

# **Software Requirements Specification**

**For**

## **Face Recognition Based Attendance System**

**Prepared by**

**Ashvin Gaonkar (2GI17CS024)**

**Ayush Sharma (2GI17CS027),**

**Hrishikesh Naik (2GI17CS042)**

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**KLS GIT BELAGAVI**

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# 1. Introduction

## 1.1 Purpose

Face is the representation of one's identity. Hence, we have proposed an automated student attendance system based on face recognition. Face recognition system is very useful in life applications especially in security control systems. The airport protection system uses face recognition to identify suspects and FBI (Federal Bureau of Investigation) uses face recognition. The inception of face recognition technology has automated various task .

## 1.2 Definitions, Acronyms and Abbreviations

**Python:** Python is an interpreted language, high-level, general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale project

**OpenCV:** OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision. The library is cross-platform and free for use under the open-source BSD license. Express: Express is a module framework for Node that you can use for applications that are based on servers that will listen for any input/connection requests from clients.

**Raspberry Pi:** The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries.

**Haar Cascade:** Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video and based on the concept of features proposed by Paul Viola and Michael Jones in their paper "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001

**Numpy:** Numpy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

**Raspberry Pi Camera:** The Raspberry Pi Camera v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens

## **1.3 Intended audience and Reading suggestions**

This document is intended for developers, project managers, marketing staff, users, testers, and documentation writers.

- Developers: This document contains all the architectural diagrams that are helpful for developers building or maintaining similar projects
- Project managers: This is a detailed document and hence very useful for the ones managing the projects as it contains the flow diagrams and also the database diagrams. This helps the handlers of websites understand the project even better.
- Marketing Staff: The scope of this project is mentioned in this document along with the use case diagram specifying what this project has to offer to a particular audience.

Users: Knowing the flow of the application can help the users get a better experience and also explore the product's capabilities.

## **1.4 References**

1] IEEE SRS format

## **1.5 Technologies Used**

### **Python Programming**

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy-to-learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

## **Image Processing**

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

## **Raspberry Pi 3**

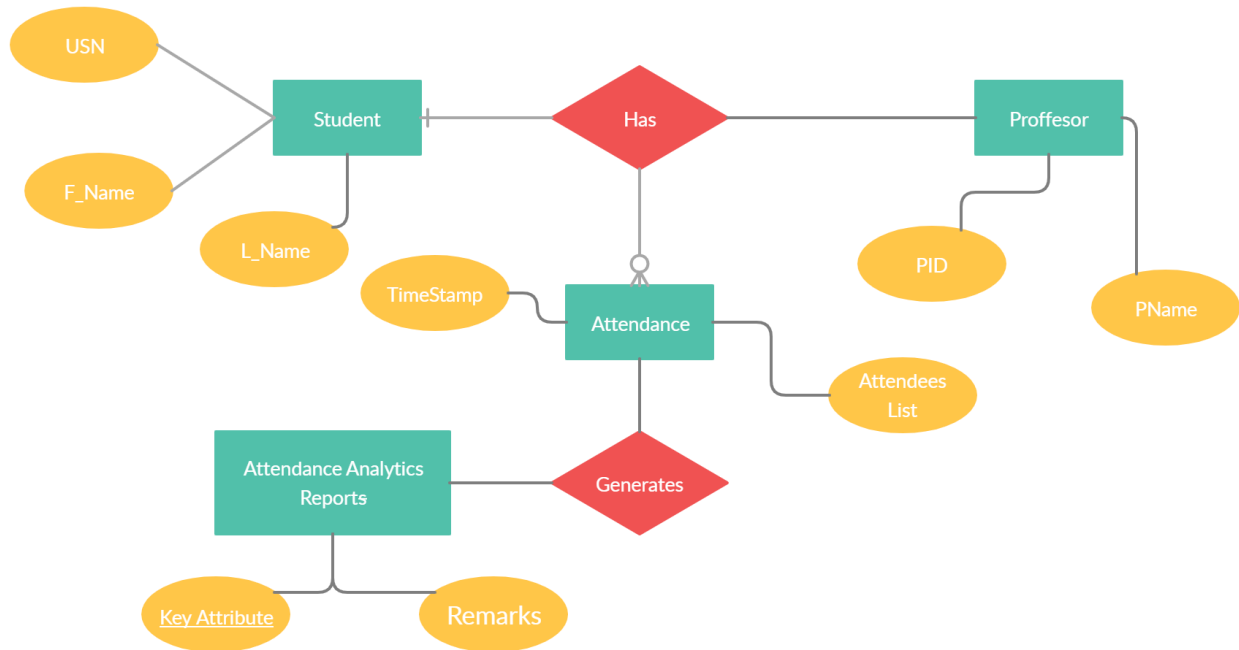
The Raspberry Pi 3 Model B is the latest version of the \$35 Raspberry Pi computer. The Pi isn't like your typical machine, in its cheapest form it doesn't have a case, and is simply a credit-card sized electronic board -- of the type you might find inside a PC or laptop but much smaller. A surprising amount. As you can see below you can use the Pi 3 as a budget desktop, media center, retro games console, or router for starters. However that is just the tip of the iceberg. There are hundreds of projects out there, where people have used the Pi to build tablets, laptops, phones, robots, smart mirrors, to take pictures on the edge of space, to run experiments on the International Space Station

## **OpenCV**

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

## 2. Overall Description

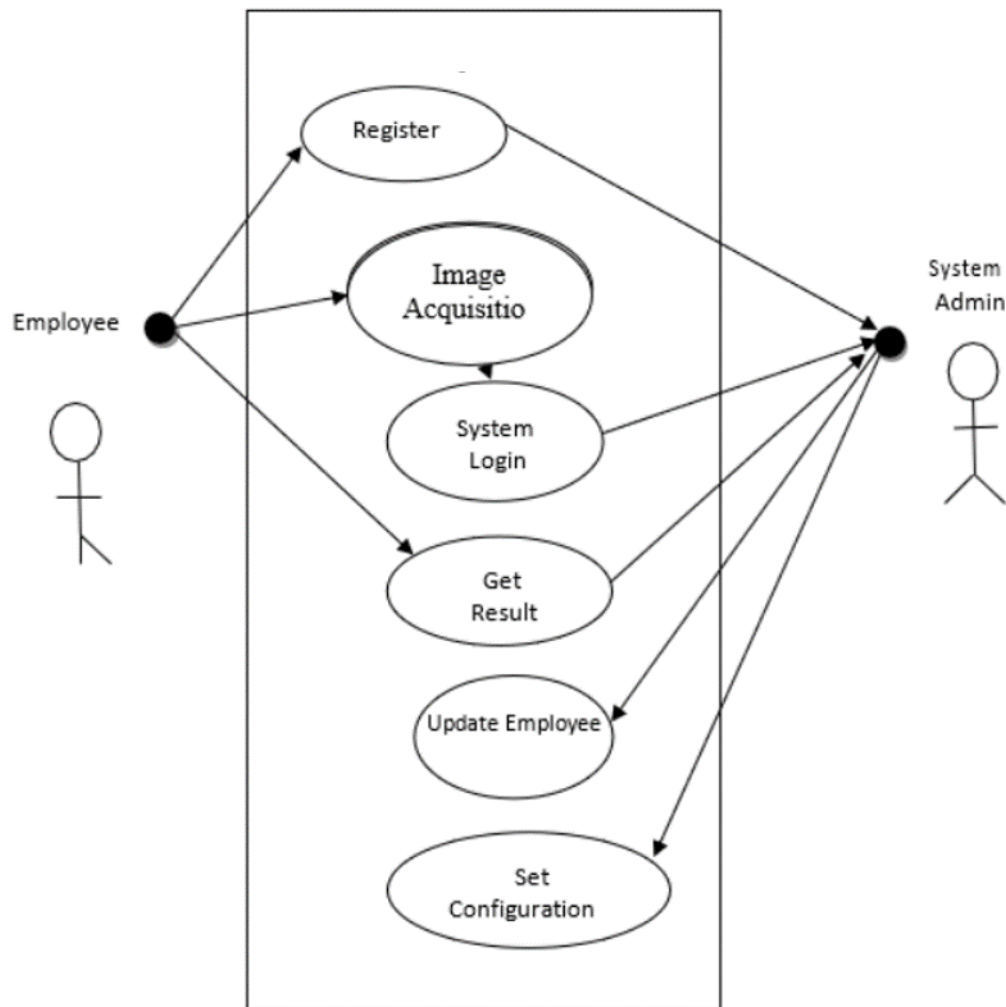
### 2.1 E-R Modeling



There are four entities namely

1. Student
2. Professor
3. Attendance
4. Attendance Analytics Reports

## 2.2 Use case and model Survey



### Employee Use Case

Specification of actors

In the analysis stage of the Face Recognition System development process, actors below are described so far.

#### Employee

Element	Details
Description	An employee whose face are recognized
Examples	An employee whose face are detected and recognized, then added to database.

**Use Cases:**

1. Register
2. System Login
3. Get Result
4. Update Employee
5. Set Configuration

**Admin**

Element	Details
Description	A System admin is a person who handles the application
Examples	System admin who logs in the system, register a new person and add to database, delete and update a registered person

**Use Cases:**

1. Register
2. Image Acquisition
3. Get Result

**Register Use Case**

Specification of Use Case

**Register**

Element	Details
Actor	System Admin
Trigger	System admin must enrol the image of face
Pre Conditions	The person is not registered
Post Conditions	The person is registered and has his face recognized



Normal Course	<ol style="list-style-type: none"> <li>1. System admin collects data and images of a persons</li> <li>2. The system admin stores the data and features of image on database.</li> </ol>
Alternative Course	The person is already registered

## Image Acquisition

Element	Details
Actor	System Admin
Trigger	System admin must take the image of a face.
Pre Conditions	<ol style="list-style-type: none"> <li>1. The person is not registered</li> <li>2. The person is registered</li> </ol>
Post Conditions	<ol style="list-style-type: none"> <li>1. The person is registered and has his face recognized</li> <li>2. The image is fed to Face Recognition System</li> </ol>

## 2.3 Product Functions

### 2.3.1 Functional Requirements

6. System functional requirements describes activities and services that must provide
7. A user must be able to manage student records.
3. An only authorized user must be able to use the system
4. A system must be attached to wireless camera and face recognition must be smooth
5. The administrator or the person who will be given the access to the system must login into system before using it
6. The information must be entered and managed properly.

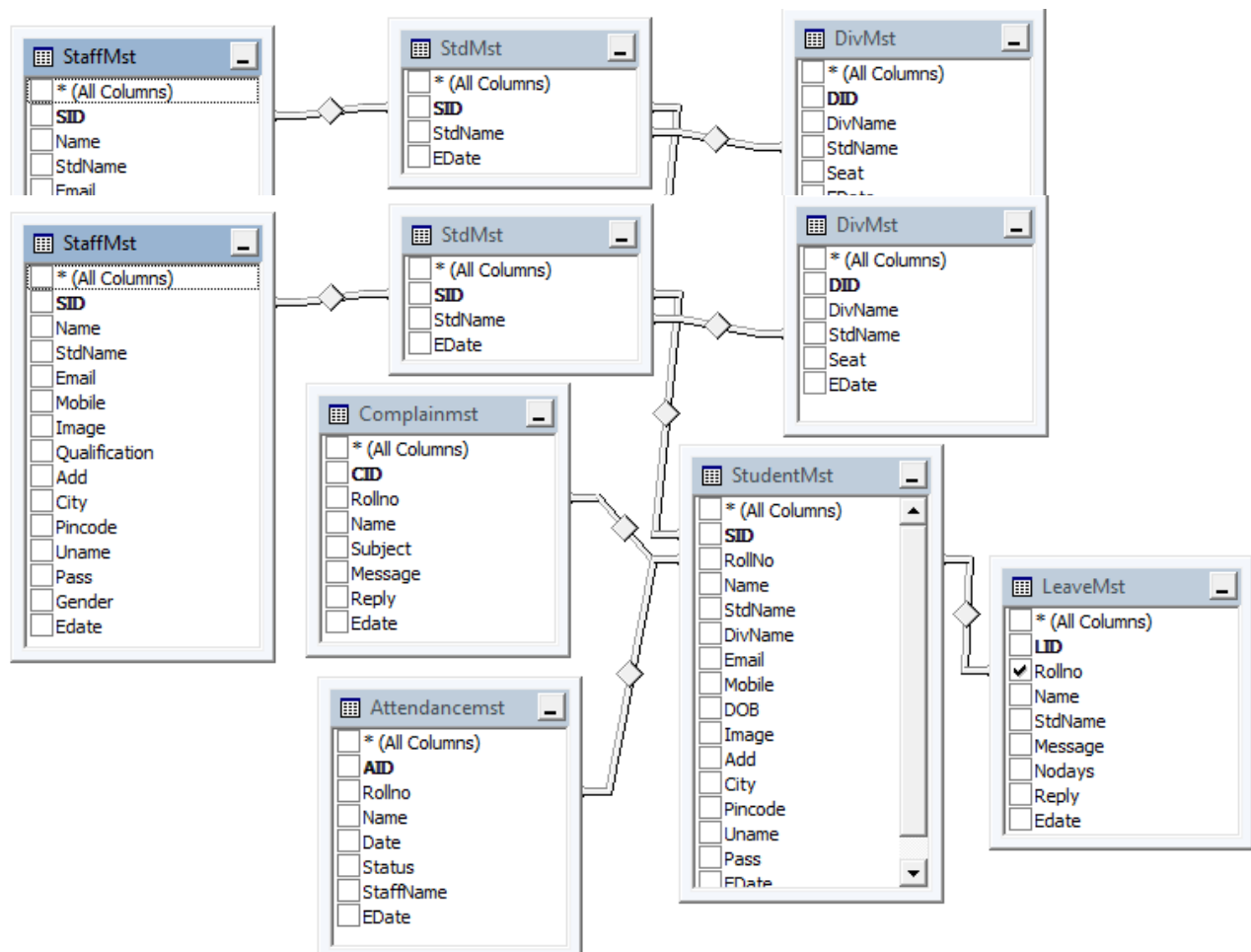
### 2.3.2 Non-Functional Requirements

Non functional requirements are the characteristics or attributes of the system that can judge its operation. The following points can clarify them.

- Accuracy and precision: The system should perform its process with accuracy and precision
- Flexibility: The system should be easy to modify, any wrong.
- Security: The system must be secure and saving students privacy
- Speed and Responsiveness: Execution of operation should be fast.

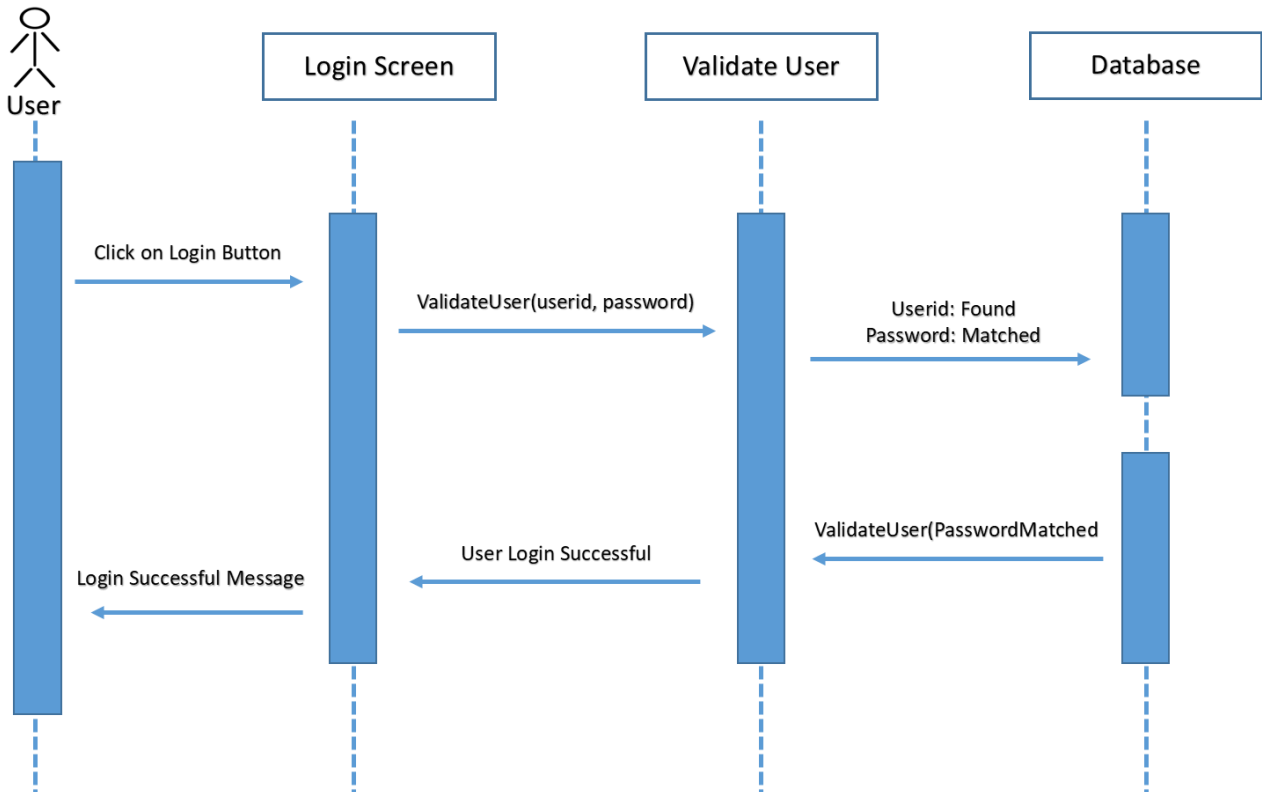
Non functional requirements are as follows:

- The GUI of the system will be user friendly
- The data that will be shown to the user will be made sure that it is correct
- The system will be extended for changes and to the latest technologies.
- Efficiency and effectiveness of the system will be made sure
- The performance of the system will be made sure.



## 2.5 Sequence Diagrams

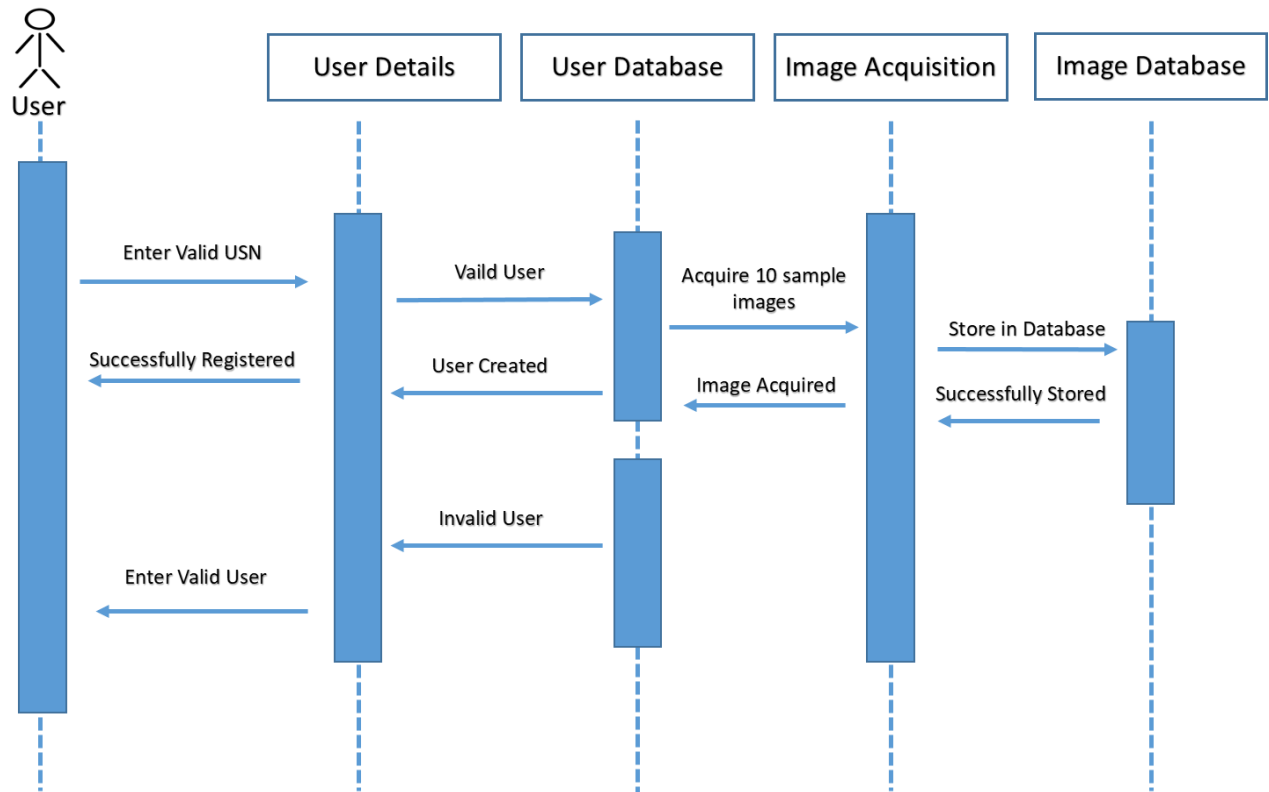
### 2.5.1 Login



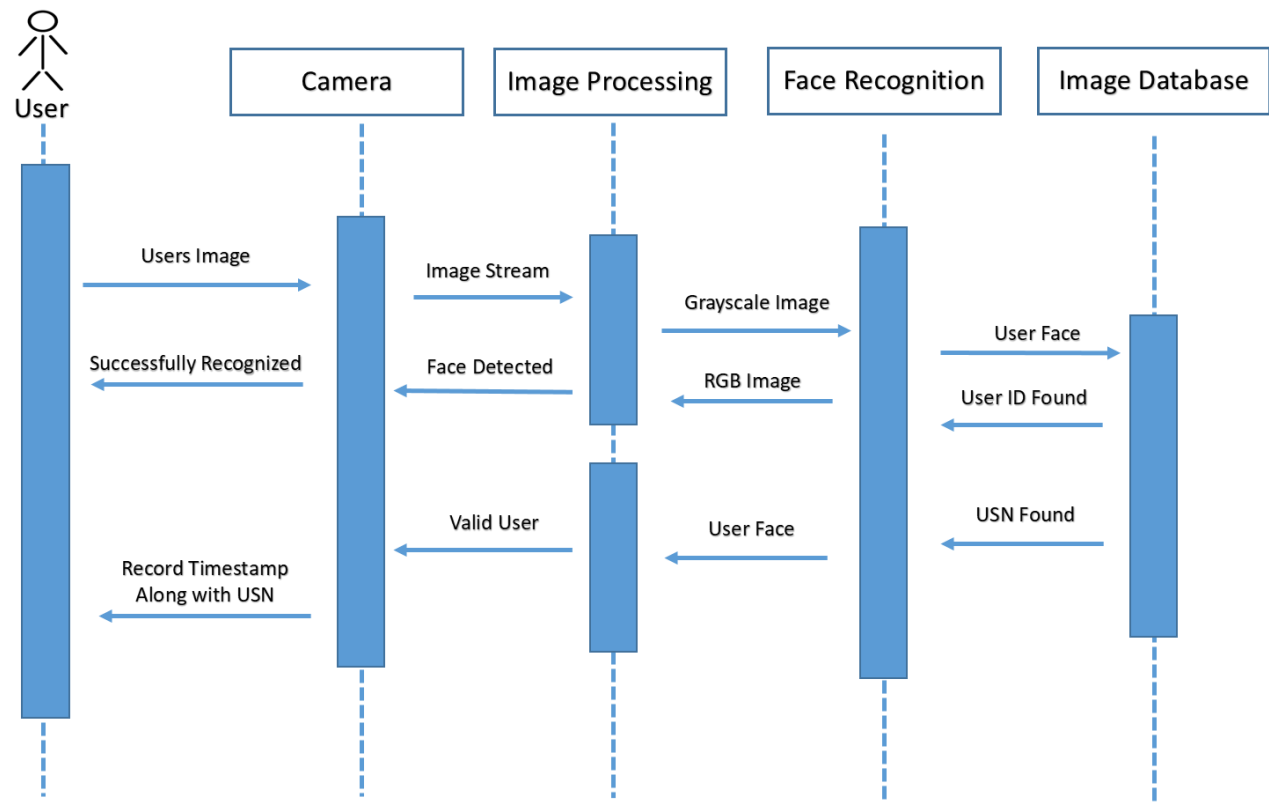
Initially the authorized admin will login to the system to initialize registration process. If the Admin credentials are not authentic then the system wont accept his password and username. The credentials are verified by checking in the database.

The Users need to provide samples of their faces to register. These samples are further preprocessed and stored in database

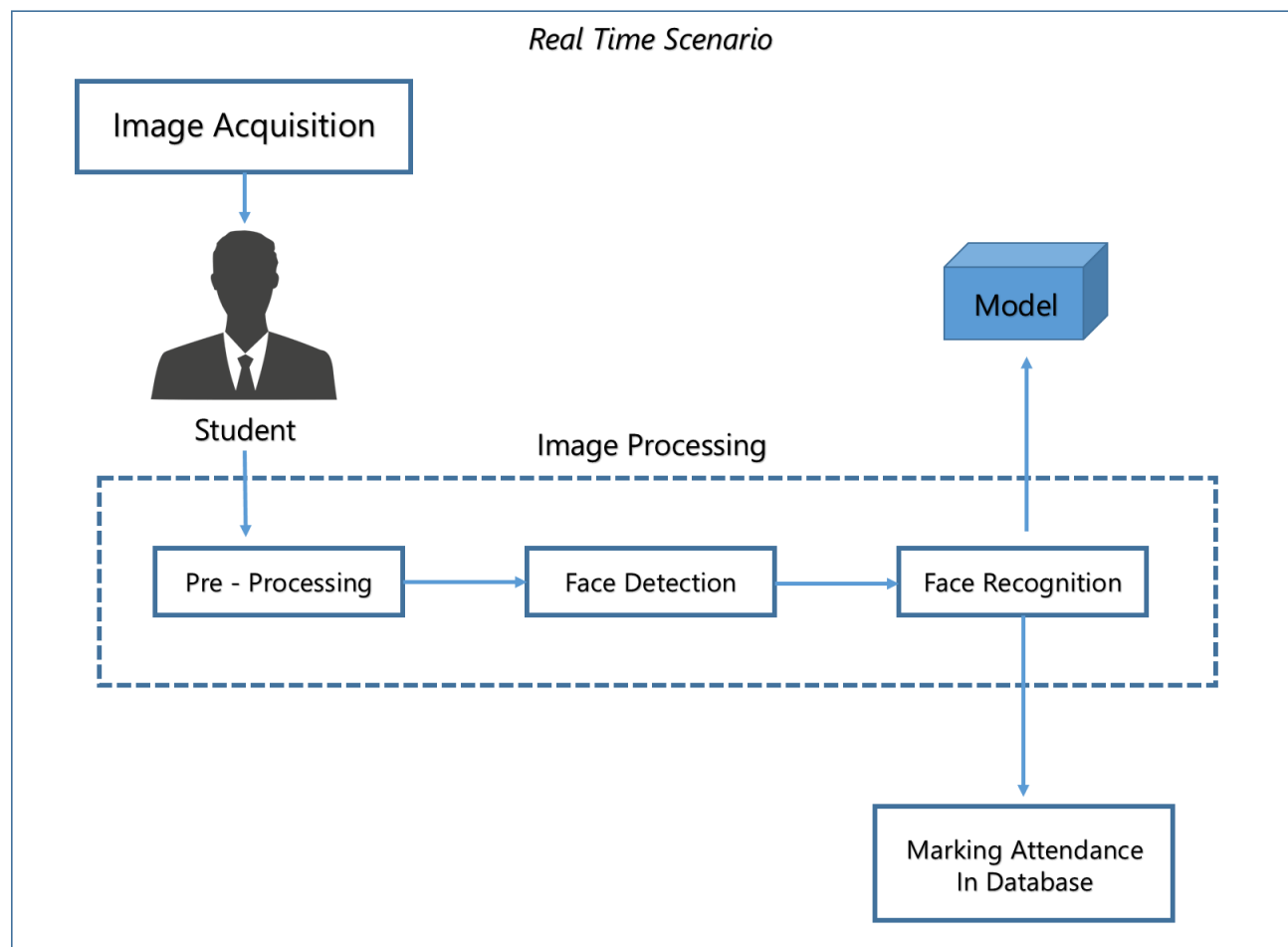
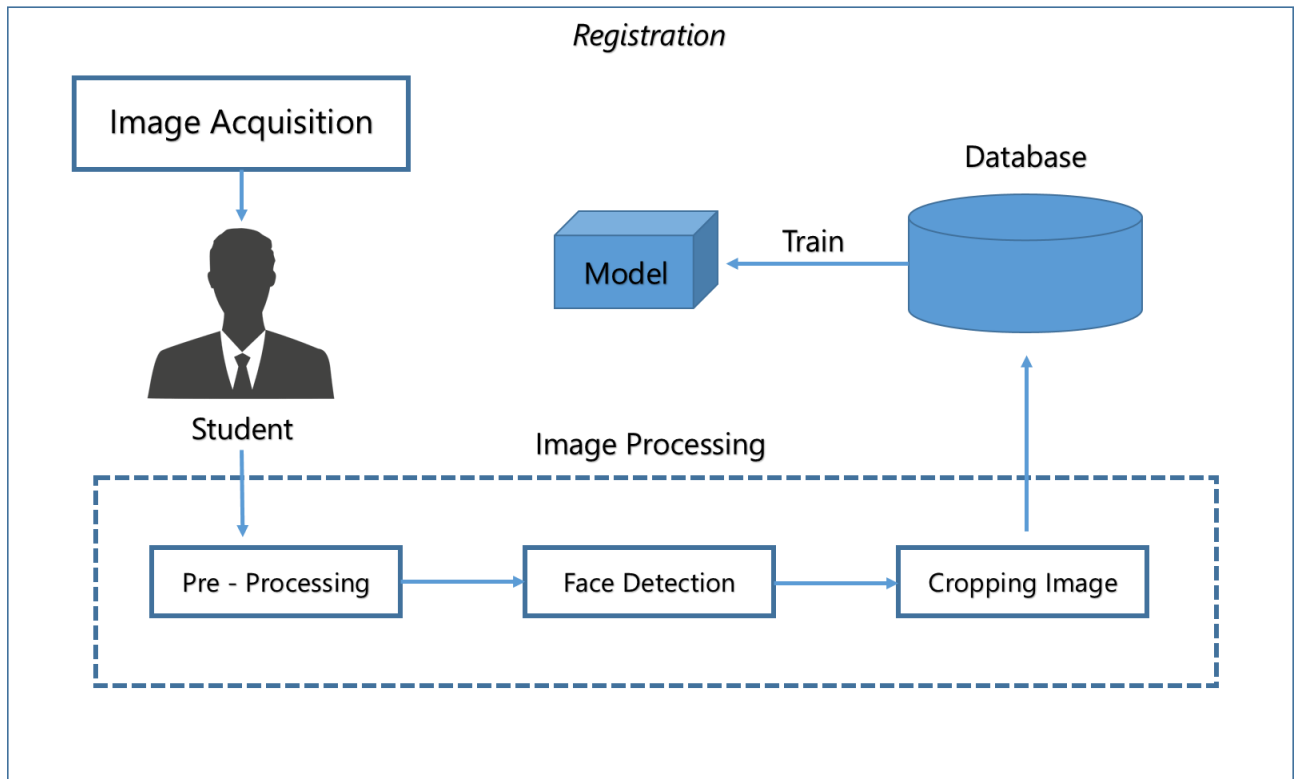
## 2.5.2 Register



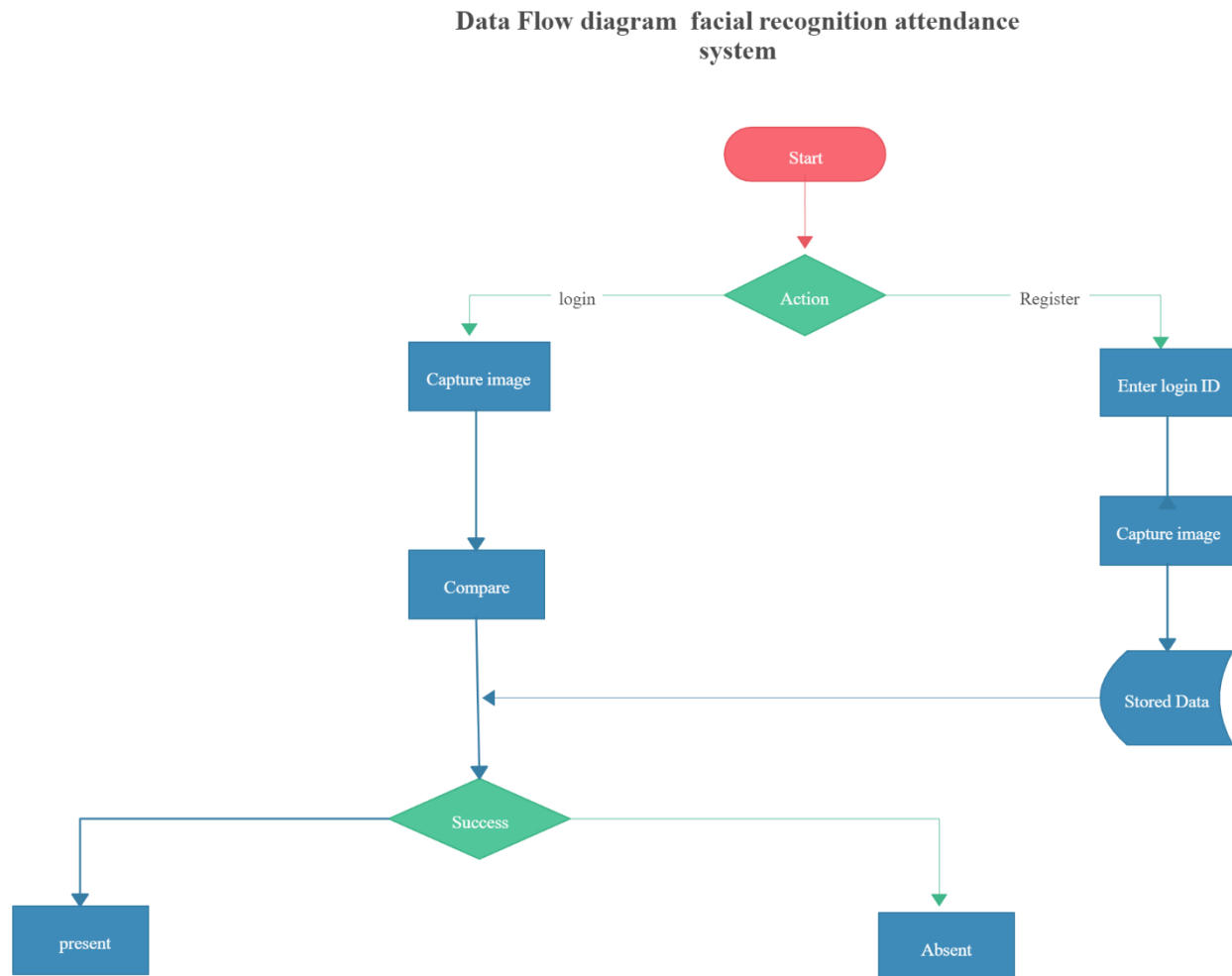
## 2.5.3 Recognition



## 2.6 Activity Diagram



## 2.7 Data Flow Diagram



## 2.8 Design and Implementation Constraints

This application is developed for academic institute having different system respectively. A notification to student stating his attendance is marked has not been implemented and is one of the major constraints. Also there need to be precise way of detecting and recognizing faces in order to avoid ambiguity among students with similar faces.

## **3. External Interface Requirements**

### **3.1 User Interfaces**

The user interface will run on Windows, provided he has python 3.6 as of this release and OpenCV and numpy modules installed on his native computer. The user can implement the same on Raspberry Pi and acquire images through Raspberry Pi Cam via Local Area Network.

### **3.2 Hardware Interfaces**

Mobile devices, laptops and home desktops are supported (Any small, medium and large screen devices that have internet access).

The data and control interactions for the flow of data between user and attendance will be through the admin.

The data obtained from the users are stored on the server side where database is created with appropriate tables.

Raspberry Pi can be used as an alternative for laptops or other such devices.

### **3.3 Communication Interfaces**

When stream of images are acquired through raspberry pi camera module the commutation is done through Internet Protocol

### **3.4 Software Interfaces**

Image processing is done with OpenCV library and GUI is developed using tkinter library. The primary programming language is Python 3.6 as of this release.

## **4. System Features**

The system is made to accommodate many features:

- Authorized by administrator
- Registration of the student details and faces
- Automatically captures 100 images at the time of registration

- Creation of student folder where images are stored is created automatically
- Face are recognized matching with registered images
- Reports are generated as and when required.

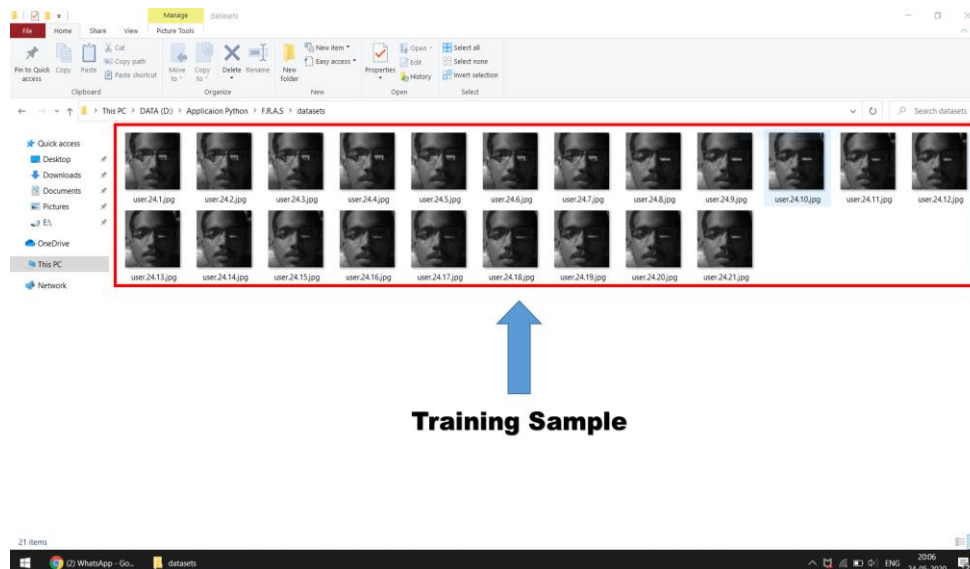
## 5. Snapshots

Login Form for Authentic Administrator



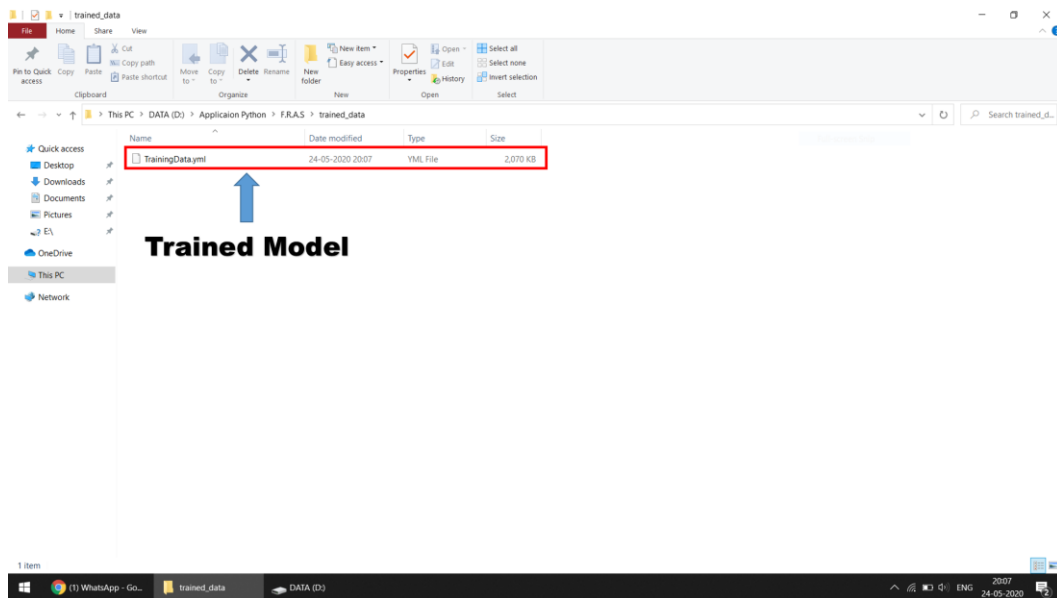
A login form with a blue background. At the top, it says "Log In" with a lock icon. Below that, there are two input fields: "User ID:" and "Password:". At the bottom, there is a "Log In →" button.

Training Samples

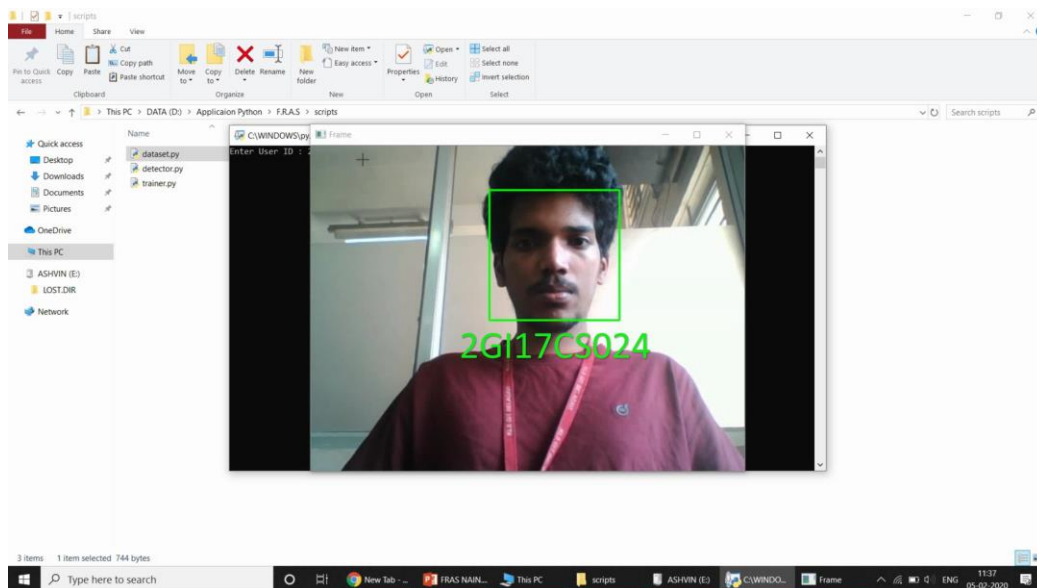




## Trained Model



## Real-time Detection



## **6. Conclusion**

The above process of Application development was designed using various software models like agile development, incremental development model, Reuse object model, and Plan driven and agile development clubbed together as per the situations. The Application was successfully developed with all the necessary business requirements, data collection and analysis, design and implementations and finally testing and meeting the latest requirements obtained by the latest market analysis.