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A Project Based Learning Report

on

“Attendance System Using Face Recognition”

Submitted to the

Savitribai Phule Pune University

In partial fulfillment of the requirements

SUBMITTED BY

by

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CERTIFICATE

This is to certify that the project based learning report entitled **“Attendance System Using Face Recognition”** being submitted by **Piyush Terkar (SI55), Mitali Chougule (SI11), Amey Deshingkar (SI69)** is a record of bonafide work carried out by him/her under the supervision and guidance of **Mr. Nikhil Dhavase** in partial fulfillment of the requirement for **SE (Information Technology Engineering) – 2019 course** of Savitribai Phule Pune University, Pune in the academic year 2020-2021

Date:

Place: Pune

Mr. Nikhil Dhavase Guide	Dr. V. S. Bidve Head of the Department	Dr.S.M.Deshpande Principal

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Abstract

Face recognition is among the most productive image processing applications and has a pivotal role in the technical field. Recognition of the human face is an active issue for authentication purposes specifically in the context of attendance of students. Attendance system using face recognition is a procedure of recognizing students by using face biostatistics based on the high-definition monitoring and other computer technologies.

The development of this system is aimed to accomplish digitization of the traditional system of taking attendance by calling names and maintaining pen-paper records and a step towards the Contactless Attendance Management System which is safest in the times of COVID-19.

Present strategies for taking attendance are tedious and time-consuming. Attendance records can be easily manipulated by manual recording. The traditional process of making attendance and present biometric systems are vulnerable to proxies.

This paper is therefore proposed to tackle all these problems. The proposed system makes the use of Haar classifiers, KNN, CNN. After face recognition attendance reports will be generated and can be downloaded in excel format. The Proposed system proved to be an efficient and robust device for taking attendance in a classroom without any time consumption and manual work.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO PROJECT:

The main objective of this project is to develop a face recognition based automated student attendance system. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images that consist of a single face only.

The test images and training images have to be captured by using the same device to ensure no quality difference. In addition, the students have to register in the database to be recognized. The enrollment can be done on the spot through the user-friendly interface.

1.2 MOTIVATION BEHIND PROJECT TOPIC:

The motivation behind this proposed work comes from the advancement of technologies like image processing, AI and machine learning and Face unlock feature given by smart-phone manufacturers.

The classroom often consists of a huge number of students which usually takes a lot of time thus creating a system which will automatically detect the present students and then marking the students accordingly will be very helpful. This system will also reduce manipulation of attendance records by the students.

1.3 OBJECTIVE OF THE WORK:

Attendance Management System Using Face Recognition is a software developed for daily student attendance in schools, colleges and institutes. It facilitates to access the attendance information of a particular student in a particular class.The purpose of developing attendance management system is to computerize the traditional way of taking attendance. Another purpose for developing this software is to generate the report automatically at the end of the session on in the middle of the session.

1.4 INTRODUCTION TO PROJECT TOPIC:

1.4.1 Aim and Objective(s) of the work

Project aims are:

- Contactless Attendance Management System which is very safe in the current times of COVID-19.
- Reduce the fake attendance.
- Reduce the time required for manual work of marking attendance.
- Develop a Reliable, Robust and Secure attendance management system.

Project objectives:

- To create a website for the registration of students.
- To take attendance using a smart camera.
- To view date wise attendance reports.
- To download the excel sheet of the attendance.
- To send email to the students after their attendance is marked successfully.

1.5 ORGANIZATION OF THE REPORT:

Our report is further divided into :

- At first the survey of the literature we went through is provided.
- Followed by the block diagram along with the system architecture of our system is shown.
- The list and implementation of the algorithms used is shown below the block diagrams.
- Lastly, the screenshots are provided of the Presenza attendance system.
- And finally, the conclusion is done along with the references.

CHAPTER 2

LITERATURE SURVEY

We have studied several papers based on the Attendance Management System. First paper we have studied is named as “Biometric Based Attendance” which was published by Mr. Yash Mittal, Ms. Prachi Aggrawal and Mr.Kapil Matani. In this paper Biometric scaled up for real time deployment, it provides a solution of late coming.

The second paper named “Finger Based Attendance Management with SMS Alert To Parents” which is published by Ms. Poonam Choudhary , Prof .G.N. Dhoot and Mr. Sopan Borale .This paper introduced a system including a terminal fingerprint module and attendance module and SMS system for alerting parents for updates about their child.

The third paper named “Smart attendance Management And Learning System” which is published by Prof. H.B. Sale, Priyanka Shelake , Tufail Siddhiqui . This paper facility of notes dictation, defaulter list, notes view, notification, details view for students, staff, teachers and Admin.

The forth paper named as “Key Authentication Based Door lock Monitoring System “Which is published by Chinmay Kulkarni , Avinash Bagul and Pranamya Korde.This project concentrates more on automation of institute security and provides lesser security than actual physical security.

The fifth paper named as “Employee Attendance Monitoring System Using Radio frequency Identity Card” Which is published by S.Mohan kumar, Sanjay Chandran, Tamil Selvan and Ajith Kumar .Facilitates automatic wireless identification using ID tags and reader method.

CHAPTER 3
METHODOLOGY/PROPOSED SYSTEM BLOCK DIAGRAM

3.1 SYSTEM ARCHITECTURE:

The proposed system architecture uses a **hybrid multi server - 3 Tier client-server architecture** .The client website forms the 1st tier , the routing server forms the 2nd tier and the database server forms the 3rd.

The system is multi-server and has 3 separate types of servers:

1. The main Routing server which forms the heart of the system
2. The database Server provided by the database management system itself
3. The smart camera(smart device/edge device) server which contains the Face-Recognition functionality

REASONING BEHIND CHOOSING THIS ARCHITECTURE:

1. **BRINGING THE 3 MOST COMPLEX DOMAINS IN COMPUTER SCIENCE TOGETHER: MACHINE LEARNING, WEB DEVELOPMENT AND INTERNET OF THINGS** are the 3 domains the project spans and this architecture makes it easy to provide interfacing between the 3 reliably.

2. **LOOSELY COUPLED SYSTEM:** Since each component of the system can function as a separate entity(node) on a network the system becomes loosely coupled even if the Routing server is at the heart of the system it, in the event of its failure the system can Route traffic to other server, thus providing **Distributed Server capabilities**

3. **HIGH SCALABILITY AND UPGRADABILITY:** Thanks to the Multi-server architecture it becomes easy to scale and upgrade the system by adding more such servers, as mentioned above this improves the Reliability of the system, the system is highly scalable and upgradable in the following ways: **a) Deploying multiple servers on different geographical locations b) Reduced access times c) Establishing system in local networks**

4. **EXCELLENT MAINTAINABILITY:** A loosely coupled system makes it easy to locate and isolate a bug as it is easy to know which module is causing the issue. The system can be equipped with state of the art error handling enabling the developer to locate and fix any bugs in deployment.

5. **SECURED WITH OWN HANDSHAKE ALGORITHM:** Each module is equipped with its own handshake protocol, to make sure that the requests are coming from a trusted and identified client, Moreover It is not possible for a client to directly communicate with the database hence data integrity is maintained making the system Reliable and Secure.

3.2 SYSTEM ARCHITECTURE DIAGRAM:

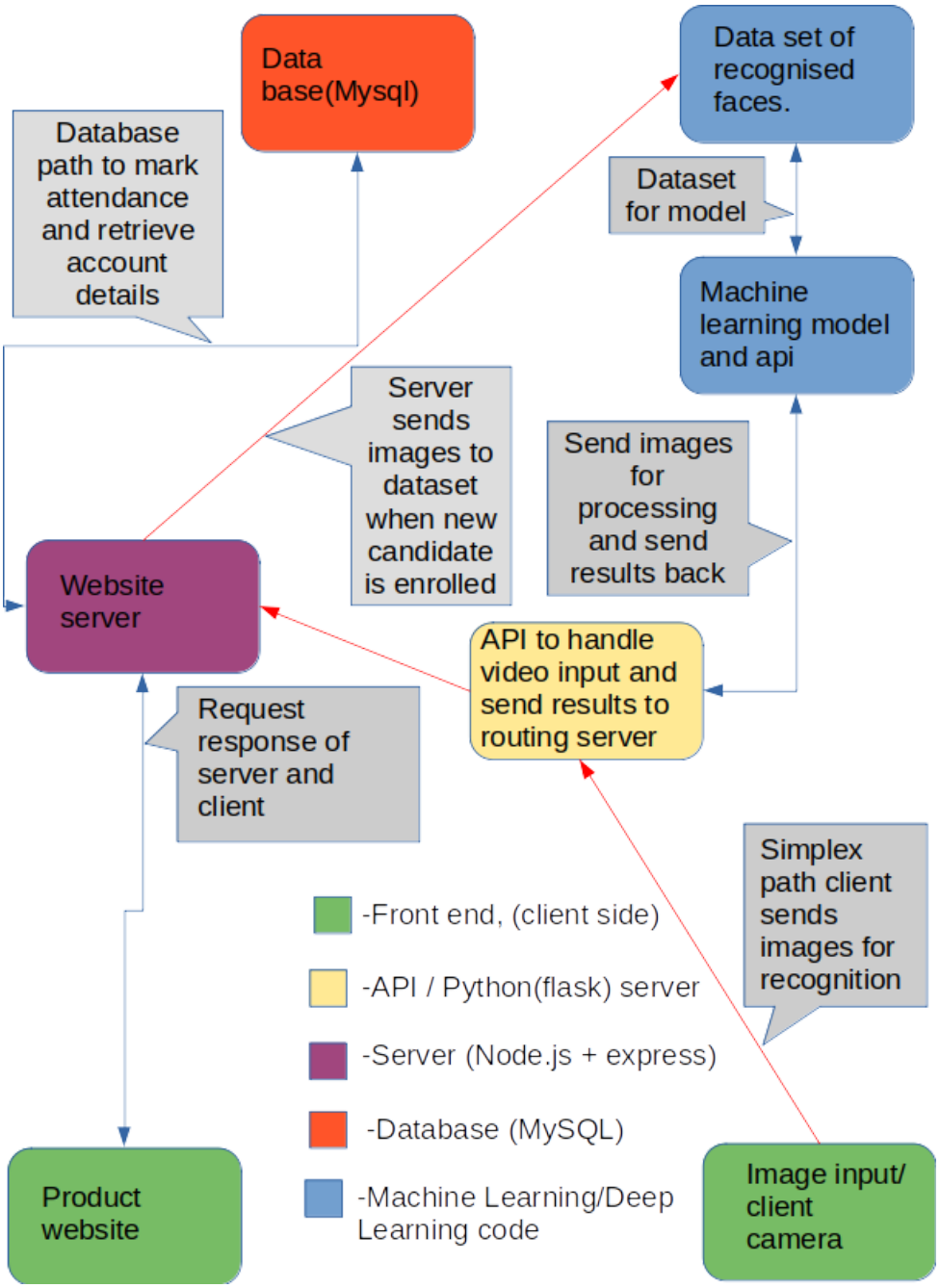


Fig 3.1 Proposed System Block Diagram/Flow chart

3.3. IMPLEMENTATION OF PROJECT:

1. **Implementation of the website:** The website is structured in a modular format and the same file/directory structure is used to implement the backend of the website. The server is at the heart and provides routing to the website, it is developed by following the principles of **Restful routing.** Validation and smartcam communication are linked with the server and provide data integrity and communication, to the IOT device(Smart camera [Raspberry Pi 3B+]).
2. **Structure Diagram:**

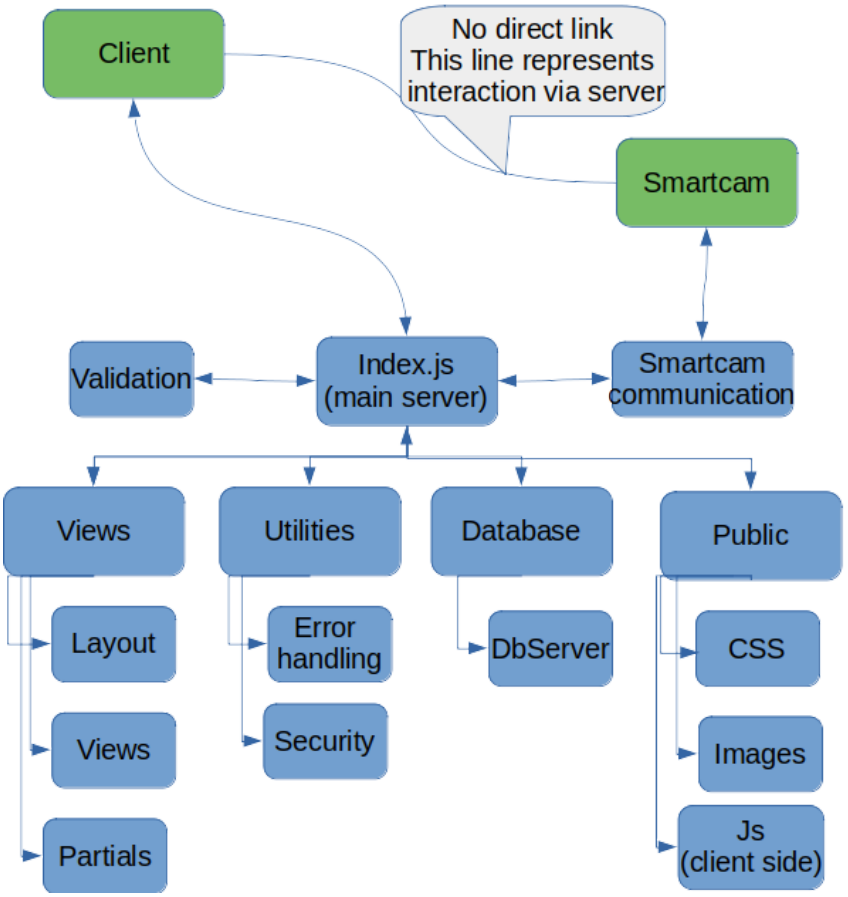


Fig 3.2 Website structure

3. **Implementation of frontend(user Interface):** There are two different types of users : 1. The college admin(who manages and keeps track of attendance) 2. The Student whose attendance is marked. The Website frontend part is accessible to the 1st type of user(the system admin) and the emails provided by the smart camera are accessible to the student, The views visible to the system admin are: The home page, The Registration page and The Report page. While

the student only interacts by showing his/her face to the smart camera which recognises his/her face and marks attendance automatically.

4. **The Views Diagram:**

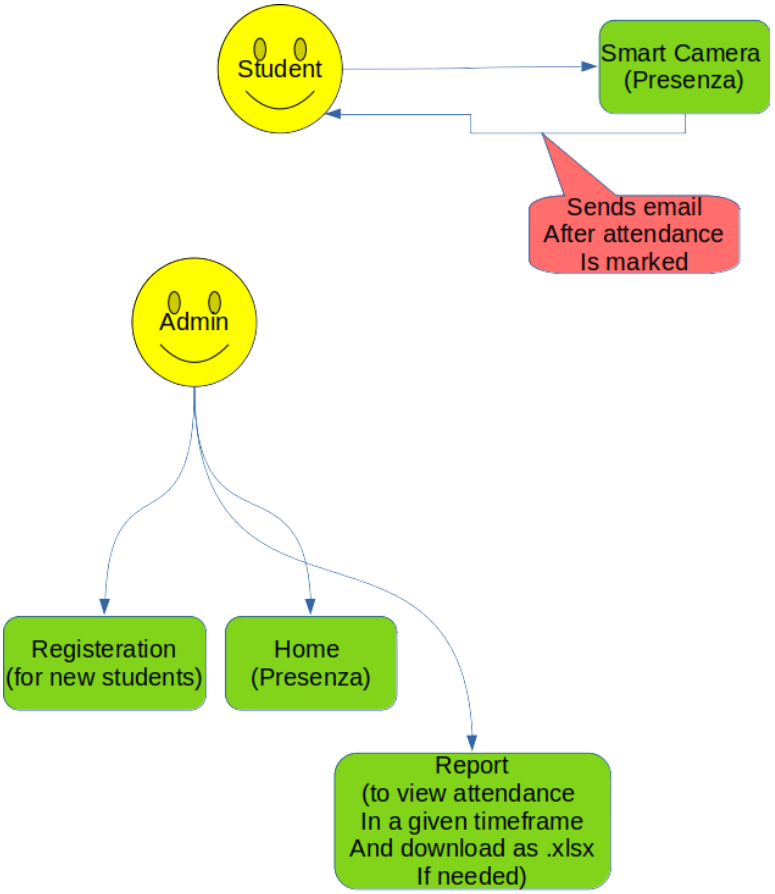


Fig. 3.3 Client Side Views(Front-end Views)

5. **Implementation of the smart camera system:** The smart camera is implemented as an IOT device capable of face-recognition and communication, The module is responsible for two basic tasks: 1. To house the facial recognition system 2. To establish communication with the server whenever needed and to receive data(regitration and marking attendance). This module also implements a special **handshake algorithm** to maintain data Integrity and prevent spoofing, the communication part is implemented by following the principles of **Restful API.**

6. Block diagram of Smart Camera:

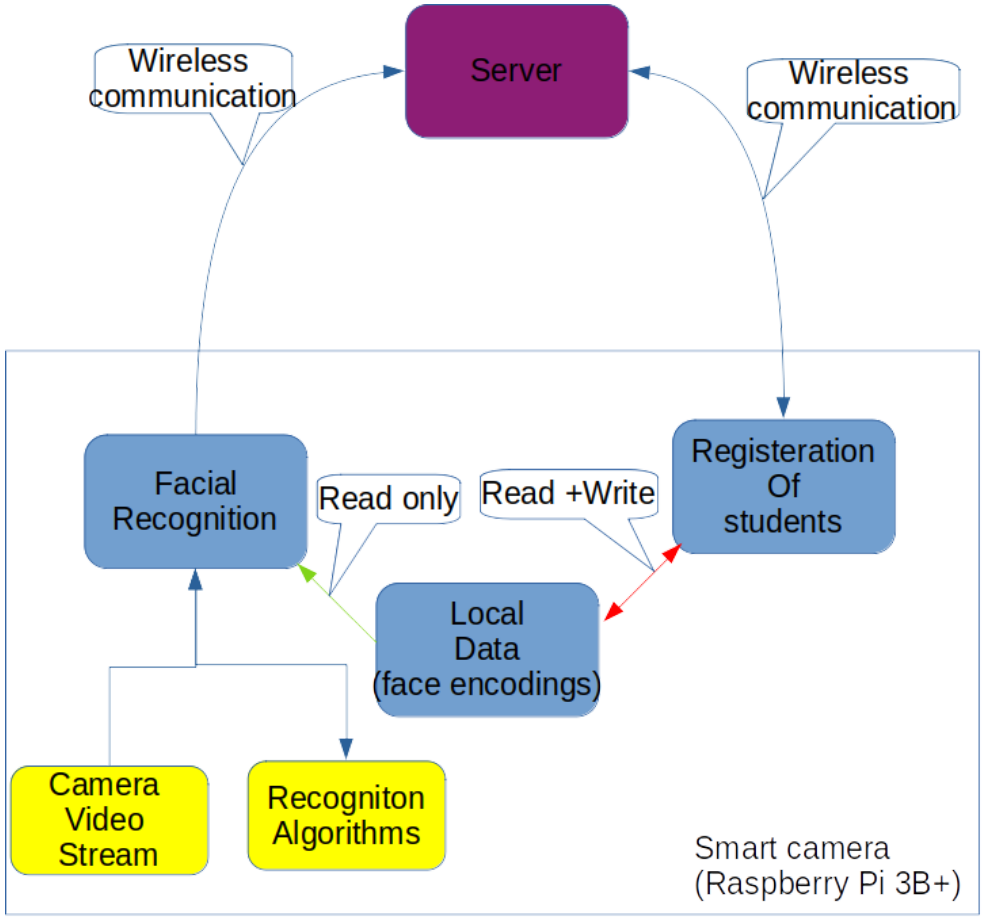


Fig 3.4 Block Diagram of Smart Camera

CHAPTER 4

IMPLEMENTATION PART

4.1 ALGORITHMS/ TECHNOLOGIES USED:

CNN

Step 1: Convolution Operation

- A convolution layer has several filters that perform the convolution operation.
- Every image is considered as a matrix of pixel values.

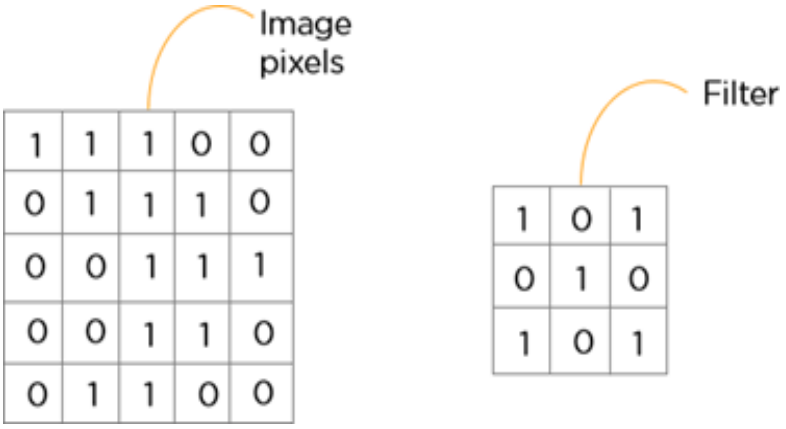


Fig 4.1 Image Pixels

Step 2: ReLU Layer

- ReLU stands for the rectified linear unit.
- Once the feature maps are extracted, the next step is to move them to a ReLU layer.
- ReLU performs an element-wise operation and sets all the negative pixels to 0.
- It introduces non-linearity to the network, and the generated output is a rectified feature map.

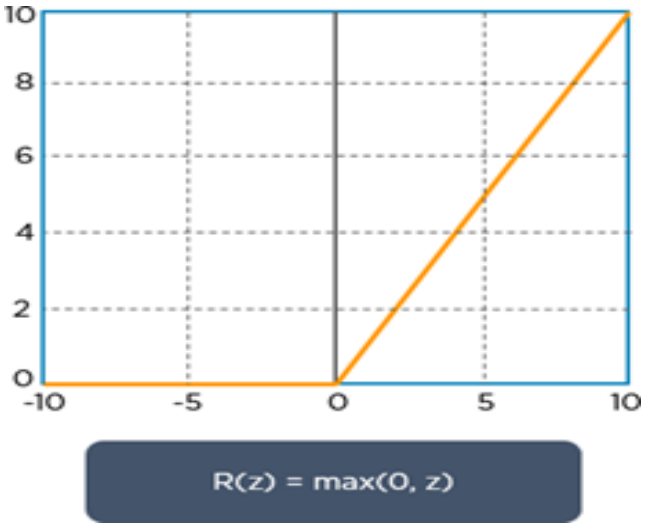


Fig 4.2 ReLU Layer

Step 3: Pooling Layer

- Pooling is a down-sampling operation that reduces the dimensionality of the feature map.
- The rectified feature map now goes through a pooling layer to generate a pooled feature map.
- The pooling layer uses various filters to identify different parts of the image like edges, corners, body, feathers, eyes, and beak.

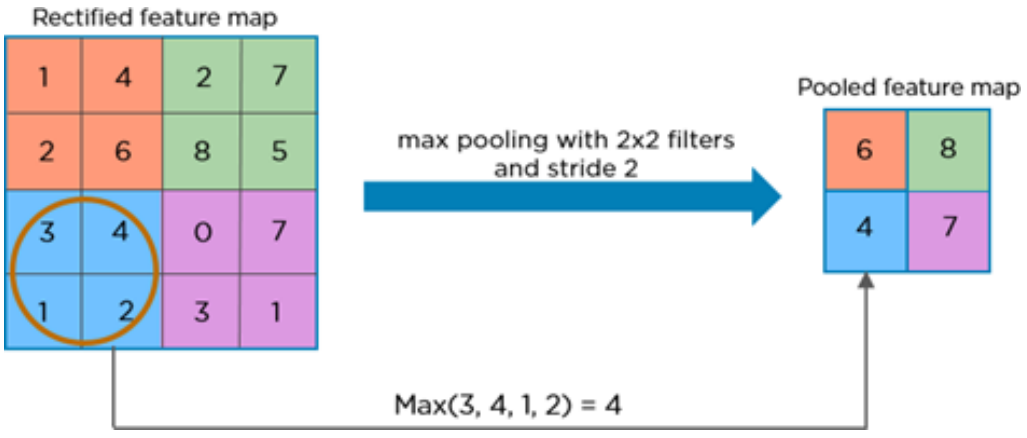


Fig 4.3 Pooling Layer

Step 4: Flattening

- Flattening is used to convert all the resultant 2 Dimensional arrays from pooled feature maps into a single long continuous linear vector.

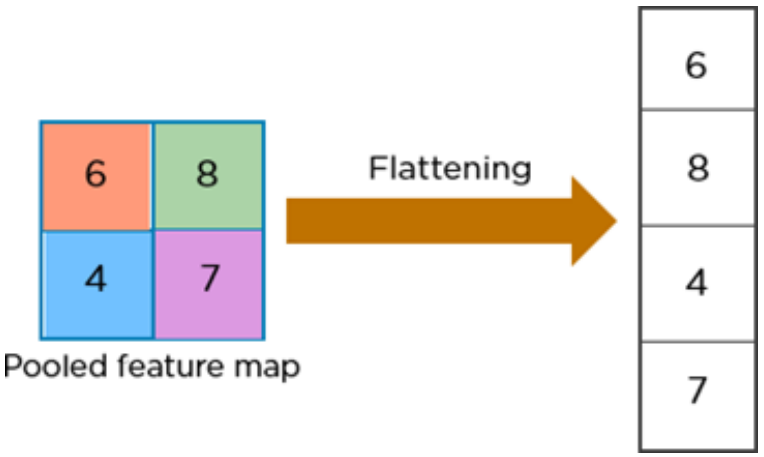


Fig 4.4 Flattening

Step 5: Fully Connected Layer

- The flattened layer is now connected with multiple hidden layers. Thus, forming a fully connected layer.

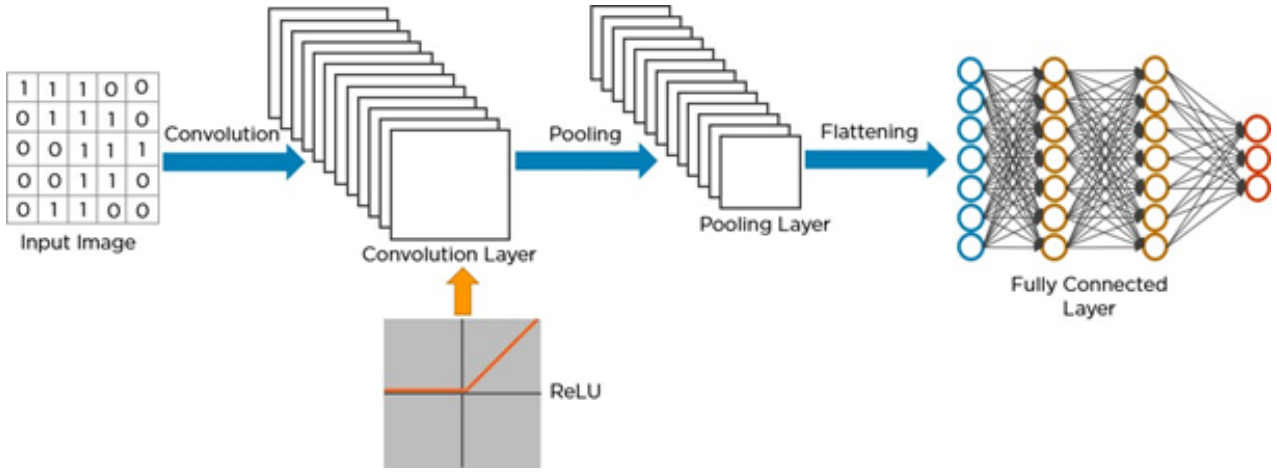


Fig 4.5 Connected Layer

Haar Cascade

Step 1: Collecting Haar Features

- A Haar feature is essentially calculations that are performed on adjacent rectangular regions at a specific location in a detection window.

- The calculation involves summing the pixel intensities in each region and calculating the differences between the sums.

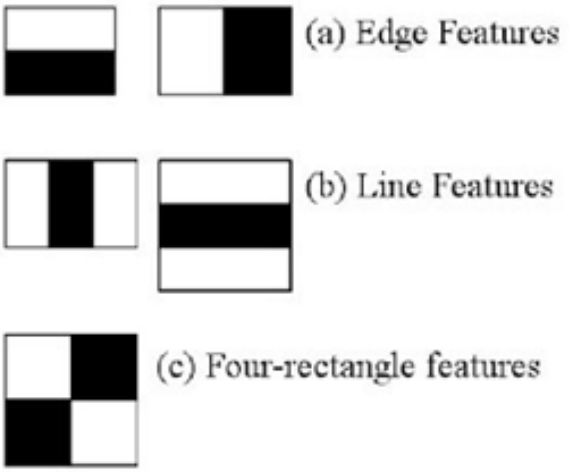


Fig 4.6 Haar Features

Step 2: Creating Integral Images

- These features can be difficult to determine for large images.
- Integral images essentially speed up the calculation of these Haar features.
- Instead of computing at every pixel, it instead creates sub-rectangles and creates array references for each of those sub-rectangles.

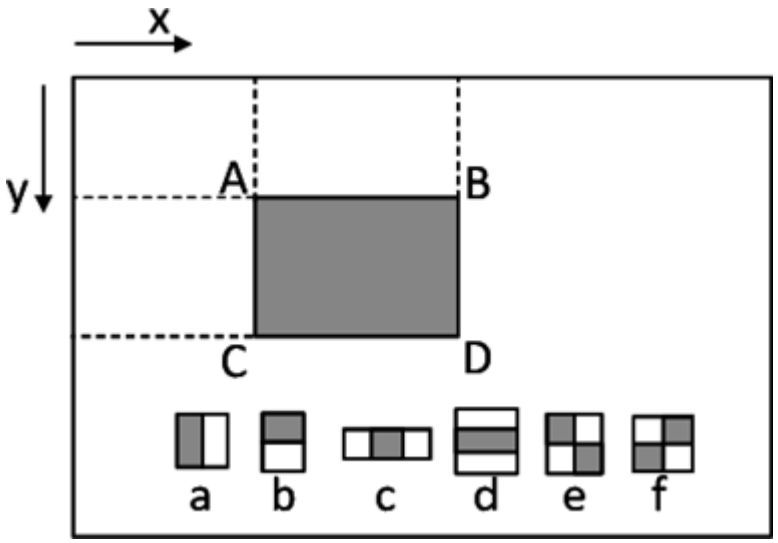


Fig 4.7 Integral Images

Step 3: Adaboost Training

- Adaboost essentially chooses the best features and trains the classifiers to use them.
- It uses a combination of “weak classifiers” to create a “strong classifier” that the algorithm can use to detect objects.

- Weak learners are created by moving a window over the input image, and computing Haar features for each subsection of the image.

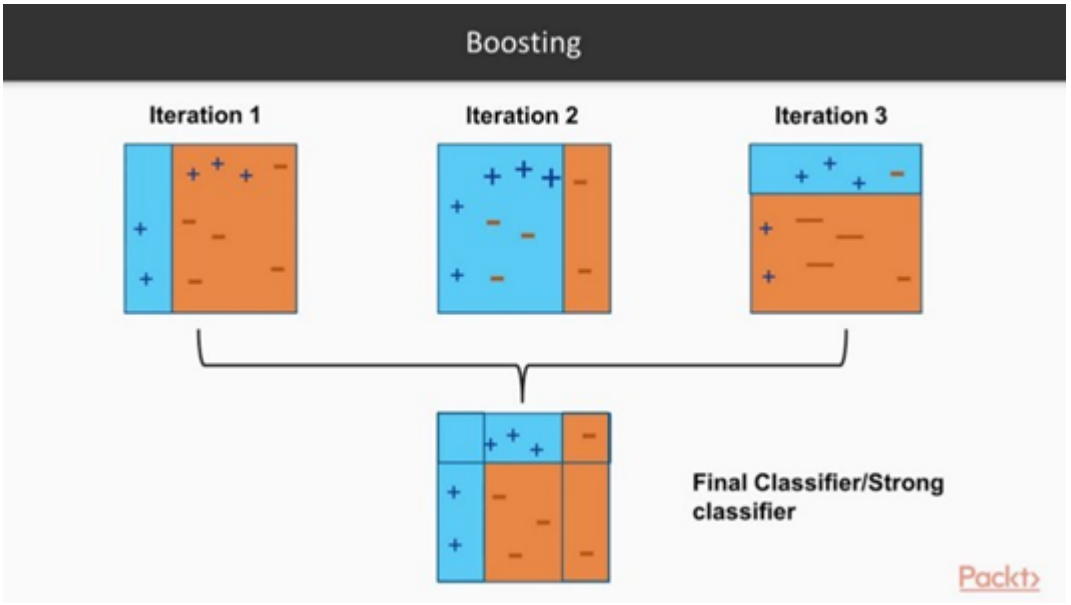


Fig 4.8 Adaboost

Step 4: Implementing Cascading Features

- The cascade classifier is made up of a series of stages, where each stage is a collection of weak learners.
- Weak learners are trained using boosting, which allows for a highly accurate classifier from the mean prediction of all weak learners.
- Based on this prediction, the classifier either decides to indicate an object was found (positive) or move on to the next region (negative).
- Stages are designed to reject negative samples as fast as possible, because a majority of the windows do not contain anything of interest.

4.2 EXECUTION STEPS:

The Execution Steps are Different for different use cases of the application, the entire application has 3 major use cases, the execution steps for each of these steps have been mentioned in detail below:

1. **Use case: Registering a NEW STUDENT(Registering a new face):**

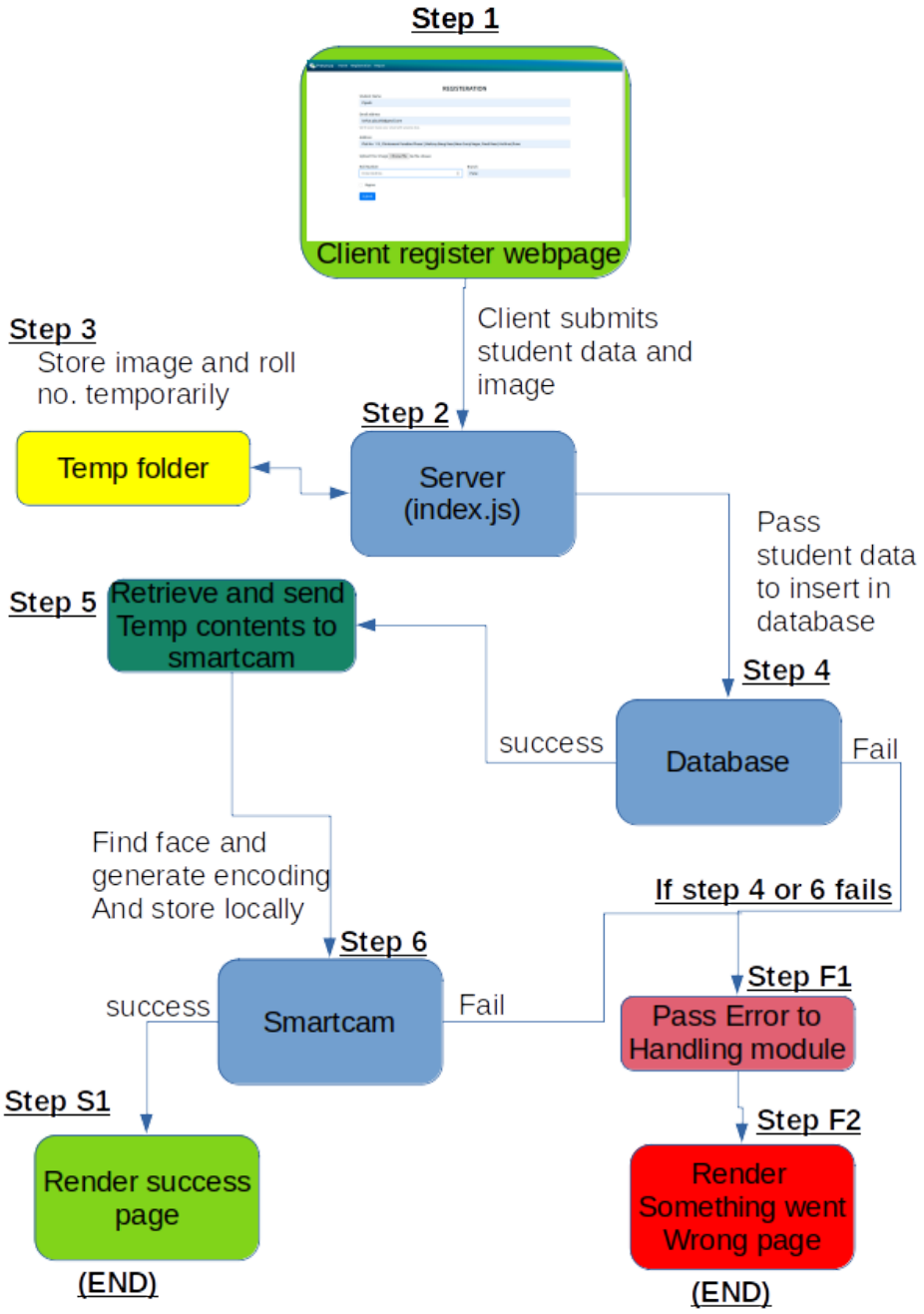


Fig 4.9 New Face Registration

2. **Use case: Retrieving attendance report and downloading:**

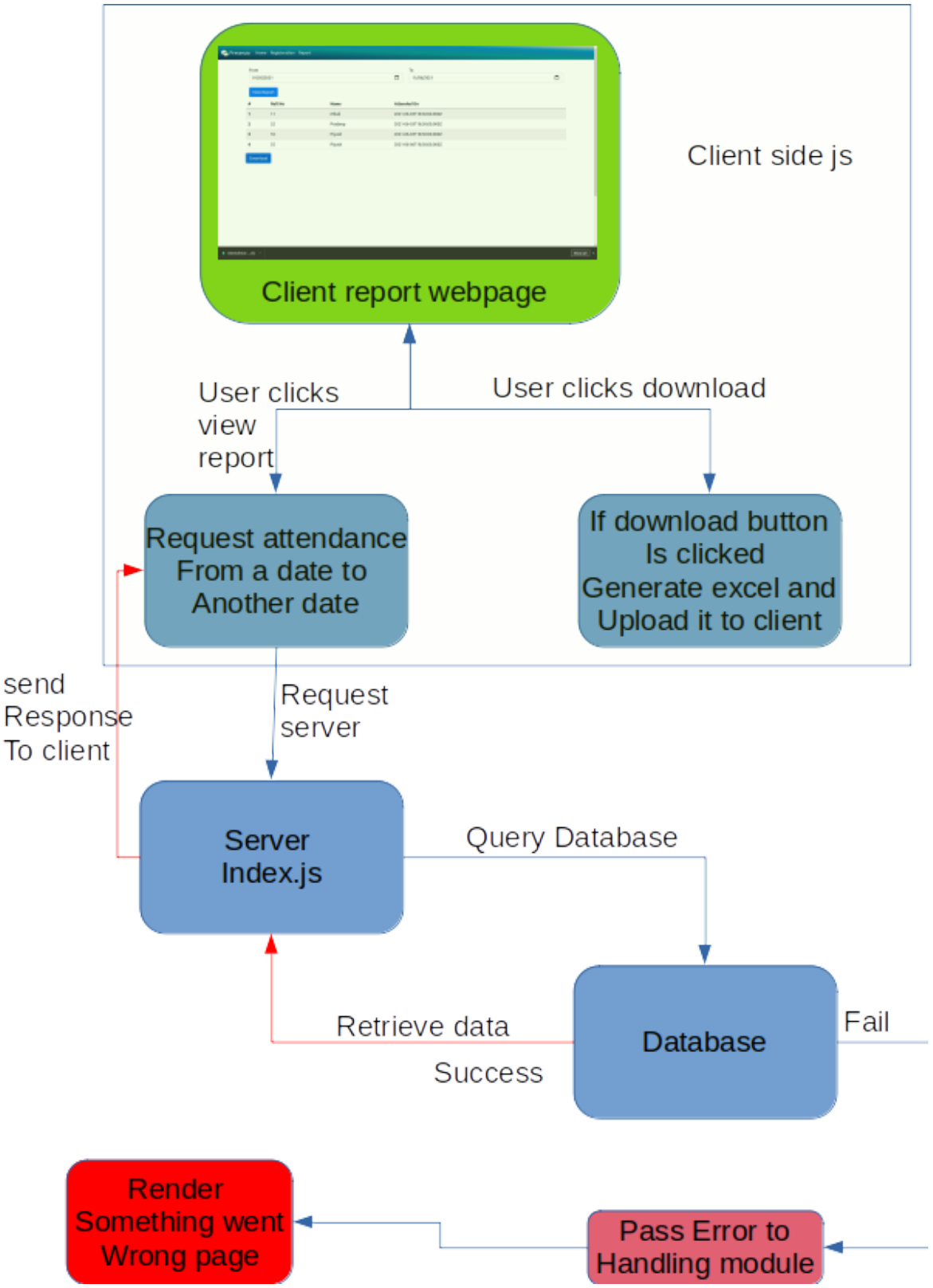


Fig 4.10 Attendance Report

3. **Use case: Functioning of the automatic face detection and attendance system:**

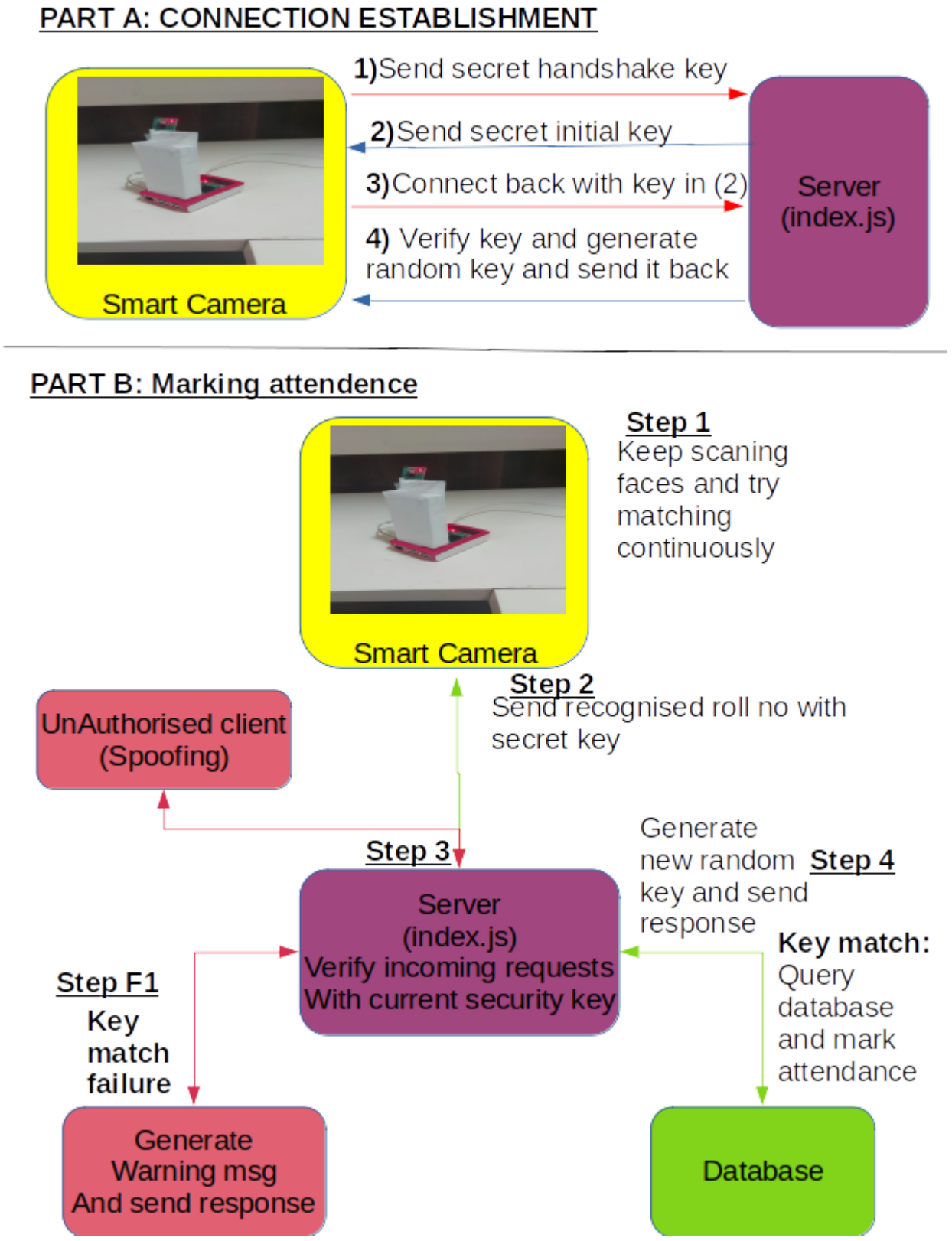
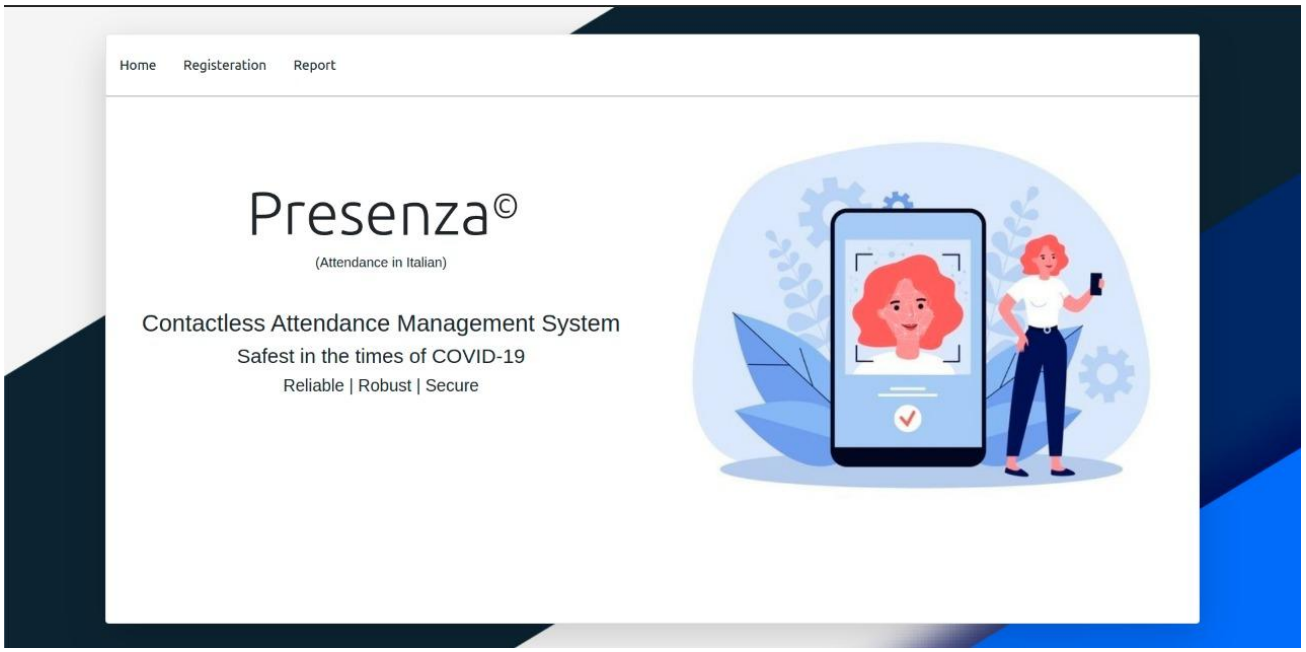


Fig 4.11 Automatic Face Detection

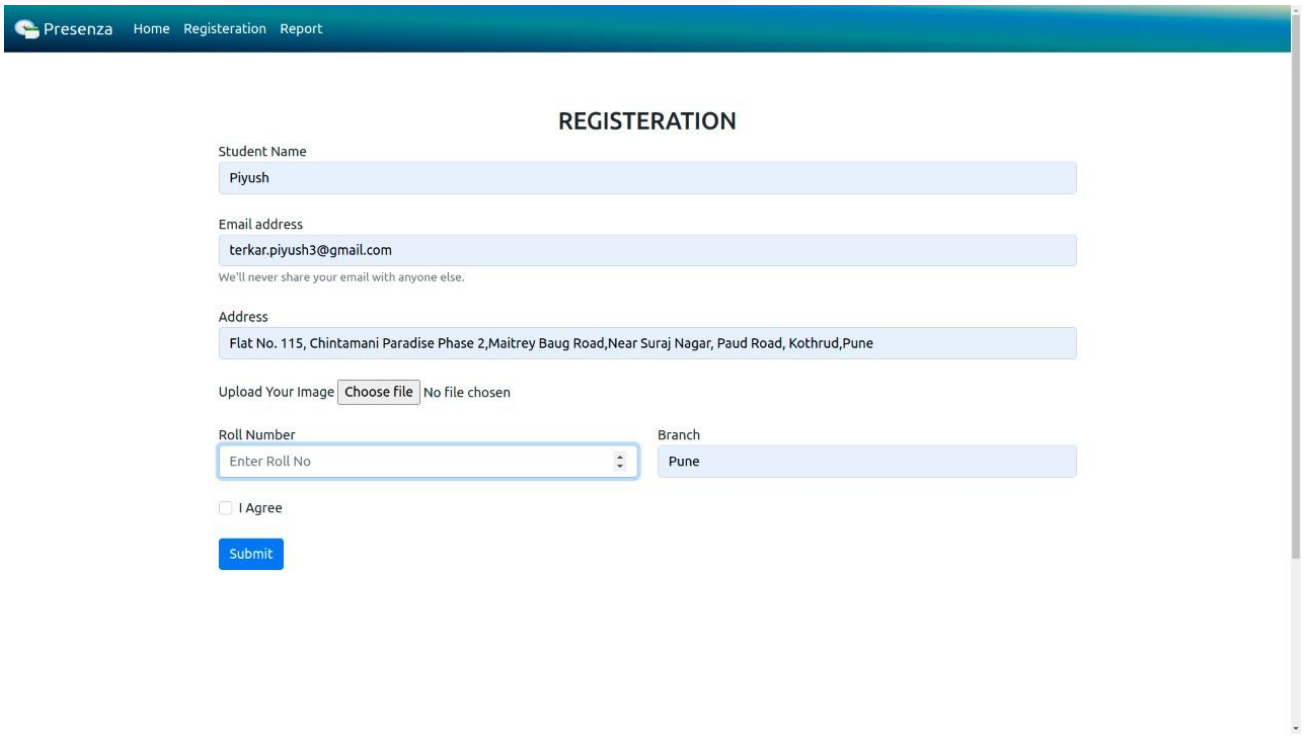
4.3 SCREENSHOTS OF RESULT

4.12 Implementation picture: Smart Camera

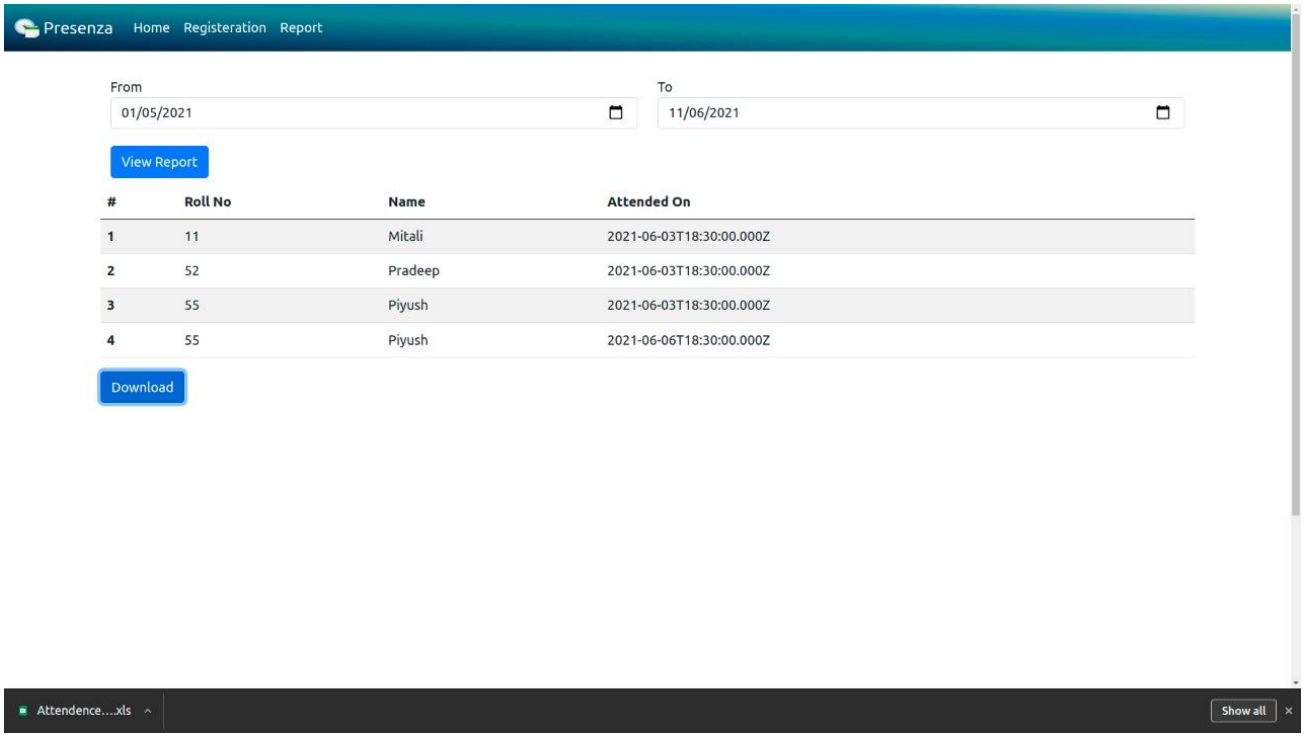
Website Screenshots



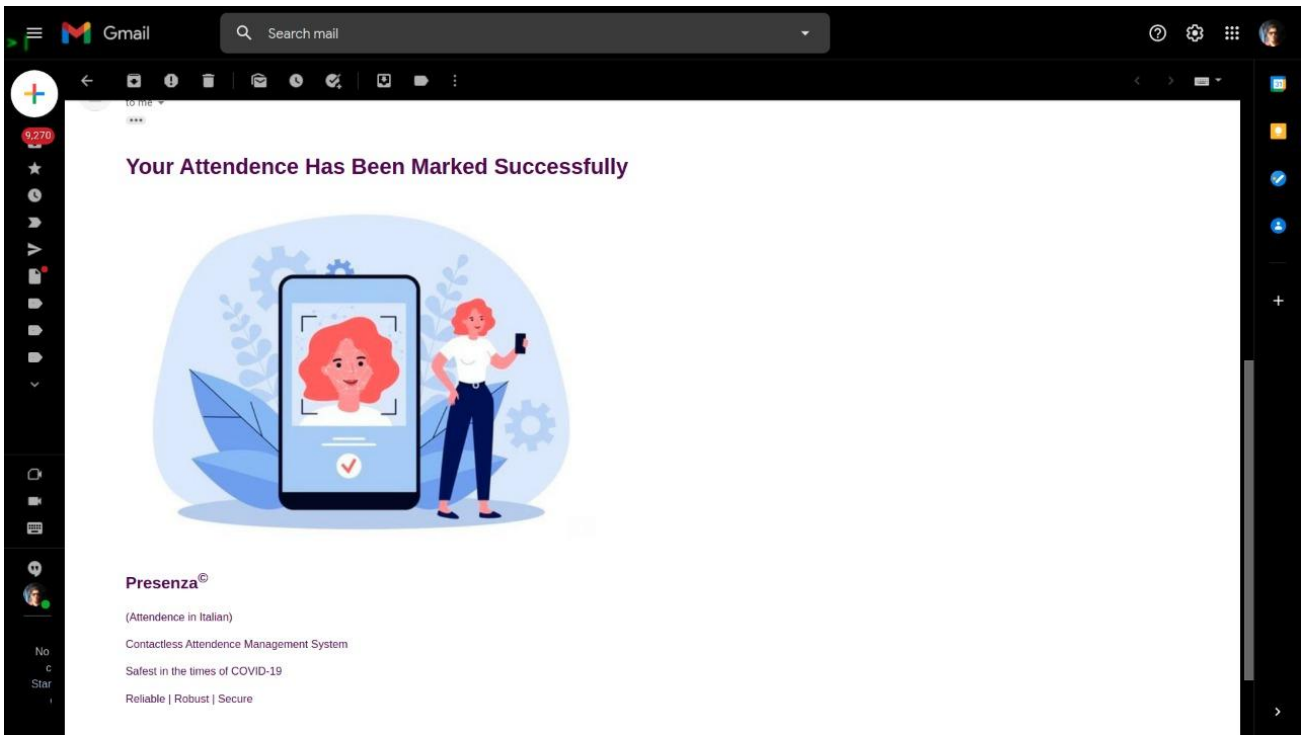
4.13 ScreenShot 1: Home Page



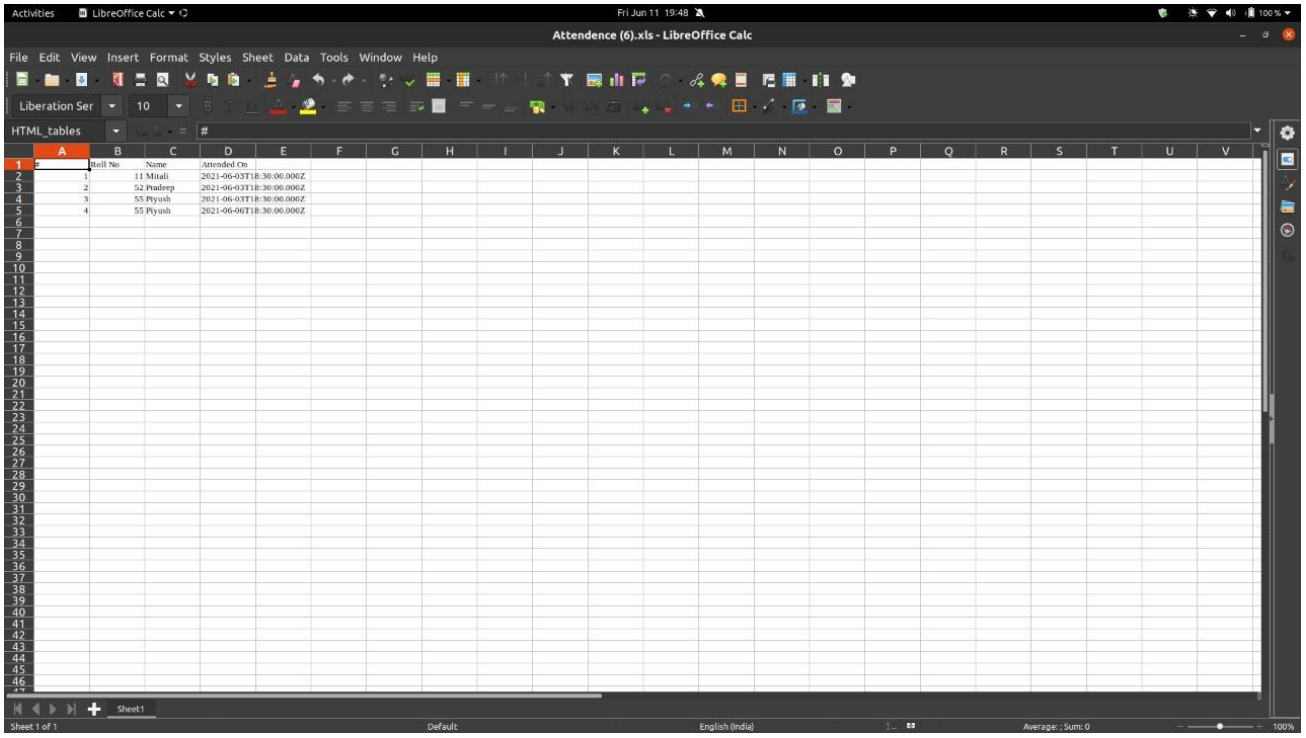
4.14 ScreenShot 2: Registration



4.15 ScreenShot 3: Report



4.16 ScreenShot 4:Email



4.17 ScreenShot 5: Excel Sheet

CONCLUSION

Finally, in the Attendance Management System Using Face Recognition, the outcome of all the hard work done for the attendance management system is here. This system marks the attendance using a Smart Camera and sends an email to the student about the confirmation of the attendance.

This software reduces the amount of manual data entry and gives greater efficiency. The User Interface of it is very friendly and can be easily used by anyone. It also decreases the amount of time taken to write details and other modules.

All the date wise details regarding the attendance can be downloaded in the form of an excel sheet. This Attendance Management System is a solution to all the problems related to the fake attendance, manual work of the teachers and provides accurate reports.

Hence, it is a Reliable, Robust and Secure Attendance Management System.

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