
Software Requirements Specification

for

Face Recognition Attendance System with Canvas LMS Integration

Version 1.0

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Table of Contents

Table of Contents	iii
Revision History	iii
1. Introduction.....	1
1.1 Purpose	1
1.2 Document Conventions	1
1.3 Intended Audience and Reading Suggestions	1
1.4 Product Scope.....	1
1.5 References	2
2. Overall Description	2
2.1 Product Perspective	2
2.2 Product Functions.....	2
2.3 User Classes and Characteristics.....	2
2.4 Operating Environment.....	3
2.5 Design and Implementation Constraints	3
2.6 User Documentation.....	3
2.7 Assumptions and Dependencies.....	4
3. External Interface Requirements	4
3.1 User Interfaces.....	4
3.2 Hardware Interfaces	4
3.3 Software Interfaces.....	4
3.4 Communications Interfaces.....	5
4. System Features	5
4.1 Facial Recognition Attendance Tracking	5
4.2 Canvas LMS Integration	5
4.3 Webpage UI for Users.....	6
4.4 Attendance Reports	6
4.5 Functional Requirements.....	7
5. Other Nonfunctional Requirements	8
5.1 Performance Requirements	8
5.2 Safety Requirements	8
5.3 Security Requirements	8
5.4 Software Quality Attributes	8
5.5 Business Rules.....	9
6. Other Requirements	9
6.1 Legal & Compliance Requirements	9
Appendix A: Glossary.....	9
Appendix B: Analysis Models	9
Appendix C: To Be Determined List.....	9

Revision History

Name	Date	Reason For Changes	Version
Team	2/8/2025	Initial completion of document	1.0
Brendon Stepanek	2/16/2025	Changed formatting of requirements	2.0

1. Introduction

1.1 Purpose

The purpose of this product is to create a face recognition system that will integrate with Canvas LMS and automate the attendance taking process in classrooms. It will seamlessly integrate with Canvas LMS APIs to allow for real-time attendance updates and data synchronization. We expect that the system will offer a minimum accuracy rate of 95% by conducting extensive testing that considers factors like lighting, camera quality, and different facial profiles. We shall ensure that our system complies with all data privacy laws and policies by encrypting and securely handling all data provided to us. To users of our system, we intend to provide user training documentation to assist in the adoption and allow for ease of use from the start.

1.2 Document Conventions

- *Requirements are categorized as either functional or non-functional.*
- *High, Medium, and Low are used to indicate any priority levels.*
- *Mandatory requirements are indicated by the words “must” or “shall”.*
- *Non-mandatory requirements are indicated by the words “should” or “may”.*
- *Any technical words are defined in the glossary.*

1.3 Intended Audience and Reading Suggestions

Developers, project managers, testers, and institutional stakeholders such as teachers, administrators, and students are among the several stakeholders for whom this paper is meant. Project managers will use it to monitor compliance and implementation milestones, while developers will use it to comprehend system requirements and integration points with Canvas LMS. This document will be used by testers to specify test cases and verify system functionality, and institutional stakeholders will examine it to make sure the system meets their learning objectives. Before diving into the technical and functional aspects, readers are advised to start with the overview sections.

1.4 Product Scope

Our Facial Recognition Attendance System aims to simplify the attendance tacking process in classrooms by using AI facial recognition. We'll be integrating a real-time, secure, and efficient attendance tracking system that is integrated with Canvas LMS. To ensure that student attendance is recorded with high accuracy, the system will make use of OpenCV and DeepFace for facial detection and recognition. Teachers and administrators will be able to review, edit, and manage attendance records using a role-based access system. Students will also be able to view their own attendance records.

1.5 References

- *Project Charter for our Facial Recognition Attendance System*
- *Work Breakdown Structure for our Facial Recognition Attendance System*
- *IEEE Recommended Practice for Software Requirements Specifications*

2. Overall Description

2.1 Product Perspective

This system, which combines AI-powered facial recognition with an LMS (Canvas) for smooth attendance tracking, is an improvement over conventional classroom attendance technique.

2.2 Product Functions

The technology uses real-time facial picture processing and capture to verify the identities of students. It automatically logs students' attendance into Canvas LMS and uses AI-powered facial recognition to verify them. Teachers can manually override attendance records if the system is unable to identify a pupil. Additionally, the system offers teachers and administrators an easy-to-use dashboard to track attendance patterns, create reports, and guarantee correct documentation. To preserve security and privacy, data encryption and role-based access control are integrated, and smooth synchronization with Canvas LMS guarantees current attendance records.

2.3 User Classes and Characteristics

The following are the user classes that we anticipate utilizing our product:

ID	Name	Description	Frequency
1	Instructors	These will be teachers and professors who plan to be in the classroom daily. Frequency of use would be the highest among the user classes. We anticipate that they will primarily utilize our product to manage attendance records and in the case of errors, manually adjust them. Technical expertise may vary from instructor to instructor, but it is expected they have a basic understanding of the Canvas system.	Highest
2	Students	These will be the students who will be checking into class (hopefully) daily. Frequency of use would be high. We anticipate that they will primarily utilize our product to confirm their class attendance using the face scan upon walking into class. Technical expertise will vary from student to student, but	High

		basic understanding of Canvas and web cameras would be necessary.	
3	Administrators	These will be IT staff at the school and the administrators of Canvas. Frequency of use would be high but more than likely the lowest of the user classes described. We anticipate that they will primarily utilize our product to manage data security, assign permissions and roles, as well as manage system setting. Technical expertise will need to be incredibly high as they need to be familiar with the Canvas System.	Medium

2.4 Operating Environment

The software must be able to operate under various hardware configurations because of the multitude of differing configurations from district to district. The major requirement is that the software will operate on a laptop/desktop with a web camera. The software will need to have full integration with Canvas LMS and must be able to access Canvas as well.

2.5 Design and Implementation Constraints

To provide real-time attendance synchronization, the system must smoothly interface with the Canvas LMS API. Processing speed is essential since face recognition must be finished in seconds to prevent delays in attendance marking. The system must also guarantee encrypted transmission and storage of biometric data while adhering to privacy and student data protection legislation. The recognition algorithm's accuracy will be impacted by hardware limitations like camera placement and resolution; therefore, calibration and positioning must be improved.

2.6 User Documentation

Towards the end of development, we intend to create the following documentation to assist users in setup, operation, and troubleshooting:

- *User Manuals*
 - *Teachers & Administrators*
 - *We'll provide a guide with instructions on taking attendance, modifying records, and generating reports.*
 - *Students*
 - *We'll provide students with a guide that provides an overview of the system, the attendance verification process, and how to view their own attendance records.*
- *Technical Documentation*
 - *We'll create documentation that covers details on our API endpoints, authentication, and our integration with Canvas. This document will also cover system components, data flow, and our technology stack.*

- *Troubleshooting Guides*
 - *We'll provide material that covers common issues that users may run into which could include failed recognitions, failed attendance recording, and API errors.*
- *Other Material*
 - *We plan to also provide short, but thorough video tutorials for users to feel they are more visual learners. These videos will feature similar instructions to our user manuals just in video format.*

2.7 Assumptions and Dependencies

Prior to attending courses, the system presumes that every student has already registered in the facial recognition database. For cloud-based processing and real-time synchronization with Canvas LMS, dependable internet connectivity is necessary. The correct camera placement and sufficient lighting in classrooms are essential for facial recognition to work well. Additionally, because the system depends on the current Canvas LMS infrastructure, any modifications to the Canvas API may affect its functionality and necessitate updating the integration procedure.

3. External Interface Requirements

3.1 User Interfaces

The system will have a web-based UI for teachers, administrators, and students.

- *Dashboard*
 - *Teachers and administrators will be able to view, modify, and generate attendance reports. Students will be able to view their own attendance records but will not be able to modify them.*
- *Live Facial Recognition Display*
 - *Teachers and administrators should have a real-time display of the facial capture feed during attendance processing*

3.2 Hardware Interfaces

- *The system requires adequate cameras and computers capable of processing the data and images in a sufficient amount of time.*
- *The system requires users to have Windows and MacOS devices.*

3.3 Software Interfaces

The system will integrate with the following:

- *Canvas LMS API*
 - *To retrieve a list of students in a class and update attendance records.*
- *Firebase Firestore*
 - *To store attendance records and user permissions.*
- *OpenCV & DeepFace*
 - *OpenCV will be used for facial detection*

- DeepFace will be used for facial recognition
- OAuth2 Authentication
 - Canvas requires the use of OAuth2 authentication for login and API access control.
- RESTful API
 - For frontend to backend communication

3.4 Communications Interfaces

- HTTP/HTTPS
 - Communications will be encrypted for security.
- API Requests
 - Attendance updates will be sent using REST API.
- Firebase Firestore
 - This database must ensure that data is synced instantaneously for attendance tracking.
- Error Reporting Feature
 - The system must have a feature that logs failed recognitions and any system errors for review.

4. System Features

4.1 Facial Recognition Attendance Tracking

4.1.1 Description & Priority

Feature Name	Description	Priority
Facial Recognition Attendance System	The system will capture student faces using OpenCV and DeepFace, then compare them with stored images, and mark attendance in Canvas.	High

4.1.2 Stimulus/Response Sequences

- Students will enter the view of the camera.
- Using OpenCV and DeepFace, the system will capture the face of the person and compare it to the faces stored in the system.
- If the student is recognized by the system, the attendance of that person is automatically marked and updated in Canvas.
- If the student is not recognized by the system, the teacher can manually mark the student's attendance.

4.2 Canvas LMS Integration

4.2.1 Description & Priority

Feature Name	Description	Priority
Canvas LMS Integration	The system will need to synchronize student attendance with Canvas in realtime and retry any failed updates.	High

4.2.2 Stimulus/Response Sequences

- The system will request a list of students enrolled in a class from Canvas.
- As students are being scanned and recognized, the system will update attendance records for each student in Canvas.
- The system should retry and log any failed record updates if any network or API errors occur.

4.3 Webpage UI for Users

4.3.1 Description & Priority

Feature Name	Description	Priority
Webpage UI	System users will have access to a dashboard where they can view, edit, and generate attendance reports depending on their permissions.	High

4.3.2 Stimulus/Response Sequences

- The user should navigate to the dashboard webpage.
- For students, they'll be able to view their own attendance records.
- For teachers, they'll have options to view individual student attendance for their classes, change attendance records for those classes, and generate attendance reports.
- For administrators, they'll have the same permissions as the previous users, but instead they'll be able to view attendance records for all classes and manage user permissions.

4.4 Attendance Reports

4.4.1 Description & Priority

Feature Name	Description	Priority
Attendance Reports	Teachers and administrators will be able to generate reports that can be used to analyze student attendance over a period of time	Medium

4.4.2 Stimulus/Response Sequences

- The administrator or teacher will select a class and date range for the report they're wanting to generate.
- The system must generate an attendance report that shows student presences and absences.

4.5 Functional Requirements

Requirement Name	Description	Priority
Facial Recognition Processing	The system must capture and process all student faces using a camera	High
Recognition Speed	The system must complete the recognition process within 5 seconds	High
Manual Attendance Recording	If a scan fails, teachers and administrators must be able to manually change a student's attendance record	High
Realtime Attendance Update	The system must update in Canvas LMS immediately after a successful facial recognition	High
Canvas LMS Class Roster	The system must be able to retrieve a list of enrolled students from Canvas	High
Error Handling	If an error occurs, the system must retry at least twice before logging an error; must also notify teachers and administrators after three attempts	Medium
User Interface/Dashboard	A dashboard must be created for teachers, administrators, and students to use the system.	High
Attendance Reports	The system must generate attendance reports that show realtime attendance data	High
Export Attendance Reports	Attendance reports should be made available for download via CSV or PDF format	Medium
Role-based Access Control	Students can view their own attendance records; teachers can view and modify attendance for their classes; administrators can view and modify attendance, and manage user roles	High
Security & Encryption	Our system must encrypt and securely store all identifiable student data according to data privacy laws	High

5. Other Nonfunctional Requirements

5.1 Performance Requirements

- *Facial recognition processing time*
 - *Less than 5 seconds*
- *Webpage UI load time*
 - *Less than 2 seconds*
- *System Uptime*
 - *99% uptime*
- *Error Handling*
 - *If the facial recognition scan fails, the system shall record the error and allow for manual record entry.*
- *Canvas Updates*
 - *The system shall provide Canvas with real-time attendance updates.*

5.2 Safety Requirements

- *Data Protection*
 - *The system must not store any raw facial images after processing.*
 - *Only necessary attendance records shall be stored in encrypted format.*
- *System Failures*
 - *Data must be recoverable in case of system failures or outages.*
 - *If facial recognition fails repeatedly, the system shall log errors for review.*

5.3 Security Requirements

- *Data Encryption*
 - *Encrypt and store all student data*
- *Role-based Access*
 - *Teachers and administrators will each have their own roles, each with their own permissions*

5.4 Software Quality Attributes

- *Reliability*
 - *System must perform in varying lighting conditions and on different devices*
 - *Facial recognition shall function accurately even with minor changes in appearance like facial hair and glasses.*
- *Usability*
 - *The system shall have an intuitive and user-friendly interface.*
 - *The UI shall be accessible for both technically and non-technically inclined users.*
 - *The facial recognition process shall be smooth and require minimal user intervention.*
- *Scalability*
 - *The system must be able to handle an increasing number of users without major performance degradation.*
 - *Facial recognition process must allow for quick processing, even with large class sizes.*

5.5 Business Rules

- Attendance Processing & Validation
 - A student's attendance must only be marked when a student's face is successfully recognized.
 - Otherwise, the system shall allow a teacher or administrator to manually mark attendance.
- User Roles & Permissions
 - Students can only view their own attendance records and cannot change them.
 - Teachers can view and override attendance for their courses only.
 - Administrators can access all attendance reports and modify individual records.
 - Administrators will also be able to manage user roles and permissions.

6. Other Requirements

6.1 Legal & Compliance Requirements

- The system must comply with FERPA and PPRA data privacy laws.
- The use of facial recognition must comply with any existing institutional policies and laws regarding biometric data.

Appendix A: Glossary

- *API: protocols that enable software applications to communicate with one another.*
- *HTTPS: Hypertext Transfer Protocol Secure*
- *UI: User Interface*

Appendix B: Analysis Models

TBD

Appendix C: To Be Determined List

1. *Analysis Models*
 - 1.1. *We've yet to create any of the diagrams or models that are to be included in this section. Once they are created, this document should be updated with their addition.*