

Railway Access Control System using Face Recognition

Veena Devi Shastrimath V., Ashwini, Andrea Olivero, Deepa Bhat

Abstract: Nowadays booking tickets and getting inside a railway station is a difficult task. Manual checking becomes a burden and time consuming. Also as everything is getting digitized in this modern world introduce face recognition and Quick Response (QR) code system for entry helps in passenger convenience. Face recognition is a method of identifying or verifying the identity of an individual using their face. Face recognition systems can be used to identify people in photos, video, or in real-time. So this system focuses on passengers' convenience through allowing them to book tickets online and by introducing face recognition system and QR code system for entry to a railway station. This system helps in identifying people who try to travel without buying tickets and also helps to apprehend the blacklisted person which increases security in the railway station. Online booking is one of the convenient ways to book the ticket. This system also provides the convenience to passenger by issuing the digital ticket in the form of QR code thus avoiding any fuss due to the loss of the physical ticket.

Keywords: Entry Control System, Face Detection, Face Recognition, User Interface.

I. INTRODUCTION

Face recognition which is a combination of machine learning and the biometric techniques which holds the qualities of both high precision and the reliability [1], [2]. This system can be used for automatically detecting the human's face from the database. In recent years Computer Vision has been widely used in the applications such as surveillance camera, 3D structure, robotics etc. This technology is used for authentication, validation, authorization, and identification. In developed countries, the database of those with suspicious act is stored by the government which is helpful to recognize the person in real-time. As there is an increase in the criminal or terrorist activities in the country, providing security in public places by blocking the blacklisted people is a difficult task. Hence designing a system which allows those who have the ticket and are not criminals to go inside the railway station just using facial recognition is necessary.

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II. LITERATURE SURVEY

Face recognition system consists of three main phases which are face detection [3], feature extraction and face recognition. From the face, we are extracting the features through CNN algorithm [4]. The algorithm CNN is used for Near-infrared (NIR) face recognition [5]. The CNN was proposed by LeCun. CNN is used to automatically learn the features from the raw images and provide partial invariance to illumination, deformation and scale. The experimental results have shown a higher recognition rate when compared to the other traditional recognition methods, such as Zernike Moments and Hermite Kernels (ZMHK) and Gabor-Directional Binary Code (GDBC). CNN has been used in the field of computer vision, language processing and speech recognition. CNN consists of two components, they are: convolution and pooling units. Specifically, the convolutional layers are used to extract features and to reduce network complexity. The pooling layers make the learned feature invariance to the geometrical shift and distortion. QR code image stores more information compared to traditional barcode. The QR code is printed on a white background consisting of black modules arranged in a square pattern. The QR code image represented by matrix has large capacity, large density of information, high stability and is more secret than one-dimensional barcode. Each QR code is composed of coding region and many functional graphs. These squares consist of calibration graph, location graph and seeking graph, etc [6].

III. METHODOLOGY

In this project, the entry camera will detect the QR code and face, which will be sent to the Nvidia Jetson Nano. When the passenger enters the Railway station, the system will ask for QR code and the passenger details will be verified. If the QR code is validated then the face is scanned, which will be used to grant access to the passenger. If the QR code is verified but the system is not able to recognize face then manual intervention is required to validate the passenger.

The face in the image is detected by the CNN, which generates 128d real valued number vector [7]. This embedding will be further used for face recognition. This computation and the controlling will be done by the Nvidia Jetson, which is a computer capable of processing graphics by using its dedicated Graphics Processing Unit (GPU). If the passenger is granted access, it displays on the screen and a beep is triggered for 2 seconds.



If the passenger is a blacklisted person then he will not be allowed inside. This will be done by blocking the person based on Aadhaar details or other details.

A server is used to run the KIOSK and store the dataset which will be used for facerecognition and ticket generation, which will then communicate with the EntryControl System(i.e., Nvidia Jetson). When the passenger registers his face, the face is detected and 128d embeddings are generated by the CNN.

A. Flowchart

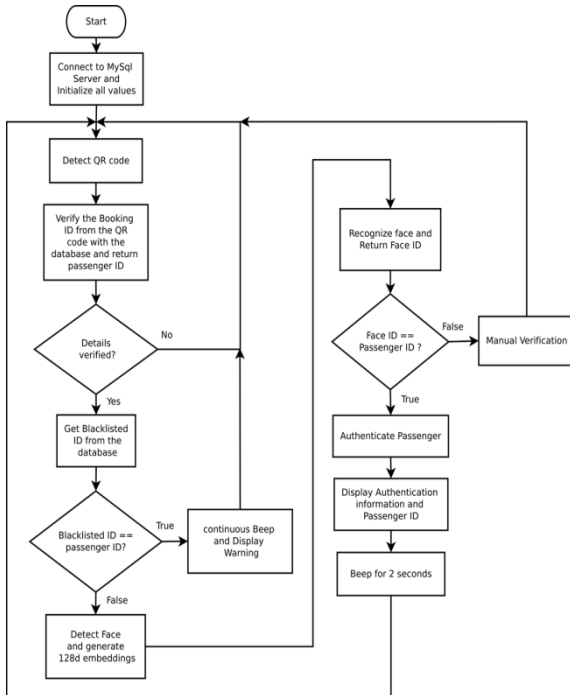


Fig. 1: Flowchart of the System

B. Explanation

- KIOSK is used for face registration and updating the details. The person has to make new registration using User Name and Password. He has to then fill his details including his Name, Aadhaar ID, Email ID and Mobile Number.
- Similarly face registration and Ticket booking is done. When registration is completed, a Unique Identification Number (UID) will be sent through an email which is used to uniquely identify the person.
- A single user can book tickets for maximum of 5 passengers through his account. So while doing this he needs to add UID of his other co-passengers.
- The blacklisted person is identified using Aadhaar card [8]. When a person enters a railway station, QR code is scanned to verify the booking ID along with the database and returns the passenger ID.
- The passenger ID is then compared with the blacklisted ID. If the passenger ID matches with the blacklisted ID, continuous beep is heard and a warning will be displaced.
- If the passenger ID doesn't match with the blacklisted ID then the face is detected and 128d embeddings are generated.
- Next the face gets recognized and the face ID is obtained. If Face ID matches with the passenger ID, the passenger is authenticated and the authenticated information along with

the passenger ID is displayed along with a small beep of 2 seconds.

- If Face ID doesn't match with the passenger ID, manual verification is done

IV. IMPLEMENTATION

A. Face Recognition

Face recognition is performed using Python and Deep learning [9]. Entry Control System (ECS): For this we will be using Nvidia Jetson nano as the control system. A web camera will be used for scanning QR code, face detection and face recognition. Python Interface is created for real-time display of passenger details (about granting access and authentication). Alert system is designed if any blocked or banned passenger enters the station. Main control System (Server): A link between the ECS and Main control System is established. This is implemented by Ethernet connection. A database management system is created for maintaining the face database and the user data.

B. KIOSK

KIOSK is used for face registration and updating. The person has to make new registration using User Name and Password. He has to then fill his details including his Name, Aadhaar ID, Email ID and Mobile Number. Similarly face registration and Ticket booking is done. This data is stored in database on a server

C. Generation of the Ticket

Ticket is generated in the form of pdf with the QR code in it. A separate email will be sent to registered passenger UID having same booking ID. When the QR code is scanned at the railway station, the details of the person is obtained

V. RESULT AND DISCUSSION

KIOSK is used for registration. Registration is done using User Name and Password. User has to enter the user name and password while registering for the first time by clicking new registration button. If he has registered already then he can directly login by entering the details. Registration page is shown in Fig. 2

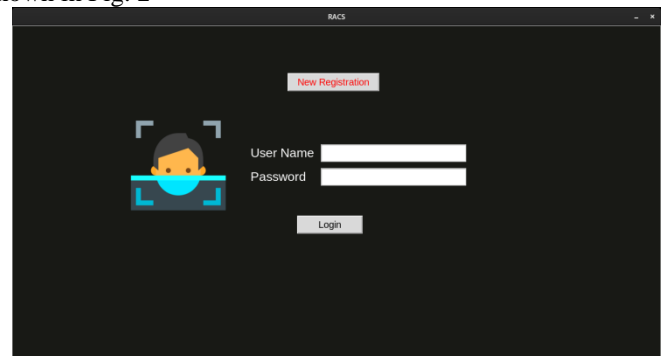


Fig. 2: Registration Page

After the new registration, the details have to be filled. Details include Name, Aadhaar ID, Email ID and Mobile Number. This page is shown in Fig. 3



Fig. 3: Details Fill-up Page

When the submit button is clicked, a booking ID will be sent to the email ID as shown in the Fig. 4

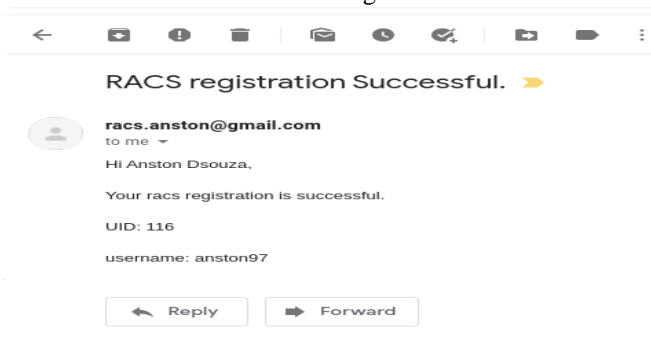


Fig. 4: Confirmation Mail for Registration

The Home page is shown in Fig. 5

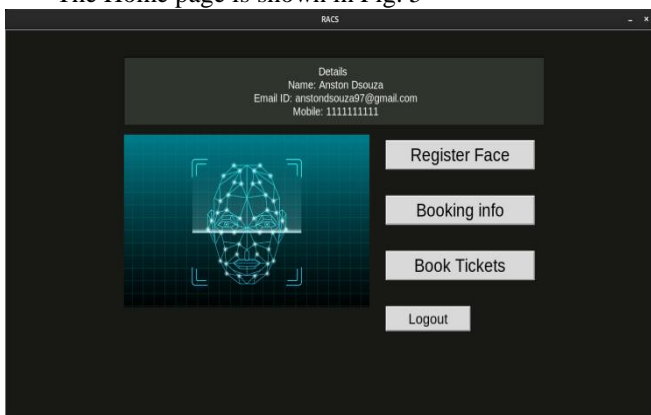


Fig. 5: Home Page

Then the face registration is done as shown in Fig. 7. Here the images are been saved in the form of 128d embeddings. This page is shown in Fig. 6

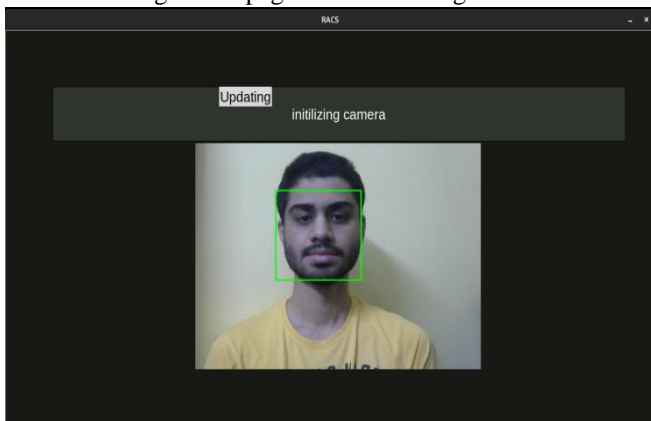


Fig. 6: Face Registration

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[array([-0.10614057, 0.15557937, 0.06349818, 0.01490116, 0.03249519,
-0.04026537, 0.01300821, -0.06893122, 0.20591675, -0.06285509,
0.24317972, 0.00535908, -0.15485217, -0.13336533, 0.02928437,
0.0831904, -0.12201557, -0.16982746, -0.05544515, -0.09410569,
-0.02156861, -0.00582501, 0.00225935, -0.00503038, -0.17328332,
-0.35229683, -0.06084474, -0.15589374, 0.00701715, -0.05047072,
0.05661646, 0.05892463, -0.18954386, -0.05479747, -0.01830538,
0.03326106, 0.00329514, 0.00917181, 0.19815686, 0.01738755,
-0.06318695, -0.06843774, 0.01409194, 0.32710683, 0.14497213,
-0.00758994, 0.03662994, -0.04887878, 0.02987764, -0.17412694,
0.11876348, 0.12085187, 0.09525532, 0.10010485, -0.10201433,
-0.12188091, 0.02143636, -0.01602833, -0.21461485, 0.02520108,
0.05067161, 0.0708594, -0.09952909, -0.02759504, 0.29434299,
0.11342549, -0.07205046, -0.10782021, 0.17748943, -0.11816689,
0.00275138, 0.05052127, -0.12544197, -0.15830459, -0.24858867,
0.12129311, 0.36397874, 0.14377771, -0.15518388, 0.03172779,
-0.12747931, -0.06343502, 0.05577315, -0.01978218, -0.10219935,
0.02381616, -0.03315266, 0.0915654, 0.14547381, 0.05740056,
-0.11902629, 0.14594142, -0.02519665, -0.05533569, 0.04050237,
-0.05501718, -0.01775723, 0.03622684, -0.15199782, -0.00941557,
0.05901962, -0.04116366, -0.00724453, 0.1071528, -0.17072484,
0.10296873, 0.06723053, -0.02790197, 0.01232914, 0.09695118,
-0.18473029, -0.09129576, 0.15910432, -0.24557585, 0.19311507,
0.08395081, 0.04520222, 0.13794184, 0.03085422, 0.07797027,
-0.00393382, -0.00298445, -0.12100582, -0.00969217, 0.0339234,
0.00923568, 0.05884296, 0.0671344 ])]
```

Fig. 7: 128d Embeddings

Next step is to add the booking information such as date, destination etc.

This page is shown in Fig. 8

Fig. 8: Ticket Booking Page

The UID number should be entered in the form shown in the Fig. 9

Fig. 9: Page for Entering UID

The passenger can book maximum of 5 tickets from his account as shown in Fig. 10. So while doing this he needs to add UID of his other co-passengers as in the Fig. 11



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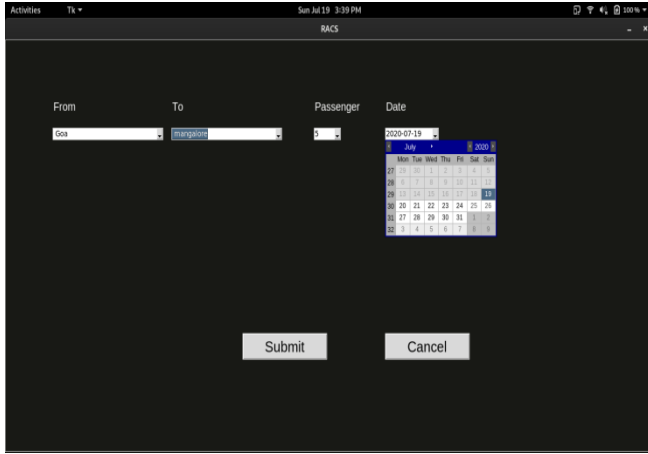


Fig. 10: Five Tickets Booking

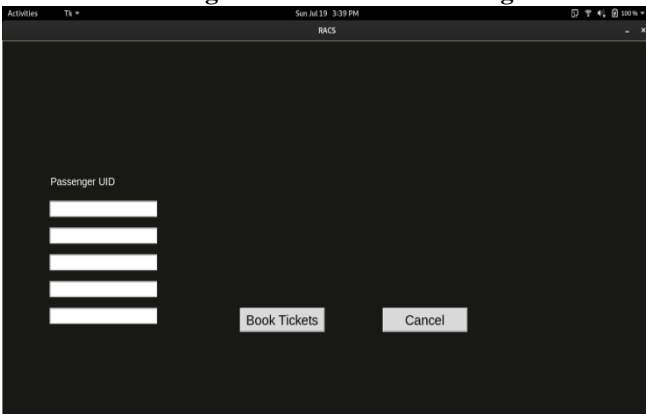


Fig. 11: Entering UID for all Passengers

The blacklisted person is identified using the Aadhaar ID. The admin page to blacklist the person is shown in Fig. 12

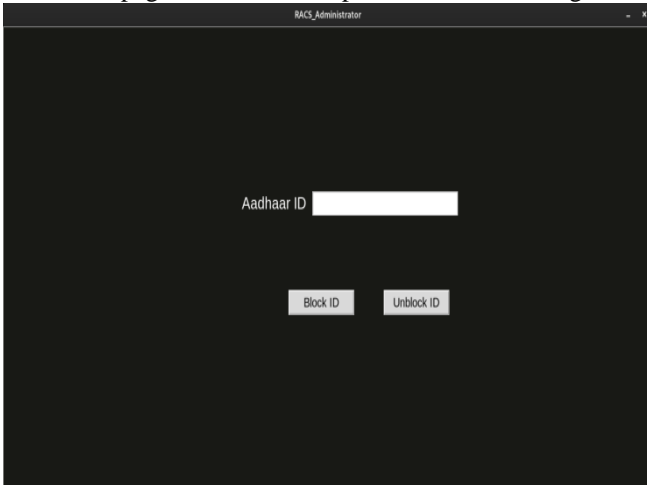


Fig. 12: Blocking Blacklisted Person

When the booking is complete, a ticket is generated in the form of pdf through a email which consists of QR code along with the details of the passenger as shown in the Fig. 13 and ticket is shown in the Fig. 14

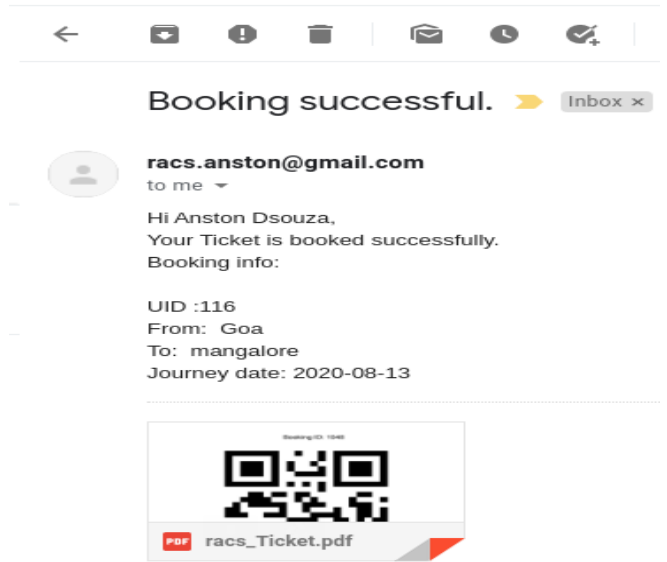


Fig. 13: Confirmation Mail for Ticket Booking



Name: Anston Dsouza
 From: Goa
 To: mangalore
 Journey Date: 2020-08-13

Fig. 14: QR Code for Ticket

When a person enters a railway station, camera will capture his image and identifies the image using 128d embeddings. If the person has booked the ticket, the screen will display a tick mark, if not then it will display a cross mark. Access granted is shown in Fig. 15. Access denied is shown in Fig. 16

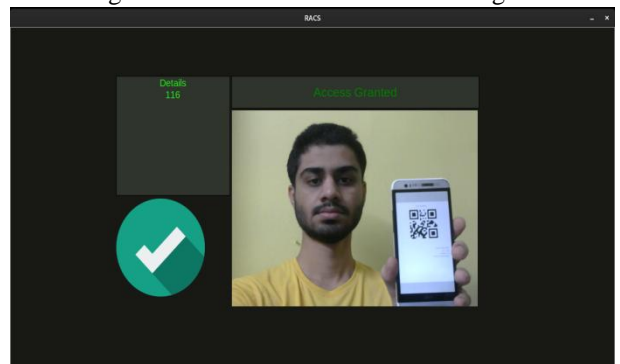


Fig. 15: Access Granted



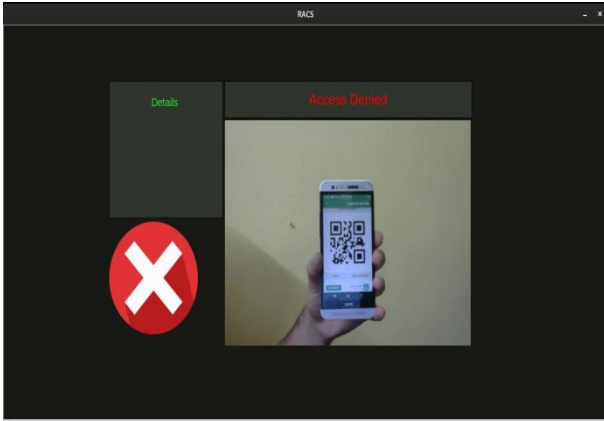


Fig. 16: Access Denied

If the person is detected in blacklist then it will be displayed as shown in Fig. 17

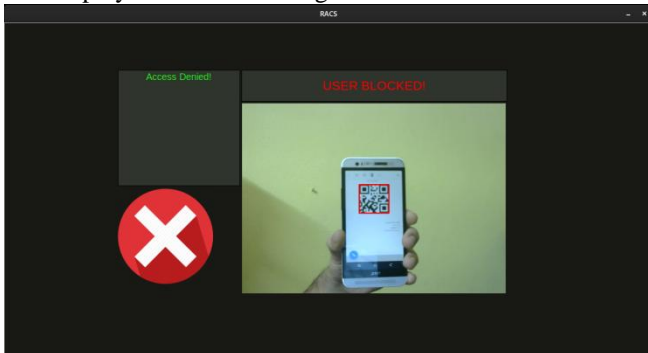


Fig. 17: Access Denied For Blacklisted Person

VI. CONCLUSION AND FUTURE WORK

As a result, this system will provide its users a complete integrated platform for registering as well as booking ticket online. This system helps in reducing manual intervention for verification by introducing face recognition which in turn reduces man power and consumes less time. Also helps to maintain the security of railway stations by denying entry to blacklisted people or criminals.

As a future work one can implement liveness detector which increases reliability by spotting fake faces and by performing anti-face spoofing. To increase accuracy in face detection, one can use high definition camera to detect faces in low lighting condition.

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