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KNOWN AND UNKNOWN FACE SMART HOME DOOR LOCK SYSTEM USING AI AND EDGE COMPUTING

K. PRIYANKA[1], S. ABIRAMI[2], P.AKILA[3], S.MALA[4], G.NIVETHA[5]

Assistant Professor Department of Computer Science and Engineering, Sri Bharathi Engineering College for Women, Pudukkottai.

Department of Computer Science and Engineering, Sri Bharathi Engineering College for Women, Pudukkottai.

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 embedded from 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.

Keywords: open smart door ,unknown person identification, send to SMS authorized person.

I. INTRODUCTION

Locks have been around for thousands of years. 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.
We were all familiar with traditional door locks on our front door.

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.

II. LITERATURE REVIEW

Literature survey is the most important step in software development process before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool programmers need lot of external support. This support can be obtained from senior programmers,

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from book or from websites. Before building the system above consideration are taken into account for developing the proposed system.

The major part of the project development sector considers and fully survey all the required needs for developing the project. For every project literature survey is the most important sector in software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy and company strength. Once this things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system he project would required and what are all the necessary software are need to proceed with the next step such as developing the tools, and the associated operations.

III. MATERIALS AND METHODS

A use case diagram is a graphical depiction of a user's possible interactions with a system. A use case diagram shows various use cases and different type of users the system has and will often be accompanied by other type of diagrams as well.

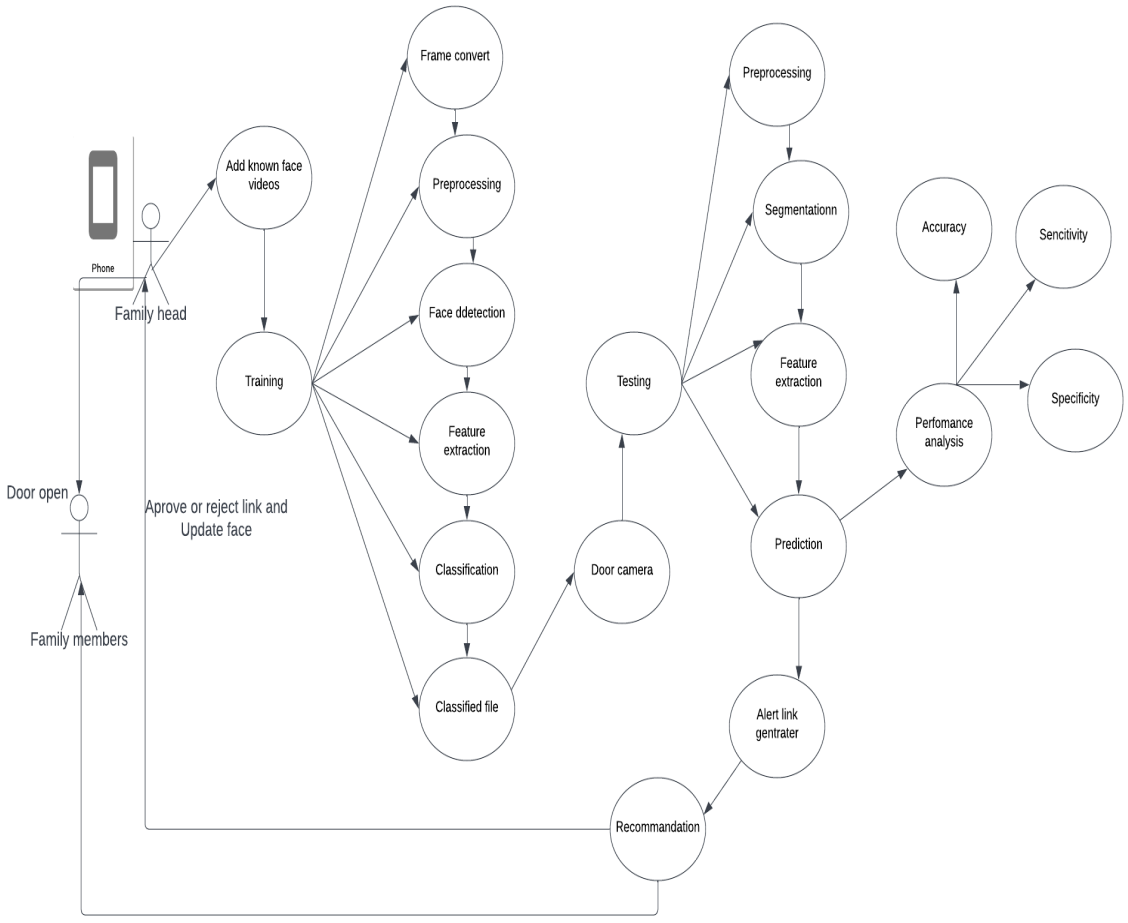

Figure 1: use case

IV. METHODOLOGY

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, wherein the system will send an SMS link to the owner of the system.

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A. architecture diagram

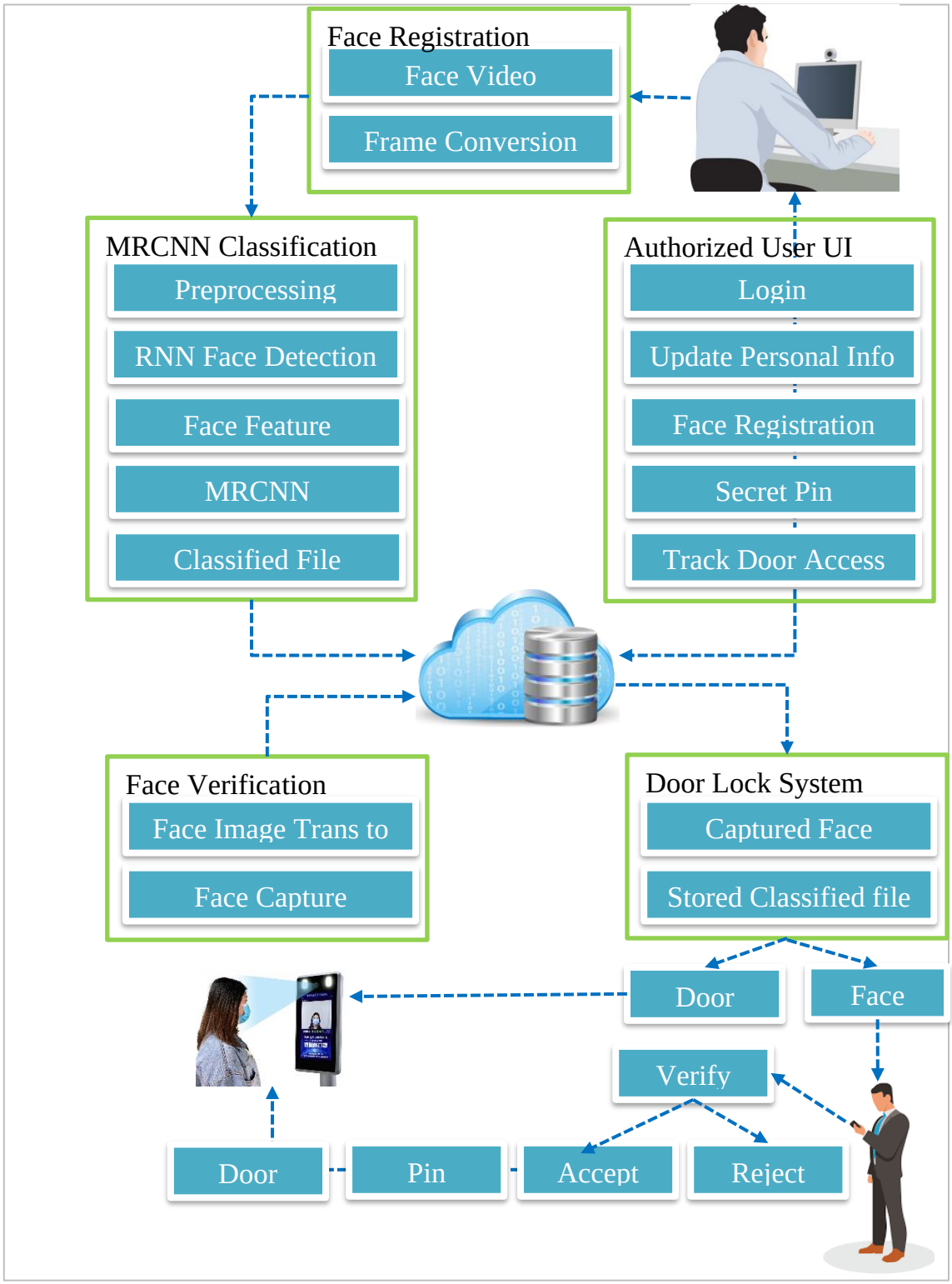

Figure 2: architecture diagram

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B.**CLASS DIAGRAM**

It is used for general conceptual modelling of the structure of the application, and for detailed modelling, translating the models into programming code .

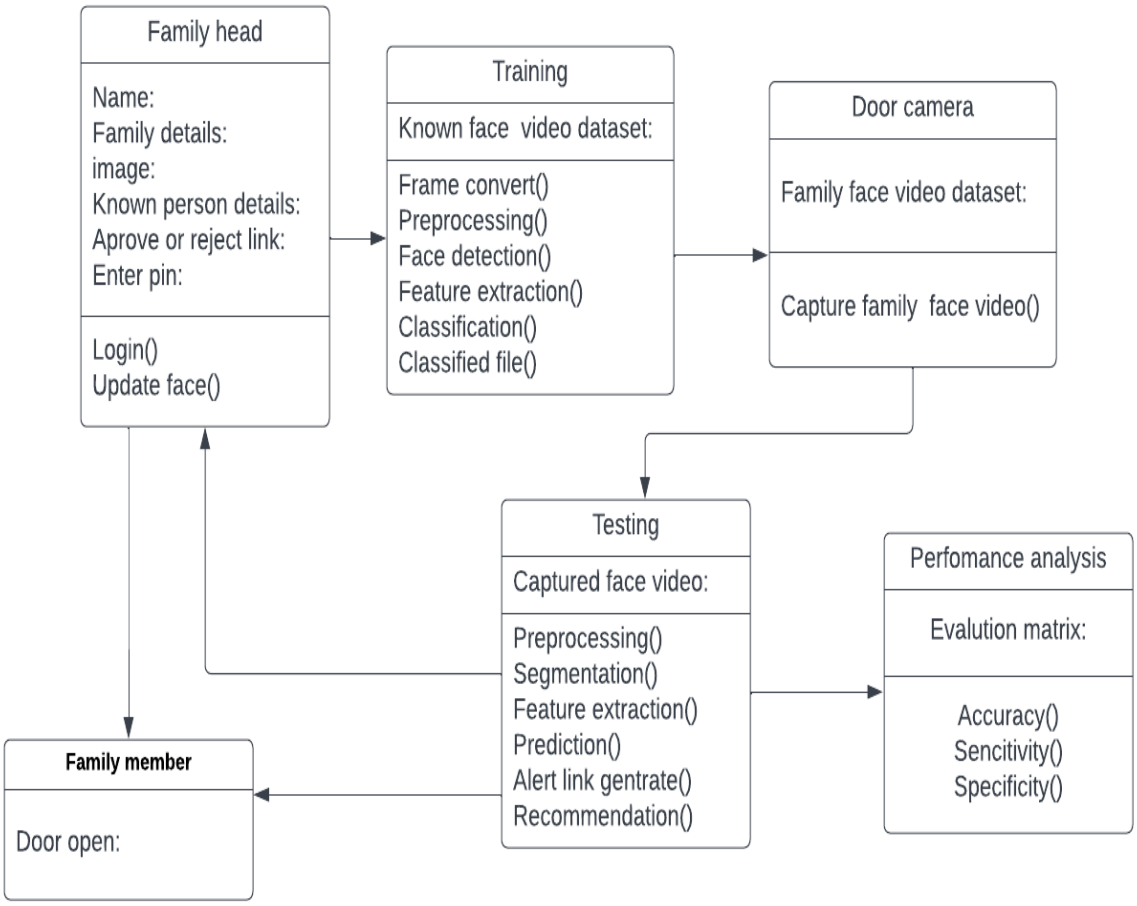

Figure 3: class diagram

✓ Face registration module: This module begins by registering a few frontal face of family members, friends or other know person.

✓ Face identification module: After capturing the object or face image from the Smart Glass Camera, the image is given to face detection module.

✓ Door access: In this module the matching process is done with trained classified result and test Live Camera Captured Classified file.

✓ Surveillance system: If a visitor enters a prohibited area, the system will send a notification to the security guard.

✓ 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

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C. Implementation

I]. Input design:

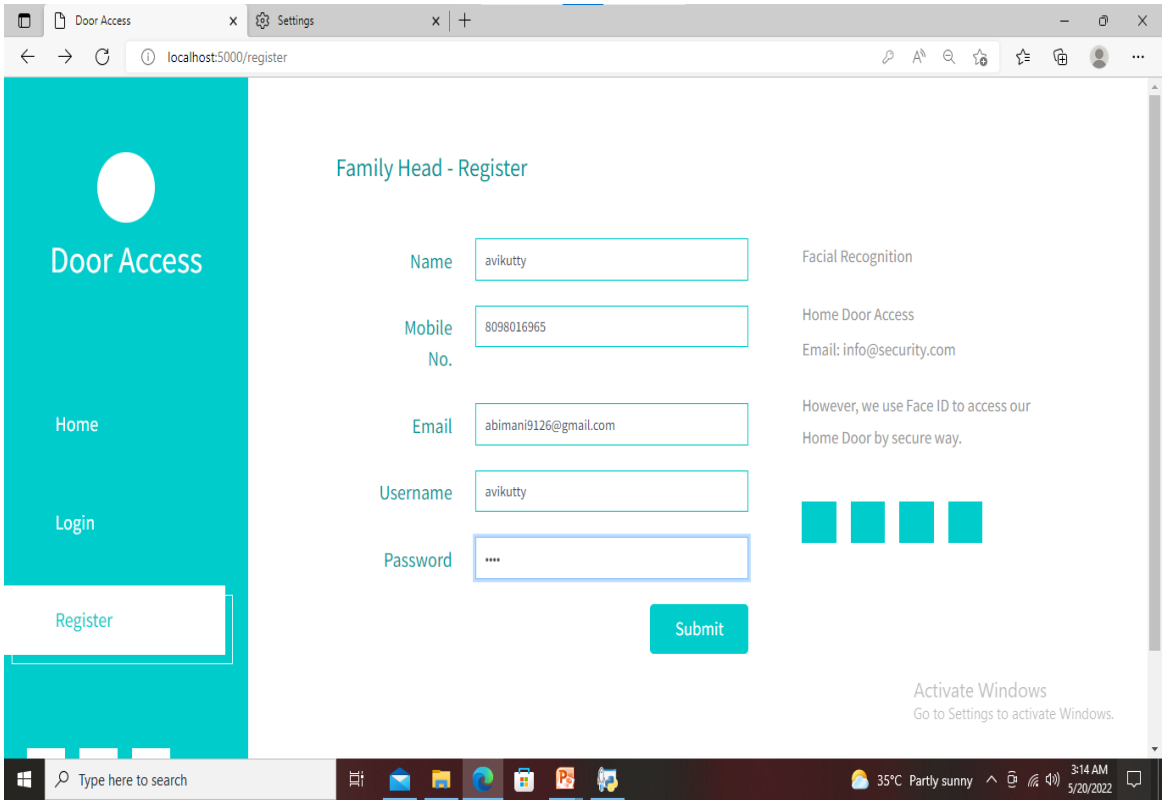

Figure 4: Login Family Head Details

The 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.

```
from flask import Flask
from flask import Flask, render template, Response, redirect, request, session, abort, url_for
from camera import Video Camera
defget_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]
```

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```
gg="f"+str(j)+".jpg"
cv2.imwrite("faces/"+gg, cropped
        ###
self.k+=1
fnn=uu+"_"+str(self.k)+".jpg"
```

Figure 5: coding

II]. Output:

The output design describes the 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.

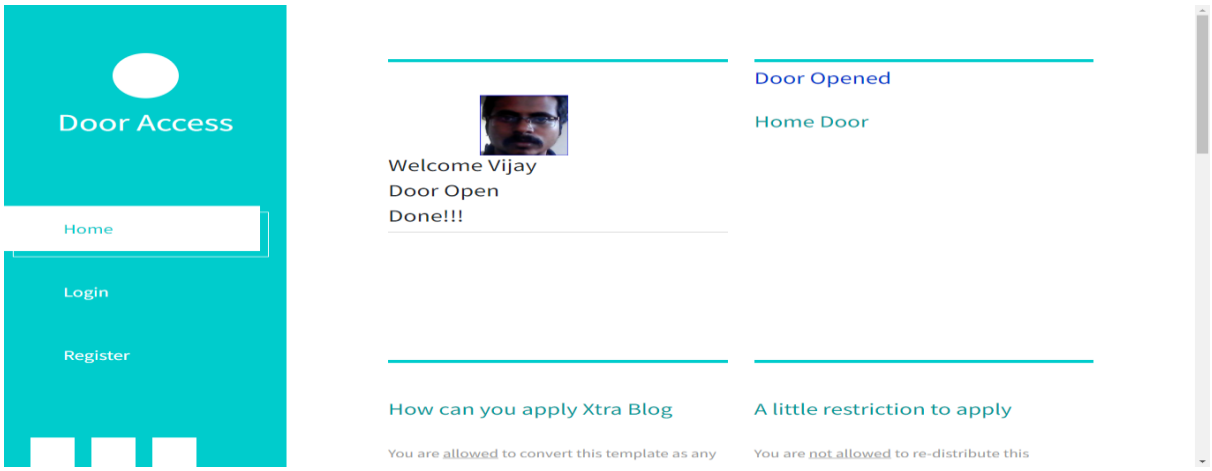

Figure 6: Verification Link Send To SMS

V. RESULTS

A.Pseudo Code/Sequence of Micro Operation/Flowcharts

```
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'))
```

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```
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')
```

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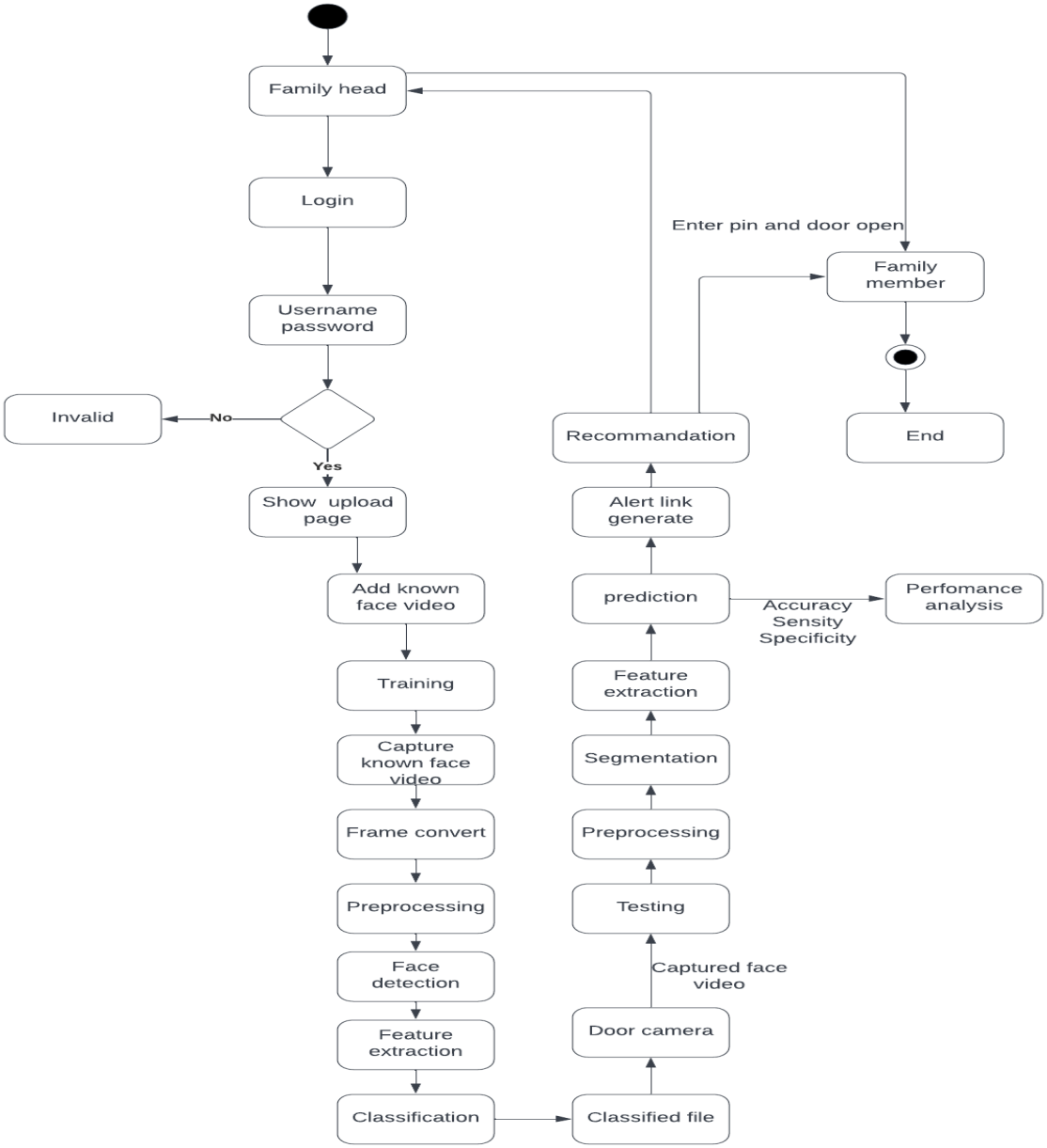

Figure 7: Flow Chart

B. Development Process for the Procurement 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.

VI 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

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recognizes masked faces. For a masked user, their eye and nose region should be clearly visible. The proposed model reports a final ac- curacy of 82.71% for the entire Home Security system.

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