KANTIPUR ENGINEERING COLLEGE

(Affiliated to Tribhuvan University)

Dhapakhel, Lalitpur

[Subject Code: CT755]

A MINOR PROJECT REPORT ON

FACE ATTENDANCE SYSTEM

Submitted by:

Ajay Chaudhary(18804)

Ashim Budha Chhetri (18815)

Ayush Niraula (18817)

Manoj Subedi (18832)

A MINOR PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR IN COMPUTER ENGINEERING

Submitted to:

Department of Computer and Electronics Engineering

April, 2022

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DEPARTMENT OF COMPUTER AND ELECTRONICS ENGINEERING

APPROVAL LETTER

The undersigned certify that they have read and recommended to the Institute of Engineering for acceptance, a project report entitled ”Face Attendance System” submitted by

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in partial fulfillment for the degree of Bachelor in Computer Engineering.

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Date: April 17, 2022

ABSTRACT

Proper student/officer's record is a key to the smooth functioning of the organization or educational institution. Therefore, there is always a demand for a proper attendance system and systematic data collection. Besides currently where everything is automated and computerized, it is not feasible to take attendance manually. Therefore, we proposed a system based on face recognition to counter this issue. A system using face recognition technology that uses a webcam to detect the face of students and save the information with name, date, and time. Our system will detect the face of the person registered and will save the data systematically. According to research, consistent attendance may be the most important element affecting his or her academic achievement. As a result, education agencies and other institutions are increasingly being requested to provide attendance statistics in a uniform format so proper data can be kept. The connection between student attendance and student success is the fundamental justification for high-quality attendance data. Teacher effectiveness is the biggest school-related indicator of student success, but even the finest teacher's capacity to create learning opportunities is harmed by persistent student absence. Especially in our country where the attendance system is manual. It is important to not only take proper attendance but also keep the data systematically.

Keywords – Face Recognition, Attendance System, Effectiveness, Data Collection.

ACKNOWLEDGMENT

For our minor project, we were helped by many people. We would like to thank all those who are related to this project. Primarily, we would thank our supervisor for being able to help us excel for project with success. Then we will thank our HOD and teachers, under whose guidance we learned a lot about this project. His suggestions and directions have helped in the completion of this project.

Finally, We would like to thank our friends who have helped us with their valuable suggestions and guidance and have been very helpful in various stages of project completion.

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CHAPTER 1
INTRODUCTION

1.1 Background

Face recognition technology is progressively turning into a universal biometric solution since, as compared to other biometric alternatives, it takes almost little effort from the user. Traditionally, students' attendance has been recorded manually using an attendance form provided by the professor in class. This is a time-consuming process. In a huge classroom, it's impossible to verify each student individually and maintain the data systematically. A face recognition system is a type of computerized biometric software that may be used to identify or validate a person by comparing patterns based on the looks of their faces. Face recognition systems have improved significantly in terms of administration in recent years, and the technology is now widely utilized for a variety of purposes, including security and commercial operations.

Face recognition, a computer-based digital technology, is a strong subject of research. Face recognition for the purpose of recording attendance is a clever use of the attendance system. Face recognition might be used in an effective attendance system to automatically record a registered individual's presence together with their information. Our proposed system additionally keeps a log file to keep track of each individual's entry in relation to instant time. Through this proposal, we believe we can develop a face attendance system that can have a major impact in solving a real-world problem.

Attendance maintenance is a significant function in all institutions to monitor the performance of the students. Every institute does this in its own way. Some of these institutes use the old paper or file-based systems and some have adopted strategies of automatic attendance using some biometric techniques. When it comes to schools and universities, the attendance monitoring system is a great help for teachers. [1] [2]

1.2 Problem Statement

Papers/registers are used by professor and manually name, or roll is called during attendance and different kind of other manual mechanisms are used in conventional attendance tracking. Constant human monitoring and awareness involved while manual attendance. Using the advantage of the technology we have directed ourselves to the development of an automatic attendance system that produces more accurate and efficient outcomes compared to manual attendance. This automated approach may be used to keep track of staff/student attendance.

With manual methods, management/institution is under constant pressure to be accurate in all aspects of workers' jobs or student's performance. It's common for a minor mistake in manual attendance, resulting in incorrect data entry or false information. This mistake might result in not just incorrect information, but also problems with the overall functioning of an institution or organization. Reporting and verifying that data may be time-consuming and costly as well. Keeping track of papers, finding information, and maintaining accuracy involve more physical and mental work. This is when Face Attendance System plays a vital role in mitigating this issue and for effective attendance tracking.

1.3 Objective

Following listed are the major objective we are considering for our proposed Face Attendance System:

1. To provide a completely automated face attendance system with accuracy and avoiding human error.
2. Effective data collection and storing with data visualization.

1.4 Area of Application

This project is ideal for any company or educational institution with a large number of students or employees to manage and a large amount of data to handle. Instead of wast-

ing time monitoring attendance and information, different organizations or institutions may focus on productive works. Within the administrative compound, students may become involved in various conflicts or illegal actions, and this technology can identify and offer information on each individual. Employees at various governmental agencies and organizations frequently attempt to exploit the manual attendance system.

Apart from that, this system may be utilized in a variety of functions and programs to keep track of visitors and VIPs. Instead of regular checks and surveillance, prisoner's data may be recorded, and continuous monitoring can be carried out with date and time saved in real-time. Upon further advancement of the system, this technology might be utilized by criminal investigators, airport security, police, and so on.

1.5 System Requirement

1.5.1 Software Requirement

This application is targeted to institutions and organizations; therefore, we cannot properly run this system on low-end devices or mobile platforms smoothly as it has some software requirements. Following listed are some of the requirements for its proper functioning:

1. Operating System: Windows, macOS.
2. Web Library and Language Involved: HTML, CSS, JavaScript, Matplotlib, Face Recognition, dlib, cmake, OpenCV, Google charts , Visual Studio Community(to support library like dlib to create c++ environment), MySql(Database), PHP (develop connection between frontend and database)
3. IDEs: Visual Studio Code, PyCharm

1.5.2 Hardware Requirement

Following listed are the hardware components required for the optimal performance of this system:

1. Laptop with Intel Core 2 Duo Processor (I series recommended), with minimum 4GB RAM (8GB recommended).

1.6 Project Features

1. Automated Face Attendance with preciseness and accuracy.
2. Effective and Systematical data/information storing.
3. Reliable and time efficient system.
4. Data visualization with statistic and graphs.

1.7 Feasibility Study

This project is ideal for any company or educational institution with a large number of students or employees to manage and a large amount of data to handle. Instead of wasting time monitoring attendance and information, different organizations or institutions may focus on

1.7.1 Economic Feasibility

Our system basically surfaces around the software aspects; therefore, it is economically feasible. Unless integrated cameras and equipped surveillance are used to monitor and detect the faces, we are intending to build our system that only uses a laptop, its camera, and the internet for its smooth functioning.

1.7.2 Schedule Feasibility

Our system is more than just face detecting software. This system is revolved around a web-based platform that allows the admin to log in and uses the system accordingly. Development using Adam Geitgey's Face Recognition library, designing frontend with HTML, CSS, and JS, using MySql database and building visualization with Google Charts and Matplotlib.

1.7.3 Technical Feasibility

This system is a web-based system and demands laptops with cameras and internet availability for its smooth functioning. Apart from that, this system is user-friendly and easy to operate without requiring any advanced hardware components.

1.7.4 Operational Feasibility

This system is made for institutions and organizations keeping in mind that, this system can be operated by technical officials. Therefore, this system may be difficult or sometimes maybe confusing to easily operate for non-technical officials.

CHAPTER 2
LITERATURE REVIEW

2.1 Related Paper

Machine learning is the idea that there are generic algorithms that can tell you something interesting about a set of data without you having to write any custom code specific to the problem. Instead of writing code, you feed data to the generic algorithm, and it builds its own logic based on the data. For example, one kind of algorithm is a classification algorithm. It can put data into different groups. The same classification algorithm used to recognize handwritten numbers could also be used to classify emails into spam and not-spam without changing a line of code. It's the same algorithm but it's fed different training data, so it comes up with different classification logic. "Machine learning" is an umbrella term covering lots of these kinds of generic algorithms.

Face detection went mainstream in the early 2000's when Paul Viola and Michael Jones invented a way to detect faces that was fast enough to run on cheap cameras. However, much more reliable solutions exist now. The simplest approach to face recognition is to directly compare the unknown face with all the pictures we have of people that have already been tagged. When we find a previously tagged face that looks very similar to our unknown face, it must be the same person. There's actually a huge problem with that approach. A site like Facebook with billions of users and a trillion photos can't possibly loop through every previous-tagged face to compare it to every newly uploaded picture. That would take way too long. They need to be able to recognize faces in milliseconds, not hours. [3]

2.2 Existing System

2.2.1 Truein

Yugstart Technologies Pvt Ltd's flagship product-platform is Truein. The company was started in the Indian city of Pune. The founders have over a decade of expertise in the IT

industry in India, the United States, and Singapore. Truein is on a mission to make staff attendance and guest entrance as frictionless as possible - without the use of expensive hardware.

Pros

1. Create a seamless experience for your staff attendance
2. Without any complicated hardware
3. Advancements of Artificial Intelligence technologies

Cons:

1. No frequent updates
2. No interactive User Interface

2.2.2 Ramco

This face recognition technology eliminates the need for any clicks, logins, or ID cards, making Ramco more efficient. Any employee will be able to register their attendance in a matter of seconds. It beautifully streamlines the employee experience while also solving the challenge of collecting and tallying attendance data, allowing the company to plug income leakage.

Pros

1. Real-time visibility into operations at the click of a button
2. Mobile-based enterprise software

Cons:

1. No proper data visualization and representation

2.2.3 Pocket Fame

Simplify, Standardize, and Automate Attendance Management for Indoor and Outdoor Staff with comprehensive touch-free Attendance Employee Tracking Management system. A tablet with the Blink-In application is mounted at the reception desk or at the entrance gate. When an employee walks up to the tablet without touching it, face recognition is automatically triggered, and attendance is recorded with a confirmation message. The system will be ready for the next employee in less than 5 seconds.

Pros

1. Employee Tracking Management solution to Simplify
   Cons
2. Standardize and Automate Attendance Management

Cons:

1. No proper data visualization and representation

CHAPTER 3
METHODOLOGY

3.1 Block Diagram

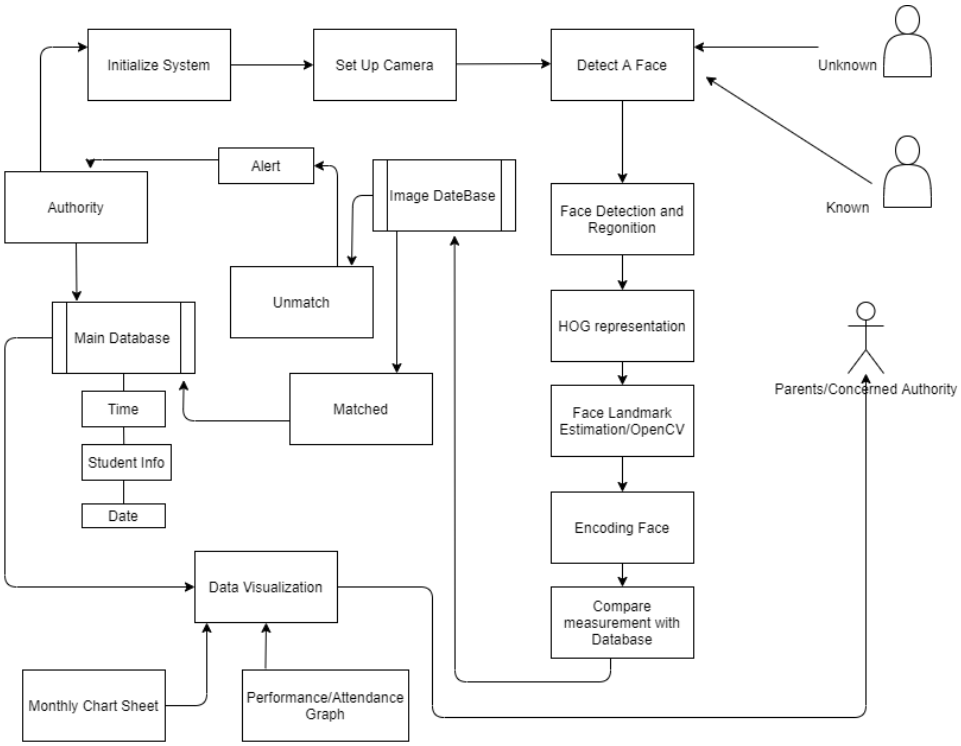

Figure 3.1: System Diagram

3.2 Face Recognition and Detection

There are basically four steps involved in recognizing a face from an image and compare it with our database. This is a basic way of detecting a face and recognizing it. We divide this entire process of face recognition into four pipelines

3.2.1 Finding a Face in an Image

The histogram of oriented gradients (HOG) is a feature for object recognition in computer vision and image processing. First step of every image recognition is detecting a face in an image. Therefore, we use something called HOG representation to figure out the face in an image. The first step is to change the colored image into black and white. Here we do not need colored data or pixel to detect face. We detect a darker

pixel in a face and put an arrow on it to show gradient. We locate the darker pixel and put an arrow in the direction the face is turning light. Therefore, an arrow points to the direction from a darker pixel to lighter pixel. These arrows are called gradients. Now we use hog method to represent the image. The original image is converted into a HOG representation, which captures the image's main characteristics independent of image brightness. Using this technique of hog representation, we can find a faces in any image. Dlib is a modern C++ toolkit containing machine learning algorithms and tools for creating complex software in C++ to solve real world problems. The histogram of oriented gradients (HOG) is a feature descriptor used in computer vision and image processing for the purpose of object detection.

Figure 3.2: Colored Image

Figure 3.3: Black and White Image

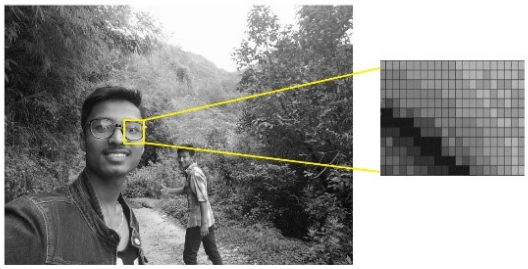

Figure 3.4: Pixel Detected

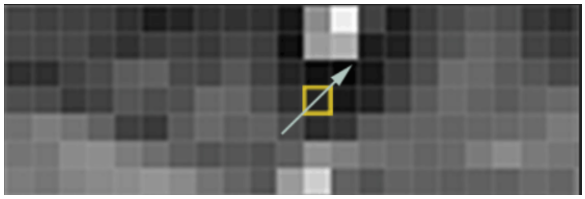

Figure 3.5: Pixel to Gradient

3.2.2 Analyze facial features

It is very easy for us to know that the following picture is of a same celebrity. But this is very hard for a computer to recognize the difference. Therefore, we have to warp the face in such a way that eyes and mouth are always centered making it easy to compare. For this we use a technique called face landmark estimation. In this technique we locate 68 landmarks within the face. Now we know where the eyes and mouth are we now try to make it as centered as possible. We carry out simple scaling, rotation, and transformation to center the eyes and mouth. We do this using affine transformation. Now, no matter which way the face is rotated, the eyes and lips are nearly in the same place in the picture. Our following step will be much more precise as a result of this. Facial landmark detection is the task of detecting key landmarks on the face and tracking them. An affine transformation is any transformation that preserves collinearity i.e., all points lying on a line initially still lie on a line after transformation and ratios of distances.

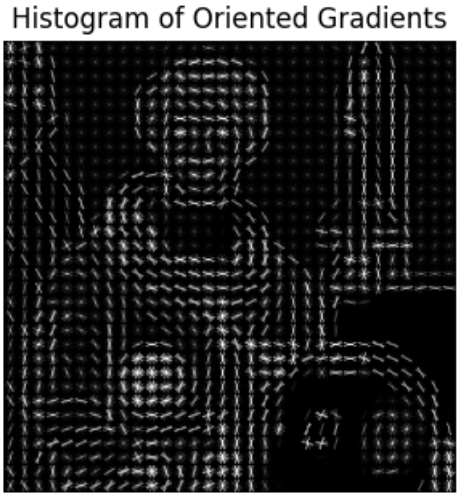

Figure 3.6: Hog Representation

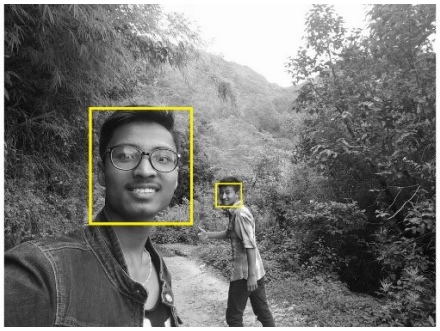

Figure 3.7: Face is Detected

3.2.3 Encoding the face

After we detect a face now its turn to encode the face detected for comparison. Now instead of comparing the ear size, eye color or nose length we use different approach. Since comparing nose length, eye color or ear size is not reliable method of encoding a face. Therefore, we use neural network to train compute itself to generate 128 different measurements for an image. Instead of comparing a pixel we pass our image through neural network here openFace. Passing this through this network we calculate 128 measurements for comparing the image. OpenFace is a Python and Torch implementation of face recognition with deep neural networks. OpenCV provides a real-time optimized Computer Vision library, tools, and hardware.

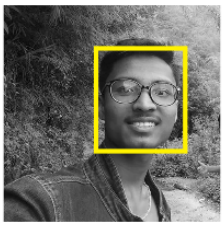

Figure 3.8: Detected Face

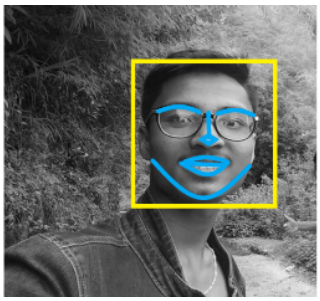

Figure 3.9: Face Landmarks Estimation

3.2.4 Finding a person

In machine learning, support-vector machines are supervised learning models with associated learning algorithms that analyze data for classification and regression analysis. Using this approach, we compare the date with the test image from our database and commence the face detection and recognition.

Figure 3.10: 68 Landmarks

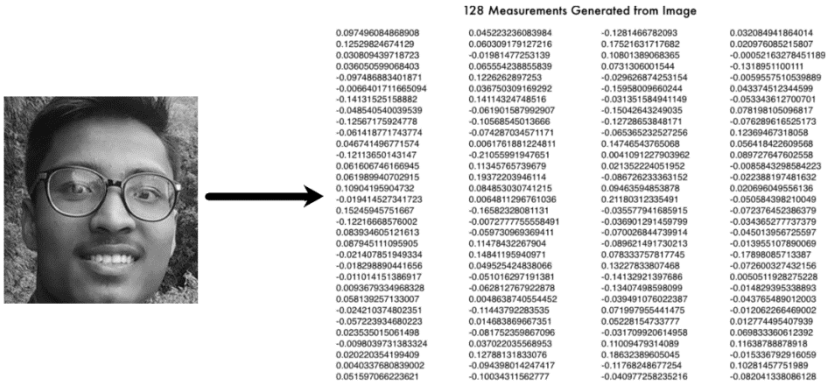

Figure 3.11: 128 Measurement

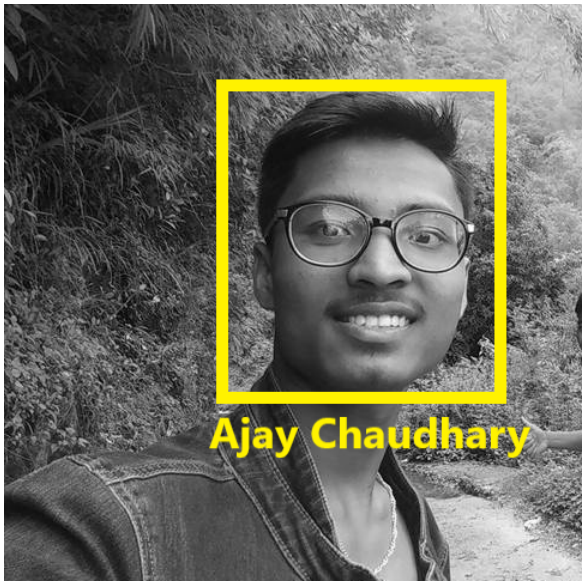

Figure 3.12: Face Recognized

3.3 HOG Representation

The histogram of oriented gradients (HOG) is a feature for object recognition in computer vision and image processing.

1. Gradient and Orientation
2. Localized and Normalized portions
3. Histogram

PROCESS OF CALCULATING THE HISTOGRAM OF ORIENTED GRADIENTS

1. The first process involved is preprocessing the data. Any sort of image is processed and broken down into a width-to-height ratio of 1:2. This is done in order to divide the images into 8*8 and 16*16 patches to extract features. Therefore simply for the very first step we divide the image into different patches.
2. The second step is to calculate the gradients that are basically the direction of x and y. We take a small patch and then calculate its pixel value. To calculate the gradient in x-direction we need to subtract the value on the left from the pixel value on the right. Using a similar process we can calculate the gradient in the y-direction by subtracting the horizontal pixels. If the result is higher, we can predict there is a sharp change in intensity. Following pictures gives a brief introduction to gradients flow.
3. The third step is to calculate the magnitude and orientation. Since we have calculated the horizontal pixel and vertical pixel, using Pythagoras theorem we can now calculate the total gradient magnitude and calculate the angle using the tan for the angles.
4. The next step for this process is to calculate the histogram of gradients in 8*8 cells. This feature extraction is not done entirely for a picture but for small, divided cells. In doing so we get features of smaller patches which are then represented with an entire picture.
5. After features are extracted from divided small patches. Now it turns to normalize the gradients. For a computer, a picture that is bright and dark is completely different. Therefore, for particular pictures, some portion of the image can be bright as compared to other portions. Therefore, we can normalize this lighting condition by normalizing the gradients by taking 16*16 blocks. we compare the 8*8 matrix to create 16*16 matrix for normalization.
6. This is the final step involved in generating hog features for the image. calculating the 16*16 blocks created and multiplying it with 36 features will give the number of resultant features generated.

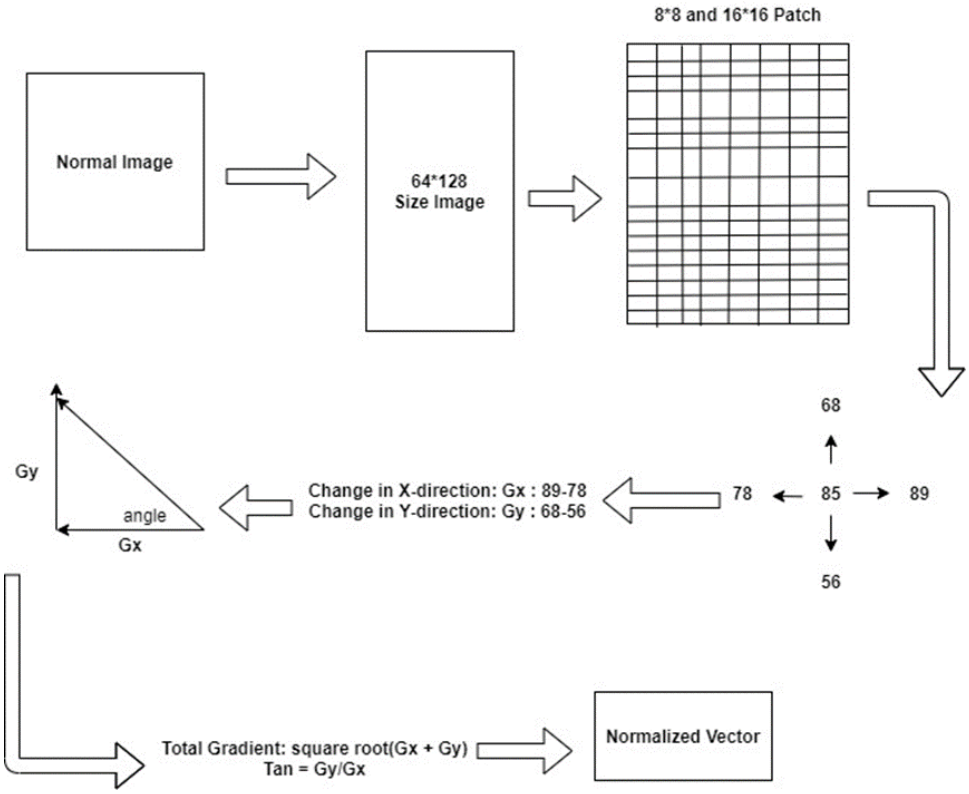

Figure 3.13: HOG Library Details

3.3.1 Adam Geitgey's Face Recognition library

Adam Geitgey also author in several article in medium has designed and documented Face Recognition library systematically. The model has an accuracy of more than ninety percent. Built using dlib's this documentaion provides us basic information to complex issue for training, encoding and comparing images.

3.4 Data Visualization

3.4.1 Web Based System

Web application development is the second phase of our project where the collected student data are accessible and displayed. For visually appealing reason and instead of looking at raw data of student it is more convenient to look at charts and graphs. We use different web technology to make this possible. We are intending to include best web technology to make the interaction more convenient and aesthetic. The process of creating a web application is known as web application development. It places a greater emphasis on engaging with the browser than on traditional technical procedures.

3.4.2 Data Visualization System Diagram

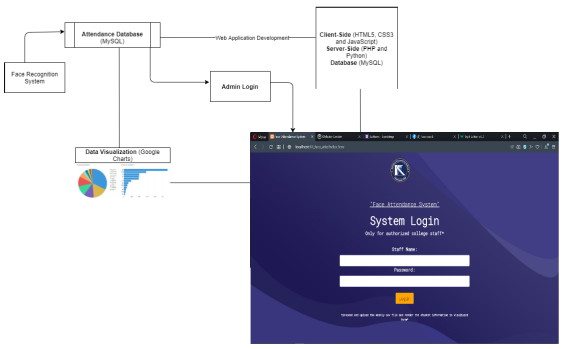

Figure 3.14: Chart Integration

3.4.3 Data Visualization

Data visualization is simply representation of the data. Using different visually appealing elements such as maps, graphs and charts we can convert any dataset into smooth graphical visualization. Simply it is the process of explaining the numbers and analyzing it for further references. For the purpose of data visualization, we are using google chart for dynamic data presentation in our web application with high accuracy and efficiency. Upon receiving the student record in our MySQL database, we call data through PHP with connection to our database. The frontend development stage within the web application is the visual development stage. For the fronted part elements are visually represented. For the fronted development we use some of the most common development tools like HTML5, CSS3 and JavaScript. Backend development stage involves everything users don't see. It is behind the scenes activities that occur when user or clients interact with the web application. Backend is used to build a core infrastructure of the application. The primary focus of backend development is interacting with database. We are intending to use python and PHP as our server-side language. The primary focus of database is to collect, process and manage data and proving secure access of that stored data. We are intending to use MySQL as our database. Upon face recognition the time of student is saved in our database and

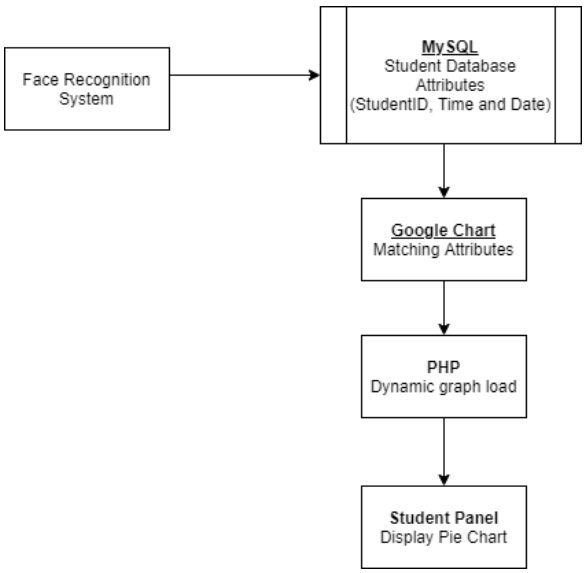

Figure 3.15: Database Integration

further process is carried out. Database is integral part of our project as all the student information are saved in the database and we use the collected data in our database for the next phase of data visualization. Data visualization involves following steps

3.4.4 Matplotlib

Matplotlib is python library that can be used and import to visualize the data. Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. We are going to plot data that is continuously being generated in real time using matplotlib. These real time plots that changes frequently is easy to monitor if the visualization is in real time.

3.4.5 MySQL database

We create database with required attributes of student to store data and information which will be called through PHP after connecting with database. These attributes will later be called to match the attributes mentioned in PHP file.

3.4.6 Google Chart

Google chart is simple yet powerful data visualization tool which can be linked with our database. The data stored in MySQL will be converted into bar chart dynamically showing the student attendance.

3.4.7 Dynamic Data Representation

Using the Script file of google chart we can dynamically show visual representation of the student attendance. For this process we manually upload csv file which is dynamically inserted into our database. Upon initializing the system, the student face is recognized. The student information and attendance are saved in our database. Upon admin login, the visualization graphs provide by google charts is dynamically displayed on admin panel. We also have a bat file designed to manually show matplotlib graphs.

3.5 Use Case Diagram

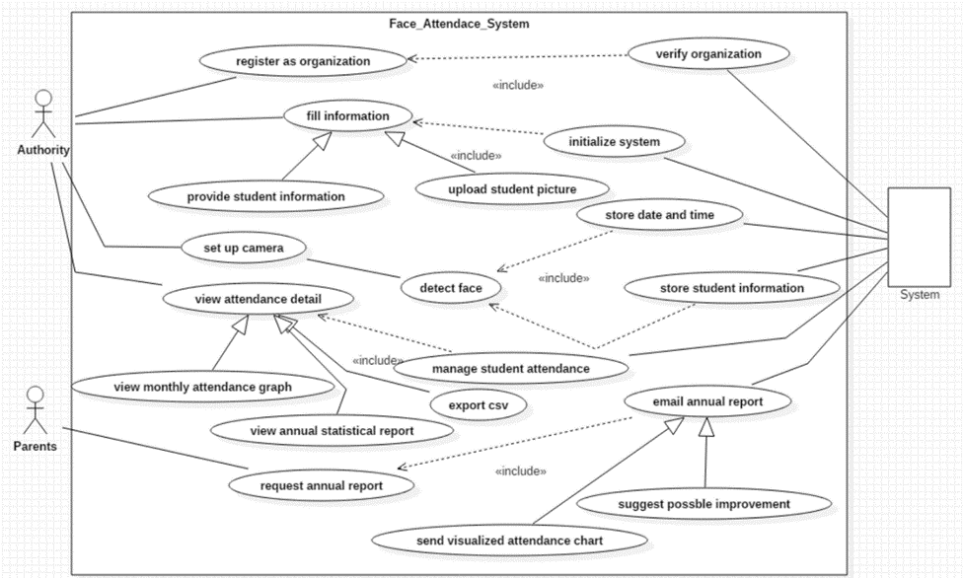

Figure 3.16: Use Case Diagram

3.6 Software Development Model

3.6.1 Increment Model

The incremental model is a software development technique that iteratively integrates the parts of the waterfall model. It entails both the creation and the upkeep of a system. The needs are divided into many components in this model. Analysis, design, implementation, testing/verification, and maintenance are all stages of incremental development. Every iteration goes through the steps of requirements, design, coding, and testing. The initial increment is frequently a core product that addresses the essential criteria, with additional features added in subsequent increments. The client receives the primary product. Following the client's analysis

of the core product, the strategy for the next increment is developed. A Successive version model is another name for this concept. The incremental model is similar to the waterfall model in that it iteratively incorporates the features of the waterfall model. In each increment, the waterfall model is used again and again. In addition, the incremental approach uses linear sequences in a certain manner.

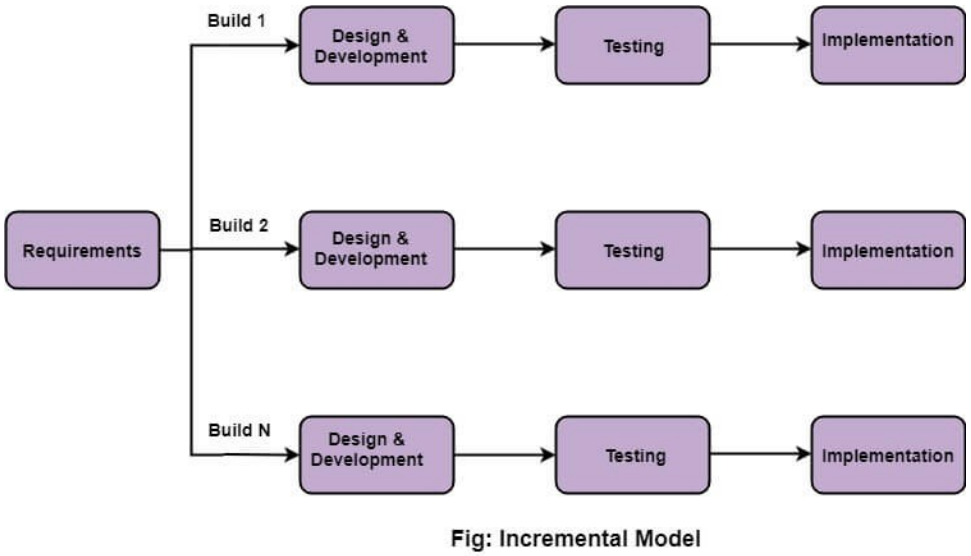

Figure 3.17: Incremental Model

3.7 System Algorithm

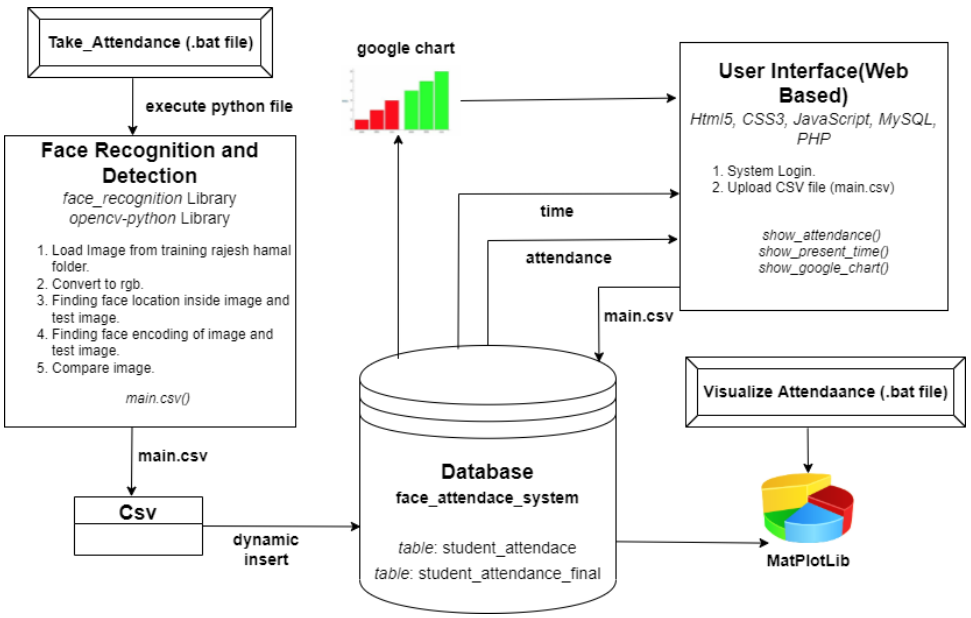

Figure 3.18: System Algorithm

CHAPTER 4
EPILOGUE

4.1 Expected Output

Our system is fully web-based and aimed at educational institutions and organizations. Here, the department head or other appropriate authority can enter student or staff information and submit student photos. Finally, the system is initiated, and face detection is enabled using the laptop's camera. The system is triggered when the face of a registered student is detected, and the instant time of the student's presence is saved in the database. The database is open to all involved authorities. Furthermore, the system is constructed in such a way that it automatically records the attendance history of students in a graphical and statistical fashion dynamically fetching data from the database. During the course of project we changed our User interface as below.

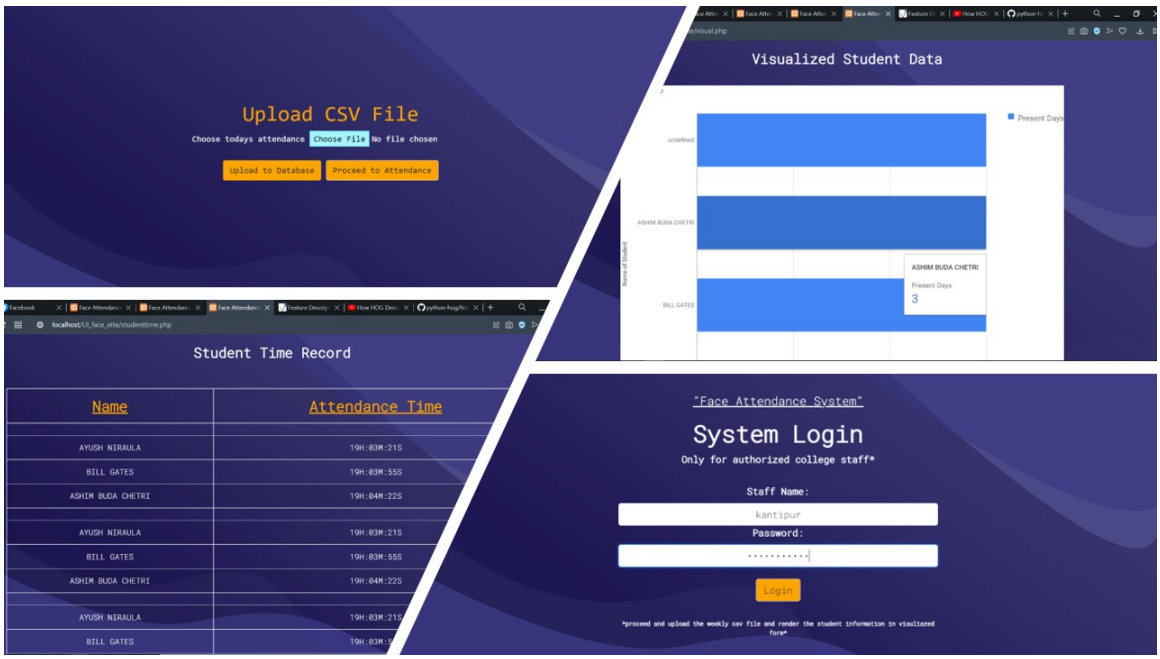

Figure 4.1: User Interface

4.2 Work Schedule

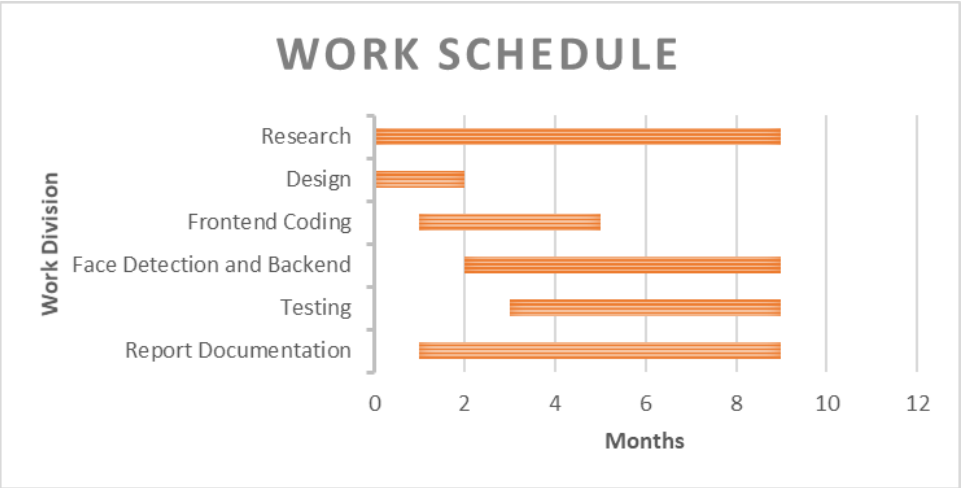

Figure 4.2: Work Schedule

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