CS341 Design Project Report

BIOMETRIC PASSPORT

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology
in
Computer Science and Engineering

Submitted by

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Certificate

This is to certify that this is a bonafide record of the Design Project work done by the student whose name is given below in partial fulfilment of the requirements of the degree of Bachelor of Technology in Computer Science and Engineering under A.P.J.Abdul Kalam Technological University during the year 2020-21.

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Institute Vision

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Institute Mission

"To contribute to the society by providing quality education and training, leading to innovation, entrepreneurship and sustainable growth."

Department Vision

"To be a centre of excellence in the field of Computer Science & Engineering education and research, which extends its appreciated services to the industry and the society."

Department Mission

"To develop engineers with excellent analytic, design and implementation skills, who can expertise themselves as computer professionals, research engineers, entrepreneurs or as managers, while fulfilling their ethical and social responsibilities, in a globally competitive environment."

Acknowledgements

We are really grateful and thankful that we managed to complete our Project within the given time. This project would not have been completed without the effort and co-operation from our group members.

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Abstract

An ideal solution to replace the usage of passports in airports with computer vision technology. The system consists of an eye, face, ear detection camera which is placed at the checkout point in the airport. The user can get the tickets if and only if the face, eye, and ear authentication passes.

The user can update their details once in 2 years through the Central Government Controlled Office. The update will be valid only if it has about 50-60% match with each data previously stored in the database and 70-80% of overall compatibility. A new applicant, he/she can easily apply for a passport through the office. The passengers can find out their flight details and other information through a website.

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Chapter 1

Introduction

1.1 Background Information

A passport is a travel document, usually issued by a country's government to its citizens, that certifies the identity and nationality of its holder primarily for the purpose of international travel. Standard passports may contain information such as the holder's name, place and date of birth, photograph, signature, and other relevant identifying information.After researching about the current existing passport system we concluded that ordinary means of identification at the airport is having many drawbacks like faking passport, unavailability of passport at urgent situations etc. So we have proposed a system that uses biometric identification which reduces the drawbacks of the current identification system at airports.

1.2 Literature Survey

In order to design this project, we made a detailed study of existing passport system. We mainly focused on the security of existing passport system and its limitations. After researching about the current existing passport system we concluded that ordinary means of identification at the airport is having many drawbacks like faking passport, unavailability of passport at urgent situations etc. We went through projects involved in this area and came to the proposed project.

1.3 About the Project work

After studying the prevalent system and their inaccuracies and results, a system is proposed which will replace the existing hard copy passports in airports with biometric authentication technology. A scanned image of the iris, ear, the face of each passport holder has to be stored in a database to check the correspondence between the stored one and the input given during verifying the person. The comparing process is carried out by feature extraction and feature matching with that of a stored sample of authorized customers in the database. If the matching is positive, then the person is allowed to get into the aeroplane and is granted access to travel.
The features include:

- Enhanced security and correct authentication at airports.
- Lesser impersonation.
- Travel cancellation due to unavailability of passport at that point is eradicated
- Better user-experience.
- Makes travel easier.
- Eco friendly.

We referred many websites to find existing functionalities and to find the limitations of existing design [1] [2] [3].

Chapter 2

Literature Survey

1. **Iris Recognition**[1]

   Iris recognition or iris scanning is the process of using visible and near-infrared light to take a high-contrast photograph of a person's iris. It is a form of biometric technology in the same category as face recognition.

   The main steps involved in iris recognition are:
   (a)Locating the iris is done with the help of Guassians functions. The blurring is first applied and the circular edge is detected as a result the iris radius and the center is identified.
   (b)Demarcating its inner and outer boundaries at the pupil and sclera, detecting the upper and lower eyelid boundaries if they occlude,and detecting and excluding any superimposed eyelashes or reflections from the cornea or eyeglasses. These processes may collectively be called segmentation.
   (c)2-D Gabor filters are used to extract features of both coherent and incoherent textual information from the iris image and generate a frequency response.The zones in frequency response is projected into a doubly dimensionless polar coordinate system.
   (d) The hamming distance (HD) is found with the help of the Gabor filters and is stored.This will be different for different iris as a result the recognition can be done easily.
   (e)The Confusion matrix which has four possible outcomes like Acceptance of Authentic (True positive in CM),Rejection of Authentic (True Negative in CM),Acceptance of Imposter (False Positive in CM),Rejection of Imposter (False Negative in CM) help to visualise the results.

2. **Ear Recognition**[2]

   Human ear contains rich and stable features. It has been found that no

two ears are exactly the same even that of identical twins. Therefore it appears that ear biometrics is a good solution for computerized human identification and verification systems.

This recognition can be done by using geometrical feature extraction.In this method the first step is to make a pre-processing phase by making all images of the ear have the same size. Then the snake model is used to detect the ear and then a median filter is applied to remove noise. After this step, the images are converted to binary format.Using canny edge and by enhancing the image, the largest boundary is calculated and then distance matrix is created and then the image features were extracted. Finally, the extracted features were classified by using nearest neighbor with absolute error distance.

The matching is done by Normalized Cross Correlation expression which requires very less time for person identification from the Haar wavelets.

3. **Face Recognition**[3]

   Face is one of the most widely used biometrics for human identity authentication. Its ability to recognize multiple persons at a time further adds up to its speed.There are many face recognition methods based on traditional machine learning.

   Viola Jones algorithm is used to detect the faces in the original images. The four main components of Viola Jones algorithm include extraction of Haar-like features, computing integral images, speeding up feature extraction using Adaboost and cascading the features selected by Adaboost. The facial areas detected by Viola Jones algorithm are cropped and used for further processing.

   The feature extraction methods involve extracting discriminative features rather than computing their geometry which makes it more robust.Shift Invariant Feature Transform (SIFT) descriptor serves important purpose in computer vision problems including point matching between views of a 3-D objects by transforming the image data into scale invariant coordinates.

   Feature extraction is cheaper and easier to implement because this is done in a cascade manner and the costly operations are applied only to the interest point location discarding the rest of the points. The Speeded Up Robust Features (SURF) is based upon automatic scale detection which focuses on the object corners, which is not only faster but also more distinctive. The computation time is reduced by using integral images introduced by Viola and Jones and Hessian detector is

used for scale detection. SURF is made invariant to rotation by incorporating Haar wavelet responses. Haar like features take adjacent rectangular regions in a detection window at a specific location in an image, sum up the pixel intensities in each region and calculate the difference between these sums, which is then used to categorize subsections of an image.

Ada boost reduces the computation time by removing redundant features from each detected window of an image based on their individual weights during processing. Only the selected features are used during all stages or iterations to save computations and speed up feature extraction. Some of the drawbacks that we face today in face recognition are:
(a)Processing speed and storage
(b)Image size,angle and quality
(c)Inter-class variability

Chapter 3

Design and Methodology

3.1 Problem Statement

A new approach for removing hard copy passports with biometric identification system with the identifiers Iris, Face, and Ear using Computer Vision technology.

3.2 Problem Objectives

1. Enhance security at airports.
2. Lesser impersonation.
3. Travel cancellation due to unavailability of passport at that point is eradicated.
4. User can track their travel record efficiently.

3.3 Design Constraints

1. Scanners should be attached to a single helmet shaped device so that all 3 scans can be done parallely.
2. High cost of construction.
3. Implementation should be done globally for this mechanism to be a success

3.4 Flowcharts

A flowchart is a type of diagram that represents a workflow or process.
The work flow is described here, verification,addition,deletion of user is included.

- At the airport user is scanned via the scanner and the data taken is compared with the currently stored database.If it is positive the passenger is allowed to travel.
- Admin can add a new user to the database with his admin privileges by scanning and approving them.
- User can actually view their personal account using the website.

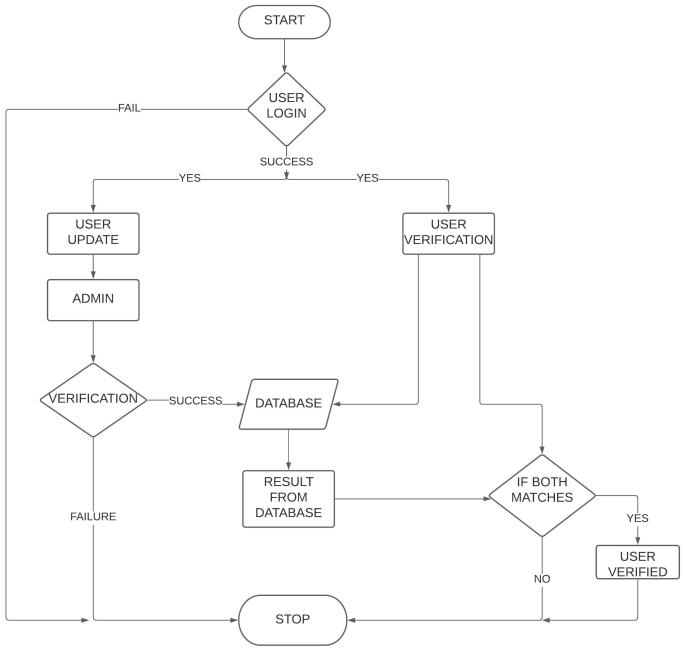

Figure 3.1: Flowchart

3.5 Data Flow Diagrams

A data-flow diagram(DFD) is a way of representing a flow of data through a process or a system. The data flow diagram 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.

3.5.1 Level 0 Data Flow Diagrams

Data Flow Diagram(DFD) Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analyzed or modeled. It's designed to be an at-a-glance view, showing the system as a single high-level process, with its relationship to external entities.
Level 0 diagram includes all the components required. The components are scanner,user,admin,database and website. The scanner sends the details and is processed by admin by cross checking it with the data in database and finally decide whether he/she can travel or not.

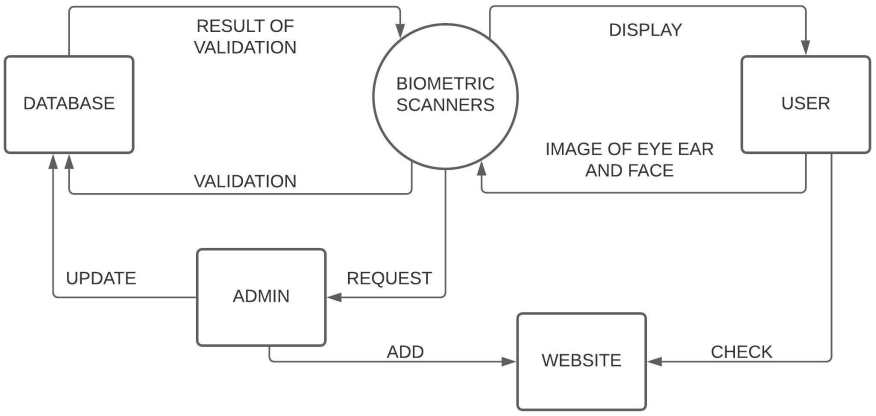

Figure 3.2: Level 0 DFD

3.5.2 Level 1 Data Flow Diagrams

A level 1 Data Flow Diagram(DFD) notates each of the main sub-processes that together form the complete system. We can think of a level 1 Data Flow Diagram as an "exploded view" of the level 0 Data Flow Diagram.
Level 1 diagram describes all the relations of a component.
The scanner scans the eye,face and ear of the user. If it is a new user, scanned images are verified by the admin and is stored in the database. If the user already exist, the scanner sends the scanned image and cross checks with the existing image in the database. If it matches the user is allowed to travel otherwise not. All the information about the user can be seen in a website where the user can login with user credentials and is managed by the admin.

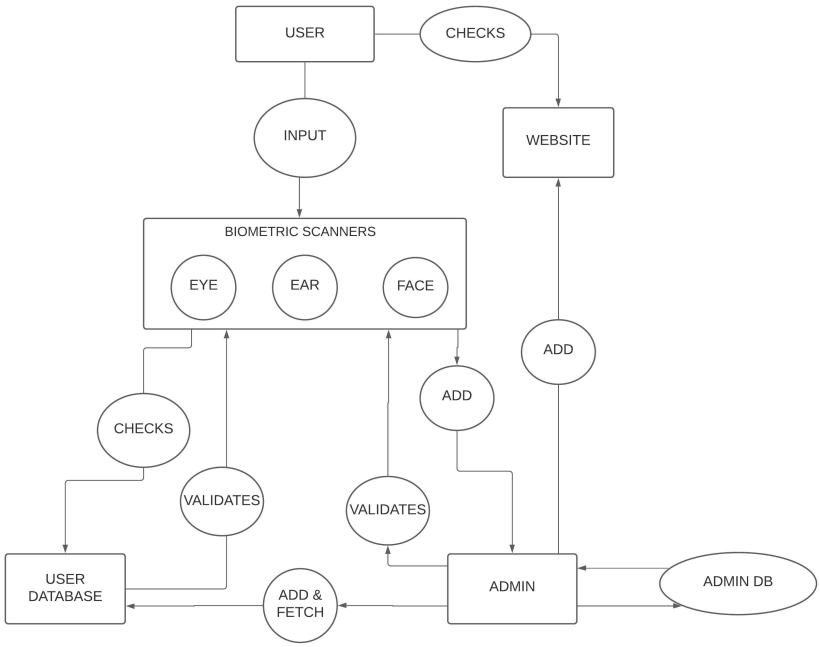

Figure 3.3: Level 1 DFD

Chapter 4

Software Design

4.1 UML Diagrams

The Unified Modeling Language(UML) is a general-purpose, developmental, modeling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system.

4.1.1 Use Case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved.

We have a bio metric scanner,user and an admin as the entities. Each have access only to certain functions like:-

1. Bio metric scanner - scans the ear,eye and face
2. They can check all the details present in the website and can also book tickets
3. Admin - They have all the admin privileges both on the website as well as on the scanner

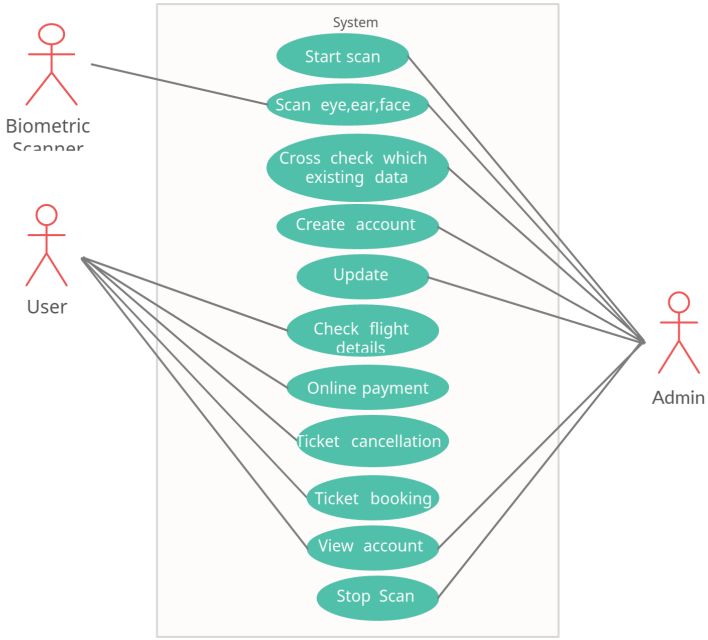

Figure 4.1: Use case diagram

4.1.2 Sequence Diagram

A sequence diagram shows object interactions arranged in time sequence. It depicts the objects involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario.

1. Verification of user at the airport
2. Displaying the account details in the website
3. Adding a new user or editing the details of existing user

At the air port user is scanned via the scanner and the data taken is compared with the currently stored database.If it is positive the passenger is allowed to travel.
Admin can add a new user to the database with his admin privileges by scanning and approving them.
User can actually view their personal account using the website.

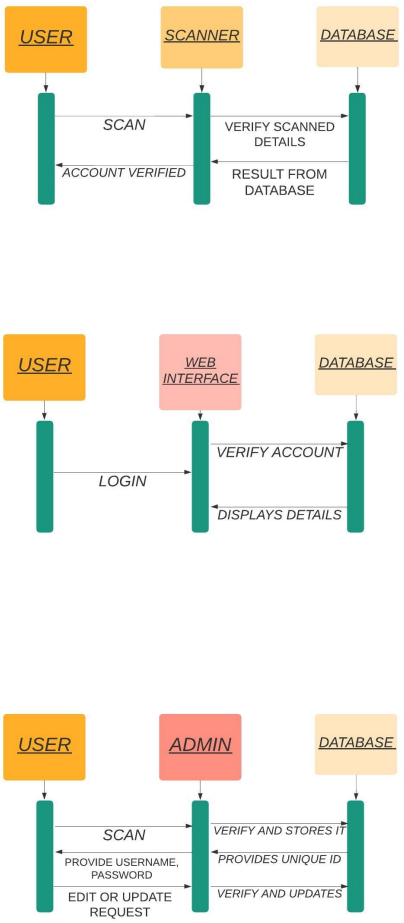

Figure 4.2: Sequence diagram

4.1.3 Component Diagram

A component diagram depicts how components are wired together to form larger components or software systems. They are used to illustrate the structure of arbitrarily complex systems.

Scanner scans the user and the collected information is crosschecked with the database. Admin adds a new user to the database, Website displays the details of user.

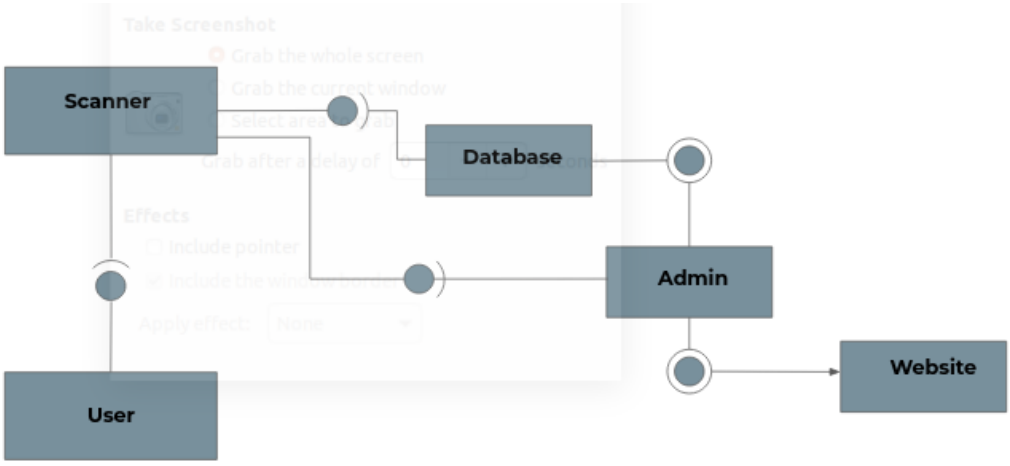

Figure 4.3: Component diagram

4.2 Database Design

4.2.1 ER Diagrams

An ER diagram shows the relationship among entity sets. In terms of Database Management System(DBMS), an entity is a table or attribute of a table in database, so by showing relationship among tables and their attributes, ER diagram shows the complete logical structure of a database.

Entities present -user,website,database,scanner,admin
Relationships - login,scans,sends data, adds

- At the airport user is scanned via the scanner and the data taken is compared with the currently stored database.If it is positive the passenger is allowed to travel.
- Admin can add a new user to the database with his admin privileges by scanning and approving them.
- User can actually view their personal account using the website.

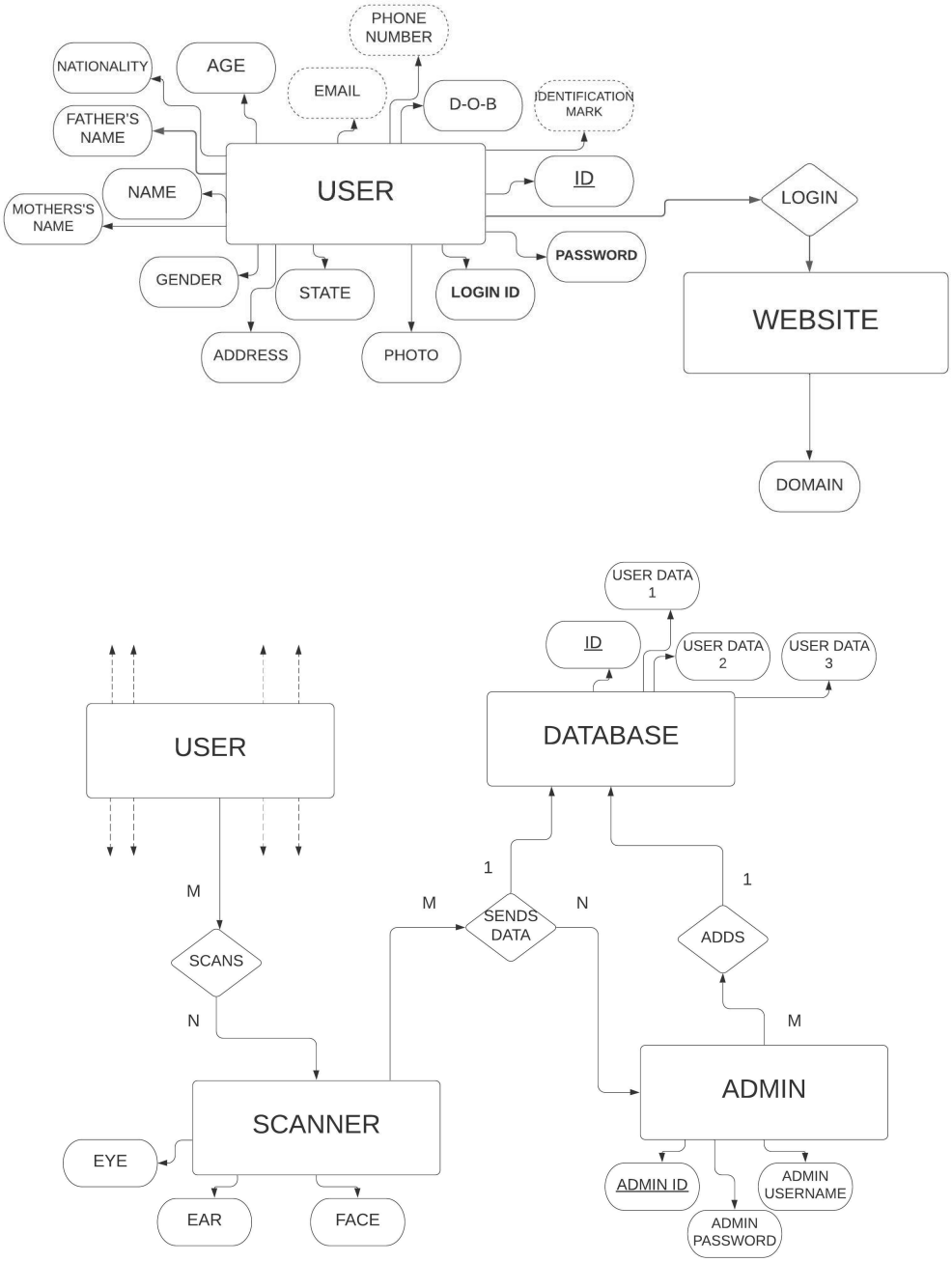

Figure 4.4: ER diagram

Chapter 5

Conclusions and Future Work

Face recognition is difficult because of generally similar shapes of faces and also numerous variations between images of the same face. These are the main points that we should improve. Enhancements suggested:-

- Improve the accuracy of sensors.
- Cloud services can be use to store the information presently in local database
- Block chain technology can be used to store the data in encrypted format.

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