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# **Software Requirements Specification**

**for**

# **Advanced Face Recognition Student Attendance System**

**Version 1.0 approved**

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## Revision History

Name	Date	Reason For Changes	Version
Vishal S	1.10.2023	Initial version of the SRS document	1.0
Yaman Gupta	5.10.2023	External Interface Requirements	1.0
Revanth Reddy	5.10.2023	Analysis Models and System Features	1.0
Vijayraj G	5.10.2023	UI prototypes	1.0



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## 1. Introduction

### 1.1 Purpose

*The purpose of this Software Requirements Specification (SRS) document, which defines the version 1.0 outline of the software requirements for the development of an "Advanced Face Recognition Student Attendance System." This system aims to enhance and modernise the process of student attendance tracking within educational institutions. The project will be referred to as "AFRSA" (Advanced Face Recognition Student Attendance) throughout this document.*

### 1.2 Intended Audience

*This document provides the software requirements for the AFRSA version 1.0. The intended audiences are*

- *Developers of this software.*
- *Software Engineers who would work on further development of the project.*
- *The Professors who would review the document.*
- *Admin who will be operating the software.*

### 1.3 Product Scope

*The Advanced Face Recognition Student Attendance System (AFRSA) is a sophisticated software solution designed to revolutionize student attendance management within educational institutions. AFRSA's primary purpose is to automate and streamline the process of tracking student attendance through advanced facial recognition technology. This system aims to enhance operational efficiency, improve data accuracy, and provide real-time attendance monitoring capabilities.*

### 1.4 References

1. *A brief history of facial recognition, 2020. [ [Click here](#) ]*
2. *John D. Woodward, Jr., Christopher Horn, Julius Gatune, and Aryn Thomas "Biometrics: A look at facial Recognition," 2003. [ [Click here](#) ]*
3. *Python Documentation [ [Click here](#) ]*
4. *OpenCV Documentation [ [Click here](#) ]*



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## 2. Overall Description

### 2.1 Product Perspective

*The Advanced Face Recognition Student Attendance System (AFRSA) represents a self-contained, standalone product designed to address the specific needs of educational institutions in managing student attendance efficiently and accurately. AFRSA is not a replacement for existing systems but rather a novel solution that integrates seamlessly into the existing educational infrastructure. While it operates independently, AFRSA may interact with other institutional systems, such as student databases or management software, through well-defined external interfaces to synchronize attendance data.*

### 2.2 Product Functions

*The AFRSA system offers the following key functions:*

- 1. Real-time face detection*
- 2. Secure Login*
- 3. Home Page*
  - i. Student Management*
  - ii. Training*
  - iii. Attendance*
  - iv. Reports*
  - v. Developer Tools*
  - vi. Help Desk*
  - vii. Exit*

### 2.3 User Classes and Characteristics

*AFRSA serves a diverse user base within the educational institution. They are as follows:*

- 1. Instructors:*
  - Frequency: Daily during the classes*
  - Characteristics: Taking attendance and managing student data.*
- 2. Administrators:*
  - Frequency: For administrative purposes*
  - Characteristics: High technical proficiency, user management and report generation.*
- 3. Students:*
  - Frequency: Occasionally when interacting with the system.*
  - Characteristics: Minimal technical expertise required. Use the system to mark their attendance.*
- 4. Developers:*
  - Frequency: Periodically for system maintenance and enhancements.*



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*Characteristics: High technical proficiency, responsible for system updates and improvements.*

## 2.4 Operating Environment

### 1. **Hardware Platform:**

*Desktops and Laptops, with graphical processing units.*

*Webcam or camera-equipped devices for face detection and image capture.*

### 2. **Operating System:**

*Windows (10 and above)*

*macOS (macOS Catalina and above)*

*Ubuntu (20.4 and above)*

### 3. **Softwares:**

*Python 3.x*

*MySQL*

*Microsoft Excel*

## 2.5 Design and Implementation Constraints

1. **Hardware Limitations:** *The system must operate on standard educational institution hardware, which may have varying capabilities in terms of processing power, memory, and camera quality.*

2. **Regulatory Compliance:** *The software must adhere to privacy and data protection regulations, especially when dealing with facial recognition data. Compliance with relevant laws, such as GDPR, is essential.*

3. **Interoperability:** *AFRSA must seamlessly integrate with existing educational software and databases, following specific communication protocols and data formats.*

4. **Security:** *A high level of security is imperative to protect facial recognition data and user credentials. Encryption, access controls, and secure authentication mechanisms are necessary.*

5. **Technology Stack:** *The choice of face recognition libraries, web development frameworks, and database systems may be limited to technologies that align with the project's goals and constraints.*

6. **User Interface Design Standards:** *Adherence to design conventions and programming standards, possibly set by the educational institution, may influence the system's user interface and overall design.*



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7. **Maintainability:** Considerations for ongoing maintenance and updates should be factored into the design to ensure long-term sustainability and ease of maintenance by the customer's organisation or IT team.

## 2.6 Assumptions and Dependencies

1. **Third-party Face Recognition Library:** It is assumed that a suitable third-party face recognition library or API, such as OpenCV or FaceAPI, will be available and compatible for use in AFRSA.
2. **Operating System Compatibility:** The assumption is made that the selected face recognition library and other software components will be compatible with the targeted operating systems, including Windows, macOS, and Linux.
3. **Hardware Accessibility:** The availability and compatibility of hardware components, such as webcams or cameras for face detection, are assumed to be in place for users.
4. **Compliance with Privacy Regulations:** It is assumed that the project will adhere to privacy regulations and that any legal and regulatory requirements related to facial recognition and data protection will be addressed.

## 3. External Interface Requirements

### 3.1 User Interfaces

AFRSA's user interface will be developed using the tkinter library in Python, providing a consistent and user-friendly experience. Key interface characteristics include:

1. **GUI Standards:** The user interface will adhere to established GUI design principles, ensuring intuitive navigation and usability.
2. **Screen Layout:** Screens will be logically organised, with clear layouts and user-friendly design to enhance user experience.
3. **Standard Buttons:** Common interface elements such as buttons for actions like "Save," "Update," "Delete," and "Exit" will be included as appropriate.
4. **Help Functionality:** A "Help" feature will be accessible to provide users with guidance and support on system usage.
5. **Error Messages:** Standardized error messages and alert dialogs will follow consistent design and display guidelines to facilitate user understanding.



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***Sample UI for Login:***

A sample user interface for a login page. It consists of a light gray rectangular box centered on a dark gray background. Inside the box, at the top, is a circular profile icon with the word 'profile' inside. Below this, the text 'Username:' is followed by a rectangular input field. Then, the text 'Password:' is followed by another rectangular input field. At the bottom of the box is a rectangular button labeled 'Login'.





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***Sample UI for Registration Window:***

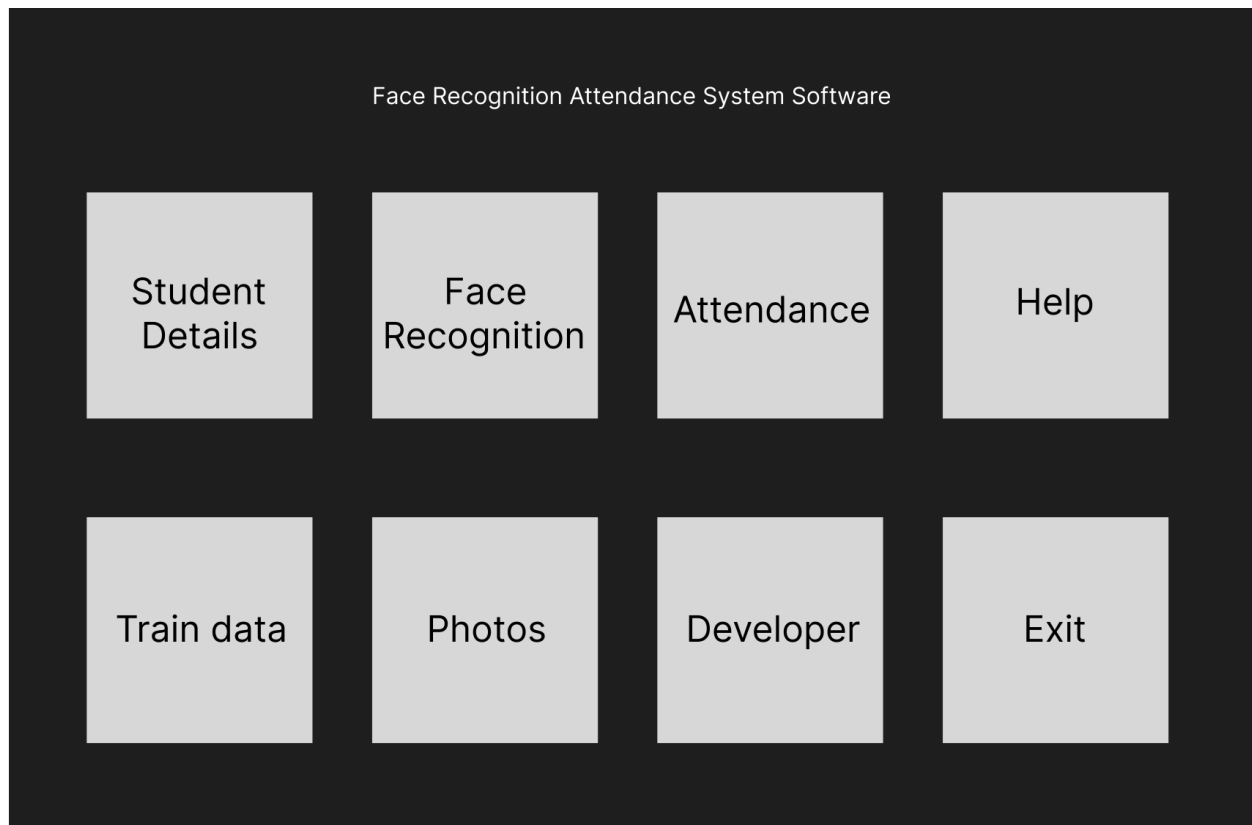
Firstname :	Lastname :
<input type="text"/>	<input type="text"/>
Contact no. :	Email :
<input type="text"/>	<input type="text"/>
Security Question :	Security Answer :
<input type="text"/>	<input type="text"/>
Password :	Confirm Password:
<input type="text"/>	<input type="text"/>
<input type="button" value="Register Now"/>	



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**Sample UI for Home Page:**





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**Sample UI for Home Page:**

Student Management

Back

Student Information

Course Information

Department :

Course:

Year:

Semester:

Student Class Information

Student ID No. :

Student Name :

Class Division :

Roll No. :

Gender :

DOB :

Email :

Phone No. :

Address :

Mentor Name :

Take Photo Sample

No Photo Sample

SAVE

UPDATE

DELETE

RESET

ADD PHOTO SAMPLE

UPDATE PHOTO SAMPLE

Student Details

Search By: 

Select Option

Search

Show All

Department

Course

Year

Semester

Student ID

Student ID

Class Div



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### 3.2 Software Interfaces

#### 1. **Operating Systems:**

*Windows (10 and above)*  
*macOS (macOS Catalina and above)*  
*Ubuntu (20.4 and above)*

*Purpose: AFRSA is designed to run on various operating systems commonly used in educational institutions. Compatibility with multiple OS versions ensures accessibility for a wider user base.*

#### 2. **Python Libraries and Framework:**

*tkinter*  
*OpenCV*  
*Other supporting Python libraries*

*Purpose: These libraries and frameworks provide essential functionalities and tools to develop and run AFRSA.*

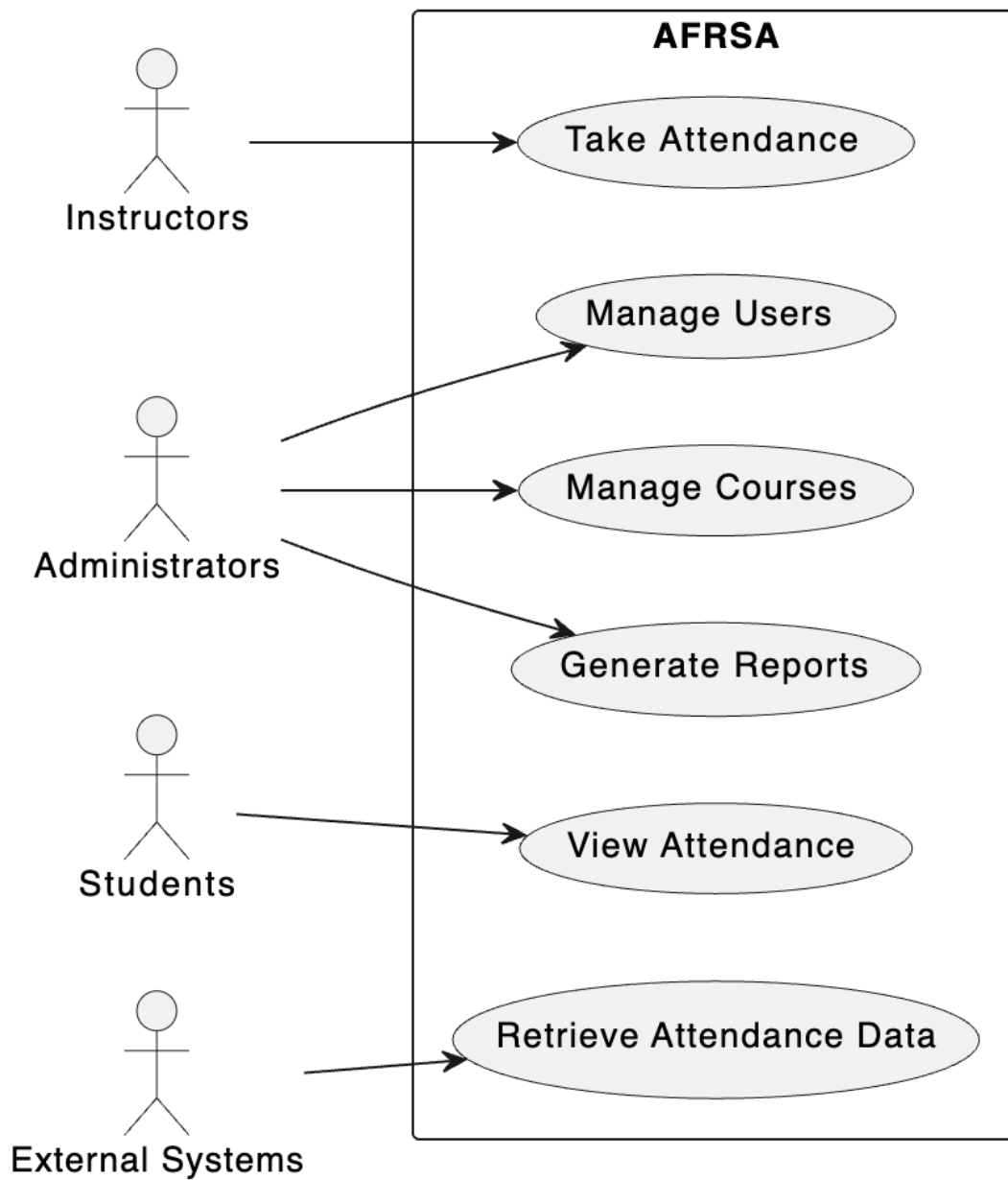
#### 3. **Excel Integration:**

*Purpose: AFRSA interfaces with Excel files to import and export data. It uses Python libraries (e.g., Pandas) to read from and write to Excel files, serving as a data storage mechanism.*

### 3.3 Communications Interfaces

1. Database management system(SQL)
2. Camera and Image capture
3. Open CV libraries
4. Data analytics and Reporting
5. Image processing
6. Time series analysis (Attendance Tracking)
7. Web Development Technologies

#### 4. Analysis Models





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## 5. System Features

Real time face detection

1] Logging Security System

(Username&Password)

2] Home Page

i) Student management system (Save, Take Photo Samples, Update, Delete, Clear)

ii) Train Photo Samples

iii) Take Attendance with Face Detection

iv) Attendance Report (Excel file & MySql database)

v) Developer Page

vi) Help Desk

vii) Exit System]

### 1: Real-time Face Detection

- **Description and Priority:** Real-time face detection is a critical feature with High priority as it forms the core functionality of the system.
- **Stimulus/Response Sequences:**
- Stimulus: User initiates the face detection process.
- Response: The system captures video frames and processes them for face detection in real-time.
- **Functional Requirements:**
- The system must access the camera or video source to capture frames.
- It should apply a face detection algorithm (e.g., Haarcascade) to each frame.
- Detected faces should be highlighted or marked.
- Real-time feedback on detected faces should be provided to the user.
- The system should continue face detection until the user stops it.

### 2: Login Security System (Username & Password)

- **Description and Priority:** The login security system is of High priority to ensure data security.
- **Stimulus/Response Sequences:**
- Stimulus: User enters login credentials (username and password).
- Response: The system validates the credentials and either grants or denies access.
- **Functional Requirements:**
- Users must have unique usernames.
- Passwords should be securely hashed and stored.
- The system should provide a login interface.
- Successful login should grant access to authorised functionalities.
- Failed login attempts should trigger security measures like account lockout or CAPTCHA.

### 3: Home Page



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- **Description and Priority:** The home page serves as a central navigation point and is of Medium priority.
- **Stimulus/Response Sequences:**
- Stimulus: User accesses the home page.
- Response: The system displays the home page with menu options.
- **Functional Requirements:**
- The home page should provide clickable menu items for various system functionalities.
- Navigation to other system components should be easy and intuitive.
- The home page should load efficiently and be responsive.

#### 4: Student Management System

- **Description and Priority:** This feature involves managing student data and is of High priority.
- **Stimulus/Response Sequences:**
- Stimulus: User selects student management from the menu.
- Response: The system displays student data and options for managing it.
- **Functional Requirements:**
- Users should be able to add, edit, delete, and clear student records.
- The system should store student information (e.g., name, class).
- It should allow for taking and storing photo samples of students.

#### 5: Train Photo Samples

- **Description and Priority:** Training photo samples is crucial for face recognition and is of High priority.
- **Stimulus/Response Sequences:**
- Stimulus: User selects the option to train photo samples.
- Response: The system processes and stores the training data.
- **Functional Requirements:**
- The system should process and recognise faces from the provided photo samples.
- It should use the recognised data for face recognition.

#### 6: Take Attendance with Face Detection

- **Description and Priority:** Taking attendance with face detection is a core function and is of High priority.
- **Stimulus/Response Sequences:**
- Stimulus: User selects the option to take attendance.
- Response: The system initiates the attendance process using face detection.
- **Functional Requirements:**
- The system should perform real-time face detection for students.
- Attendance should be marked based on detected faces.
- It should have mechanisms to handle errors or missed detections.

#### 7: Attendance Report (Excel file & MySQL database)



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- **Description and Priority:** Generating attendance reports is important and is of Medium priority.
- **Stimulus/Response Sequences:**
- Stimulus: User requests attendance reports.
- Response: The system generates and provides reports in Excel format and stores data in a MySQL database.
- **Functional Requirements:**
- The system should allow users to select date ranges and classes for generating reports.
- It should export attendance data to Excel files.
- It must store attendance data in a MySQL database for future reference.

#### 8: Developer Page

- **Description and Priority:** The developer page is for administrative purposes and is of Low priority.
- **Stimulus/Response Sequences:**
- Stimulus: Administrator accesses the developer page.
- Response: The system displays developer-related options and functionalities.
- **Functional Requirements:**
- The developer page should provide access to system configuration and maintenance tools.
- It should be secured and only accessible by authorised personnel.

#### 9: Help Desk

- **Description and Priority:** The help desk is a support feature and is of Medium priority.
- **Stimulus/Response Sequences:**
- Stimulus: User requests help or support.
- Response: The system provides access to help resources or assistance.
- **Functional Requirements:**
- The help desk should offer resources such as FAQs, documentation, or contact information for support.
- Users should be able to submit help requests or inquiries.

#### 10: Exit System

- **Description and Priority:** Exiting the system is a basic function and is of Medium priority.
- **Stimulus/Response Sequences:**
- Stimulus: User initiates the exit or logout process.
- Response: The system logs the user out and exits gracefully.
- **Functional Requirements:**
- The system should provide a logout option.
- It should clear user sessions and ensure data security upon exit.





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## 6. Other Nonfunctional Requirements

### 6.1 Performance Requirements

#### 1. **Real-time Face Detection Performance:**

- The system should be able to achieve real time face detection, processing a minimum of 10 frames per second during the attendance tracking.

#### 2. **UI Responsiveness:**

- The UI should respond to user interaction within 1 second, even while heavy load condition.

#### 3. **Database Responsiveness:**

- The queries for attendance should complete within 2 seconds.

#### 4. **Accuracy of Face Recognition:**

- The system should achieve a face recognition accuracy rate of at least 90%.

#### 5. **Security Response Time:**

- The login and access control should introduce a negligible delay.

### 6.2 Safety Requirements

#### 1. **Privacy Protection:**

- AFRSA must comply with all relevant privacy regulations and should not capture, store, or process any personally identifiable information (PII) of students other than what is necessary for attendance tracking.

#### 2. **Access Control:**

- Access to the AFRSA system should be restricted to authorized personnel only, with role-based access control.

#### 3. **User Content:**

- The system should obtain explicit user consent before capturing or processing any biometric data for attendance tracking.

#### 4. **Regular Audits:**

- Conduct regular security audits and assessments to identify vulnerabilities and ensure compliance with safety and privacy requirements, by possibly employing a third party security experts.

#### 5. **Training and Awareness:**

- Provide training and awareness programs for system admins and users on privacy, system usage and security practices.



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### 6.3 Security Requirements

#### 1. **Security Awareness Training:**

- *Provide security awareness training to all the system user and admins to educate them on the potential security risks and policies.*

### 6.4 Software Quality Attributes

#### 1. **Usability:**

- *The system's UI should be user-friendly and intuitive.*

#### 2. **Reliability:**

- *AFRSA should have the uptime of at least 95% to ensure continuous availability for attendance tracking.*

#### 3. **Portability:**

- *AFRSA should be portable across the supported operating systems, I.e Windows, macOS, Ubuntu OS without any code modification.*

### 6.5 Business Rules

#### 1. **User Authentication:**

- *Only registered instructors and system admins have the access to sensitive functionalities like student data and attendance tracking.*

#### 2. **Data Privacy:**

- *AFRSA should capture and process only minimal biometric data necessary for attendance tracking and must obtain explicit user consent.*

#### 3. **Student Data Management:**

- *System admins have the authority to add, update, and delete student records, ensuring the accuracy of student data.*

#### 4. **Attendance Records:**

- *Attendance records should be generated automatically based on face detection and stored securely.*



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## 7. Other Requirements

*1. Database Requirements: AFRSA shall employ a relational database management system (e.g., MySQL) for storing student and attendance data securely.*

## Appendix A: Glossary

### 1. **SRS (Software Requirements Specification):**

A document that describes the functional and non-functional requirements of the software system being developed.

### 2. **Haarcascade:**

A machine learning object detection method used for detecting objects, including faces, in images or video streams.

### 3. **MySQL:**

An open-source relational database management system used to store and manage structured data, such as student records and attendance data.

### 4. **CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart):**

A security measure that helps distinguish between human users and automated bots by requiring users to complete a challenge, typically involving text recognition.

### 5. **CSV (Comma-Separated Values):**

A plain-text file format used to store tabular data, often used for exporting and importing data, such as attendance records.

### 6. **Excel:**

A popular spreadsheet application developed by Microsoft often used for creating and managing reports and data.



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## Appendix B: Field Layouts

An Excel sheet containing field layouts and properties/attributes and report requirements.

Sample sheet with information required to register the customer

Field	Length	Data Type	Description	Is Mandatory
Username	ANY	String	Login username of the admin	Y
Password	ANY	Alphanumeric.	Login password of admin	Y
Department of the	30	String	course student is taking	Y
Student id	13	Alphanumeric	ID of the student	Y
Section	1	Character	Section of the student	Y
Semester	1	Numeric	Correct semester of the student	Y
Student name	60	String	Name of the student	Y
Mail	50	Alphanumeric	Mail id of the student	Y
Phone number	10	Numeric	Contact of the student	Y
Gender	1	Enum	Gender of the student	Y
DOB	10	Timestamp	Date of birth of the student	Y



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**Sample Report Requirements: Include the fields to be included in the report**

**Attendance Report**

Name of the student

Attendance status(present/absent)

Time of attendance

Date of the day



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## Appendix C: Requirement Traceability Matrix

S I . No	Requirement ID	Brief Description of Requirement	Architecture Reference	D e s i g n Reference	Code File Reference	T e s t Case ID	System T e s t Case ID
1	RQ001	Login Security System (Username & Password)					
2	RQ002	Home Page					
3	RQ003	Student Management System					
4	RQ004	Real-time face detection					
5	RQ005	Train Photo Samples					
6	RQ006	Take Attendance with Face Detection					
7	RQ007	Attendance Report (Excel file & MySQL database)					
8	RQ008	Developer Page					
9	RQ009	Help Desk					
10	RQ010	Exit System					



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