**VERSION AND APPROVALS**

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**Version #**

**Date**

**Revised By**

**Reason for change**

**1**

**.0**

**5/04/2023**

**Mr. Dhlakama**

**Implementation of Graphic User Interface**

**)**

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**GUI**

This document has been approved as the official Business Requirements Document for **Student Attendance Facial Recognition System**, and accurately reflects the current understanding of business requirements. Following approval of this document, requirement changes will be governed by the project’s change management process, including impact analysis, appropriate reviews and approvals.

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| **DOCUMENT APPROVALS** | |  |  |  |
| **Approver Name** | **Project Role** | | **Signature/Electronic Approval** | **Date** |
| **Mr Dhlakama** | **Mark Student Attendance using facial recognition machine learning algo** | | **Mr Dhlakama** | **10/04/2023** |
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# TABLE OF CONTENTS

VERSION AND APPROVALS ....................................................................................... 2

PROJECT DETAILS ................................................................................................... 2

OVERVIEW .............................................................................................................. 2

DOCUMENT RESOURCES ......................................................................................... 2

GLOSSARY OF TERMS .............................................................................................. 3

PROJECT OVERVIEW ............................................................................................... 3

*4.1 Project Overview and Background ..................................................................................................... 3*

*4.2 Project Dependencies ......................................................................................................................... 4* *4.3 Stakeholders ....................................................................................................................................... 5*

KEY ASSUMPTIONS AND CONSTRAINTS ...................................................................... 5

*5.1 Key Assumptions and Constraints ............................................................................................................ 5*

BUSINESS REQUIREMENTS....................................................................................... 6

*General / Base .......................................................................................................................................... 6*

*Security ..................................................................................................................................................... 6*

*Reporting .................................................................................................................................................. 7*

*Usability .................................................................................................................................................... 7*

*Audit .......................................................................................................................................................... 8*

APPENDIXES ........................................................................................................... 9

*Appendix A – The process of attendance taking: ..................................................................................... 9*

*Appendix B – Flow Chart of the image retrieval process: ...................................................................... 10* *Appendix C- List of Group Members: ..................................................................................................... 11*

## PROJECT DETAILS

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| --- | --- |
| **Project Name** | Student Attendance Facial Recognition System |
| **Project Type** | ***New Initiative*** |
| **Project Start Date** | 23/02/2023 |
| **Project End Date** | 02/05/2023 |
| **Project Sponsor** |  |
| **Primary Driver** | ***Efficiency*** |
| **Secondary Driver** |  |
| **Division** |  |
| **Project Manager** | Sydney Chikanya |

## OVERVIEW

This document defines the high level requirements [insert project name]. It will be used as the basis for the following activities:

* Creating solution designs
* Developing test plans, test scripts, and test cases
* Determining project completion
* Assessing project success

## DOCUMENT RESOURCES

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| --- | --- | --- |
| **Name** | **Business Unit** | **Role** |
| Students | Student community | Primary end-users of attendance facial recognition system |
| IT Department | Technology team | Responsible for the installation, maintenance, and updates to the facial recognition system |
| Security | Personnel Campus security team | Responsible for monitoring the facial recognition system for security or access control purposes |
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## GLOSSARY OF TERMS

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| **Term/Acronym** | **Definition** |
| Student attendance facial recognition system | A computer-based system designed to aid the teacher (and school management) in tracking the attendance of students using facial recognition technology. |
| os | This is an in-built Python module that allows Python applications to interact effectively and efficiently with the Operating system. |
| pickle | Python programming language module used for serializing (converting data types to byte-streams) and de-serializing (retrieving data types from byte-streams) data objects easily. |
| numpy | The numpy module is an indispensable Python package that provides efficient high-performance numerical computations and array functions. |
| cv2 | This module is an OpenCV-Python library designed to provide real-time computer vision and image processing functions. |
| face\_recognition | A Python module primarily designed to face detection and recognition functionalities "Such as encoding a face, face comparison, and detection." |
| cvzone | The cvzone module is a Python library for developers to assist them in creating real-time computer vision and image processing apps. |
| dlib | Dlib is a modern C++ toolkit that contains machine learning algorithms and tools for creating complex software in C++ |
| C++ development environment | In order to build and compile the Dlib library from source, a C++ development environment such as Visual Studio, GCC or Clang is required. Once the library is compiled, the Python bindings are generated using tools such as SWIG or CMake. |
| FireBase | Realtime cloud database |
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## PROJECT OVERVIEW

### 4.1 Project Overview and Background

In educational institutions, keeping track of student attendance is a critical task. The traditional method of marking rolls is prone to errors, and there is also a risk of proxy attendance, which ultimately affects the quality of education.

The objective of this project is to create a student attendance system using facial recognition technology to significantly minimize the manual intervention required in the attendance process.

The system will use a web camera to take images of students before the start of each class. Image processing techniques will be implemented to obtain the faces of the students in the images, and facial recognition algorithms will be used to verify the students' identities. The system aims to identify the student in under a second.

This system will store the student's attendance information in a database, allowing the administration to access the data with real-time updates. This information will increase transparency and allow teachers to monitor their students' attendance. The system will ensure the accuracy of the information collected and will be immune to proxy attendances.

To develop such a system, various tools and libraries will be used, such as Python, OpenCV, and face\_recognition. The project will require training the facial recognition algorithm with the images of the student's faces. The project's primary focus is to establish a database that stores the attendance record of students, and this will be achieved using Firebase Realtime Database.

Overall, this project aims to provide educational institutions with a reliable, efficient and secure method of marking attendance, making student record-keeping a much easier task for administration and teachers alike.

### 4.2 Project Dependencies

The student attendance facial recognition system requires the following dependencies:

1. **Python 3.8 or higher:** The project is developed using Python programming language and requires Python 3.8 or higher to run.

1. OpenCV: OpenCV is an open-source computer vision library that is used for the detection and recognition of faces in images or video. The project requires OpenCV for face detection and recognition.

1. **C++ Development Environment:** is an open-source machine learning library that is used for training deep neural networks. The project requires C++ Development Environment to train and test the deep learning model for facial recognition.

1. NumPy: NumPy is a numeric python library used for scientific computation and data analysis. The project requires NumPy for data manipulation.

6. **Firebase Realtime Database**: the firebase.admn.db module is the Firebase module that is used to interact with the Realtime Database component of Firebase.

### 4.3 Stakeholders

The following comprises the internal and external stakeholders whose requirements are represented by this document:

|  |  |
| --- | --- |
|  | **Stakeholders** |
| 1. | Students |
| 2. | School Administration |
| 3. | Parents and Guardians |

**KEY ASSUMPTIONS AND CONSTRAINTS**

### 5.1 Key Assumptions and Constraints

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| **#** | **Assumptions** |
| 1 | The facial recognition technology being used is reliable and accurate. |
| 2 | The students are aware of the implementation of the system and are willing to participate. |
| 3 | The system is not influenced by external factors such as lighting, camera angle, or student hairstyle changes. |
| 4 | The system will be used solely for attendance tracking purposes and not for any other purposes. |
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| **#** | **Constraints** |
| 1 | The cost of implementing the system is within the budget allocated for the project. |
| 2 | The system must comply with data privacy laws and regulations. |
| 3 | The system must be accessible to all students regardless of any disabilities they may have. |
| 4 | The system must be able to handle a large number of students in real-time, without significantly slowing down the attendance process. |

## BUSINESS REQUIREMENTS

The following sections document the various business requirements of this project.

The requirements in this document are prioritized as follows:

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| --- | --- | --- |
| Value | Rating | Description |
| 1 | Critical | This requirement is critical to the success of the project. The project will not be possible without this requirement. |
| 2 | High | This requirement is high priority, but the project can be implemented at a bare minimum without this requirement. |
| 3 | Medium | This requirement is somewhat important, as it provides some value but the project can proceed without it. |
| 4 | Low | This is a low priority requirement, or a “nice to have” feature, if time and cost allow it. |
| 5 | Future | This requirement is out of scope for this project, and has been included here for a possible future release. |

### General / Base

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| ***REQ#*** | **PRIORITY** | **DESCRIPTION** | **RATIONALE** |  |
| **1** | High | The system shall capture facial images of students | This requirement is critical for the system to accurately record the attendance of students. |  |
| **2** | High | The system shall store the captured images securely and only authorized personnel shall have access to the data. | This requirement is critical to ensure the privacy and security of student data. |  |
| **3** | High | The system shall use facial recognition technology to match the captured image with the student's record in the school database. | This requirement is critical to accurately identify students and record their attendance. |  |
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### Security

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| ***REQ#*** | **PRIORITY** | **DESCRIPTION** | **RATIONALE** |  |
| **7** | High | The system shall require secure login credentials for authorized personnel to access the attendance data | This requirement is critical to prevent unauthorized access to student data. |  |
| **8** | high | The system shall encrypt all captured facial images and attendance data to prevent unauthorized access | This requirement is critical to ensure the privacy and security of student data. |  |
| **9** | Medium | The system shall have a backup and recovery plan in case of data loss or system failure. | This requirement is important to ensure data integrity, but the project can proceed without it. |  |
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### Reporting

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| ***REQ#*** | **PRIORITY** | **DESCRIPTION** | **RATIONALE** | **USE CASE** |
| **10** | High | The system shall generate daily attendance reports for each class | This requirement is critical for the school to track student attendance. |  |
| **11** | Medium | The system shall allow authorized personnel to generate custom attendance reports based on specific criteria. | This requirement is important for further analysis of attendance data, but the project can proceed without it. |  |
| **12** | Low | The system shall provide real-time alerts to authorized personnel if a student is absent for a certain number of consecutive days. | This is a low priority requirement and can be implemented later if time and cost allow it. |  |
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### Usability

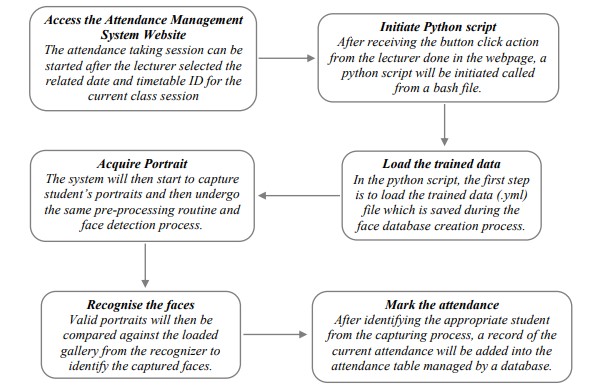
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***REQ#*** | **PRIORITY** | **DESCRIPTION** | **RATIONALE** | **USE CASE** |
| **13** | High | The system shall have a user-friendly interface for authorized personnel to easily access attendance data. | This requirement is critical to ensure authorized personnel can efficiently use the system. |  |
| **14** | Medium | The system shall provide clear instructions for students to follow during the image capture process. | This requirement is important to ensure accurate attendance data, but the project can proceed without it. |  |
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### Audit

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| ***REQ#*** | **PRIORITY** | **DESCRIPTION** | **RATIONALE** | **USE CASE** |
| **16** | High | The system shall keep a log of all access to attendance data, including the date, time, and user who accessed the data. | This requirement is critical for auditing purposes and to ensure data privacy. |  |
| **17** | Medium | The system shall have a mechanism to detect and alert authorized personnel of any suspicious activity or attempts to access the system. | This requirement is important for security purposes, but the project can proceed without it. |  |
| **18** | Low | The system shall maintain a record of attendance data for at least five years. | This is a low priority requirement and can be implemented later if time and cost allow it. |  |
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## APPENDIXES

**Appendix A – The process of attendance taking:**



**Appendix B – Flow Chart of the image retrieval process:**

