protect their homes and bank lockers against threats such as robbery, burglary and thefts, this system can be installed in the doors of their homes or lockers. To keep living residences safe from such violent crime requires not only better action from the authorities but also greater readiness from citizens. Keeping the same in mind, this door monitoring system is to make people more watchful and vigilant when it comes to home-safety. Reports also note that while people are aware of rise of digital locks, there is no proactive or effective implementation when it comes to protecting assets within homes. This means a high percentage of people who are not equipped to deal with the threat to home security and, surprisingly, the most common theft in India is home theft. This article examines and analyses the security measures that address the difficulties that are faced by the house owners and also the bank locker holders. Current door monitoring system methods involves the use of digital locks, Wi-Fi technology to check the status of the door periodically leading to a reduction in theft and robbery or burglary that happens per every 3 minutes in India as per reports. According to the report, Indians continue to place greater emphasis on keeping their online safety systems up-to-date in order to ensure safety of their homes. Using LoRa technology, it can endlessly monitor the status of the door i.e. whether it is open or closed and based on the status further actions like alarming, sending an emergency notification are done to notify and alert the owner and to improve security. Lora Technology reconfigured the IoT by enabling long distance data connections while using very little power. LoRaWAN fills a technical gap for mobile-based and a WiFi network which needs higher power or high bandwidth or even the inability to penetrate into deep indoor areas.

Merits:

- It enabling long distance data connections while using very little power.
- Endlessly monitor the status of the door i.e. whether it is open or closed and based on the status further actions like alarming, sending an emergency notification are done to notify and alert the owner.
- Security is high.

Demerits:

- High bandwidth.
- Need higher power.
- Even the inability to penetrate into deep indoor areas.

3. Anti-Spoofing Door Lock Using Face Recognition and Blink Detection

Authors: Romit Ganjoo; Anjali Purohit

Year: 2021

Link: <https://ieeexplore.ieee.org/document/9358795>

Objective:

The aim of this project is to detect a human face using texture analysis which includes computing a Histogram of Gradients (HOG) over a region of the face and then uses Support Vector Machines (SVMs) to recognize a face.

Methodology:

Face recognition is a diverse field of computer vision that enables one to detect and recognize a person's face. Face recognition system refers to machines that gather and analyse data from a person's face and store it in the form of encodings and then matching these encodings for recognition. It is one of the most successful applications of computers. In recent years, various different methods have been developed for facial recognition and their usage depends on the type of system requirements. Detecting a human face in an image is the first major challenge that possess and making a robust mechanism to differentiate a human face from an image, even in improper lighting and background conditions, is highly required. This article focuses on an approach to detect a human face using texture analysis which includes computing a Histogram of Gradients (HOG) over a region of the face and then uses Support Vector Machines (SVMs) to recognize a face. The raspberry pi acts as the brain of the system. The raspberry pi is programmed with the SVM model for facial recognition. A proper communication is established between the peripheral devices and the raspberry-pi module once they are properly connected to the raspberry-pi module through the GPIO pins. The ultrasonic sensor is used to detect if there is someone standing in front of the door. The face image is taken through a pi-camera and then the blinking mechanism is activated to count number of blinks. Then, the relay is used to trigger the solenoid key upon successful execution of the process.

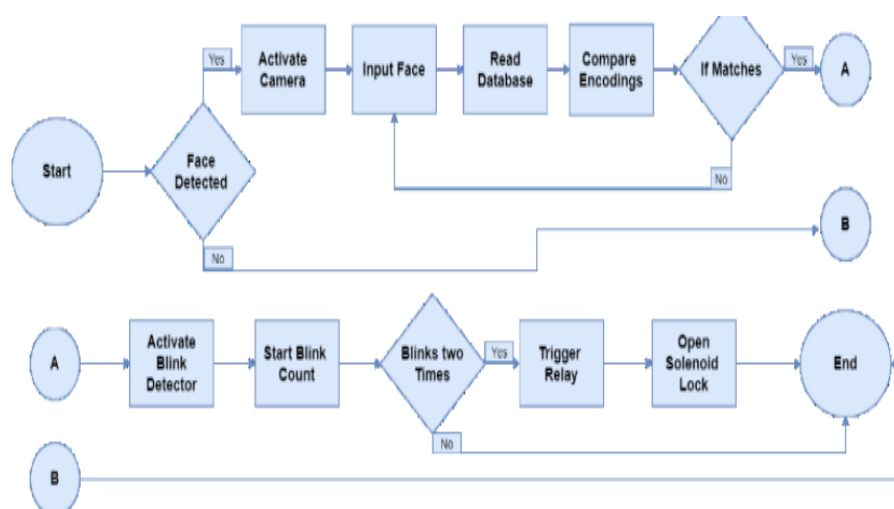


Figure 2.2-System Process Overview

Merits:

- This will allow customers to authenticate from home and a lot of time can be saved.

- Eliminate fake attendances.
- Security is high.

Demerits:

- Not reliable.
- High cost.
- Efficiency is low.

4. Intelligent fingerprint lock based on STM32

Authors: Bokang Yang; Huiwen Xia; Wangdi Du

Year: 2020

Link: <https://ieeexplore.ieee.org/document/9327366>

Objective:

The aim of this project is an intelligent fingerprint lock system based on STM32 for home lock system.

Methodology:

With the rise of all kinds of intelligent home and short rent industry, all kinds of smart door locks become popular because of their various unlocking methods and convenient key distribution. Intelligent door lock has a variety of unlocking methods including password, fingerprint, and NFC card. These rich unlocking methods can help short-term landlords set a short-term fingerprint or password for their tenants to avoid the risk of traditional keys being copied. At the same time, with the continuous development of smart phone users, a smart phone can also be used as a key, which is very convenient. This article, an intelligent fingerprint lock system based on STM32 is studied. The fingerprint identification technology and the traditional password input method are combined to realize the identification of the user, with high security. The system is composed of MCU control module, fingerprint identification module, electromagnetic lock module, user interaction module and power supply part. These systems cooperate with each other to realize a series of functions such as accurate fingerprint identification and unlocking. In terms of program, C language is used for modular programming, which is convenient for debugging and maintenance and upgrading. After the actual test, the system has high recognition rate, fast response speed, and can adapt to various use environment, and has a broad market prospect.

Merits:

- High recognition rate.
- fast response speed.
- It can adapt to various use environment.

Demerits:

- Time consuming process
- High cost.

5. Automatic Door Lock System by Face Recognition

Authors: Sharvani Yedulapuram, Rajeshwarrao Arabelli, Kommabatla Mahender, Chintoju Sidhardha

Year: 2020

Link: https://www.researchgate.net/publication/347371861_Automatic_Door_Lock_System_by_Face_Recognition

Objective:

The aim of this project is a face recognition door lock system using raspberry pi for security purpose.

Methodology:

Nowadays, as the technology is increasing, facilities for human beings are increasing. In day to day activities, life of people has become very easier with the incorporation of many technologies. On the other hand, it also creates security issues. This article proposed face recognition door lock system using raspberry pi for security purpose. Implementation of the system is for monitoring whether any unknown person is entering in to the door. This article has established communication with electronic devices through face detection with the help of Pi camera Raspberry Pi platform. For software coding Python and Open CV libraries are used. In order to get accurate and clear picture of an intruder have proposed Haar classifier method for face detection. As soon as the person enters near the door, pi camera captures the image and face detection process is done then if it matches with database images then the door is unlocked otherwise a message with the picture of a person will be sent to the registered mobile through GSM and LAN network.

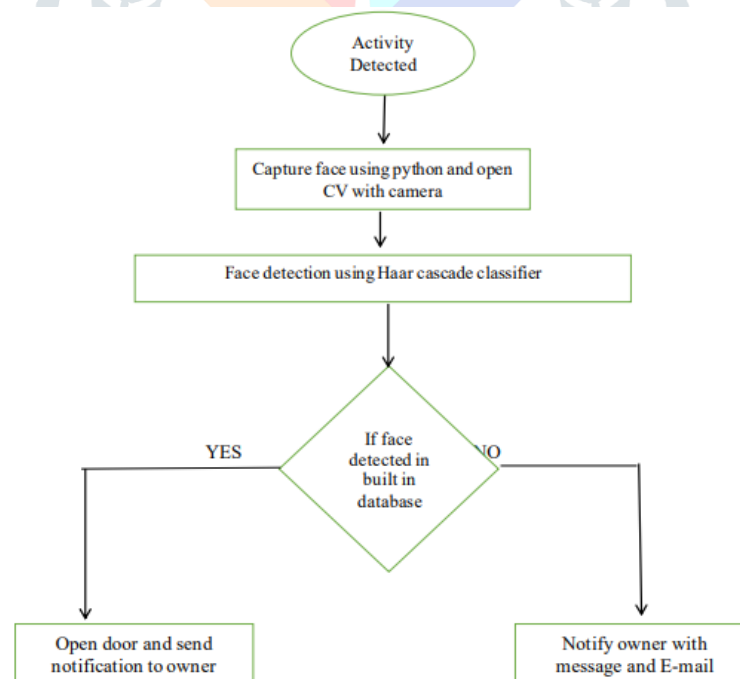


Figure 2.3-Flow chart of the proposed system

Merits:

- It get accurate and clear picture of an intruder.
- Low cost.

Demerits:

- The traditional door locks have a problem that almost anyone can break and enter into your house.
- Creates security issues.

6. Smart Home with Virtual Assistant Using Raspberry Pi

Authors: Shubhang Khattar; Anisha Sachdeva; Rishi Kumar; Richa Gupta

Year: 2019

Link: <https://ieeexplore.ieee.org/document/8776918>

Objective:

The aim of this project is to extended to provide more smart features and functionalities for smart home lock system.

Methodology:

Over the last decade smart phones have gained popularity like no other. People enjoy using Smart Phones due to their ease of use. They enjoy doing all their work even without touching the Phone. They interact with the Virtual Assistant like Siri, Cortana for all their work. They rely completely on the virtual assistants for their small to big tasks, like to call someone, to check the emails or to enquire about temperature. But till now the virtual assistants are limited to phones only, also devices like Google Home and Alexa cannot do much tasks around the house. This system revolves around the Virtual Assistant created specifically for homes and named as “OLIVIA” which can be installed anywhere inside the house as it lives on Raspberry Pi which is small computer and does not take much space and power to operate. The system is smart enough to identify and differentiate between the owner and stranger using face recognition and act accordingly. In this system, Olivia can interact with the stranger at the door in case the owner is not present at home and will notify the owner about the visit using Email and SMS along with the image of the stranger. Similarly, Olivia can be integrated to other systems and appliances such as tube lights, air conditioners etc. making them smarter.

Merits:

- It does not take much space.
- Accuracy is high.
- Security is high.

Demerits:

- High computation.
- High cost.

7. IOT Based Smart Door Locks

Authors: Dr.N.Krishnamoorthy, Kalaimagal.R,Gowri Shankar.S, Abdhul Asif.N.S

Year: 2018

Link: https://www.researchgate.net/publication/333103183_IOT_Based_Smart_Door_Locks

Objective:

The aim of this project is to security improvement based on door lock system based on IOT devices.

Methodology:

The IoT technology is that the interaction between individuals to individuals, machine to machine communication network. Application services supported data and communication technology has been actively investigated within the knowledge data society. Above all, the foremost ascent will be determined in convergence services which mixes over 2 parts for a similar purpose. Convergence services influence represent Internet of Things (IoT) technology, because it permits all objects to produce intelligent service and interactive communication through wired or wireless networks. Moreover, the IoT trade is deemed the core industrial field of the long run. IoT provides convenient and effective services in anywhere at any time, on the far side the technical and economical restrictions, still because the temporal and spatial limits by providing services needed in numerous varieties of fields. It also aids the distribution of intelligent terminals which incorporates good phones, in conjunction with the advancement of knowledge and communication technology. Meanwhile, the demand on convenience and speed has augmented within the economic sectors of contemporary society. The monetary sector, amongst alternative fields, need IoT technology as mentioned above. monetary institutes have augmented the distribution of unmanned and automatic machines to strengthen aggressiveness by advancing monetary services, streamlining the business processes, automating the system, and ultimately reducing prices. The proposed work approaches with the recent IoT technologies along with the mobile communication techniques to authenticate the status of the conventional device.

Merits:

- Security and safety is high.
- Low cost.
- Accuracy is high.

Demerits:

- Not safety.
- Time consumption and cost is high.

8. Pose and Illumination Invariant Face Recognition for Automation of Door Lock System

Authors: Amritha Purushothaman; Suja Palaniswamy

Year: 2018

Link: <https://ieeexplore.ieee.org/document/8473103>

Objective:

The aim of this project is a secured door lock system which is based on face recognition.

Methodology:

Biometrics is unique to an individual, and is used in many systems that involve security. Face is one of such biometrics that has gained importance in applications like security systems, identification of criminals, control of door access, attendance, identity verification, emotion recognition etc., Face recognition can be considered as one of the most reliable method for security check since it is non-invasive and can be done without the subject being aware of it. The face recognition algorithms can be grouped into three categories: Holistic, Feature-based and Hybrid. The complete face is taken as input data in holistic methods, whereas in feature based approach, the local features are extracted first. Hybrid method is a combination of both these methods. Most of the face recognition systems available today work under controlled environment. Variation in lighting, pose, facial expression, occlusion, ageing ,etc., are some of the key factors that greatly influence the accuracy and efficiency of face detection and recognition. The proposed system detects and identifies the face for different pose and illumination. Hence using face recognition for door access is a great way to ensure security.

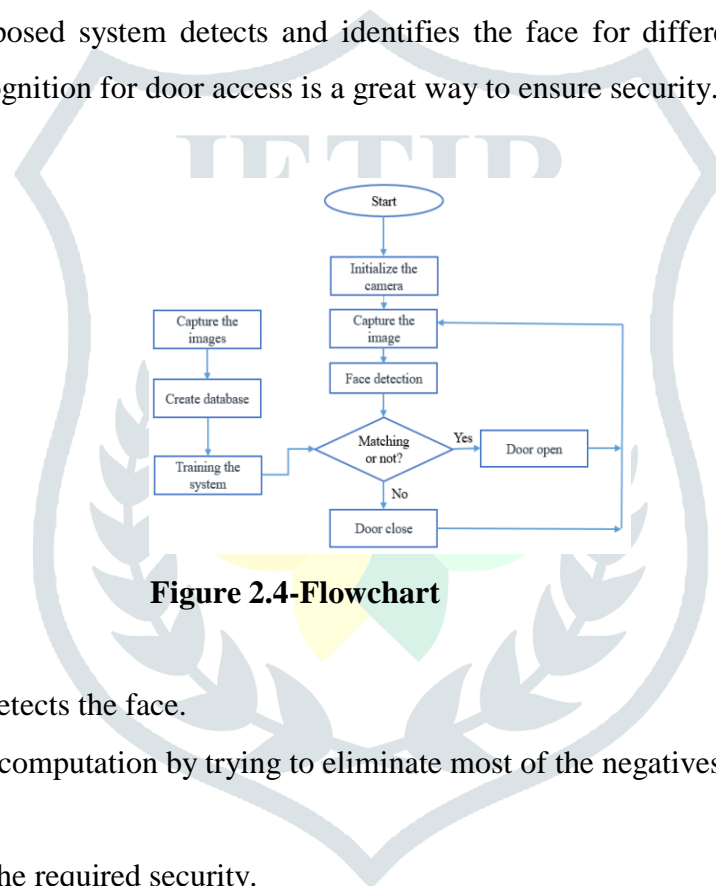


Figure 2.4-Flowchart

Merits:

- It efficiently detects the face.
- To reduce the computation by trying to eliminate most of the negatives in the initial stages.

Demerits:

- Fails to offer the required security.
- High computation.

9. Design and Implementation of a Fingerprint Based Lock System for Shared Access

Authors: Jayasree Baidya, Trina Saha, Ryad Moyashir, Rajesh Palit

Year: 2017

Link:

https://www.researchgate.net/publication/314195194_Design_and_implementation_of_a_fingerprint_based_lock_system_for_shared_access

Objective:

The aim of this project is a need for a secure system to prevent unauthorized access especially in shared access environment.

Methodology:

Security has always been a major concern for the households and the office environment, and for this concern various approaches are in place to address the problem. Most of the major door lock security systems have several loopholes which could be broken down to gain access to the desired places, and it creates a concern for a secure lifestyle and proper working environment. Additionally, terrorism and unauthorized access to places have become a major issue now-a-days, and there is a need for a secure system to prevent unauthorized access especially in shared access environment. With this consideration, a design and prototype of a biometric fingerprint based door lock system. Biometric systems such as fingerprint provide tools to enforce reliable logs of system transactions and protect an individual's right to privacy. The RFID or password-based door lock mechanisms can easily be compromised when the RFID card or passwords are shared or stolen, thus for facilities with shared access require biometric based secure system. The design and implementation of fingerprint based lock system is customizable and flexible. This door locking mechanism is comparatively cost-effective than the available lock systems in the traditional market. Fingerprint based lock system has high accuracy rate and is also quick to recognize fingerprints which enable seamless integration with the users and provides tighter security. In our country, private and government organizations are very much concerned about security. Many companies are interested in using this type of locking mechanism but the system which is available have very high installation cost. Due to this excessive cost, many small firms cannot afford such systems. Keeping the installation cost in mind this article planned to develop a system that should be affordable to both large and small firms. This design can be improved by more intensive development and additional features such as more locks can be added to the system. Thus this article do not need to spend so much for just one lock if this can be used to control several doorways. A system to save prints without the use of a computer could have been made, but it will require more parts than the ones used. In order to maintain security properly, the keypad should be placed inside the security room. A system for batteries could also be made or even solar powered.

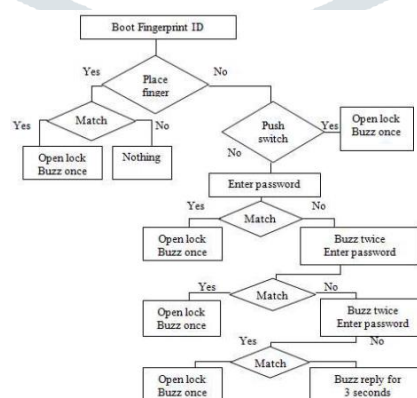


Figure 2.5-Flowchart of entire system.

Merits:

- The system is very secure.
- Its flexibility is high.

- A power failure will make it unworkable. In that case, connect the system with an IPS or add rechargeable batteries to the system.

Demerits:

- High cost.
- It depends on electricity.
- Power failure will make it unworkable.

10. Door Lock System via Web Application

Authors: CharoenVongchumyen, PakornWatanachaturaporn.

Year: 2017

Link: <https://ieeexplore.ieee.org/document/8075909>

Objective:

The aim of this project is to solve the common problem of the conventional door-locking system.

Methodology:

The major problems for everyone about the door lock are sometimes people forgot to lock the door back home or sometimes people did not sure that lock the door or not. So people have to go back to check for sure or leave it and risk of home burgling. Furthermore, Key losing is also the most common problem for people. The conventional doors lock use the knob and mechanical bolt to lock and use the metal key to operate in the cylinder to open or lock the door. The code of the key depends on the cuts of the keys. In most key, they have 5 – 6 cuts per key with 5-6 step per cut. The maximum combination of the key are 66 equal to 46,656 possible patterns with is not enough to the entire unique key is need. This article proposes the smart way to solve the common problem of the conventional door-locking system. The important problems of the ordinary door-locking systems are key lost, forgetting to lock the system and cannot check the lock status from remote. To solve these problems, this article proposed a method to lock-unlock the system which utilizes the web application and passcode alongside the usual method of using the ordinary keys. The proposed system can remotely lock, remotely unlock, remotely check door state, remotely check door locking state, send the email to the owner in case of someone knocking on the door and generate the temporary passcode to use in specific date and time.

Merits:

- High quality.
- Security high.
- Accuracy is high.

Demerits:

- Expensive.
- Time consuming process.

CHAPTER 3

SYSTEM ANALYSIS

3.1 Existing System

In existing system various types of techniques have been applied for door lock systems. Few approaches are shown here

- **Traditional lock system:**

The key is stock or broken inside the lock Your key may be stuck due to misaligned door latch or that some components of the lock are not properly lubricated. If the key is stuck, forcing it to turn may lead to breaking the key inside the locks. Understand that you are low on time and in a hurry to meet up with an appointment. However, if you notice that the key is stuck on the lock, do not force it to open or close; you may end up aggravating the problem.

- **Slow door locks**

Stiffened or slow door locks may occur as a result of the accumulation of dirt or grime in your locks. If you notice that the handle of your lock is slow or it is difficult inserting the key into the lock.

- **Histogram of Oriented Gradients (HOG) and Support Vector Machines (SVM):**

Detect a human face using texture analysis which includes computing a Histogram of Gradients (HOG) over a region of the face and then uses Support Vector Machines (SVMs) to recognize a face. It is resulted of 82.68 % accuracy for face recognition when the lighting conditions are optimum. During the night time the system efficiency drops by the maximum number and is unable to detect blinks.

- **Haar cascade classifier:**

Recognizing of faces is done by using Haar cascade classifiers. For this testing, it used 40 images only. Computer vision is used in the IOT. For security purpose, it implemented real time face detection by Haar classifier. It is resulted of 89 % accuracy for face recognition.

- **One time password (OTP) and SMS:**

Android application for the premise owner and Chatbot for the guest to automate the process of door locking and replacing the need of lock key with PIN. It fully exploits the capacity of the IoT environment to monitor and grant access to also unlike the other systems present in the market, our system doesn't require the guest to install any application.

Disadvantages:

- Stiffened or slow door locks.
- Forgot the keys, key cards.
- Increasing the burden of managing key cards person.
- A serious security risk if your kids or pets are locked inside.
- Accuracy is low.

- Time consuming process.
- Fingerprint lock can have problems reading fingerprints due to various reasons such as sensitivity to moisture, lotions, oils, sweat and dry skin.
- It difficult shutting or locking your door properly.

3.2 Proposed System

Authorized access has come a long way from using keys, pin codes, cards, and fingerprints. We now find ourselves stepping into the era of face recognition. When you think of locks, traditional door locks are probably what comes to mind. These locks have a keyhole and a manual latch. Traditional locks have some issues like forgot their keys, door lock get stuck, easily break the lock etc. People feel that traditional lock is not safe so people gets move to smart locks system but even smart lock systems also have some issues like forgot their codes, fingerprint can't get access etc. This project proposed a model Mask R-CNN, named G-Mask for accessing the door lock systems. Thus this project designed the method of the face recognition system when an unknown person face is being detected or captured, where in the system will send an SMS link to the owner of the system.

Using Mask R-CNN, named G-Mask model, that model detects an unknown person face gets captured then the system will send an SMS link to the owner that link have that unknown or unauthorized person captured face and ask permission for the owner if the owner or user gives permission then only the door gets opened otherwise not.

- **Mask R-CNN model:**

The proposed method is extended from the Mask R-CNN framework, which is the state-of-the-art object detection scheme and demonstrated impressive performance on various object detection benchmarks. As stated in Figure 3.1, the proposed G-Mask method consists of two branches, one for face detection and the other for face and background image segmentation. Face Feature Module is used to extract the facial features of the input image, and the Region of Interest (RoI) is rapidly generated on the feature map through the Region Proposal Network (RPN). We also use the Region of Interest Align (RoIAlign) to faithfully preserve exact spatial locations and output the feature map to a fixed size. At the end of the network, the bounding box is located and classified in the detection branch, and the corresponding face mask is generated on the image in the segmentation branch through the Fully Convolution Network (FCN).

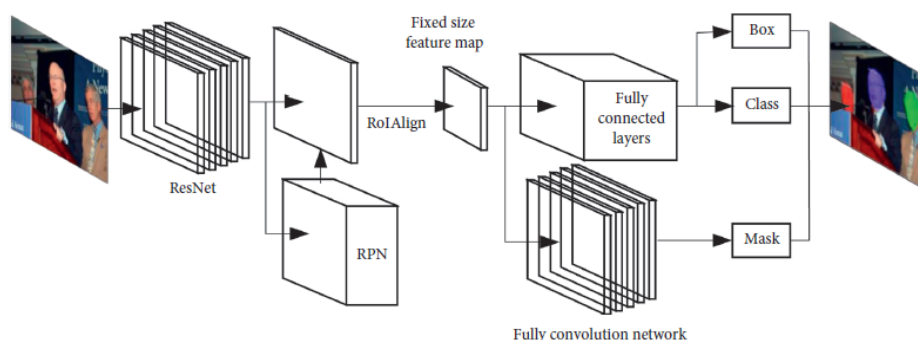


Figure 3.1. MRCNN

Mask RCNN is a deep neural network aimed to solve instance segmentation problem in machine learning or computer vision. In other words, it can separate different objects in a image or a video. You give it an image, it gives you the object bounding boxes, classes and masks. This is a major benefit to the end user, but it is also especially beneficial to multifamily buildings and offices by reducing their burden of managing key cards.

- **Remote Control Access**

The registration process one can conveniently grant access to new users even remotely. And can also customize settings and easily give one-time or temporary access to your premises. It analyses the faces of every person trying to enter and allows entry only the persons pre-authorized by the user.

- **Face Verification Link**

Face Verification Link will be generated and sent to user to verify the identity of unauthorized user through some dedicated artificial intelligent agents, for remote certification, which either authorizes the door to open appropriately or signals a security-violation alert to the security guard and enable the buzzer.

- **Blacklist**

It allows the user to create “blacklist” or banned individuals to detect and prohibit them from entering your business.

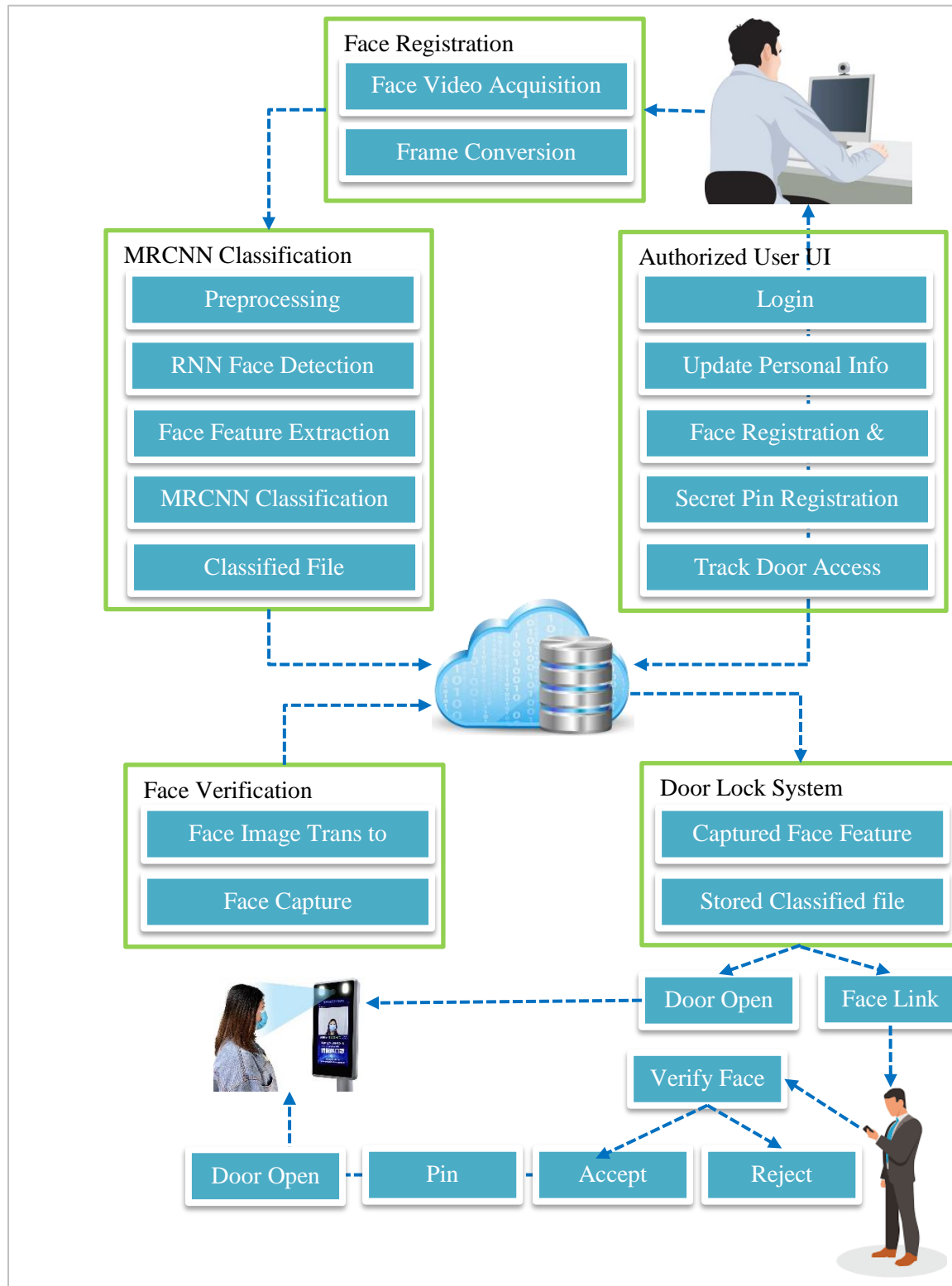
Advantages

- Big benefit to the end user and also multifamily buildings.
- Offices or hotels by reducing their burden of managing key cards.
- Touchless access to doors.
- No need to remember to grab a key card.
- High security for the home, since you are verifying the person directly.
- Facial recognition access systems can be combined with automatic door openers. With this combination, a person can walk up to a door, look at the reader, and the door would prop open automatically.
- Provide a secure, privacy-oriented platform for using face recognition.
- Accuracy rate over 99%
- Recognition speed under 0.2 seconds
- Fast recognition in low-light environments, even in complete darkness
- Face anti-spoofing ensures access security
- Data encryption to protect data privacy
- Quick and easy registration with various access methods
- Remote control via mobile or pc or laptop
- Convenient web configurations.
- **Easily export information via Excel files:** AI Security Solution supports exporting reports of individuals identified in the background. These reports can then be imported into other applications for cross-system use.

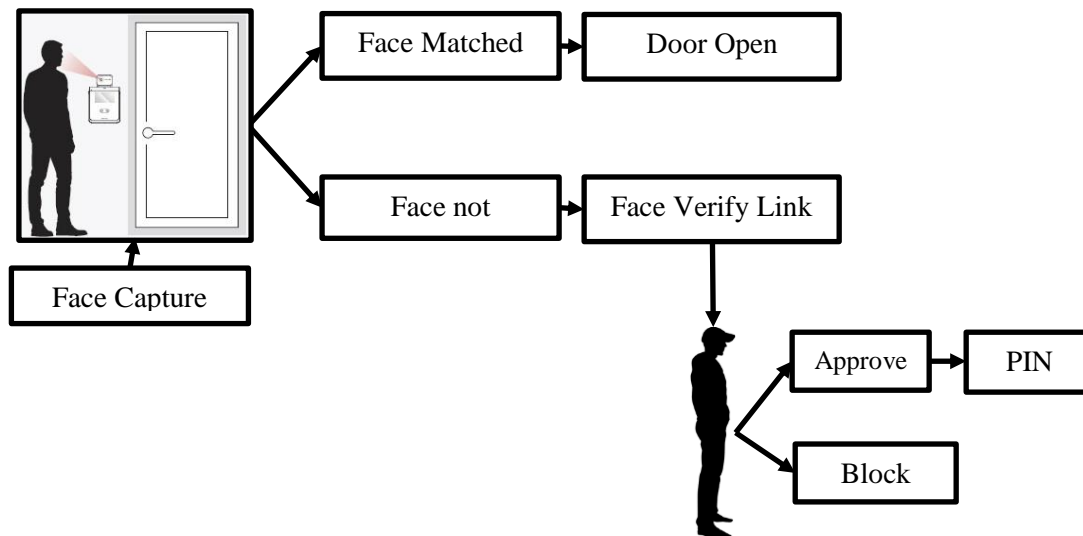
CHAPTER 4

PROBLEM DEFINITION

4.1. System Flow



4.2. Door Lock System



4.3 DFD Diagrams

A data-flow diagram is a way of representing a flow of a data of a process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow, there are no decision rules and no loops.

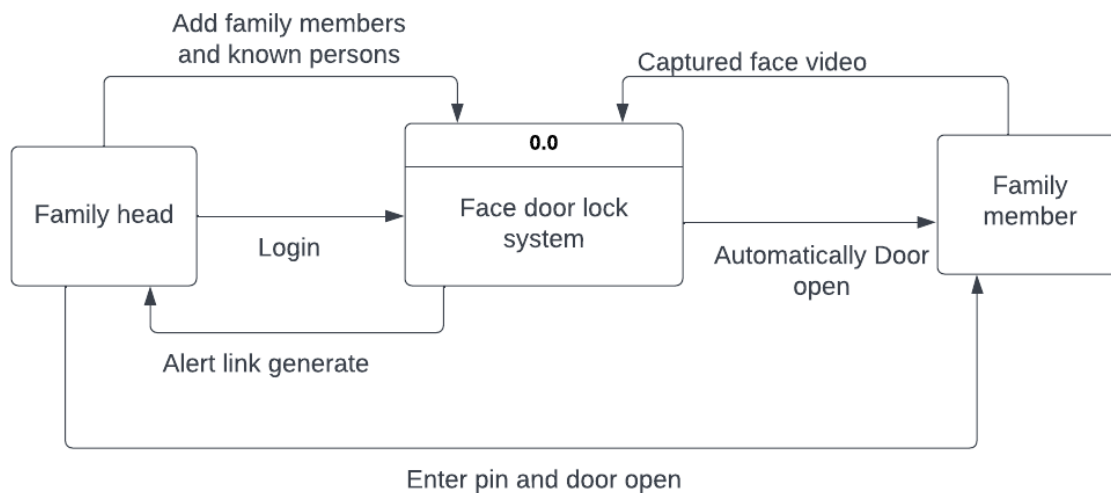
The visual representation makes it a good communication tool between User and System designer. Structure of DFD allows starting from a broad overview and expand it to a hierarchy of detailed diagrams. DFD has often been used due to the following reasons: ... Determination of physical system construction requirements.

Data flow Symbols:

Symbol	Description
	An entity . A source of data or a destination for data.
	A process or task that is performed by the system.
	A data store , a place where data is held between processes.
	A data flow .

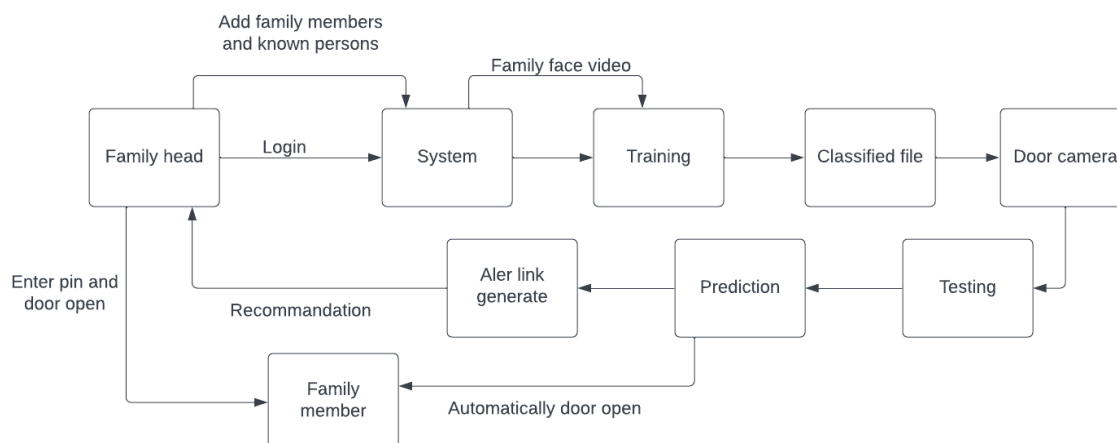
Level 0

A level 0 data flow diagram (DFD), also known as a context diagram, shows a data system as a whole and emphasizes the way it interacts with external entities. This DFD level 0 example shows how such a system might function within a typical retail business.



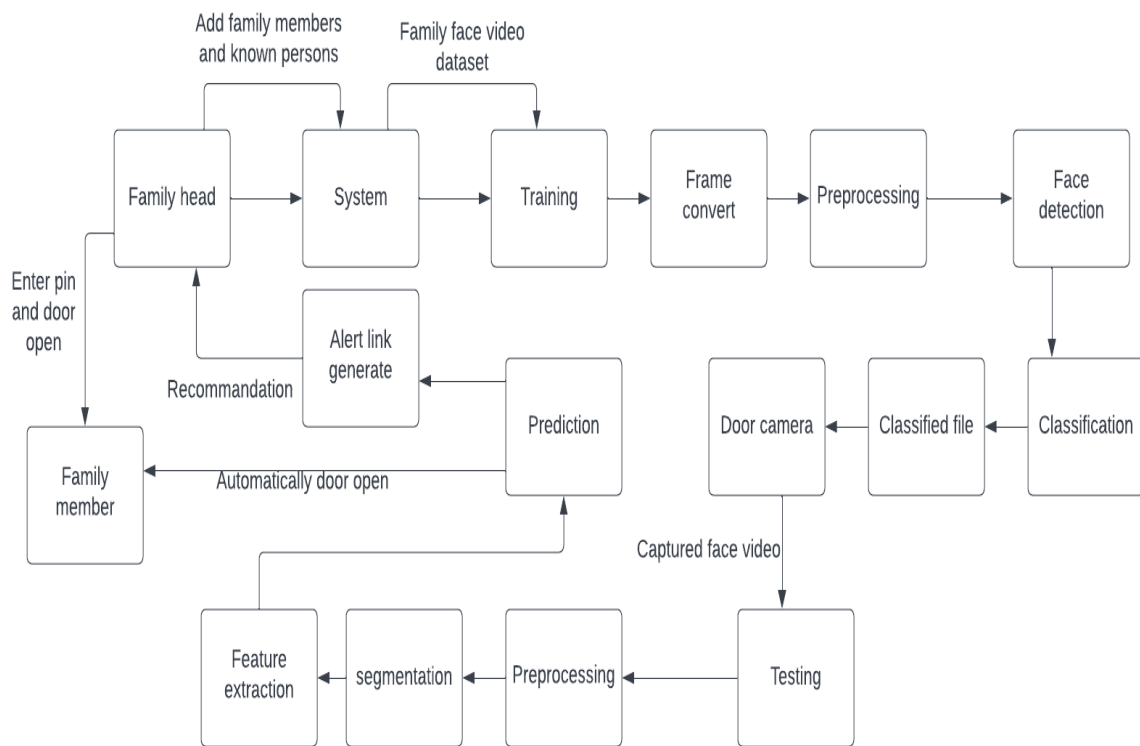
Level 1

A context level DFD is the most basic form of DFD. It aims to show how the entire system works at a glance. There is only one process in the system and all the data flows either into or out of this process. Context level DFD's demonstrates the interactions between the process and external entities.



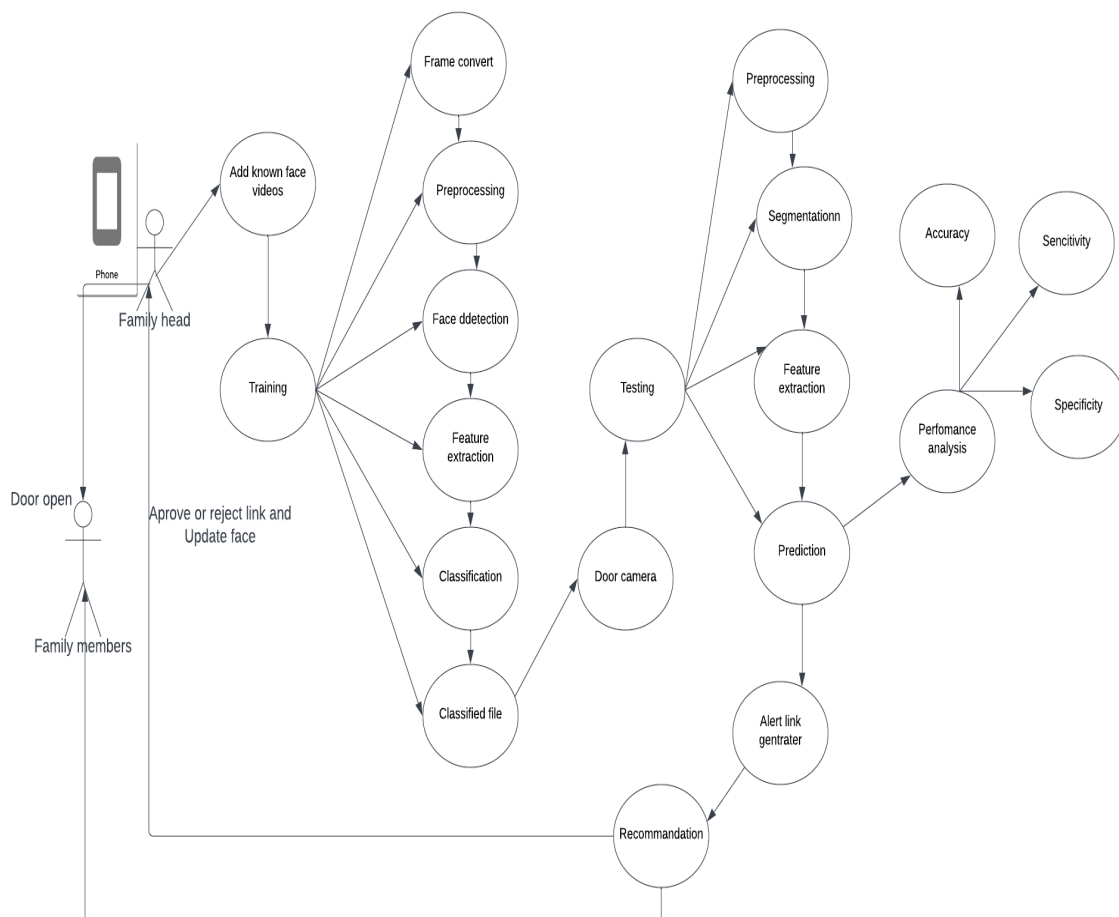
Level 2

A level 2 data flow diagram (DFD) offers a more detailed look at the processes that make up an information system than a level 1 DFD does. It can be used to plan or record the specific makeup of a system. ... You can then input the particulars of your own system.

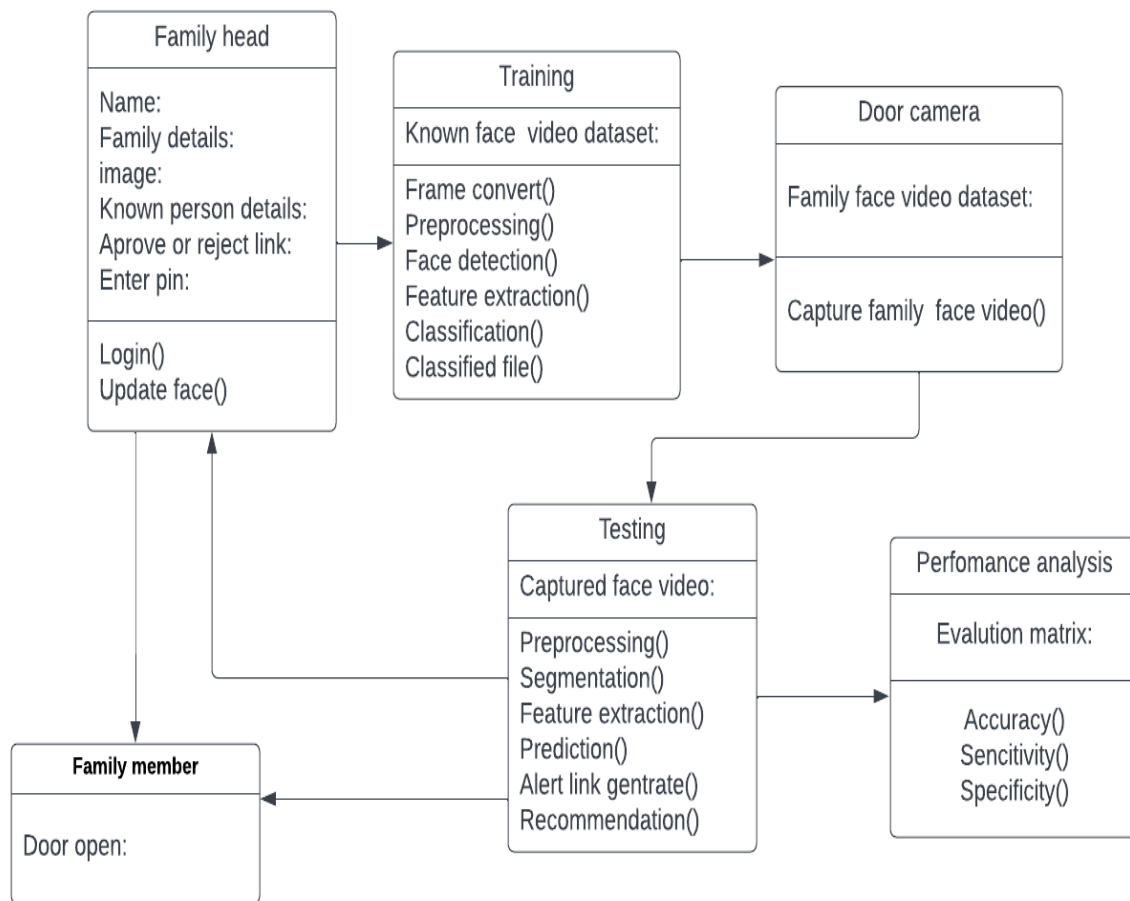


4.4 UML Diagrams

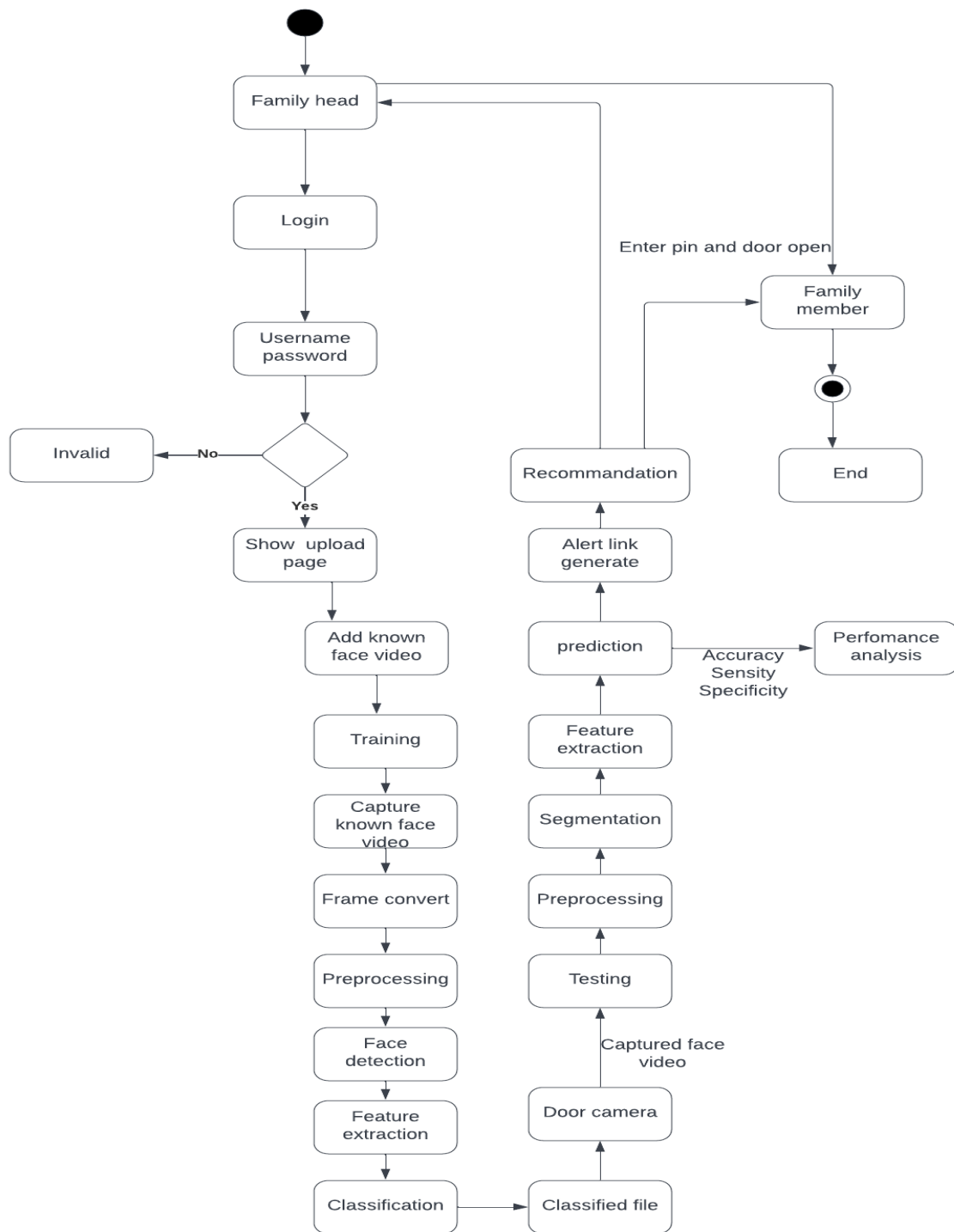
Usecase diagram



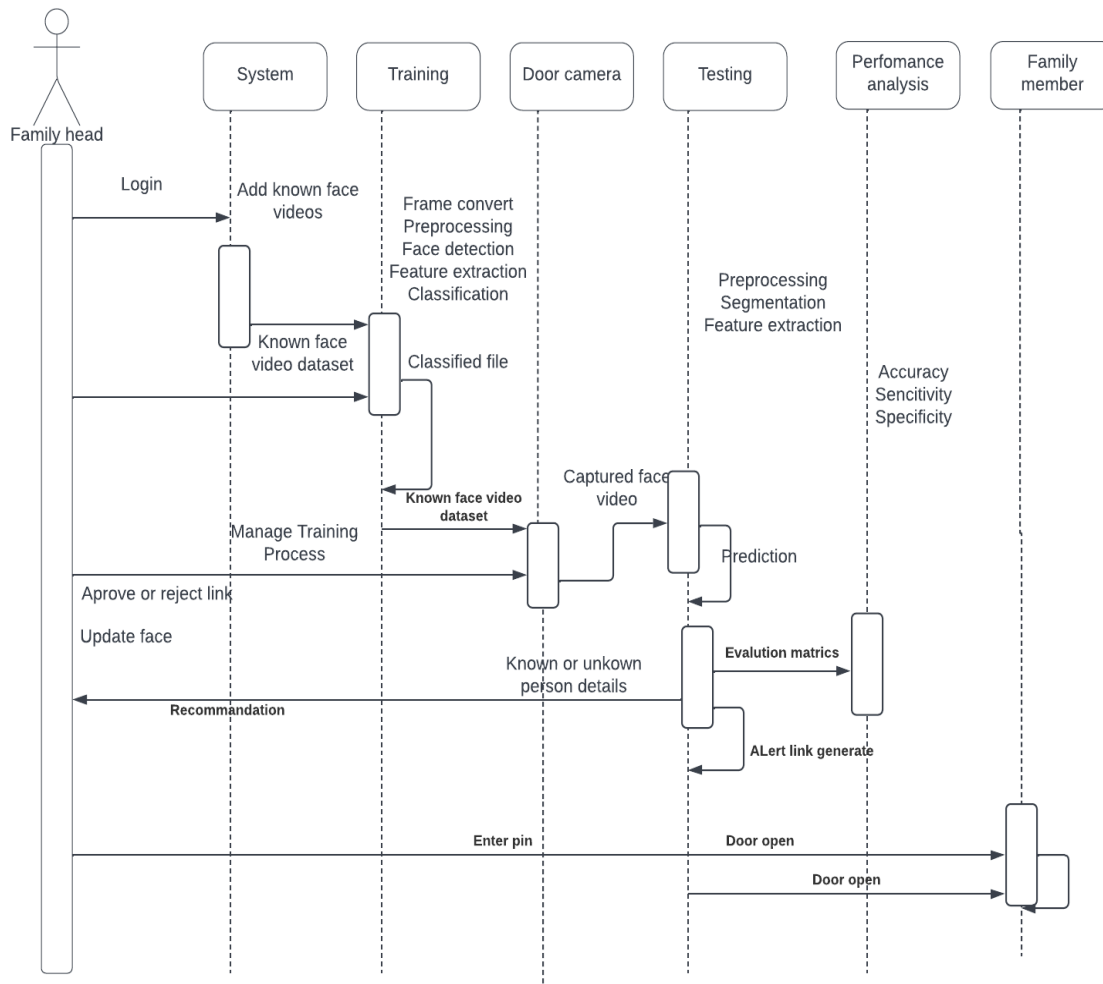
Class diagram



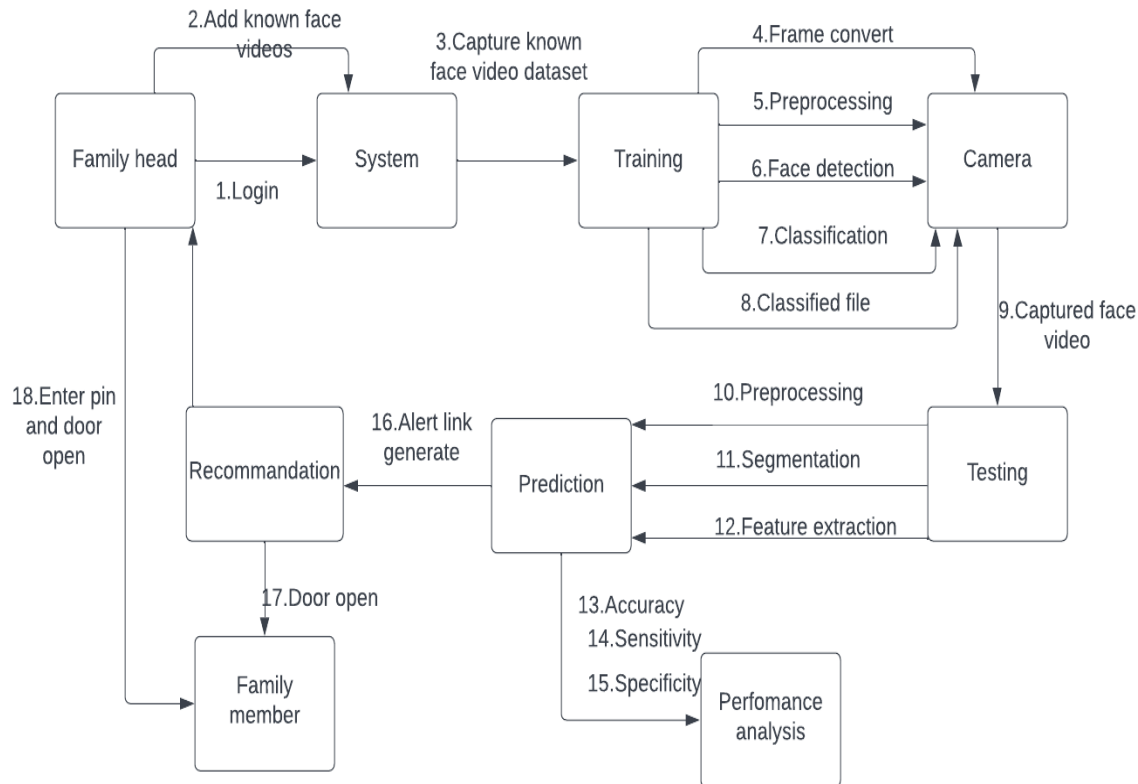
Activity Diagram



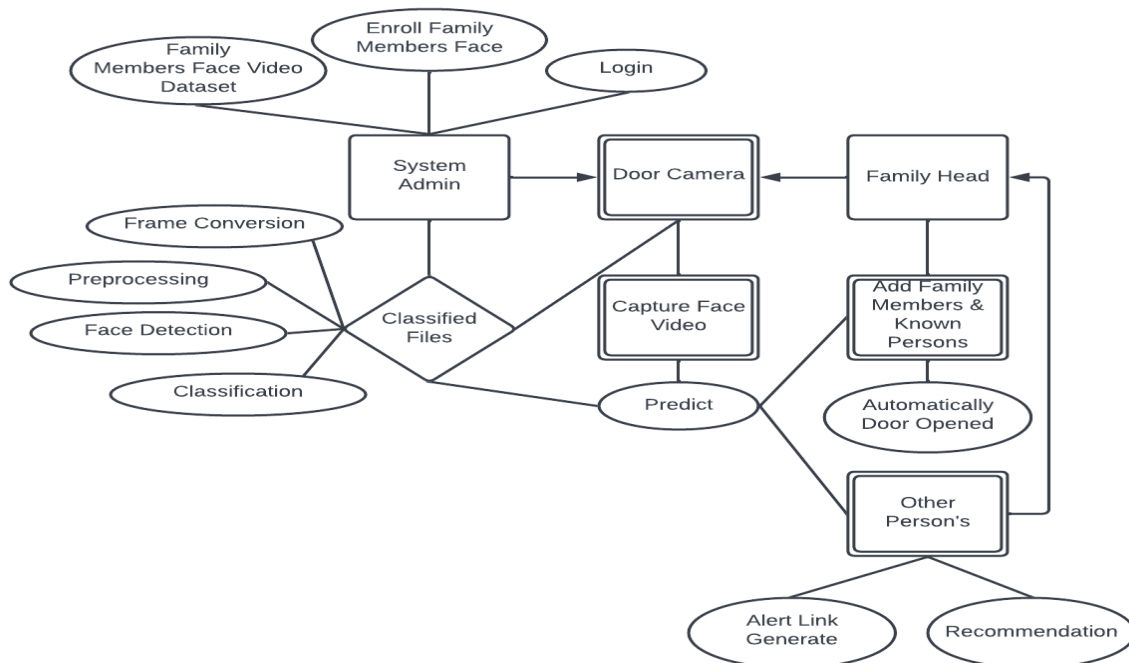
Sequence Diagram



Collaboration Diagram



E-R Diagrams



TableDesign

Database: face_door_open

Table structure for table fd_face

Field	Type	Null	Default
id	int(11)	Yes	NULL
vid	int(11)	Yes	NULL
vface	varchar(30)	Yes	NULL

Table structure for table fd_history

Field	Type	Null	Default
id	int(11)	Yes	NULL
rid	int(11)	Yes	NULL
vid	int(11)	Yes	NULL
name	varchar(20)	Yes	NULL
vface	varchar(20)	Yes	NULL
dtime	timestamp	Yes	CURRENT_TIMESTAMP

Table structure for table fd_register

Field	Type	Null	Default
id	int(11)	Yes	NULL
name	varchar(20)	Yes	NULL
mobile	bigint(20)	Yes	NULL
detail	varchar(50)	Yes	NULL
email	varchar(40)	Yes	NULL
uname	varchar(20)	Yes	NULL
pass	varchar(20)	Yes	NULL
rdate	varchar(20)	Yes	NULL
fimg	varchar(30)	Yes	NULL
rid	int(11)	Yes	NULL
utype	varchar(20)	Yes	NULL
detect	int(11)	Yes	NULL
vface	varchar(20)	Yes	NULL
pin	varchar(20)	Yes	NULL

Table structure for table fd_temp

Field	Type	Null	Default
id	int(11)	Yes	NULL
vface	varchar(20)	Yes	NULL

4.5 Problem Description

Let's first clarify the distinction between 'smart' and 'traditional' locks. Most people are not used to the term 'traditional' locks - we simply call them 'locks', essentially referring to the average door lock that is non-automated and has to be manually engaged. You rotate the key and a deadbolt locks your door - easy! On the other hand, smart locks (in their simplest form) are automated versions of traditional locks or retrofitting accessories, which can be integrated into smart home systems. They too usually operate a traditional deadbolt - but the mechanism can be engaged and controlled remotely, which can bring many improvements to the overall home security experience. But there is a lack of issues in both traditional and smart lock systems such as fingerprint not access, forgot the key cards, security is low etc. So, to avoid the above issues this project proposes a facial recognition system for the door lock system.

Facial recognition used to be a futuristic idea. Today, however, use the face ID to access our smartphones and other smart devices every day. It's a secure and convenient form of access to our information. Now, face recognition is creating the same secure and convenient access to our physical spaces. Face recognition can now be used to provide access to buildings or home in a safe, touchless manner. The process flow is user or owner registered their faces in the system and user generate the pin by itself or by using automatic generate pin. Then the user adds the authorized users faces list in the system. If an unknown person or guest enters into the house the system captured that unknown person or guest face and sends an SMS Link to the owner to get approval to open the door, that SMS Link will have the captured unknown face and owner should enter the Pin and select the option of approve then only unknown person gets enter into the house. If the owner feels that the guest can enter into their house at any time so he can add his face to his authorized list. The system also gives history of people details or list who are all enter into that house

4.4. Block Description

1. Smart Door Access System Dashboard

A dashboard for background data management provides administrators at-a-glance information about building access by family members and friends can use. Individuals can be classified and graded into different categories and warning level in the facial information database, so customers can perform corresponding actions and processing after face recognition. For example, individuals can be classified into a whitelist, special list, temporary deployment and other warning targets. Customers can connect different systems such as door opening, door closing, and notification of security guards according to their needs.

Face Recognition in Access Control & Door Intercoms. To register, each individual to be added to the access system (eg. residents in an MDU/apartment building or multi-tenant office workers) requires an initial face scan or photograph of their face. The access control system uses AI algorithms to convert the image of the face into what is effectively a series of 'co-ordinates' - accurately pinpointing the distances between eyes, nose, mouth, ears, etc. - to create a unique identifying string of numbers which is stored in the system's database. In doing so, the access control system does not actually store an image/photograph of the individual's face stored as class label with encrypted format. A face recognition-based system will use access control end-points featuring integrated, web cameras which will provide a live face scan of the individual at the door or gate. To authenticate each individual's identity and, therefore, allow access, the system will accurately match the unique face 'co-ordinates' to those stored on the database.

2. Face Registration Module

2.1. Face Enrollment

This module begins by registering a few frontal face of family members, friends or other know person. These templates then become the reference for evaluating and registering the templates for the other poses: tilting up/down, moving closer/further, and turning left/right.

2.1.1. Face Image Acquisition

Cameras should be deployed in door to capture relevant video. Computer and camera are interfaced and here webcam is used.

2.1.1.1. Frame Extraction

Frames are extracted from video input. The video must be divided into sequence of images which are further processed. The speed at which a video must be divided into images depends on the implementation of individuals. From we can say that, mostly 20-30 frames are taken per second which are sent to the next phases.

2.1.2. Pre-processing

Object or Face Image pre-processing are the steps taken to format images before they are used by model training and inference. The steps to be taken are:

- Read image
- RGB to Grey Scale conversion
- Resize image

Original size (360, 480, 3) — (width, height, no. RGB channels)

Resized (220, 220, 3)

- Remove noise (Denoise)

smooth our image to remove unwanted noise. We do this using gaussian blur.

- Binarization

Image binarization is the process of taking a grayscale image and converting it to black-and-white, essentially reducing the information contained within the image from 256 shades of grey to 2: black and white, a binary image.

2.1.3. RNN Face Detection

Therefore, in this module, Region Proposal Network (RPN) generates RoIs by sliding windows on the feature map through anchors with different scales and different aspect ratios. Face detection and segmentation method based on improved RPN. RPN is used to generate RoIs, and RoI Align faithfully preserves the exact spatial locations. These are responsible for providing a predefined set of bounding boxes of different sizes and ratios that are going to be used for reference when first predicting object locations for the RPN.

2.1.4. Face Feature Extraction

After the face detection, face image is given as input to the feature extraction module to find the key features that will be used for classification. With each pose, the facial information including eyes, nose and mouth is automatically extracted and is then used to calculate the effects of the variation using its relation to the frontal face templates.

2.1.5. MRCNN Face Classification

Mask Region-based convolutional neural networks or regions with CNN features (MR-CNNs) are pioneering approaches that apply deep models to object detection. MR-CNN models first select several proposed regions from an image (for example, anchor boxes are one type of selection method) and then label their categories and bounding boxes (e.g., offsets). These labels are created based on predefined classes given to the program. They then use a convolutional neural network to perform forward computation to extract features from each proposed area. In MR-CNN, the inputted image is first divided into nearly two thousand region sections, and then a convolutional neural network is applied for each region, respectively. The size of the regions is calculated, and the correct region is inserted into the neural network. It can be inferred that a detailed method like that can produce time constraints. Training time is significantly greater compared to YOLO because it classifies and creates bounding boxes individually, and a neural network is applied to one region at a time. In 2015, Fast MR-CNN was developed with the intention to cut down significantly on train time. While the original MR-CNN independently computed the neural network features on each of as many as two thousand regions of interest, Fast MR-CNN runs the neural network once on the whole image. At the end of the network is a novel method known as Region of Interest (ROI) Pooling, which slices out each Region of Interest from the network's output tensor, reshapes, and classifies it. This makes MR-CNN more accurate than the original R-CNN. However, because of this recognition technique, fewer data inputs are required to train MR-CNN and R-CNN detectors.

2.2. Face Identification

After capturing the object or face image from the Smart Glass Camera, the image is given to face detection module. This module detects the image regions which are likely to be human. After the face detection using Region Proposal Network (RPN), face image is given as input to the feature extraction module to find the key features that will be used for classification. The module composes a very short feature vector that is well enough to represent the face image. Here, it is done with FRCNN with the help of a pattern classifier, the extracted features of face image are compared with the ones stored in the face database. The face image

is then classified as either known or unknown. If the image face is known, corresponding person is identified and proceed further.

3. Door Access

In this module the matching process is done with trained classified result and test Live Camera Captured Classified file. Hamming Distance is used to calculate the difference according to the result the door is open or generate face verification link and sent to the authorised person of the door access system for approval.

4. Surveillance System

If a visitor enters a prohibited area, the system will send a notification to the security guard. The fast and accurate facial image analysis engine can instantly differentiate family members, friends or other visitors and individuals in specific lists in the surveillance image and automatically provide notifications to authorized user. Our AI Security Solution also provides anti-trailing, intrusion detection and other functions to ensure asset protection and personnel safety.

5. Performance Analysis

In this module we able to find the performance of our system using SENSITIVITY, SPECIFICITY AND ACCURACY of Data in the datasets are divided into two classes not pedestrian (the negative class) and pedestrian (the positive class). Sensitivity, specificity, and accuracy are calculated using the True positive (TP), true negative (TN), false negative (FN), and false positive (FP). TP is the number of positive cases that are classified as positive. FP is the number of negative cases that are classified as positive. TN is the number of negative cases classified as negative and FN is the number of positive cases classified as negative.

$$\text{Sensitivity} = \frac{TP}{TP + FN}$$

$$\text{Specificity} = \frac{TN}{TN + FP}$$

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

CHAPTER 5

System Specification

5.1 Hardware specification

- Processors: Intel® Core™ i5 processor 4300M at 2.60 GHz or 2.59 GHz (1 socket, 2 cores, 2 threads per core), 8 GB of DRAM
- Disk space: 320 GB
- Operating systems: Windows® 10, macOS*, and Linux*

5.2 Software specification

- Server Side : Python 3.7.4(64-bit) or (32-bit)
- Client Side : HTML, CSS, Bootstrap
- IDE : Flask 1.1.1
- Back end : MySQL 5.
- Server : WampServer 2i
- OS : Windows 10 64 –bit or Ubuntu 18.04 LTS “Bionic Beaver”

CHAPTER 6

SOFTWARE DESCRIPTION

Python 3.7.4

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under the GNU General Public License (GPL). This tutorial gives enough understanding on Python programming language.

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages.

Python is a MUST for students and working professionals to become a great Software Engineer specially when they are working in Web Development Domain. I will list down some of the key advantages of learning Python:

Python is Interpreted – Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.

Python is Interactive – You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.

Python is Object-Oriented – Python supports Object-Oriented style or technique of programming that encapsulates code within objects.

Python is a Beginner's Language – Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

The Python Package Index (PyPI) hosts thousands of third-party modules for Python. Both Python's standard library and the community-contributed modules allow for endless possibilities.

The most basic use case for Python is as a scripting and automation language. Python isn't just a replacement for shell scripts or batch files; it is also used to automate interactions with web browsers or application GUIs or to do system provisioning and configuration in tools such as Ansible and Salt. But scripting and automation represent only the tip of the iceberg with Python.

General application programming with Python

You can create both command-line and cross-platform GUI applications with Python and deploy them as self-contained executables. Python doesn't have the native ability to generate a standalone binary from a script, but third-party packages like cx_Freeze and PyInstaller can be used to accomplish that.

Data science and machine learning with Python

Sophisticated data analysis has become one of fastest-moving areas of IT and one of Python's star use cases. The vast majority of the libraries used for data science or machine learning have Python interfaces, making the language the most popular high-level command interface to for machine learning libraries and other numerical algorithms.

Web services and RESTful APIs in Python

Python's native libraries and third-party web frameworks provide fast and convenient ways to create everything from simple REST APIs in a few lines of code to full-blown, data-driven sites. Python's latest versions have strong support for asynchronous operations, letting sites handle tens of thousands of requests per second with the right libraries.

Metaprogramming and code generation in Python

In Python, everything in the language is an object, including Python modules and libraries themselves. This lets Python work as a highly efficient code generator, making it possible to write applications that manipulate their own functions and have the kind of extensibility that would be difficult or impossible to pull off in other languages.

Python can also be used to drive code-generation systems, such as LLVM, to efficiently create code in other languages.

“Glue code” in Python

Python is often described as a “glue language,” meaning it can let disparate code (typically libraries with C language interfaces) interoperate. Its use in data science and machine learning is in this vein, but that's just one incarnation of the general idea. If you have applications or program domains that you would like to hitch, but cannot talk to each other directly, you can use Python to connect them.

Python 2 vs. Python 3

Python is available in two versions, which are different enough to trip up many new users. Python 2.x, the older “legacy” branch, will continue to be supported (that is, receive official updates) through 2020, and it might persist unofficially after that. Python 3.x, the current and future incarnation of the language, has many useful and important features not found in Python 2.x, such as new syntax features (e.g., the “walrus operator”), better concurrency controls, and a more efficient interpreter.

Python 3 adoption was slowed for the longest time by the relative lack of third-party library support. Many Python libraries supported only Python 2, making it difficult to switch. But over the last couple of years, the number of libraries supporting only Python 2 has dwindled; all of the most popular libraries are now compatible with both Python 2 and Python 3. Today, Python 3 is the best choice for new projects; there is no reason to pick Python 2 unless you have no choice. If you are stuck with Python 2, you have various strategies at your disposal.

Python’s libraries

The success of Python rests on a rich ecosystem of first- and third-party software. Python benefits from both a strong standard library and a generous assortment of easily obtained and readily used libraries from third-party developers. Python has been enriched by decades of expansion and contribution.

Python’s standard library provides modules for common programming tasks—math, string handling, file and directory access, networking, asynchronous operations, threading, multiprocessors management, and so on. But it also includes modules that manage common, high-level programming tasks needed by modern applications: reading and writing structured file formats like JSON and XML, manipulating compressed files, working with internet protocols and data formats (webpages, URLs, email). Most any external code that exposes a C-compatible foreign function interface can be accessed with Python’s ctypes module. The default Python distribution also provides a rudimentary, but useful, cross-platform GUI library via Tkinter, and an embedded copy of the SQLite 3 database. The thousands of third-party libraries, available through the Python Package Index (PyPI), constitute the strongest showcase for Python’s popularity and versatility.

For example:

The **Beautiful Soup** library provides an all-in-one toolbox for scraping HTML—even tricky, broken HTML—and extracting data from it. Requests makes working with HTTP requests at scale painless and simple. Frameworks like Flask and Django allow rapid development of web services that encompass both simple and advanced use cases. Multiple cloud services can be managed through Python’s object model using Apache Libcloud. NumPy, Pandas, and Matplotlib accelerate math and statistical operations, and make it easy to create visualizations of data.

Python’s compromises

Like C#, Java, and Go, Python has garbage-collected memory management, meaning the programmer doesn’t have to implement code to track and release objects. Normally, garbage collection happens automatically in the background, but if that poses a performance problem, you can trigger it manually or disable it entirely, or declare whole regions of objects exempt from garbage collection as a performance enhancement.

An important aspect of Python is its dynamism. Everything in the language, including functions and modules themselves, are handled as objects. This comes at the expense of speed (more on that later), but makes it far easier to write high-level code. Developers can perform complex object manipulations with only a few instructions, and even treat parts of an application as abstractions that can be altered if needed.

Python's use of significant whitespace has been cited as both one of Python's best and worst attributes. The indentation on the second line below isn't just for readability; it is part of Python's syntax. Python interpreters will reject programs that don't use proper indentation to indicate control flow. Syntactical white space might cause noses to wrinkle, and some people do reject Python for this reason. But strict indentation rules are far less obtrusive in practice than they might seem in theory, even with the most minimal of code editors, and the result is code that is cleaner and more readable. Another potential turnoff, especially for those coming from languages like C or Java, is how Python handles variable typing. By default, Python uses dynamic or "duck" typing—great for quick coding, but potentially problematic in large code bases. That said, Python has recently added support for optional compile-time type hinting, so projects that might benefit from static typing can use it.

What is MySQL? – An Introduction to Database Management Systems

Database Management is the most important part when you have humungous data around you. MySQL is one of the most famous Relational Database to store & handle your data. In this **What is MySQL** blog, you will be going through the following topics:

- What are Data & Database?
- Database Management System & Types of DBMS
- Structured Query Language (SQL)
- MySQL & its features
- MySQL Data Types

What are Data & Database?

Suppose a company needs to store the names of hundreds of employees working in the company in such a way that all the employees can be individually identified. Then, the company collects the **data** of all those employees. Now, when I say data, I mean that the company collects distinct pieces of information about an object. So, that object could be a real-world entity such as people, or any object such as a mouse, laptop etc.

Database Management System & Types of DBMS

A **Database Management System (DBMS)** is a software application that interacts with the user, applications and the database itself to capture and analyze data. The data stored in the database can be modified, retrieved and deleted, and can be of any type like strings, numbers, images etc.

Types of DBMS

There are mainly 4 types of DBMS, which are Hierarchical, Relational, Network, and Object-Oriented DBMS.

- **Hierarchical DBMS:** As the name suggests, this type of DBMS has a style of predecessor-successor type of relationship. So, it has a structure similar to that of a tree, wherein the nodes represent records and the branches of the tree represent fields.
- **Relational DBMS (RDBMS):** This type of DBMS, uses a structure that allows the users to identify and access data *in relation* to another piece of data in the database.
- **Network DBMS:** This type of DBMS supports many to many relations wherein multiple member records can be linked.
- **Object-oriented DBMS:** This type of DBMS uses small individual software called objects. Each object contains a piece of data, and the instructions for the actions to be done with the data.

Structured Query Language (SQL)

SQL is the core of a relational database which is used for accessing and managing the database. By using SQL, you can add, update or delete rows of data, retrieve subsets of information, modify databases and perform many actions. The different subsets of SQL are as follows:

- **DDL (Data Definition Language)** – It allows you to perform various operations on the database such as CREATE, ALTER and DELETE objects.
- **DML (Data Manipulation Language)** – It allows you to access and manipulate data. It helps you to insert, update, delete and retrieve data from the database.
- **DCL (Data Control Language)** – It allows you to control access to the database. Example – Grant or Revoke access permissions.
- **TCL (Transaction Control Language)** – It allows you to deal with the transaction of the database. Example – Commit, Rollback, save point, Set Transaction.

Using MySQL

Of course, there's not a lot of point to being able to change HTML output dynamically unless you also have a means to track the changes that users make as they use your website. In the early days of the Web, many sites used "flat" text files to store data such as usernames and passwords. But this approach could cause problems if the file wasn't correctly locked against corruption from multiple simultaneous accesses. Also, a flat file can get only so big before it becomes unwieldy to manage—not to mention the difficulty of trying to merge files and perform complex searches in any kind of reasonable time. That's where relational databases with structured querying become essential. And MySQL, being free to use and installed on vast numbers of Internet web servers, rises superbly to the occasion. It is a robust and exceptionally fast database management system that uses English-like commands. The highest level of MySQL structure is a database, within which you can have one or more tables that contain your data. For example, let's suppose you are working on a table called users, within which you have created columns for surname, first name, and email, and you now wish to add another user. One command that you might use to do this is: `INSERT INTO users VALUES ('Smith', 'John', 'jsmith@mysite.com');` Of course, as mentioned earlier, you will have issued other commands to create the database and table and to set up all the correct fields, but the INSERT command here shows how simple it can be to add new data to a database. The INSERT command is an example of SQL (which stands for Structured Query Language), a language designed in the early 1970s and

reminiscent of one of the oldest programming languages, COBOL. It is well suited, however, to database queries, which is why it is still in use after all this time. It's equally easy to look up data. Let's assume that you have an email address for a user and you need to look up that person's name. To do this, you could issue a MySQL query such as: `SELECT surname, first name FROM users WHERE email='jsmith@mysite.com';` MySQL will then return Smith, John and any other pairs of names that may be associated with that email address in the database. As you'd expect, there's quite a bit more that you can do with MySQL than just simple `INSERT` and `SELECT` commands. For example, you can join multiple tables according to various criteria, ask for results in a variety of different orders, make partial matches when you know only part of the string that you are searching for, return only the nth result, and a lot more. Using PHP, you can make all these calls directly to MySQL without having to run the MySQL program yourself or use its command-line interface. This means you can save the results in arrays for processing and perform multiple lookups, each dependent on the results returned from earlier ones, to drill right down to the item of data you need. For even more power, as you'll see later, there are additional functions built right into MySQL that you can call up for common operations and extra speed.

The Apache Web Server

In addition to PHP, MySQL, JavaScript, and CSS, there's actually a fifth hero in the dynamic Web: the web server. In the case of this book, that means the Apache web server. We've discussed a little of what a web server does during the HTTP server/client exchange, but it actually does much more behind the scenes. For example, Apache doesn't serve up just HTML files—it handles a wide range of files, from images and Flash files to MP3 audio files, RSS (Really Simple Syndication) feeds, and more. Each element a web client encounters in an HTML page is also requested from the server, which then serves it up. But these objects don't have to be static files, such as GIF images. They can all be generated by programs such as PHP scripts. That's right: PHP can even create images and other files for you, either on the fly or in advance to serve up later. To do this, you normally have modules either precompiled into Apache or PHP or called up at runtime. One such module is the GD library (short for Graphics Draw), which PHP uses to create and handle graphics.

Apache also supports a huge range of modules of its own. In addition to the PHP module, the most important for your purposes as a web programmer are the modules that handle security. Other examples are the Rewrite module, which enables the web server to handle a varying range of URL types and rewrite them to its own internal requirements, and the Proxy module, which you can use to serve up often-requested pages from a cache to ease the load on the server. Later in the book, you'll see how to actually use some of these modules to enhance the features provided by the core technologies we cover. About Open Source Whether or not being open source is the reason these technologies are so popular has often been debated, but PHP, MySQL, and Apache are the three most commonly used tools in their categories. What can be said, though, is that being open source means that they have been developed in the community by teams of programmers writing the features they themselves want and need, with the original code available for all to see and change. Bugs can be found and security breaches can be prevented before they happen. There's another benefit: all these programs are free to use. There's no worrying about having to purchase additional

licenses if you have to scale up your website and add more servers. And you don't need to check the budget before deciding whether to upgrade to the latest versions of these products.

What Is a WAMP, MAMP, or LAMP?

WAMP, MAMP, and LAMP are abbreviations for “Windows, Apache, MySQL, and PHP,” “Mac, Apache, MySQL, and PHP,” and “Linux, Apache, MySQL, and PHP,” ¹³ www.it-ebooks.info respectively. These abbreviations describe a fully functioning setup used for developing dynamic Internet web pages. WAMPs, MAMPs, and LAMPs come in the form of a package that binds the bundled programs together so that you don't have to install and set them up separately. This means you can simply download and install a single program and follow a few easy prompts to get your web development server up and running in the quickest time with the minimum hassle. During installation, several default settings are created for you. The security configurations of such an installation will not be as tight as on a production web server, because it is optimized for local use. For these reasons, you should never install such a setup as a production server. However, for developing and testing websites and applications, one of these installations should be entirely sufficient.

Using an IDE

As good as dedicated program editors can be for your programming productivity, their utility pales into insignificance when compared to Integrated Developing Environments (IDEs), which offer many additional features such as in-editor debugging and program testing, as well as function descriptions and much more.

Web Framework

Web Application Framework or simply Web Framework represents a collection of libraries and modules that enables a web application developer to write applications without having to bother about low-level details such as protocols, thread management etc.

Flask

Flask is a web framework. This means flask provides you with tools, libraries and technologies that allow you to build a web application. This web application can be some web pages, a blog, a wiki or go as big as a web-based calendar application or a commercial website.

Flask is often referred to as a micro framework. It aims to keep the core of an application simple yet extensible. Flask does not have built-in abstraction layer for database handling, nor does it have form a validation support. Instead, Flask supports the extensions to add such functionality to the application. Although Flask is rather young compared to most Python frameworks, it holds a great promise and has already gained popularity among Python web developers. Let's take a closer look into Flask, so-called “micro” framework for Python.

Flask was designed to be easy to use and extend. The idea behind Flask is to build a solid foundation for web applications of different complexity. From then on you are free to plug in any extensions you think you need. Also, you are free to build your own modules. Flask is great for all kinds of projects. It's especially good for prototyping.

Flask is part of the categories of the micro-framework. Micro-framework is normally framework with little to no dependencies to external libraries. This has pros and cons. Pros would be that the framework is light,

there are little dependency to update and watch for security bugs, cons is that some time you will have to do more work by yourself or increase yourself the list of dependencies by adding plugins. In the case of Flask, its dependencies are:

➤ **WSGI**

Web Server Gateway Interface (WSGI) has been adopted as a standard for Python web application development. WSGI is a specification for a universal interface between the web server and the web applications.

➤ **Werkzeug**

It is a WSGI toolkit, which implements requests, response objects, and other utility functions. This enables building a web framework on top of it. The Flask framework uses Werkzeug as one of its bases.

➤ **Jinja2**

Jinja2 is a popular templating engine for Python. A web templating system combines a template with a certain data source to render dynamic web pages.

- built-in development server and fast debugger
- integrated support for unit testing
- RESTful request dispatching
- Jinja2 templating
- support for secure cookies (client-side sessions)
- WSGI 1.0 compliant
- Unicode based

Plus, Flask gives you so much more **CONTROL** on the development stage of **your project**. It follows the principles of minimalism and lets you decide how you will build your application.

- Flask has a lightweight and modular design, so it easy to transform it to the web framework you need with a few extensions without weighing it down
- ORM-agnostic: you can plug in your favorite ORM.
- Basic foundation API is nicely shaped and coherent.
- Flask documentation is comprehensive, full of examples and well structured. You can even try out some sample application to really get a feel of Flask.
- It is super easy to deploy Flask in production (Flask is 100% WSGI 1.0 compliant”)
- HTTP request handling functionality
- High Flexibility

To sum up, Flask is one of the most polished and feature-rich micro frameworks available. Still young, Flask has a thriving community, first-class extensions, and an **elegant API**. Flask comes with all the benefits of fast templates, strong WSGI features, **thorough unit testability** at the web application and library level, **extensive documentation**. So next time you are starting a new project where you need some good features and a vast number of extensions, definitely check out Flask.

CHAPTER 7

TESTING

PROJECT TESTING AND IMPLEMENTATION

Software testing is a method of assessing the functionality of a software program. There are many different types of software testing but the two main categories are dynamic testing and static testing. Dynamic testing is an assessment that is conducted while the program is executed; static testing, on the other hand, is an examination of the program's code and associated documentation. Dynamic and static methods are often used together. Important aspect, of face recognition is the ability to recognise a single face, under relatively controlled conditions. The essence of such a system is the ability to reject unknown faces. Example applications include a security entry system with controlled lighting, in which a known position and orientation of the face, and a neutral expression, can be assumed; and a workstation security system that continually verifies that the user was the same person that logged on. Rejecting unknown faces is currently an elusive goal, yet it is vital to such high security applications.

All of the recognition results cited in the introduction were based on the closest match to a pool of faces. The results are therefore not even strictly recognition, but rather the selection, from a limited number of possibilities, of the most likely match, with no attempt at rejection if the match is bad. They first tightened the criterion for a matching face so much that only face images that were very similar to a pool faces were accepted and all others rejected. In this way, they were able to reject every distractor; however, despite the very standardised input images the system also rejected valid personnel. Their application however did not involve 'one-shot' recognition, and they worked with few hundred pictures of a subject, and accepted recognition if at least one of these cues matched a member of the pool. In their tests, they reported success with this method.

Result and Discussion

In this project, Mask-RCNN model not only realized the bounding box localization of the face target but also separated the face information from the background image by binary mask, so that more detailed face information could be obtained through the above process.

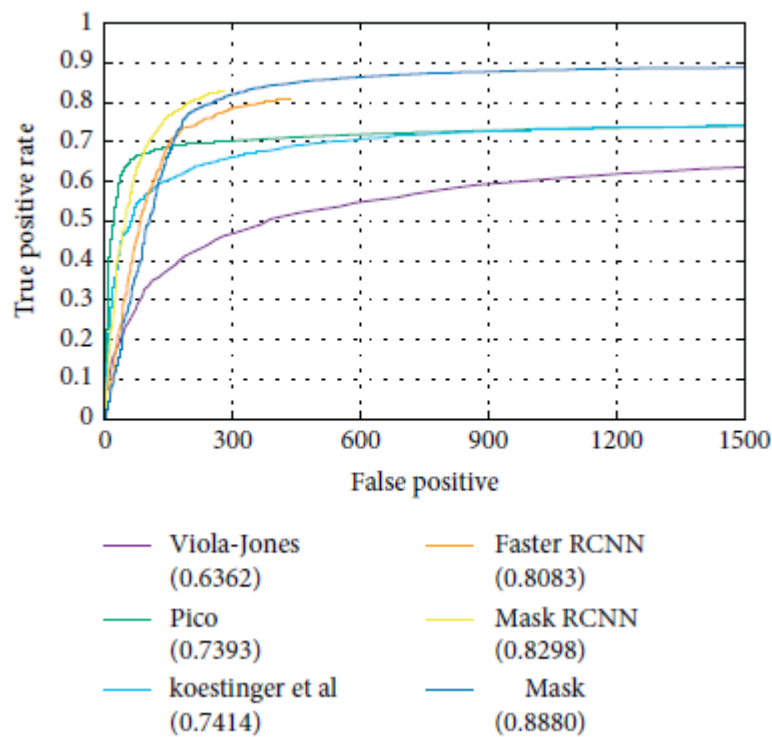


Figure 5.1. Comparison Chart

For effective comparison, the training data of the G-Mask, Mask R-CNN, and Faster R-CNN models are the same, which is the dataset constructed in this work. We compared the true positive rates at 1500 false positives, and the results are shown in Figure 5.1. It can be seen from Figure 5.1 that Mask RCNN performs better than Faster R-CNN when there are more than 160 false positives. When there are more than 280 false positives, the performance of Mask is better than that of Mask R-CNN. Furthermore, our method can achieve 88.80% true positive rate in 1500 false positives, which exceeded all the comparison methods. The comparison results of the Fddb dataset show that our proposed Mask CNN method has achieved promising results, demonstrating that our method can segment face information while detecting effectively.

CHAPTER 8

Conclusion

This paper presents a solution for Smart Home Security. Models for facial and speaker recognition have been proposed for user authentication. Mask- Region Convolutional neural network with Face Net based on one-shot learning is used for facial authentication-processing is done for the captured image of the user. Based on the features extracted, the minimum distance for facial recognition. Using these parameters, the user is classified as either a member in the database or unidentified. Apart from this, the model not only recognizes the identities of unmasked faces but also recognizes masked faces. For a masked user, their eye and nose region should be clearly visible. The proposed model reports a final accuracy of 82.71% for the entire Home Security system.

Future Enhancement

Facial recognition access control systems can also be integrated with other logistical and system platforms, such as time & attendance, automatic payment systems or building management systems, helping to develop smart building environments.

SCREENSHORT

Door Access

Home

Register

Family Head - Register

Name:

Mobile No.:

Email:

Username:

Password:

Submit

Facial Recognition

Home Door Access

Email: info@security.com

However, we use Face ID to access our Home Door by secure way.

Door Access

Home

Login

Register

Family Head - Register

Add Face Template

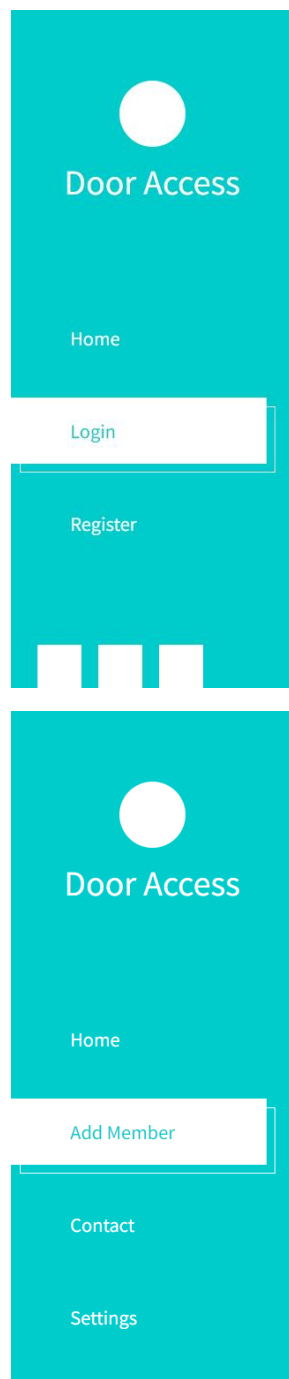
Facial Recognition

Home Door Access

Email: info@security.com

However, we use Face ID to access our Home Door by secure way.

Door Access



Login

Username

Password

Login



120 Lorem ipsum dolor sit amet,
consectetur adipiscing 10550

Tel: 060-070-0980

Email: info@company.com

Maecenas eu mi eu dui cursus
consequat non eu metus. Morbi ac
turpis eleifend, commodo purus
eget, commodo mauris.

Add Family Members

Submit

Categories


Visual Designs
Travel Events
Web Development
Video and Audio
Etiam auctor ac arcu
Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra
scelerisque a sit






Door Access

[Home](#)

[Add Member](#)

[Contact](#)

[Settings](#)



Door Access

[Home](#)

[Add Member](#)

[Settings](#)

[Door Access History](#)

Family Members



Vijay

(Family Head)
Mobile No.: 9524331890
Detail: Admin
Add Face 10-12-2021



Santhosh

(2.Family Member)
Mobile No.: 8940228614
Detail: Brother
Add Face 10-12-2021

PIN Setting

[Add New PIN](#)
[Generate New PIN](#)

Your PIN : 3809

Categories

Visual Designs
Travel Events
Web Development
Video and Audio
Etiam auctor ac arcu
Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra
scelerisque a sit



Categories


Visual Designs
Travel Events
Web Development
Video and Audio
Etiam auctor ac arcu
Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra
scelerisque a sit





Door Access





[Home](#)

[Add Member](#)

[Settings](#)

[Door Access History](#)

Door Access History

	2021-12-11 13:40:28
Vijay	
	2021-12-11 13:39:12
Vijay	
	2021-12-11 13:32:58
Unknown	
	2021-12-11 13:31:33

Categories

[Visual Designs](#)
[Travel Events](#)
[Web Development](#)
[Video and Audio](#)
[Etiam auctor ac arcu](#)
[Sed im justo diam](#)


Related Posts

 [Image](#)

Duis mollis diam nec ex viverra
scelerisque a sit

 [Image](#)





Door Access

[Home](#)

[Login](#)

[Register](#)



Face Verification

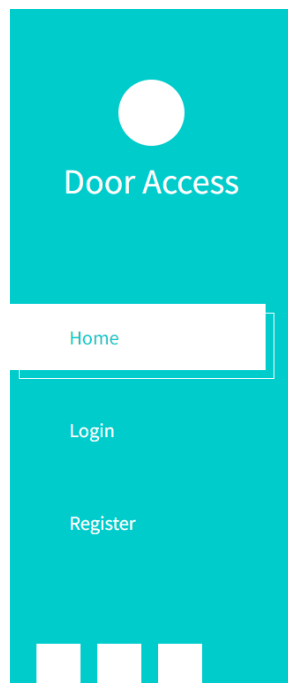
Home Door

How can you apply Xtra Blog

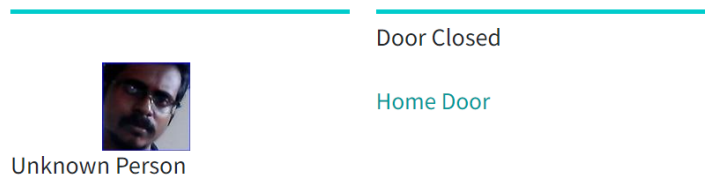
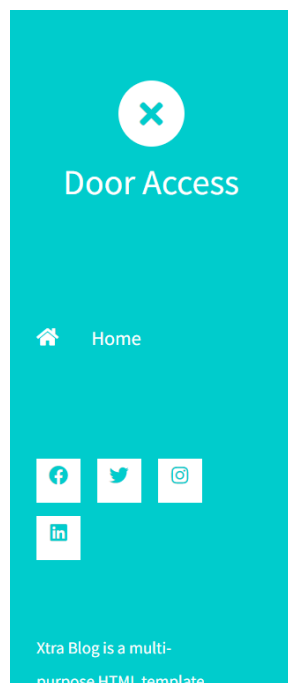
You are allowed to convert this template as any

A little restriction to apply

You are not allowed to re-distribute this



Verification in Link



How can you apply Xtra Blog

Door Closed

Home Door

You are allowed to convert this template as any

You are not allowed to re-distribute this



Verification



Open

Block


Categories

Visual Designs
Travel Events
Web Development
Video and Audio
Etiam auctor ac arcu
Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra
scelerisque a sit




Door Access

[Home](#)

[Login](#)

[Register](#)




Door Access

[Home](#)




[Login](#)


[Register](#)




Door Access

[Home](#)



Xtra Blog is a multi-purpose HTML template



Unknown Person
Door Open

Door Opened


Home Door

How can you apply Xtra Blog

You are allowed to convert this template as any

A little restriction to apply

You are not allowed to re-distribute this



Welcome Vijay
Door Open
Done!!!

Door Opened

Home Door


How can you apply Xtra Blog

You are allowed to convert this template as any

A little restriction to apply

You are not allowed to re-distribute this


Verification



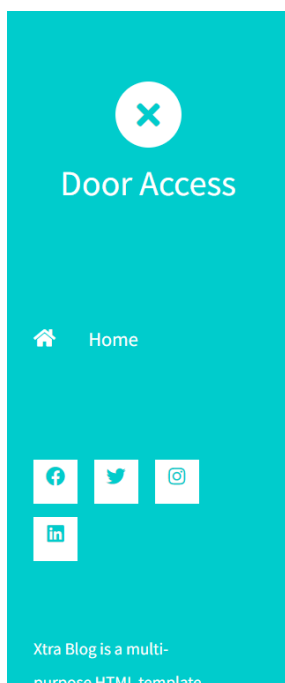
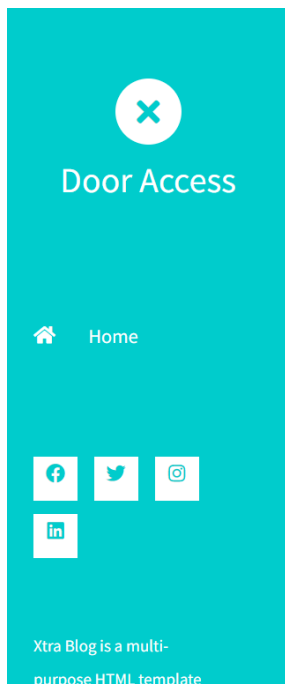
Categories

- Visual Designs
- Travel Events
- Web Development
- Video and Audio
- Etiam auctor ac arcu
- Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra scelerisque a sit



Verification



Open

Block

Enter the PIN

Submit

Are you save this person details for future purpose?

Yes

No

Verification



Open

Block

Raj

8870989296

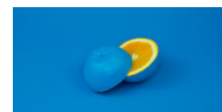
Brother

Save

Categories

Visual Designs
Travel Events
Web Development
Video and Audio
Etiam auctor ac arcu
Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra
scelerisque a sit

Categories

Visual Designs
Travel Events
Web Development
Video and Audio
Etiam auctor ac arcu
Sed im justo diam

Related Posts



Duis mollis diam nec ex viverra
scelerisque a sit

CODING

Training

```

from flask import Flask
from flask import Flask, render_template, Response, redirect, request, session, abort, url_for
from camera import VideoCamera
def get_frame(self):
    success, image = self.video.read()
    #self.out.write(image)
    face_cascade = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
    # Read the frame
    #_, img = cap.read()
    # Convert to grayscale
    gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
    # Detect the faces
    faces = face_cascade.detectMultiScale(gray, 1.1, 4)
    # Draw the rectangle around each face
    j = 1
    for (x, y, w, h) in faces:
        mm=cv2.rectangle(image, (x, y), (x+w, y+h), (255, 0, 0), 2)
        cv2.imwrite("myface.jpg", mm)
        image = cv2.imread("myface.jpg")
        cropped = image[y:y+h, x:x+w]
        gg="f"+str(j)+".jpg"
        cv2.imwrite("faces/"+gg, cropped)
        ###
        self.k+=1
        fnn=uu+"_"+str(self.k)+".jpg"

        ff2=open("det.txt","w")
        ff2.write(str(self.k))
        ff2.close()
        if uu1=="2":
            cv2.imwrite("static/frame/"+fnn, cropped)
        if uu1=="3":
            cv2.imwrite("static/temp/"+fnn, cropped)
        mm2 = PIL.Image.open('faces/'+gg)
        rz = mm2.resize((100,100), PIL.Image.ANTIALIAS)
        rz.save('faces/'+gg)
        j += 1
    for rs in dt:
        ##Preprocess
        path="static/frame/"+rs[2]
        path2="static/process1/"+rs[2]
        mm2 = PIL.Image.open(path).convert('L')
        rz = mm2.resize((200,200), PIL.Image.ANTIALIAS)
        rz.save(path2)

        ""img = cv2.imread(path2)
        dst = cv2.fastNlMeansDenoisingColored(img, None, 10, 10, 7, 15)
        path3="static/process2/"+rs[2]
        cv2.imwrite(path3, dst)
        img = cv2.imread(path2)
        gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
        ret, thresh = cv2.threshold(gray,0,255,cv2.THRESH_BINARY_INV+cv2.THRESH_OTSU)

        # noise removal

```

```

kernel = np.ones((3,3),np.uint8)
opening = cv2.morphologyEx(thresh,cv2.MORPH_OPEN,kernel, iterations = 2)

# sure background area
sure_bg = cv2.dilate(opening,kernel,iterations=3)

# Finding sure foreground area
dist_transform = cv2.distanceTransform(opening,cv2.DIST_L2,5)
ret, sure_fg = cv2.threshold(dist_transform,0.7*dist_transform.max(),255,0)

# Finding unknown region
sure_fg = np.uint8(sure_fg)
segment = cv2.subtract(sure_bg,sure_fg)
img = Image.fromarray(segment)
segment = Image.fromarray(segment)
path3="static/process2/"+rs[2]
segment.save(path3)

image = cv2.imread(path2)
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
edged = cv2.Canny(gray, 50, 100)
image = Image.fromarray(image)
edged = Image.fromarray(edged)
path4="static/process3/"+rs[2]
edged.save(path4)
##
###Segmentation using RNN
def crfrnn_segmenter(model_def_file, model_file, gpu_device, inputs):

    assert os.path.isfile(model_def_file), "File {} is missing".format(model_def_file)
    assert os.path.isfile(model_file), ("File {} is missing. Please download it using "
                                         "./download_trained_model.sh").format(model_file)

    if gpu_device >= 0:
        caffe.set_device(gpu_device)
        caffe.set_mode_gpu()
    else:
        caffe.set_mode_cpu()

    net = caffe.Net(model_def_file, model_file, caffe.TEST)

    num_images = len(inputs)
    num_channels = inputs[0].shape[2]
    assert num_channels == 3, "Unexpected channel count. A 3-channel RGB image is expected."

    caffe_in = np.zeros((num_images, num_channels, _MAX_DIM, _MAX_DIM), dtype=np.float32)
    for ix, in_ in enumerate(inputs):
        caffe_in[ix] = in_.transpose((2, 0, 1))

    start_time = time.time()
    out = net.forward_all(**{net.inputs[0]: caffe_in})
    end_time = time.time()

    print("Time taken to run the network: {:.4f} seconds".format(end_time - start_time))
    predictions = out[net.outputs[0]]

    return predictions[0].argmax(axis=0).astype(np.uint8)

```

```

def run_crfrnn(input_file, output_file, gpu_device):
    """ Runs the CRF-RNN segmentation on the given RGB image and saves the segmentation mask.
    Args:
        input_file: Input RGB image file (e.g. in JPEG format)
        output_file: Path to save the resulting segmentation in PNG format
        gpu_device: ID of the GPU device. If using the CPU, set this to -1
    """

    input_image = 255 * caffe.io.load_image(input_file)
    input_image = resize_image(input_image)

    image = PILImage.fromarray(np.uint8(input_image))
    image = np.array(image)

    palette = get_palette(256)
    #PIL reads image in the form of RGB, while cv2 reads image in the form of BGR, mean_vec = [R,G,B]
    mean_vec = np.array([123.68, 116.779, 103.939], dtype=np.float32)
    mean_vec = mean_vec.reshape(1, 1, 3)

    # Rearrange channels to form BGR
    im = image[:, :, ::-1]
    # Subtract mean
    im = im - mean_vec

    # Pad as necessary
    cur_h, cur_w, cur_c = im.shape
    pad_h = _MAX_DIM - cur_h
    pad_w = _MAX_DIM - cur_w
    im = np.pad(im, pad_width=((0, pad_h), (0, pad_w), (0, 0)), mode='constant', constant_values=0)

    # Get predictions
    segmentation = crfrnn_segmenter(_MODEL_DEF_FILE, _MODEL_FILE, gpu_device, [im])
    segmentation = segmentation[0:cur_h, 0:cur_w]

    output_im = PILImage.fromarray(segmentation)
    output_im.putpalette(palette)
    output_im.save(output_file)
    ###Feature extraction & Classification
    def DCNN_process(self):

        train_data_preprocess = ImageDataGenerator(
            rescale = 1./255,
            shear_range = 0.2,
            zoom_range = 0.2,
            horizontal_flip = True)

        test_data_preprocess = (1./255)

        train = train_data_preprocess.flow_from_directory(
            'dataset/training',
            target_size = (128,128),
            batch_size = 32,
            class_mode = 'binary')

```

Testing

```

test = train_data_preprocess.flow_from_directory(
    'dataset/test',
    target_size = (128,128),
    batch_size = 32,
    class_mode = 'binary')

## Initialize the Convolutional Neural Net

# Initialising the CNN
cnn = Sequential()

# Step 1 - Convolution
# Step 2 - Pooling
cnn.add(Conv2D(32, (3, 3), input_shape = (128, 128, 3), activation = 'relu'))
cnn.add(MaxPooling2D(pool_size = (2, 2)))

# Adding a second convolutional layer
cnn.add(Conv2D(32, (3, 3), activation = 'relu'))
cnn.add(MaxPooling2D(pool_size = (2, 2)))

# Step 3 - Flattening
cnn.add(Flatten())

# Step 4 - Full connection
cnn.add(Dense(units = 128, activation = 'relu'))
cnn.add(Dense(units = 1, activation = 'sigmoid'))

# Compiling the CNN
cnn.compile(optimizer = 'adam', loss = 'binary_crossentropy', metrics = ['accuracy'])

history = cnn.fit_generator(train,
    steps_per_epoch = 250,
    epochs = 25,
    validation_data = test,
    validation_steps = 2000)

plt.plot(history.history['acc'])
plt.plot(history.history['val_acc'])
plt.title('Model Accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()

plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('Model Loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()

test_image = image.load_img('\\dataset\\', target_size=(128,128))
test_image = image.img_to_array(test_image)
test_image = np.expand_dims(test_image, axis=0)
result = cnn.predict(test_image)

```



```

print(result)

if result[0][0] == 1:
    print('feature extracted and classified')
else:
    print('none')

```

DATABASE:FACE DOOR OPEN

Table structure for table fd_face

Field	Type	Null	Default
id	int(11)	Yes	NULL
vid	int(11)	Yes	NULL
vface	varchar(30)	Yes	NULL

Table structure for table fd_history

Field	Type	Null	Default
id	int(11)	Yes	NULL
rid	int(11)	Yes	NULL
vid	int(11)	Yes	NULL
name	varchar(20)	Yes	NULL
vface	varchar(20)	Yes	NULL
dtime	timestamp	Yes	CURRENT_TIMESTAMP

Table structure for table fd_register

Field	Type	Null	Default
id	int(11)	Yes	NULL
name	varchar(20)	Yes	NULL
mobile	bigint(20)	Yes	NULL
detail	varchar(50)	Yes	NULL
email	varchar(40)	Yes	NULL
uname	varchar(20)	Yes	NULL
pass	varchar(20)	Yes	NULL
rdate	varchar(20)	Yes	NULL

fimg	varchar(30)	Yes	NULL
rid	int(11)	Yes	NULL
utype	varchar(20)	Yes	NULL
detect	int(11)	Yes	NULL
vface	varchar(20)	Yes	NULL
pin	varchar(20)	Yes	NULL

Table structure for table fd_temp

Field	Type	Null	Default
id	int(11)	Yes	NULL
vface	varchar(20)	Yes	NULL

CHAPTER 9

REFERENCES

1. B. Septian, A. Wijayanto, F. Utaminingrum, and I. Arwani, "Face Recognition Untuk Sistem Pengaman Rumah Menggunakan Metode HOG dan KNN Berbasis Embedded," Pengemb. Teknol. Inf. dan Ilmu Komput., vol. 3, no. 3, pp. 2774–2781, 2019.
2. R. A. Isaac, A. Agarwal, and P. Singh, "Face Recognition Security Module using Deep Learning," J. Netw. Commun. Emerg. Technol., vol. 8, no. 10, pp. 10–13, 2018.
3. J. Nasir and A. A. Ramli, "Design of Door Security System Based on Face Recognition with Arduino," vol. 3, no. 1, pp. 127–131, 2019.
4. F. Faisal and S. A. Hossain, "Smart security system using face recognition on raspberry Pi," 2019 13th Int. Conf. Software, Knowledge, Inf. Manag. Appl. Ski. 2019, no. August, 2019.
5. M. F. A. Hassan, A. Hussain, M. H. Muhamad, and Y. Yusof, "Convolution neural network-based action recognition for fall event detection," Int. J. Adv. Trends Comput. Sci. Eng., vol. 8, no. 1.6 Special Issue, 2019.
6. A. R. Syafeeza, M. K. Mohd Fitri Alif, Y. Nursyifaa Athirah, A. S. Jaafar, A. H. Norihan, and M. S. Saleha, "IoT based facial recognition door access control home security system using raspberry pi," Int. J. Power Electron. Drive Syst., vol. 11, no. 1, pp. 417–424, 2020.
7. Meera Mathew, Divya R S, "Survey on Various Door Lock Access Control Mechanisms," International Conference on circuits Power and Computing Technologies (ICCPCT), pp.1-3, 2017. DOI: 10.1109/ICCPCT.2017.8074187
8. Pradnya R. Nehete, J. P. Chaudhari, et al., "Literature survey on door lock security systems," International Journal of Computer Applications, Vol.153, No.2, pp.13-18, 2016. DOI: 10.5120/ijca2016911971

9. Neelam Majgaonkar, Ruhina Hodekar, et al., "Automatic Door Locking System," International Journal of Engineering Development and Research, Vol.4, No.1, 2016.
10. Madhusudhan M and Shankaraiah, "Implementation of automated door unlocking and security system," International Journal of Computer Applications, pp. 5-8, 2015.
11. Hteik Htar Lwin, Aung Soe Khaing, Hla Myo Tun, "Automatic Door Access System Using Face Recognition," International Journal Of Scientific Technology Research, Vol.4, No.6, 2015.
12. Anuradha R.S, Bharathi R, et al., "Optimized Door Locking and Unlocking Using IoT for Physically Challenged People," International Journal of Innovative Research in Computer and Communication Engineering, Vol.4, No.3, 2016. DOI: 10.15680/IJIRCCE.2016. 0403120
13. Chi-Huang Hung, Ying-Wen Bai, Je-Hong Ren, "Design and Implementation of a Door Lock Control Based on a Near Field Communication of a Smartphone," IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW), 2015. DOI: 10.1109/ICCE-TW.2015.7216992
14. Am-Suk Oh, "A Study on Automatic Doorway Access Control System Including Server Based On Bluetooth Local Communication," International Journal of Control and Automation Vol.8, No.11, 2015. DOI: 10.14257/ijca.2015.8.11.07
15. IEEE Standards, IEEE 802.15.7-2011. "IEEE Standard for Local and Metropolitan Area Networks-Part 15.7: Short- Range Wireless Optical Communication Using Visible Light," September 2011 [Online]. Available: https://standards.ieee.org/standard/802_15_7-2011.html. DOI: 10.1109/IEEESTD.2011.6016195
16. IEEE Standards, IEEE 802.15.7-2018. "IEEE Standard for Local and metropolitan area networks--Part 15.7: Short- Range Optical Wireless Communications," April. 2019 [Online]. Available: <https://ieeexplore.ieee.org/servlet/opac?punumber=8697196>. DOI: 10.1109/IEEESTD.2019.8697198
17. Jaesang Cha, Minwoo Lee, Vinayagam Mariappan, "VTASC - Light based Flexible Multi-Dimensional Modulation Technique for OWC," IEEE COMSOC MMTC Communications - Frontiers, Vol.13, No. 2, pp.39-43, 2018.
18. Jaesang Cha, Vinayagam Mariappan, Sukyoung Han, Minwoo Lee, "Smartphone Color-Code based Gate Security Control," International Journal of Advanced Smart Convergence, Vol.5, No. 3, pp.66-71, 2016. DOI: 10.7236/IJASC.2016.5.3.66
19. He, K., Zhang, X., Ren, S., Sun, J., "Deep residual learning for image recognition," In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pp. 770-778, 2016. DOI 10.1109/CVPR.2016.90
20. Sutskever, I., Vinyals, O., et al., "Sequence to sequence learning with neural networks," In Proceedings of the 27th International Conference on Neural Information Processing Systems, pp.3104-3112, 2014.