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Automated Attendance System Using Face Recognition

Educational Technology (EdTech)

Senior Project

By

Hassan Rhayel & Mohammad Bahja

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Abstract

Significance:

The Automated Attendance System Using Face Recognition stands as a beacon of technological innovation in the domain of education, security, traffic, management, etc. And most likely, we came up with this idea to help make it easier to keep track of who's in class, which saves instructor's a ton of time as it is simpler and more efficient way to deal with that automatically.

Dedication:

Me and my fellow colleague have studied what could help in enhancing some technological features in our university lately and came up with this impactful idea. We would like to dedicate this project to our university, Lebanese International University which greeted us to the campus, environment, friends, instructors and the major.

We would like to dedicate this project to everyone who helped us through achieving this piece of work including our instructor, Dr. Ali Choumane, who guided us through every step, and who also advised us by solving every obstacle that we went through and made us believe in achieving it.

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Executive Summary:

The Face Recognition Attendance System project aimed to develop an automated solution for managing classroom attendance using facial recognition technology. It is involved designing and implementing a web-based application that captures images of students automatically upon entering the class and processes the images to detect and recognize the faces and updates the attendance record of each individual student.

Key Findings & Outcomes:

- Successful deployment of a working prototype system that tracks attendance by recognizing and capturing faces.
- Higher efficiency when compared to manual techniques for documenting attendance.
- Identified opportunities for additional development, such as improving user interface design and facial recognition algorithms.

Recommendations & Next Steps:

- Test and validate the system in real-world scenarios to ensure performance and dependability.
- Optimize facial recognition algorithm for improved real-time performance.
- Consider scalability and deployment options to increase uptake among educational institutions.

Chapter 1: Project Overview

In this chapter, we are going to start with the introduction, talk a little bit about our project, what are the goals of it, boundaries that it will cover, challenges and issues to overcome and the project's requirements.

1.1 Introduction:

In Today's educational space, traditional methods of recording student attendance often prove to be time-consuming and imprecise. Manual attendance-taking processes, which involve use of paper or electronic systems such as excel sheets which rely on manual data entry, can be inefficient and effort requiring for educators. Moreover, student variety and bigger classes bring a big challenge for accurately tracking attendance.

Recognizing these challenges, me and my colleague embarked on developing an innovative solution which is Automated System Using Face Recognition. Tapping into advancements in facial recognition technology, our project offers an approach to automating the attendance-taking process, not only to educational settings, but also to security, trafficking, events, public facilities, access control systems, hospitality industries and many more.

By harnessing the power of smart technology such as Artificial Intelligence to track who's in class automatically. All an instructor must do is press the Take Attendance button and pass the video frame through the students when they arrive. This saves tons of time, is super accurate, and makes things easier for everyone.

Furthermore, it can recognize all kinds of students, even if they change their hairstyles, grow a beard, put on makeup, or wear new glasses. This means everyone gets marked present the right way, no matter what.

In addition, it's not just for schools, our system can be used for work training, conferences, even concerts!

Basically, any place where need to keep track of who's there, our facial recognition can handle it. It's super flexible and can work everywhere, and anywhere!

1.2 Objectives:

Creating a user-friendly interface is our top one priority. We'll achieve this by gathering feedback from educators, administrators, and students to understand their needs. We then create clear, user-friendly prototypes that follow design best practices. Accessibility is vital, so everyone can use the system comfortably. Throughout the development, real users test the interface, helping us identify areas for improvement. By continuously refining the interface based on this feedback, we guarantee a smooth and positive experience for all.

1.3 Scope:

1. Our Project involves creating a smart attendance system which uses facial recognition to track students' attendance in classroom automatically.
2. Automated System Using Facial Recognition aims to make attendance-taking easier for teachers, doctors, admins and more convenient for students.
3. We'll work closely with teachers, students, and tech experts to make sure it meets everyone's needs.

1.4 Limitations:

1. Our system may have trouble recognizing faces in certain lighting or weather conditions.
2. We'll need to make sure that we handle students' data carefully to respect their privacy.
3. Technical issues like hardware compatibility and processing power could affect how well the automated attendance system works.
4. We'll need to focus on the most important features due to time and resource constraints.

1.5 Technology Constraints:

Software used: Visual Studio Code, Xampp, Web browser

Languages: HTML, CSS

Programming Languages: PHP, JavaScript

Frameworks & Libraries: Face Recognition, Flask, cv2(OpenCV), numpy, mysql.connector, bcrypt

Database: MySQL

Hardware: Computer, laptop

Our system will rely on facial recognition algorithms and machine learning techniques, which may require powerful hardware and computing resources.

Compatibility with existing classroom infrastructure, such as cameras and network systems, may pose a challenge.

The availability of reliable internet connectivity could affect the real-time functionality.

Continuous monitoring and maintenance will be necessary to address any software bugs or performance issues and errors

Chapter 2: Literature Review

This chapter talks about the foundation of the project, and what sector it belongs to. Artificial intelligence and Machine Learning are examples of the units, diving into Computer Vision, which is a field of AI and the libraries we used.

2.1 Introduction

1. Introduction to Literature Review:

- Overview of the purpose and significance of conducting a literature review.

2. Historical Perspectives:

- To see how we've kept track of who's showing up and how computers learned to recognize faces.

3. Current State of Attendance Tracking:

- Review of existing methods and systems used for tracking attendance in educational settings.

4. Facial Recognition Technology:

- Examine, and explore how things work, what it's used for, and how it's constantly getting better.

5. Educational Applications:

- Look for online academic databases, school websites, news articles, or even educational technology conferences.

6. Challenges and Limitations:

- Discussion around the challenges, limitations, and considerations with facial recognition technology.

7. Opportunities for Innovation

- Figuring out new ways to improve these systems by addressing the gaps or areas where research hasn't fully explored how facial recognition attendance system works in real-life situations.

2.2 Artificial Intelligence (AI)

2.2.1 Introduction to AI & its modern technology:

- AI stands for Artificial Intelligence. It's the field of computer science focusing on creating Intelligence machines capable of copying human functions like learning, understanding and problem solving. Some machines in our era are now performing specific tasks intelligently instead of humans which saves a lot of time and work.
- There are many branches of AI, and most importantly is machine learning which is about algorithms that are trained on using a lot of data to identify patterns and make decisions and improve accuracy in programming.
- Nowadays, AI is used in many aspects such as:
- **Automation & Efficiency**, how well an AI system can perform tasks with minimum resources like time, memory, or energy (labor shortage) and frees the employees from boring, and repetitive tasks so they can focus on better strategic works and reduces delays, errors, or cost.
- **Enhanced User Experiences**, ways users interact with products or services like facial, voice, fingerprint, and eye retina recognition in smartphones.
- **Data Analysis & Decision Making**, AI helps in generating deeper insights from data, enhance and improve data tests and visualization for better decision-making in areas like finance, healthcare, and marketing.
- **Innovation & Problem Solving**, AI is used to tackle complex and hard challenges in scientific research, like drug discovery and climate change by analyzing huge data sets and modeling such scenarios.

2.2.2 AI Techniques utilized in face recognition system:

- AI plays a critical role in face recognition systems, handling everything from **finding faces in an image** to **identifying the person in it**.
- **Face Detection**, this system identifies the human face, like the eyes, nose, and mouth in an image or video frame for the initial detection.
- **Facial Feature Extraction**, this process extracts the face components from the face detection such as the distances between the eyes, the shape of the jawline, and position of the cheeks to be converted into mathematical representation called **facial feature vector**.
- **Machine Learning for Recognition**, which has two main approaches, Face Verification and Face Recognition. In Face Recognition, the extraction of the feature vector is compared with the database which has known faces, if there is a match then the system will identify the individual. For the Face Verification, the extracted feature vector is compared with a claimed identity (either verified or rejected), the system will work on probability and the score will indicate the chance of a match.
- **Deep Learning for Enhanced Accuracy** works on a lot of data that allows models to learn more about patterns and improves accuracy. Deep Learning models are trained on huge datasets of faces with countless expressions, poses and lighting conditions. This enhances the system's ability to recognize faces with higher accuracy.

2.2.3 Overview of AI concepts (Machine Learning & Deep Learning):

- **Machine Learning (ML)**: The idea behind machine learning is by teaching a computer to learn from experience. ML algorithms require large datasets of data, that is text, images, and numbers to analyze, identify patterns and relationships. So, when you train the

ML model can make decisions on new, and unseen data. Some examples can be sorting emails as spam or not spam.

- **Deep Learning (DL):** Deep Learning is a subset of machine learning that uses neural networks (subset of AI) such as ChatGPT, Gemini and Chatsonic which are interconnected nodes or neurons in a layered structure that is inspired by the human brain. This makes deep learning effective for tasks like image recognition or natural language processing (NLP) which understands human language such as chatbots, text extraction, and text summarization.
- **Differences between Deep Learning & Machine Learning:** Machine Learning might involve memorizing vocabulary and grammar rules, while Deep Learning is more like showing thousands of pictures and automatically recognizing the patterns that define each image, by looking at a lot of examples, it allows them to recognize patterns and making decisions without needing specific instructions.

2.3 Computer Vision

2.3.1 Computer Vision & Image Processing:

- **Image Processing** is the process of transforming an image into a digital form and performing certain operations to get some useful information from it. Such techniques are noise reduction, sharpening (detail in a photo for emphasizing texture) and color correction (changing colors in an image).
- **Computer Vision** aims to extract meaning and the understanding from images and videos and uses techniques such as a **foundation**. Some tasks are **object detection**, **image classification** and **facial recognition**.

- Computer vision has a great impact in image processing by improving image quality (sharpening, color correction and noise reduction) and feature extraction (outlining objects, and edge detection for identification).

2.3.2 Computer Vision algorithms:

- Step 1 is **Image Preprocessing**
- Step 2 is **Feature Extraction**
- Step 3 is **Machine Learning Models** such as **Convolutional Neural Networks (CNNs)**. These models are trained on massive datasets of labeled images and specifying what the image contains. In summary, CNN is used primarily for image recognition and processing.
- Step 4 is **Model Training**, which involves CNN analyzing the labeled images and identifying the correlation between features and labels.
- Step 5 is **Interpretation and Recognition**. Once the model is trained, the model can analyze new, unseen images and extracts features from new image and compares them to the knowledge it gained during training taking the 3 forms, Object Detection, Image Classification and Facial Recognition.

2.4 OpenCV (Open-Source Vision Library)

2.4.1 Introduction to OpenCV:

- What is **OpenCV**? A powerful and widely used open-source computer vision and machine learning software library that provides a comprehensive set of functions and algorithms.
- As we talked about **Image Processing, Object Detection and Recognition, Facial Recognition**, and **Feature Extraction** which are also tasks for OpenCV.
- Machine Learning Integration is also an algorithm that automates repetitive tasks and optimizes workflows and allows you to leverage machine learning models for computer vision tasks.

2.4.2 Key Features:

- **Real-time Processing:** Processing of images and videos for applications like self-driving cars or video surveillance.
- **Image Segmentation:** Applies image processing algorithms to divide an image into different segments (simplify, change, or enhance the image), such as autonomous driving for determining the road.
- **Python Bindings & Active Community:** Integrates well with Python, making it accessible and user-friendly for developers familiar with Python. It is backed by a large and active developer community for providing support and resources.
- And mainly **Cross-Platform Compatibility**, as it runs on multiple operating systems like Windows, Linux, macOS, and Android, making it versatile for different development environments.

2.4.3 Benefits & Users:

- It is open-source and free.
- Easier to learn with a lot of documentation and tutorials.
- Always up to date with new features and bug fixes.
- People who use OpenCV are mostly **Researchers** to develop and test new computer vision features and algorithms. **Engineers** build applications in fields such as robotics, self-driving cars, and augmented reality (user interaction with digital information) and **Hobbyists**.
- You can visit <https://docs.opencv.org/4.x/> to know more about OpenCV and documentation.

2.4.4 Overview of key OpenCV functions:

- **cv2.VideoCapture():** this function allows capturing video from a webcam or loading a video file, and that is the first step in the code.
- **cv2.cvtColor():** This function converts images between different color spaces such as BGR to grayscale.

- **cv2.resize()**: Images can be resized to improve processing speed.
- **cv2.CascadeClassifier. detectMultiScale()**: for identifying and localizing faces within an image or video frame.
- **Cv2.norm()**: calculates distances between facial encodings.
- **Cv2.dnn.readNetFromModelZoo()**: loads pre-trained deep learning models for facial landmark detection (to detect specific points on the face (e.g., eyes, nose, mouth)).

2.5 Face Recognition Library

2.5.1 Definition:

- **Face Recognition Libraries** are software collections specifically designed for facial analysis tasks within computer vision projects. They provide pre-trained models and functions to streamline development and enhance the accuracy of face recognition applications. They are libraries for Python built on top of DLib and OpenCV. The aim is to provide an easy-to-use API for face recognition tasks.

2.5.2 Advantages:

- **Pre-built Functionality**: By offering pre-trained models and functions specifically.
- **Improved Accuracy**
- **Ease Of Use**
- **Flexibility**
- In daily life, it helped find missing people, protected businesses from theft, improved photo organization, strengthened security measures, improved medical treatment, etc.

2.5.3 Disadvantages:

- Threatens privacy.

- Imposes personal freedom.
- Violates personal rights.
- Data vulnerabilities.
- Technology can be manipulated.
- Errors can implicate innocent people.

2.5.4 Popular Face Recognition Libraries:

- **dLib**: provides powerful deep learning toolkit with pre-trained models for face detection, landmark detection, and face recognition.
- **FaceNet**: A deep learning model from Google AI, known for its high accuracy.
- **OpenFace**: A toolkit built on top of FaceNet, offering user-friendly functions for face recognition tasks.
- **MTCNN (Multi-task Cascaded Convolutional Networks)**: A deep learning model specifically designed for accurate face detection. It can be integrated with OpenCV for improved face localization.

2.5.5 Face Recognition Algorithms and Techniques:

- **Eigenfaces/Fisherfaces**: Uses statistical methods to determine the variance of faces in a collection of face images and use those variances to encode and decode a face in a machine learning way, without the full information reducing computation and space complexity.
- **Local Binary Patterns (LBP)**: An effective texture descriptor for images which threshold the neighboring pixels based on the value of current pixel for simplicity and robustness.
- **Deep Learning Techniques**: Such as CNNs, FaceNet and OpenFace.
-

2.5.6 Integration of Face Recognition Library:

1. System Models: Data Acquisition Module Preprocessing Module, Face Recognition Module, Decision-Making Module and Database Management Module.

- **Data Acquisition Module** might capture video from a webcam, load video recordings, or receive images from other sources.
- **Preprocessing Module** performs tasks like resizing images, converting color spaces, or applying noise reduction.
- **Face Recognition Module** which handles Face Detection, Facial Landmark Detection and Face Recognition.
- **Decision-Making Module** trigger actions like unlocking a door, granting access to a system, or sending an alert. In summary, it identifies a decision, then gathers information and assesses alternative resolutions.
- **Database Management Module** might manage the database of known faces and their corresponding information like names and IDs.

2. *FRL Integration* integrates with the system architecture:

- **Library Import:** By importing the FRL you need (such as dLib, or FaceNet) into your code.
- **Model Loading:** FRL provides functions for loading the pre-trained models for face detection, landmark detection, and face recognition.
- **Function Calls** such as locating faces, extracting key facial points, or comparing extracted features using techniques, algorithms, and libraries.

4. *Data Flow:*

- Data flows from **Data Acquisition Module** to the **Preprocessing Module**.
- Preprocessed images/frames are then passed to the **Face Recognition Module**
- FRL processes the data and extracts facial features and compares them to the database, sometimes FRL might require **Database Management Module** databases for tasks like enrolling new faces or updating existing information.
- Then the results and scores are passed to the **Decision-Making Module** which acts based on the outcome.



Figure 1 - Computer Vision Autonomous Vehicle



Figure 2 - Object Detection

Chapter 3: System Design

This chapter presents the functional and non-functional requirements that this project contains and goes through the Use Case Diagram and the software architecture of the system.

3.1 Functional Requirements:

1. The system should be able to capture the images of the students that are entering the classroom.
2. The facial recognition technology should be able to identify the students from the images that it captured.
3. To record the attendance automatically based on the recognized faces.
4. Secure login functions for instructors so they can access the system.
5. Allow instructors to manage classes, by adding, deleting, or editing class information.

3.2 Nonfunctional Requirements:

3.2.1. Performance

1. Real-time processing: The system should be able to recognize faces in real-time to make sure the attendance is recorded when the students enter the classroom.
2. Response time: The system should not take time and must correspond directly within a short time to ensure minimal delay in marking.

3. Scalability: The system should be able to deal with large number of students in class for attendance without drop in performance.
4. Throughput: The system should be able to take more than one student per time or simultaneously.

Then the system should recognize faces and mark attendance instantly, so class can start on time.

3.2.2. Security

1. Data Encryption: Student data and images must be encrypted to prevent unauthorized access.
2. Authentication: Include strong passwords and third-party applications for authentication.
3. Data Privacy: Ensure student privacy is maintained through providing data options for data deletion.

To make sure student data and system access are secure and protected from unauthorized access.

3.2.3. Scalability

1. Horizontal Scalability: The system should be able to add more classes, instructors, and students.

2. Cloud Integration: The system should be able to integrate with cloud services such as AWS, Azure, or Google Cloud.
3. Resource Optimization: Improve the efficiency of resources such as CPU, memory, and storage to make sure it handles maximum loads.

System should handle any size class, as the school adds more students and classes, the system must easily adapt to keep up.

3.2.4. Usability

1. User-friendly interface: The system should have prototypes that are simple and easy to use in the interface.
2. Responsive design: The interface should be responsive to all devices with different screen sizes.
3. Minimalist Design: Minimal and only the essential designs to make the interface simple to reduce load on users.
4. Clear Instructions: Provide clear and evident instructions to guide the users through the system's functionality.

To create a user-friendly interface that has a simple prototype and is easy for the instructors to navigate.

3.2.5. Reliability

1. Error Handling: System must implement robust error handling mechanisms to manage any unexpected situations and the system should not lose any data while that happens.
2. Regular Updates: Keep the system up to date with the latest security patch to keep maintaining the reliability of the system.

Ensure the system operates smoothly, even if the internet goes down.

3.3 Requirements Analysis Summary:

The functional requirements outline the main points that the Automated Attendance System Using Face Recognition must possess to effectively automate attendance tracking in educational settings. This includes the ability to capture student images on entry, to use facial recognition technology for identification, and record attendance automatically. In addition to security login and class management features to ensure protection.

In parallel, the non-functional requirements focus on performance, security, scalability, usability, and reliability steps of the system. Performance is major for making sure of marking attendance on time, while security prevents any unwanted visits or viruses. Scalability provides much larger class sizes, space or storage and growth over time, while utility ensures a user-friendly interface for instructors. Finally, reliability intercepts any loss of connection and keeps the server of the system up.

By catching up to these requirements, the system aims to provide strong, well organized, user-friendly solution for attendance

management, addressing key challenges faced by instructors in manual processes.

Table 1 – Requirement Analysis

Requirement ID	Requirement Type	Description	Priority
AASUFR-FR-001	Functional	Capture student images upon entry	High
AASUFR-FR-002	Functional	Utilize facial recognition technology for student identification	High
AASUFR-FR-003	Functional	Record attendance automatically	High
AASUFR-FR-004	Functional	Implement secure login functions for instructors	Medium
AASUFR-FR-005	Functional	Allow instructors to manage classes by adding, deleting, or editing class information	Medium
AASUFR-NFR-001	Non-Functional	Guarantee real-time attendance marking for optimal performance	Medium
AASUFR-NFR-002	Non-Functional	Implement robust security measures to protect student data and system access	High
AASUFR-NFR-003	Non-Functional	Establish scalability to accommodate varying class sizes and growth	High
AASUFR-NFR-004	Non-Functional	Create a user-friendly interface for easy navigation by instructors	High
AASUFR-NFR-005	Non-Functional	Ensure uninterrupted operation, even in the	Medium

event of internet
connectivity issues

Requirement ID	Requirement Type	Description	Priority
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3.4 UML Use Case Diagram & Scenario (Narrative)

3.4.1 Use Case Diagram

Instructor actor uses the interface to log in to **view dashboard** then **select class**. Top level use cases are **Add Student, Take Attendance & Retrieve Student Attendance History**. When the **Instructor** presses on **Save Information**, the data is saved & sent to the **Database** actor.

Use Case: Manage Attendance System

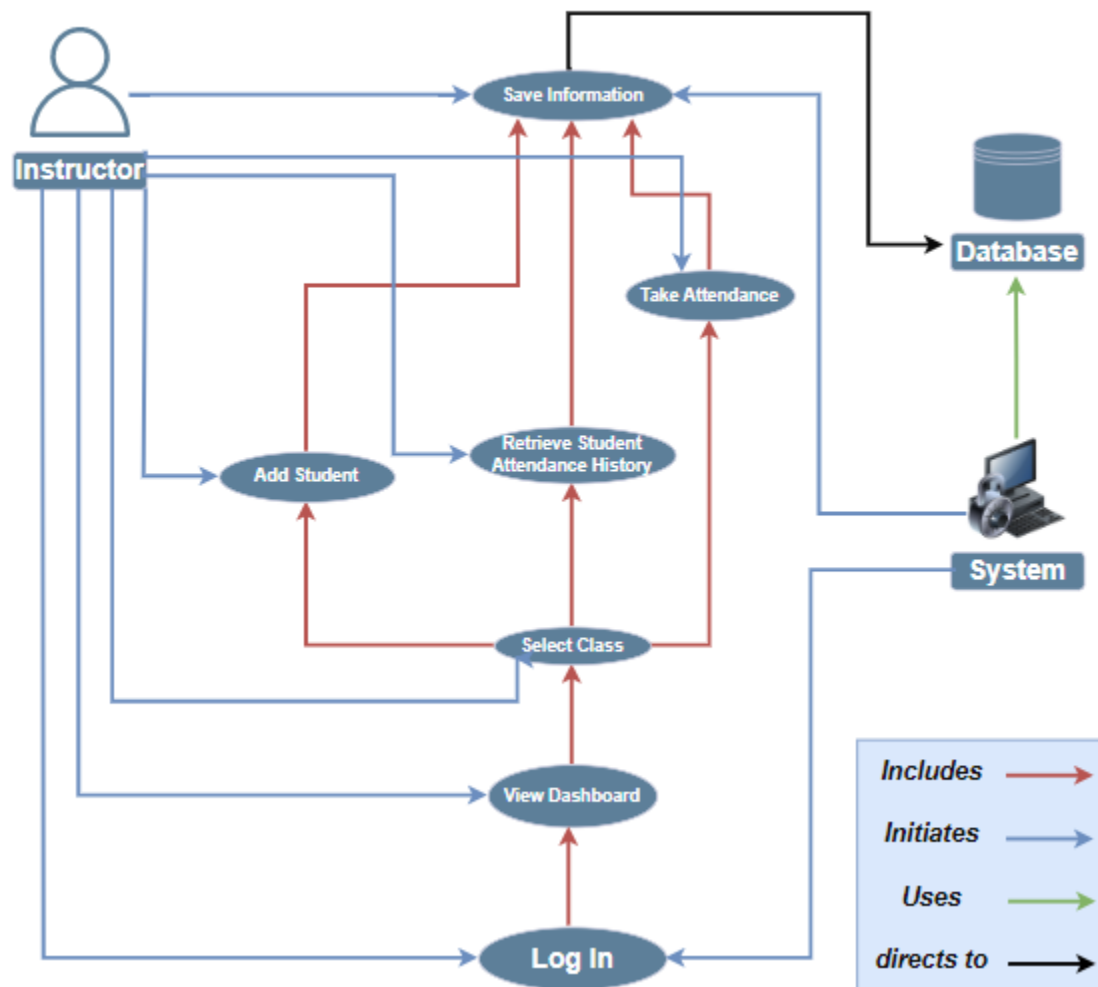


Figure 3 - Use Case Diagram

3.4.2 Use Case Scenario

In this narrative, we will talk about the actors, the priority, steps of how the interface works, instructor's actions and how the system will respond.

Table 2 – Use Case Narrative

Use Case Name Manage Attendance System	
Use Case ID	AUT-01
Actor(s)	Instructor, System, Database
Primary Actor	Instructor
Priority	High
Brief Description	Instructors use the system to manage attendance for individual classes. They log in, select a class, and access options to take attendance, add students, or view attendance history

<p>Basic Flow</p> <ol style="list-style-type: none"> 1. Instructor logs in and is directed to the dashboard. 2. Dashboard shows classes taught by the instructor. 3. Instructor selects a class 4. System navigates to class details page with 3 options, Take Attendance, Add Student & View Student Attendance History 	<p>Alternative Flow</p> <ol style="list-style-type: none"> 1. If login fails: <ul style="list-style-type: none"> • Error message prompts re-entry of credentials • Repeat login process 2. If technical issues occur during attendance: <ul style="list-style-type: none"> • Error messaging advises retrying • Option to manually record attendance
<p>Pre-condition</p> <p>The instructor has successfully logged in to the attendance system.</p>	<p>Post-condition</p> <p>Upon completion of managing attendance for the selected class, the instructor has successfully recorded and updated attendance records for the class.</p>
<p>Actor Action/System Response</p> <ol style="list-style-type: none"> 1. Instructor navigates to login page. <ul style="list-style-type: none"> • System prompts for username and password. • Instructor enters credentials. 2. System authenticates credentials. <ul style="list-style-type: none"> • If Successful, directs instructor to dashboard. 3. Instructor selects class from dashboard. <ul style="list-style-type: none"> • System navigates to class details page. 4. On class details page, corresponding options. <ul style="list-style-type: none"> • System presents corresponding options 	

3.5 Software Architecture

Software Architecture refers to a high-level structure of software system. That means we can see how different components and modules interact with each other and that includes the organization of software components, their relationships, and the guidelines for future development.

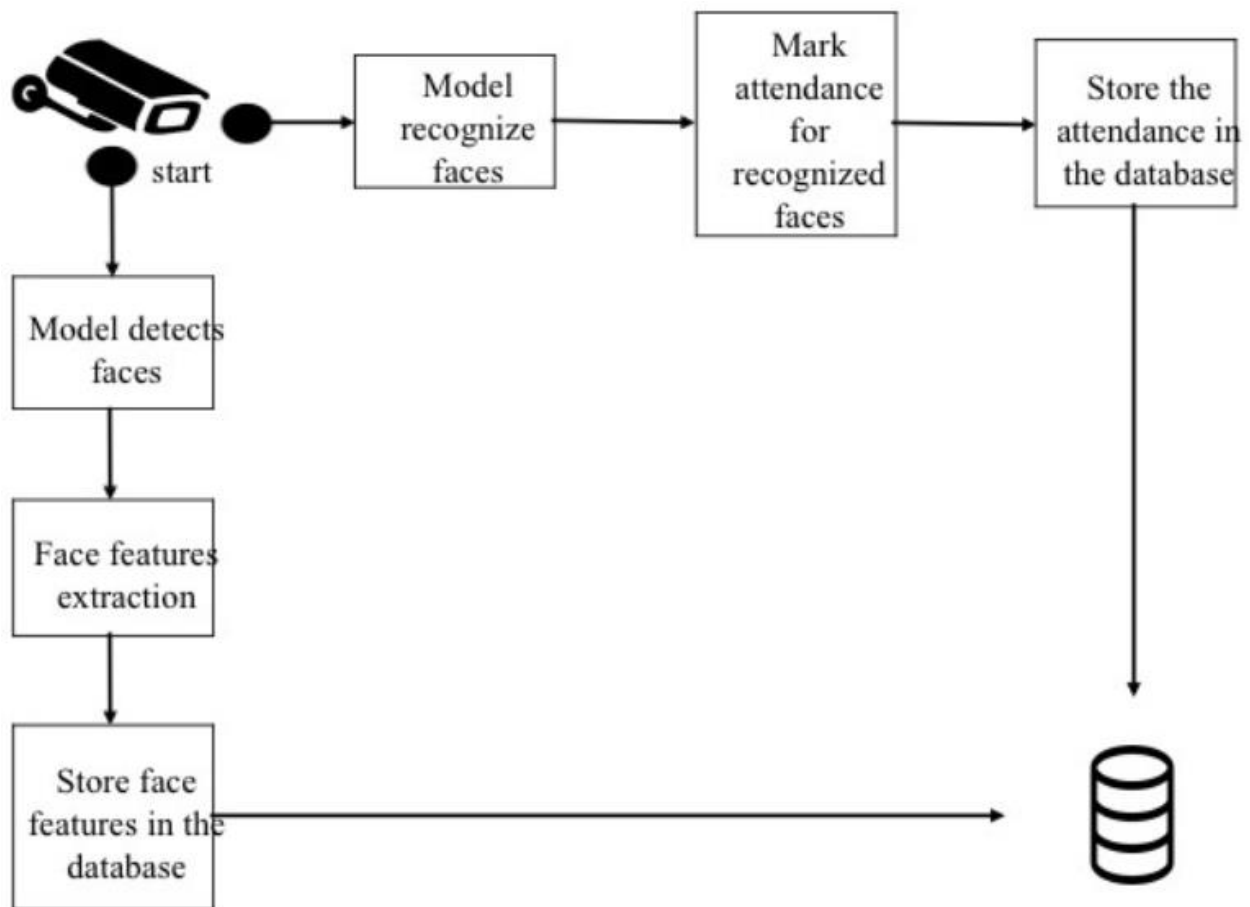


Figure 4 – Software Architecture

Chapter 4: Implementation

This chapter displays all the details of the website, pages, buttons, prototypes, content, structure, design, and functionality.

4.1 Login Page

Login Page has two buttons, Admin Login and Doctor Login.

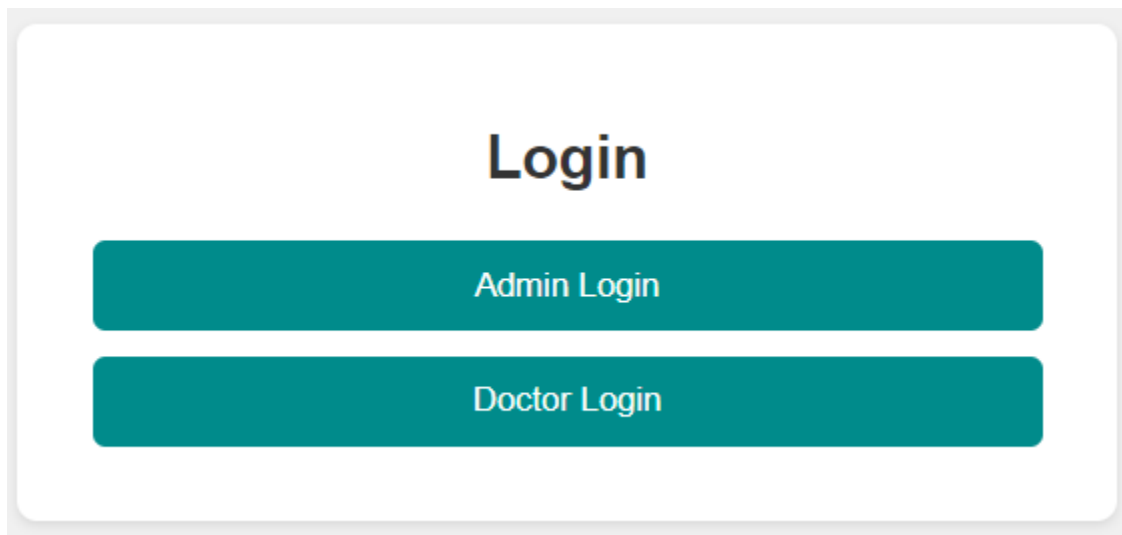


Figure 5 – Login Page

4.1.1 Admin Login

This page requires inputting username and password fields of the admin to log in, or else you can go back to the login page.

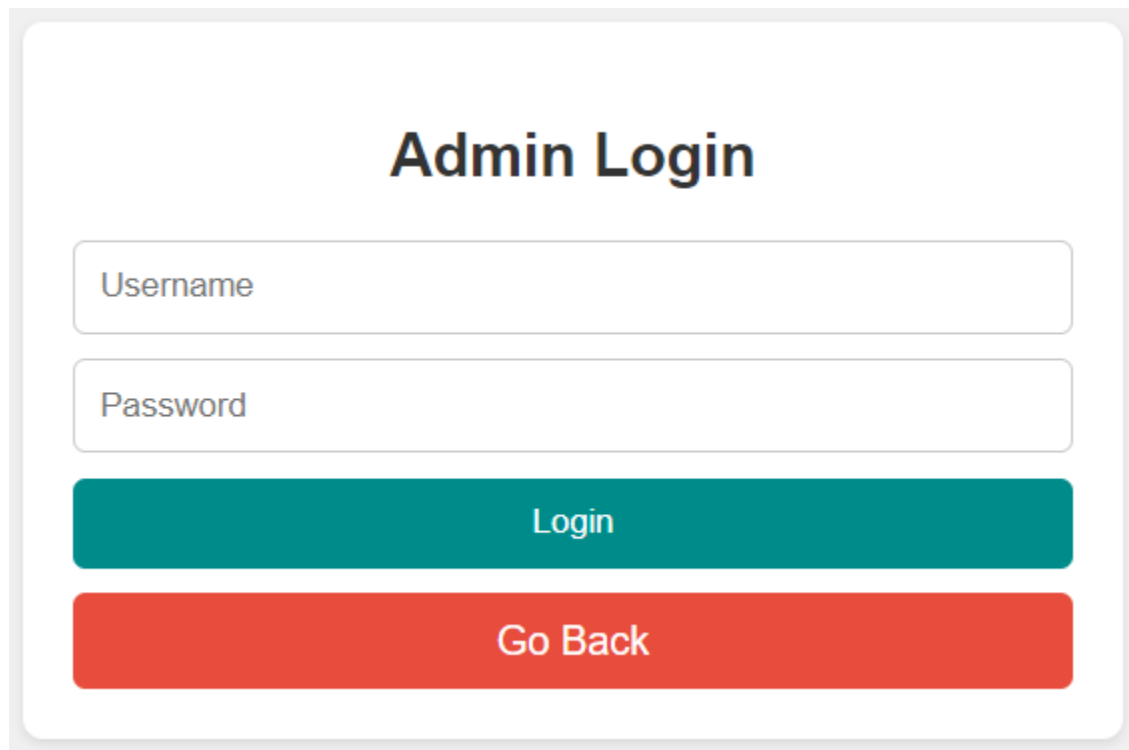
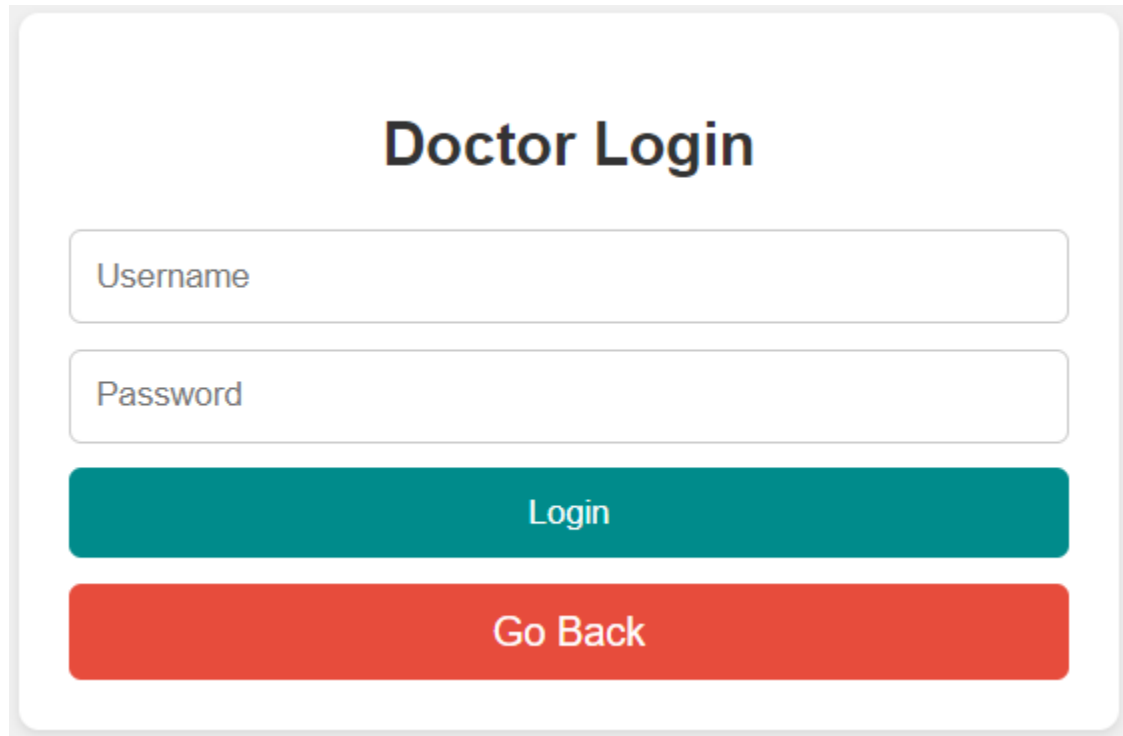
The image shows a web form titled "Admin Login" centered at the top. Below the title are two input fields: "Username" and "Password", each with a light gray border and rounded corners. Under the "Password" field is a teal-colored button with the text "Login" in white. Below the "Login" button is a red-colored button with the text "Go Back" in white. The entire form is set against a light gray background with a subtle shadow.

Figure 6 – Admin Login Page

4.1.2 Doctor Login

This page requires inputting username and password fields of the doctor to log in, or else you can go back to the login page.

The image shows a 'Doctor Login' form. It has a title 'Doctor Login' in bold black text. Below the title are two input fields: 'Username' and 'Password'. Below these fields are two buttons: a teal 'Login' button and a red 'Go Back' button.

Doctor Login

Username

Password

Login

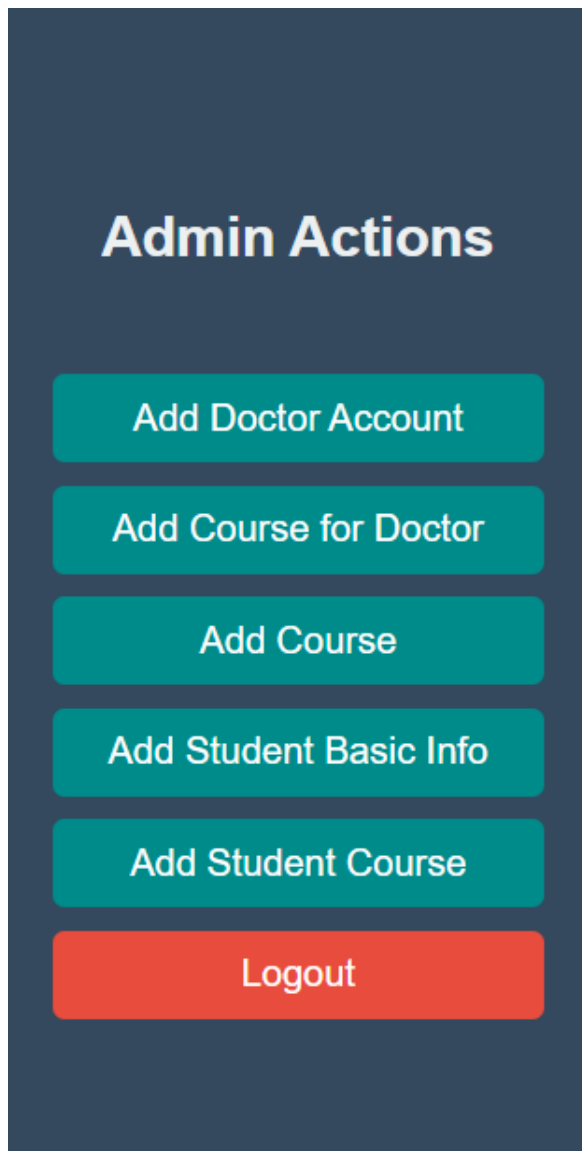
Go Back

Figure 7 – Doctor Login Page

4.2 Admin Credentials

The admin has the main actions to add a doctor, student and to add and attach courses for them.

Table 3 – Admin Actions



4.2.1 Add Doctor Account

This page contains inputting fields for Username & Password to create the doctor's account and select Add Doctor button, or go back to the dashboard of the admin.

4.2.2 Add Course for Doctor

This page contains inputting a field for Username (doctor's username) & a dropdown menu to select one option from the lists of courses ("Select a Course"), and select Add Course button, or go back to the dashboard of the admin.

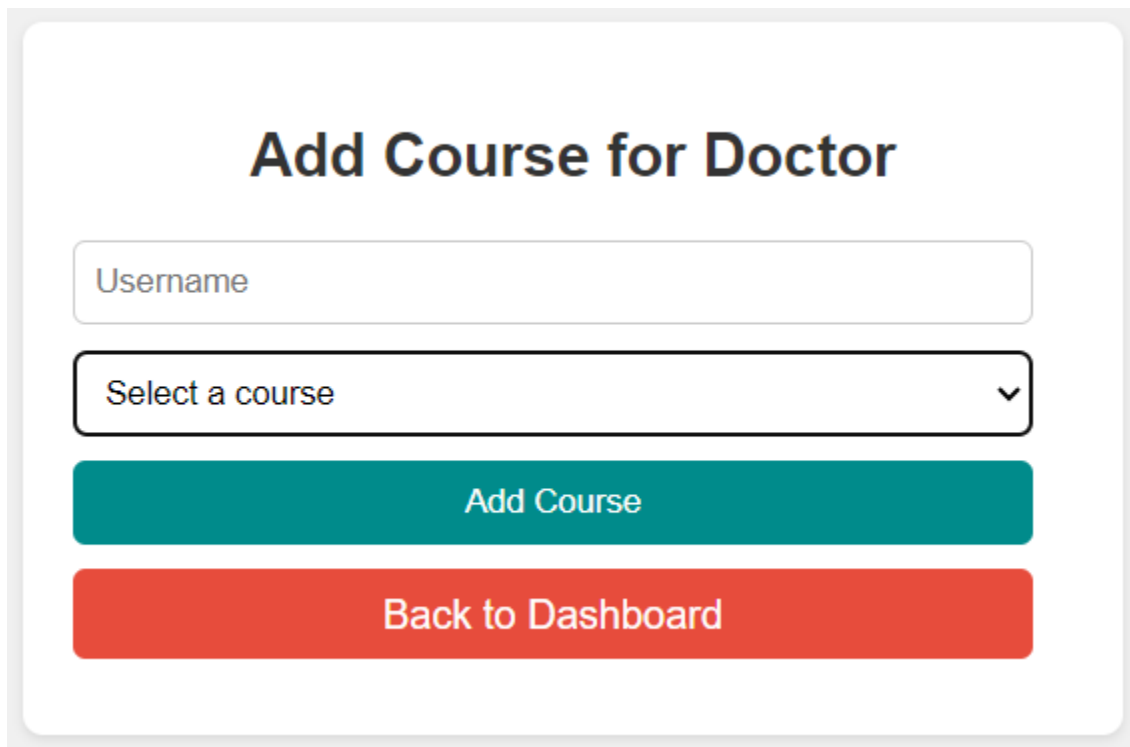
The screenshot shows a web form titled "Add Course for Doctor" in a large, bold, black font. Below the title, there is a text input field with the placeholder text "Username". Underneath the input field is a dropdown menu with the text "Select a course" and a downward-pointing chevron icon on the right. Below the dropdown menu are two buttons: a teal button with the text "Add Course" and a red button with the text "Back to Dashboard". The entire form is enclosed in a light gray rounded rectangle with a subtle drop shadow.

Figure 8 – Add Course for Doctor

4.2.3 Add Course

This page allows you to input field for the Course Name you want to add, and press Add Course button, or go back to the dashboard of the admin.

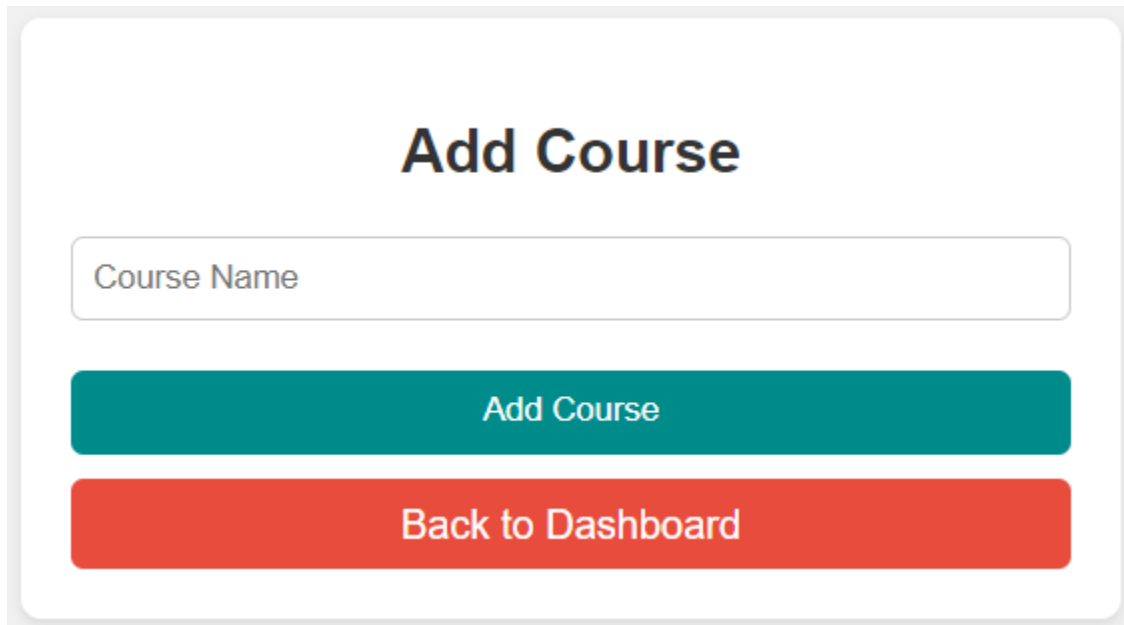
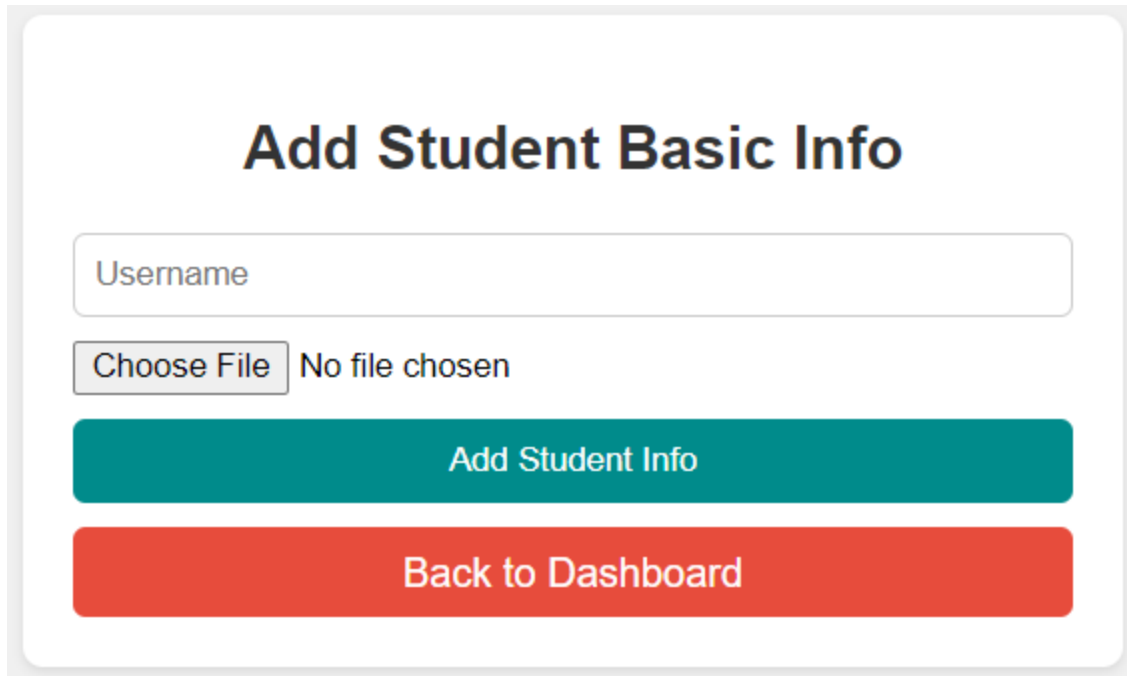
The image shows a web form titled "Add Course" in a large, bold, black font. Below the title is a text input field with the placeholder text "Course Name". Underneath the input field are two buttons: a teal button labeled "Add Course" and a red button labeled "Back to Dashboard". The entire form is enclosed in a light gray rounded rectangle with a subtle drop shadow.

Figure 9 – Add Course

4.2.4 Add Student Basic Info

This page contains a username input field to add the name of the student, and a file upload field to add the image of the student and press Add Student Info to successfully add the student to the system, or go back to the dashboard of the admin.



Add Student Basic Info

Choose File No file chosen

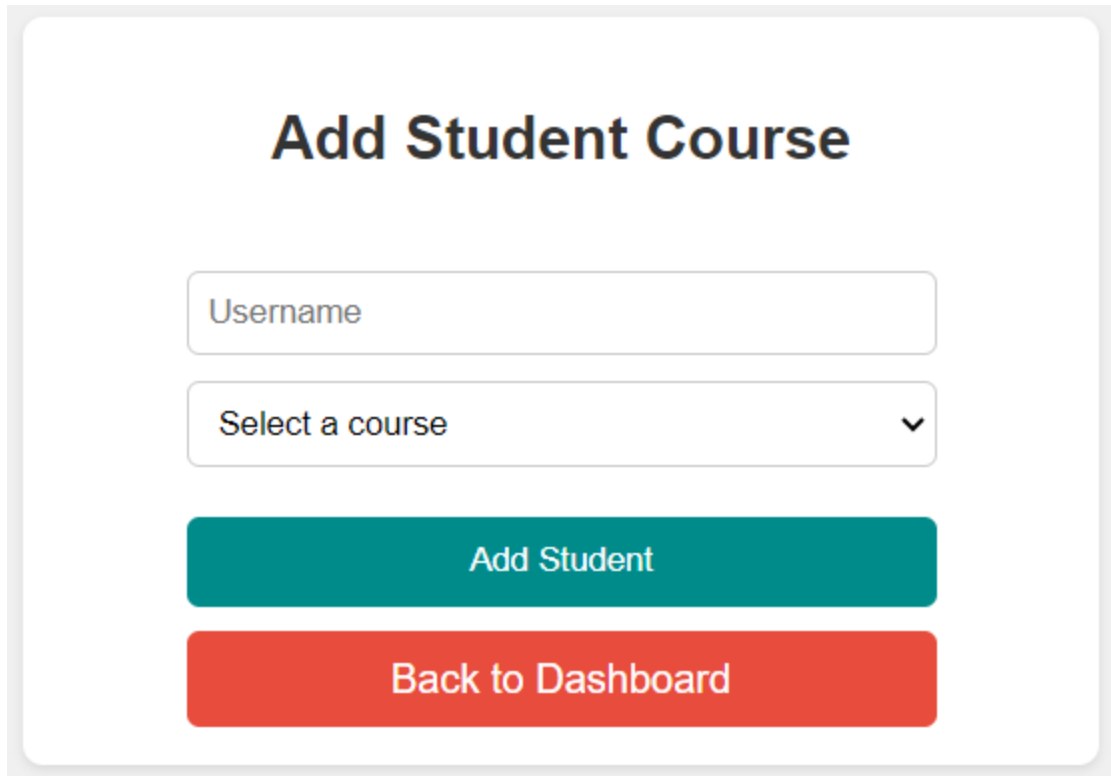
Add Student Info

Back to Dashboard

Figure 10 – Add Student Basic Info

4.2.5 Add Student Course

This page contains inputting a field for Username (student's username) & a dropdown menu to select one option from the lists of courses ("Select a Course"), and select Add Course button, or go back to the dashboard of the admin.

The image shows a web form titled "Add Student Course" in a bold, dark font. Below the title, there are two input fields: a text box labeled "Username" and a dropdown menu labeled "Select a course" with a downward arrow icon. Below these fields are two buttons: a teal button labeled "Add Student" and a red button labeled "Back to Dashboard". The entire form is enclosed in a light gray rounded rectangle.

Add Student Course

Figure 11 – Add Student Course

4.2.6 Logout

Logout of the admin's account and get back to the main login page.

4.3 Doctor Credentials

The Doctor has at least one course that contains the students where he/she can take their attendance and check their attendance records.

4.3.1 Doctor's Panel for Courses

On the left side of the Doctor's dashboard page, there is a list of courses for the doctor which he/she selects a certain course to take attendance or check attendance records of the students.

Table 4 – Doctor's Courses

Courses
CSCI300
CSCI250
CSCI370
CSCI373
CSCI490
CSCI380
CSCI351
CSCI430
CSCI426
CSCI 900

4.3.2 Take Attendance

The Video Feed Page has a video frame that locates the students and take their attendance and on the right side, their name appears with the green fleck indicating the presence of the students, and once the doctor is done with taking the attendance, he/she can press the stop button that instructs back to the doctor's dashboard.

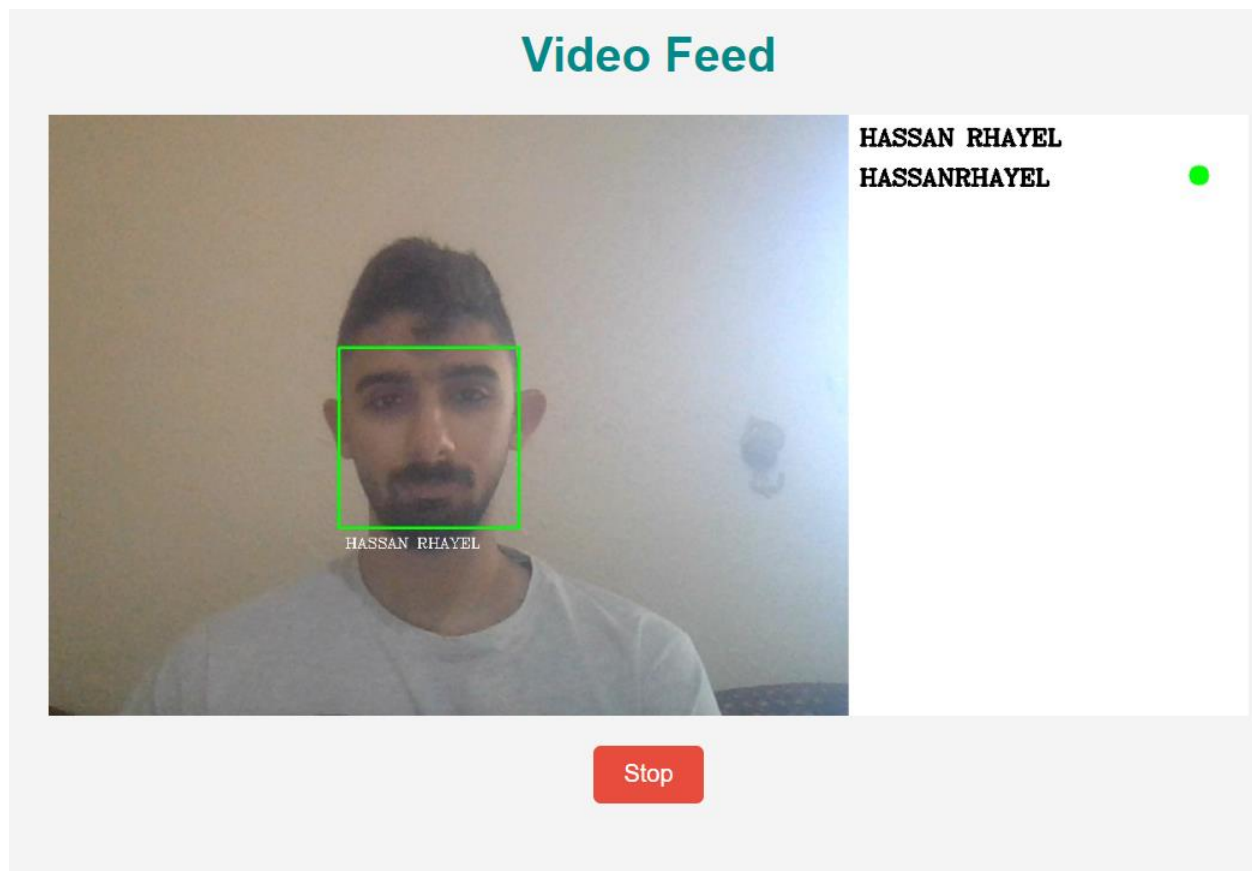


Figure 12 – Video Feed

4.3.3 Attendance Records

This Page shows the records, ID of the record, course name, the date when the attendance was taken and the details section of the record, in which you can view by clicking on the “Details” button, or you can press “Back to Dashboard” to go back to the doctor’s dashboard.

Table 5 – Attendance Records

Attendance Records			
Attendance ID	Course Name	Date	Action
0	CSCI300	2024-05-24	Details
Back to Dashboard			

4.3.4 Attendance Details

This page shows the attendance details of the certain record that was taken in a specific class, date, and time. It shows the status of the students, whether they are present, or absent in the class.

Table 6 – Attendance Details

Attendance Details	
Student Name	Status
MohamadBahja	present
MohamadIssa	absent
MohamadHamadi	absent
JaberMobarak	absent
HasanRhayel	absent

Back to Attendance

4.3.5 Logout

Logout of the doctor's account and get back to the main login page.

Chapter 5: Final Insights & Future Directions

This chapter covers the conclusion, references, future work, references, and final remarks, providing a comprehensive closure to the project.

5.1 Conclusion

Summarize the overall achievements and outcomes of the project. It covers the key findings, successes, and the impact of the Automated Attendance System Using Face Recognition.

The Automated Attendance System Using Face Recognition developed an efficient solution for automating attendance tracking and provided valuable insights into the potential applications and challenges of facial recognition technology in many domains.

5.2 Future Work

Discuss different fields for further development and research. Try these technologies in different places such as high-level organizations for security purposes, hospitals for visitor management and operational efficiencies. Also, amplify the system's software and hardware for better experience and performance and for compatibility and reliability everywhere.

5.2.1 Improving Facial Recognition Accuracy

Refining the facial recognition algorithms to handle lighting conditions, angles, wide range, and from farther positions.

5.2.2 Integration With Other Systems

Use facial recognition technology in other areas such as hospitals, banking, and finance such as authentication, ATM security and fraud prevention, or airports and transportation such as security checks and boarding verification.

5.2.3 Hardware Enhancements

Upgrade the cameras, deploy edge computing devices to process data locally, improve the processing units and the network infrastructures.

5.2.4 Software Enhancements

Refine and optimize the system and algorithms to improve accuracy. Implement cloud-based services to enhance scalability and handle larger volumes of data. Develop mobile applications for iOS and Android operating system platforms

and enhance software security measures to protect from sensitive student data and comply with privacy regulations.

5.3 References

5.3.1 Websites

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- Face Recognition GitHub Repository. (2023). Face Recognition. Retrieved from https://github.com/ageitgey/face_recognition
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5.3.2 YouTube Videos

- Face Recognition Based Attendance Monitoring System: https://www.youtube.com/watch?v=rVQv1TwvQBc&list=PL6DmgjJvD9Oafq_xqHwPYl3y-hVNBmfNnc&ab_channel=SMARTTECHMAGIX.
- Python Project Tutorial, Advance, Face Recognition, Student Attendance System: <https://www.youtube.com/watch?v=mYVS7QjNjvg&t=1348s>

5.3.3 Articles & Books

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- Smith, J. (2022, January 5). The Future of AI in Education. Medium. Retrieved from <https://medium.com/the-future-of-ai-in-education>
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
- Szeliski, R. (2010). Computer Vision: Algorithms and Applications. Springer.
- Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach (4th ed.). Pearson.

5.4 Final Remarks

5.4.1 Website as a Gateway

The website for our face recognition attendance system serves as a crucial gateway for users to interact with the system. It provides essential information about the system's capabilities, features, and benefits, helping users understand its value proposition.

5.4.2 Continuous Evolution & Updates

Moving forward, the website should continue to evolve to reflect updates and improvements to the face recognition attendance system. Regular updates to the website's content and design will help maintain user engagement and ensure that users have access to the most current information about the system.

5.4.3 Mobile Optimization

To maximize accessibility and convenience, the website should be optimized for mobile devices, ensuring a seamless user experience across different

platforms. This includes implementing responsive design principles, reducing load times, and ensuring that all features and functionalities are easily accessible on smaller screens.

5.4.4 Security Enhancements

Security is another critical aspect to consider as the website evolves. Ensuring that user data is protected through robust security measures and compliance with data protection regulations will build trust and encourage more users to adopt our system. Regular security audits and updates will help mitigate potential risks and maintain the integrity of the system.

5.4.5 User Engagement & Promotion

Overall, the website plays a critical role in promoting our face recognition attendance system and supporting its users. By continuously improving and maintaining the website, we can enhance the overall user experience and maximize the system's impact in various organizations. Effective website management will not only drive user engagement but also contribute to the broader success of our face recognition attendance system, establishing it as a reliable and innovative solution in the market.