

AUTOMATED LIBRARY MANAGEMENT SOFTWARE WITH FACE RECOGNITION BASED ATTENDANCE AND LOGIN SYSTEM



DELHI TECHNOLOGICAL UNIVERSITY
[Formerly Delhi College of Engineering]
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PROJECT REPORT

*Submitted in the partial fulfillment of the
Requirements of the degree
Bachelors of Technology
(Computer Engineering & Engineering)*

SOFTWARE ENGINEERING (CO-301)

Submitted by :
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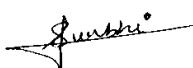
Guided by :
Prof.Prashant Giridhar Shambharkar (Assistant Professor)

CANDIDATE'S DECLARATION

We, (Tanuja Kumari (2K18/CO/370), Surbhi Anand (2K18/CO/365)) students of Bachelors of Technology (Computer Science And Engineering), hereby declare that the project dissertation titled, “AUTOMATED LIBRARY MANAGEMENT SOFTWARE WITH FACE RECOGNITION BASED ATTENDANCE AND LOGIN SYSTEM” which is submitted by us to Department of Computer Science and Engineering, Delhi Technological University, Delhi in partial fulfilment of the requirement for the award of the degree of Bachelor of Technology, is original and not copied from any source without citation. This work has not previously formed the basis for the award of any degree, diploma associateship, fellowship, or any other similar title or recognition.

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ACKNOWLEDGEMENT

Exchange of ideas generates the new object to work in a better way whenever a person is helped and cooperated by others his heart is bound to pay gratitude and obligation to them. To develop a project is not a one-man show. It is essentially a collective work, where every step taken with all precautions and care.

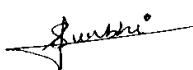
Therefore our first duty is to thanks all persons who provided me with basic help in forming the outline and strategy for my humble effort.

We, (Tanuja Kumari (2K18/CO/370), Surbhi Anand (2K18/CO/365)) express our sincere gratitude to **Prof. Prashant Giridhar Shambharkar** (Assistant Professor, CSE) for his valuable guidance and timely suggestions during the entire duration of our dissertation work, without which this work would not have been possible. We are highly indebted for his gestures, invaluable suggestions and boosting confidence to make this successful. The success of this work is mostly due to his suitable guidance. We would like to convey our deep regards to all faculty members of Department of Computer Science And Engineering, who have bestowed their great efforts and Guidance at appropriate time without which it would have been very difficult on our part to finish this work.

Finally we would like to thank our friends for their advice and pointing out the mistakes. We also thank our class fellows , who helped us a lot during our project work.



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2018-2022

CERTIFICATE

This is to certify that the project entitled " AUTOMATED LIBRARY MANAGEMENT SOFTWARE WITH FACE RECOGNITION BASED ATTENDANCE AND LOGIN SYSTEM " prepared by Tanuja Kumari (2K18/CO/370) and Surbhi Anand (2K18/CO/365) for the partial fulfillment of the requirements of the Bachelors of Technology degree, embodies the work, we all are doing during 5th semester of our course under due supervision of the supervisor from this college. To the best of my knowledge this work has not previously formed the basis for award of any degree, diploma associateship, fellowship or any other similar title or recognition.

Date : 25th November, 2020

Place : Delhi Technological University, Bawana Road, Delhi, 110042

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1) INTRODUCTION

1.1) PROBLEM STATEMENT

Technology was disrupting the established systems everywhere in a positive way until the coronavirus pandemic at once brought the entire world to a grinding halt. It necessitated more disruptive technologies or application of the existing ones in the new reality unveiled by the current world-wide crisis.

What was considered the most advanced system for registering the students attendance, has become not only redundant, but also lethal with any kind of human body touch based contact carries enough risk of people getting contracted with the deadly virus. When the lockdown was imposed and offices suspended functioning, libraries have suspended contact-based biometric and manual attendance systems to prevent the spread of covid-19.

What are the alternatives being considered for the biometric and manual attendance system in a library?

Contactless attendance systems based on face recognition serve for the purpose and are a Secure alternative for biometric and manual attendance system.

As the coronavirus pandemic continues to evolve, all colleges and schools are encouraging their students to work remotely and to limit in-person interactions, replacing them with video and telephone conferences. On the other hand, there are some activities in a library which cannot be performed by an automated library management software like issuing of the hard copy of books . Face Recognition is a contactless technology that can work in any scenario.

The innovation in my project is the use of Face Recognition Technology and incorporating an Attendance and Login Software based on it. After comparing all the existing open-source Library Management System (Kova, Evergreen, BiblioteQ, Opals, etc.) that doesn't provide a solution to any automated Attendance System that serves for the purpose and is a Secure alternative for biometric or manual attendance system.

Face Recognition would not only help to shift to a contactless solution but, Face Recognition Technology is faster than other solutions. It offers you the Identification-on-the-Go approach, which helps in controlling traffic by more than ten times and reduces the congestion in the libraries or other places like airports, railway stations, enterprises, schools, etc.

1.2) OBJECTIVE

The main objective of this Innovative Project is a step towards Human-Computer Interaction (HCI), where the prime focus is towards setting up an attendance and login software for library Management System without human interaction and as an alternative to the biometric attendance system.

The Face Detection and Face Recognition technology as developed here provides a solution to secure Attendance marking for students registered in the library during the ongoing pandemic to reduce human touch interaction. The future of facial recognition is growing. It would be no surprise to see this technology providing better security in the future and integrated into our daily lives. In addition to the face recognition based Attendance and Login System, we have built an Automated Library Management System. The project is implemented at the administrative end, and thus only the administrator is guaranteed access.

The main objective of the Library Management System is to manage the details of Address, Member, Issues, Books, Students. It contains the entire library operations from issuing books to ordering the book records with a face recognition based student registration and attendance portal. The project aims to build an application program to reduce the manual work for managing the Address, Member, Librarian, Issues. The purpose of Library Management System is to automate the existing manual system with the help of computerized equipment and full-fledged computer software, fulfilling their requirements, so that their valuable data/information can be stored for a more extended period with easy accessing and manipulation of the same.

Here we have proposed a library management for facial recognition system to reduce the crowd of students in this not only in pandemic of coronavirus as well as for our daily usage also. The role of the library management system is to keep records of students and books. It maintains the catalog of the books. Manually, keeping records requires a lot of time, effort, cost and maintenance. Our problem statement is concerned with creating such a library management system so that it decreases our efforts, cost and management. So, in order to do so we introduced computerised face recognition library management system in which the student database is barcoded or registered with the face of the student.

1.3) PROJECT SCOPE

Face recognition systems work very well under constrained conditions, although all systems work much better with frontal images and constant lighting. All current face recognition algorithms do not do that good under the vastly varying conditions under which humans need to and are able to identify other people. Next generation person recognition systems will need to recognize people in constrained situations as well as adapt new modifications.

The project is based on believe that identification systems that are robust in natural environments, in the presence of noise and illumination changes, cannot rely on a single modality, so that fusion with other modalities is essential. Technology used in smart environments has to be unobtrusive and allow users to act freely. Considering all the requirements, identification systems that use face recognition and speaker identification seem to us to have the most potential for wide-spread application.

Cameras and microphones today are very small, light-weight and have been successfully integrated with other systems. The researchers are beginning to look deep into the matter and to demonstrate that unobtrusive audio-and-video based person identification systems can achieve high recognition rates without requiring the user to be in highly controlled environments.

Today, one of the fields that uses facial recognition the most is security. Facial recognition is a very effective tool that can help law enforcing organisations to recognize criminals and defaulters. Many software companies are leveraging the technology to help users access their technology and make the best use out of it. This technology can be further developed to be used in other avenues such as ATMs, accessing confidential files, or other sensitive materials as and when needed as per the convenience of the organization.

1.4) OVERVIEW

The modern India, that has been on growing tip of advancement is bringing about a lot of change in the Indian markets and the way this change is brought is something that is to be appreciated. So, it becomes our privilege to accept and welcome new technology. So, does this technology of face recognition steps in and has made its place in the market around. The older ways along with this face recognition technology marks the excellence of the organisation it must do away with the old practices.

A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. There are multiple methods in which facial recognition systems work, Local Binary Pattern Histogram(LBPH) algorithm which labels the pixels of an image by thresholding the neighbourhood of each pixel and considers the result as binary number and accordingly after which it generates prediction based on the histogram generated to compare and recognise images or person. It is also described as a Biometric Artificial Intelligence based application that can uniquely identify a person by analysing patterns based on the person's facial textures and shapes.

There are two primary applications of machine learning that analyze images containing faces: face detection (to see if an image contains face) and face recognition (to recognise the face). A face recognition system takes an image of a face and makes a prediction about whether the face matches other faces in a provided database. The Face recognition system developed is designed to compare and recognise potential match of face in the video or image regardless of their expression, facial hair, and age. The face recognition system can provide an estimate of the confidence level of the prediction as a result of recognition in the form of a probability or confidence score.

Confidence scores are a critical component of face detection and recognition systems. These systems make predictions of whether a face exists in an image or matches a face in another image or real -time recognition, with a corresponding level of confidence in the prediction. Users of these systems should consider the confidence score/similarity threshold provided by the system when designing their application and making decisions based on the output of the system.

2) PROPOSED WORK

2.1) Local Binary Pattern Histogram Algorithm

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

Local Binary Patterns Histogram algorithm was proposed in 2006. It is based on local binary operator. It is widely used in facial recognition due to its computational simplicity and discriminative power. More specifically, once LBP is combined with the descriptor histogram of oriented gradients (HOG). It obviously improves the execution of identification on some datasets. The image is divided into cells (4×4 pixels) for the encoding of features. It is contrasted by using a clockwise or counter-clockwise bearing of surrounding pixel values. The value of each neighbor's intensity is compared to the central pixel. The location is assigned a 1 or a 0 depending on the difference whether it is higher or lower than 0. The result gives a single cell an 8-bit value.

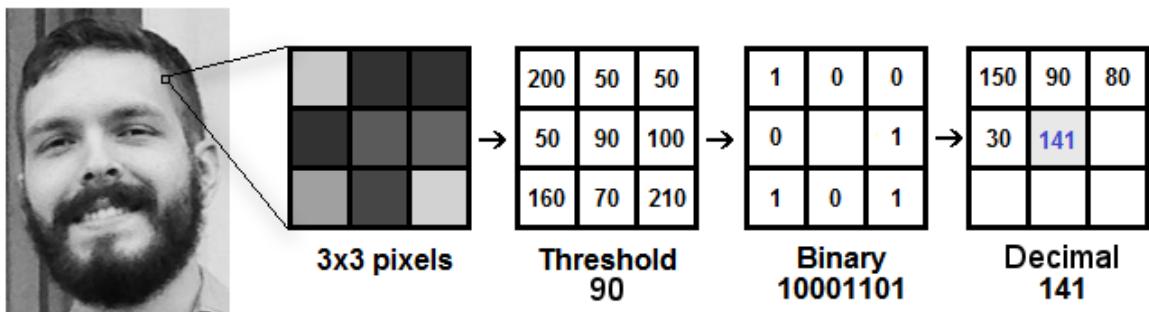


Fig 1: Procedure of the LBPH Algorithm

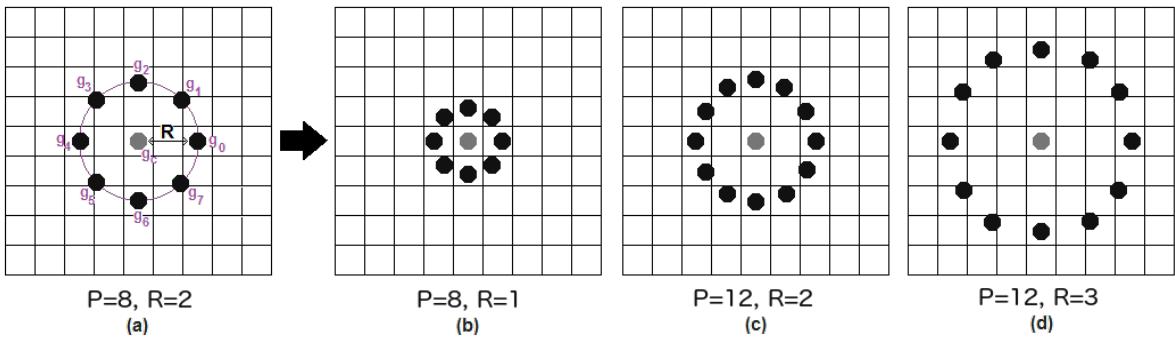
If the illumination condition of the image is changed, the final result is equivalent to the previous result. Histograms are used in larger cells as well as the frequency of values that make system robust. Edges can be identified as the quality changes by dissecting the results in the cell. It is possible to obtain feature vectors by calculating the values of all cells and connecting the histograms. Pictures can be grouped by ID-connected handling methods. Input pictures are classified using the same procedure and the data set is contrasted and separation is obtained. It is very well recognized by setting a limit value whether it is a known or obscure face.

2.2) Working of the LBPH Algorithm

Now that we know a little more about face recognition and the LBPH, let's go further and see the steps of the algorithm:

Parameters: the LBPH uses 4 parameters:

1. **Radius:** the radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.
2. **Neighbors:** the number of sample points to build the circular local binary pattern.
3. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.
4. **Grid X:** the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.
5. **Grid Y:** the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.



Training the Algorithm:

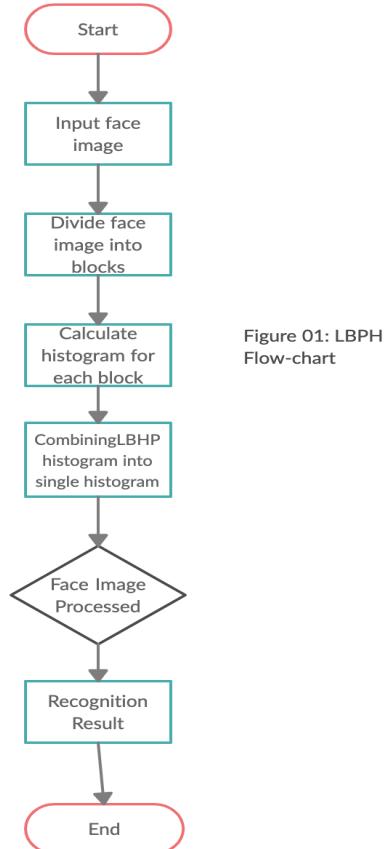
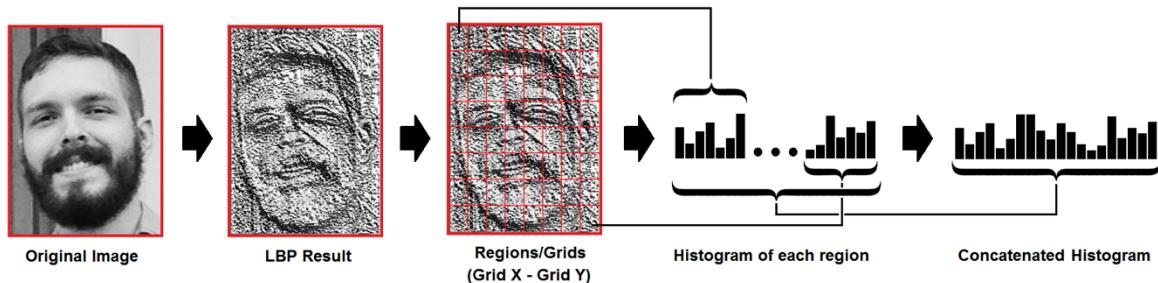
First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID. With the training set already constructed, let's see the LBPH computational steps.

Applying the LBP operation:

The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

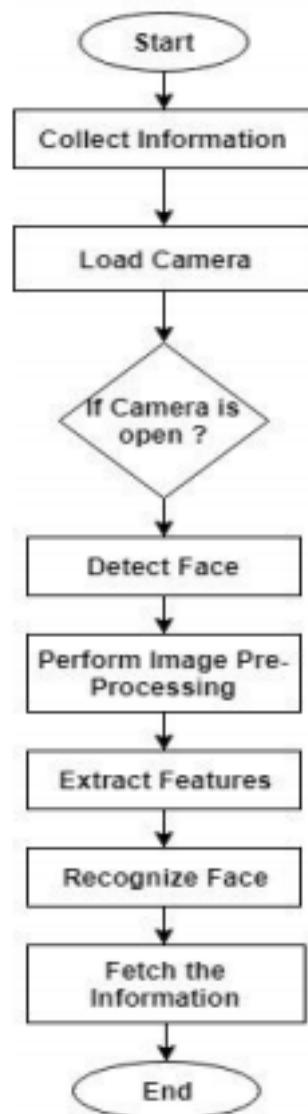
Extracting the Histograms:

Now, using the image generated in the last step, we can use the Grid X and Grid Y parameters to divide the image into multiple grids, as can be seen in the following image:



2.3) Methodology of the Face Recognition Based Attendance System

The proposed face recognition approach has four main steps: module for image acquisition, module for extraction of features, module for training classifier database, and module for classification. Initially, the face datasets are collected by the image acquisition module. Then, a series of salient features are extracted by applying feature extraction module. These facial features are used to analyze face landmarks which represent human identity information. In the next process, the classifier is trained for recognizing the face. In the last module, the system recognize face image and fetch information about the person from the SQLite database.



2.4) SOFTWARE DEVELOPMENT CYCLES

2.4.1) V Model

One of the major handicaps of waterfall SDLC model was that, defects were found at a very later state of the development process, since testing was done at the end of the development cycle. It became very challenging and costly to fix the defects since it was found at a very later stage. To overcome this problem, a new development model was introduced called the “V Model”.

V model is now one of the most widely used software development processes. Introduction of V model has actually proved the implementation of testing right from the requirement phase. V model is also called as verification and validation model.

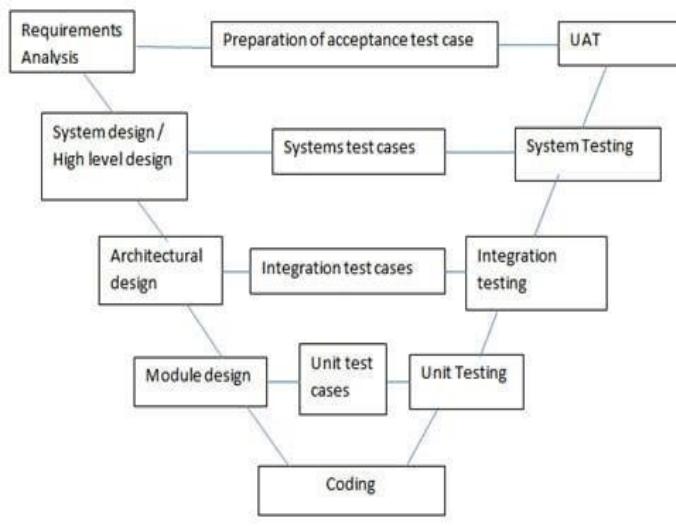


Fig 3: V curve for software development

The project follows the same model and during the initial phases of the model the following are performed :

I. Requirement analysis : The analysis in this phase was performed and all requirements were understood and worked upon.

II. System Design : The system was designed keeping in mind the technical and logical viewpoints and other aspects.

III. Architectural Design : It was maintained using python and spyder and corresponding UML and DFD were generated and followed.

IV. Module Design : The project was divided into small well managed modules to increase modularity of the code and promote less chances of bug. After the module designing phase, the coding starts

V. Coding : The project was developed using python and maintained on spyder (comes in Anaconda package) and the UML, DFD and Flowchart generated as per flow and design were followed and maintained.

The next phase of the model begins with testing :

VI. Unit Testing : It was performed on the modules and verification of single unit and modules were done using test cases.

VII. Integration Testing : performed by bringing different module together and using the top to bottom approach, combined modules were tested for correctness and matched with the requirements.

VIII. System Testing : the whole project was combined and tested as well as seen for any bug or fault and thus, a bug free application was generated.

2.5) SOFTWARE REQUIREMENT

The need of knowing the system as a whole is very necessary to ensure success of software that is developed. Making it implementable and portable is the prior condition before development.

2.5.1) Software Requirement

The needed software and all other dependent libraries for its implementation are :

- I. Programming Language : Python
- II. GUI toolkit : Tkinter(Tk)
- III. Library Installer : Anaconda Prompt
- IV. Libraries used : Version
 - 1. Opencv-python : 3.4.0.12
 - 2. OpenCv-contrib-python : 3.4.0.12
 - 3. Pillow : 5.0.0
 - 4. Argparse : 1.4.0
 - 5. Numpy : 1.14.0
- V. Operating System : Windows 7 or later/Linux or MAC OS or later.

2.5.2) Hardware Requirement

The hardware requirement are as follows :

- I. Web Camera/USB Camera
- II. System Hard Disk : 500 Gb or more
- III. RAM : 4 GB or more
- IV. Core : 2.4 GHz Intel® Core™2 Duo

2.6) FEASIBILITY STUDY

2.6.1) TECHNICAL FEASIBILITY

The technical feasibility is the prime pillar over which a project depends for its future success. As it is rightly said that a strong foundation often leads to tall buildings, similarly a right and clear analysis of the program and project that is going to build makes it clear whether the future of the project stands still or if it is a short-lived scope. Being technically sound prior to the arrangement and dealings of software is a mark of true developer and the team as a whole. Instead of wasting time, dwindling around to configure the lacks due to which project fails, it is quite effective to make a brief study about the technical aspects of the project, its life and all other involved factor.

Not only this helps in technical area of project rather it is the bridge that tells and stimulate other department as well to put their efforts and do the other associated task. So the project of Face recognition via LBHP algorithm and implemented using python language thus possesses no future complication as and when referred to the technique and the scientific problem solving method associated with it. The system's Integrated webcam, say primary or USB connected is easily accessible and python makes it easy to integrate it within one's program and code. The secondary advantage that python brings with itself is its compatible nature and wide variety of enriched libraries that seems to do the work effectively then other could have done. Further the library whose support is leveraged here is called with the name of OpenCv and is quite easy to implement with a lot inbuilt function that have supported in the constructive learning and building of the whole project. The manpower associated is not great and therefore development is cost effective and way beyond in terms of use of technology as it is based on the latest technology of python that helps us build neural networks and machine learning models. With required hardware and software, the project can be delivered as a technically sound and implementable project.

2.6.2) ECONOMIC FEASIBILITY

When seen through the eyes of a person with business attitude this project seems to be fit because of the fact that somewhere down the line the whole project brings a cost-effective measure in the security of a firm and establishment. At the same time rendering a whole new horizon of security. Since it requires less manpower of development so the cost here itself comes down and secondly the factor of maintenance that plays a crucial role in deciding the cost factor is also not overrated and thus bringing the whole economic feasibility to a level of acceptance.

Operational feasibility is mainly concerned with issues like whether the system will be used if it is developed and implemented. Whether there will be resistance from users that will affect the possible application benefits? To which the answer is that it is quite flexible and will easily be accepted by people and others when applied to the daily work flow.

2.7) PROJECT DESCRIPTION

2.7.1) Project Functionalities

Being the technology of today, this project has the following functions and features that it extends for the purpose of usage.

- Adding Face : With this feature a new face to the organisation can be registered by using the interface of a form, wherein the person needs to enter his details.
 1. ID Generator : within form mentioned above this feature generates an ID for the person who has filled in the details.
 2. Save to Database : saves the data entered by the new person into the database and provides a feature to save images and make them available for the training.
- Training Images : the dataset generated by the faces of the registered new person will be preprocessed and trained through the model for recognition to carry out.
- One to Many face identification : Basically speaking of which this property will identify the person from many persons and then predict the person based on some probabilistic value.
- Attendance Marking: This feature will be highly useful during the explosion of deadly corona virus being a contactless technology. The details will pertain to the database according to the implementation of the face recognition technology and the area where it is deployed.

2.7.2) Dependencies

The libraries of python that are used to build this project serves us the purpose of developing interfaces and integration of various modules and thus be our dependencies and in short the backbone of our project :

1. **OpenCV** : This library is also called as computer vision library. Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel). The library is cross-platform and free for use under the open-source BSD license. OpenCV supports the deep learning frameworks TensorFlow, Torch/PyTorch and Caffe. OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. There are bindings in Python, Java and MATLAB and OCTAVE.
2. **sciPy** : sciPy (pronounced “Sigh Pie”) is a Python-based ecosystem of open-source software for mathematics, science, and engineering. In particular, these are some of the core packages :
 - a. NumPy : Base N-dimensional array package
 - b. SciPy library : Fundamental library for scientific computing
 - c. Matplotlib : Comprehensive 2D Plotting
 - d. Sympy : Symbolic mathematics
 - e. Pandas : Data structures & analysis

2.8) FLOW CHART AND DIAGRAM

2.8.1) UML(Unified Modelling Language) Diagram

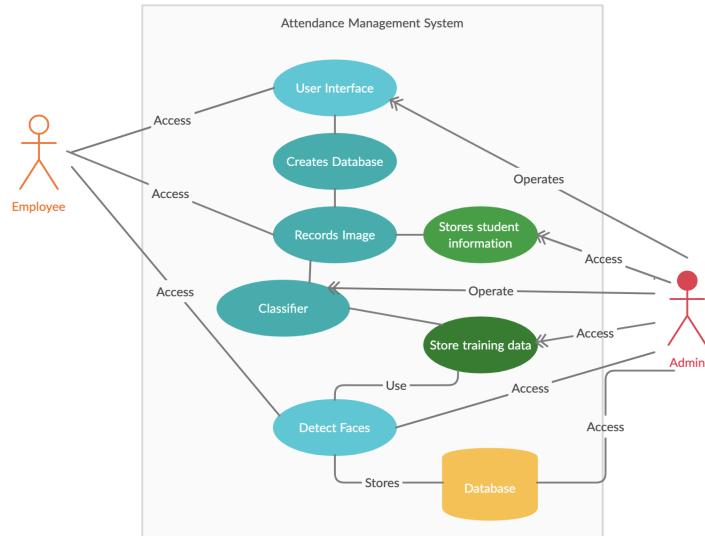


Fig 4: Use Case Diagram for Face Recognition System

2.8.2) Sequence Diagram

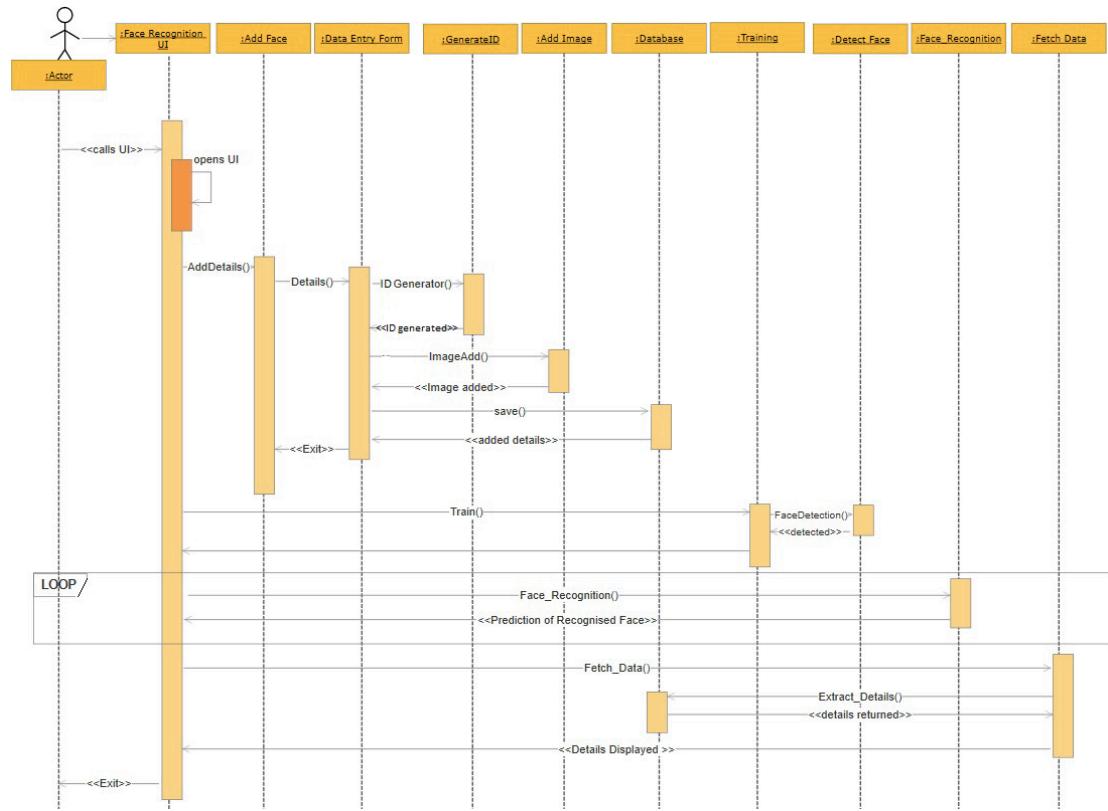


Fig 5: Sequence Diagram for Face Recognition System

2.8.3) Deployment Diagram

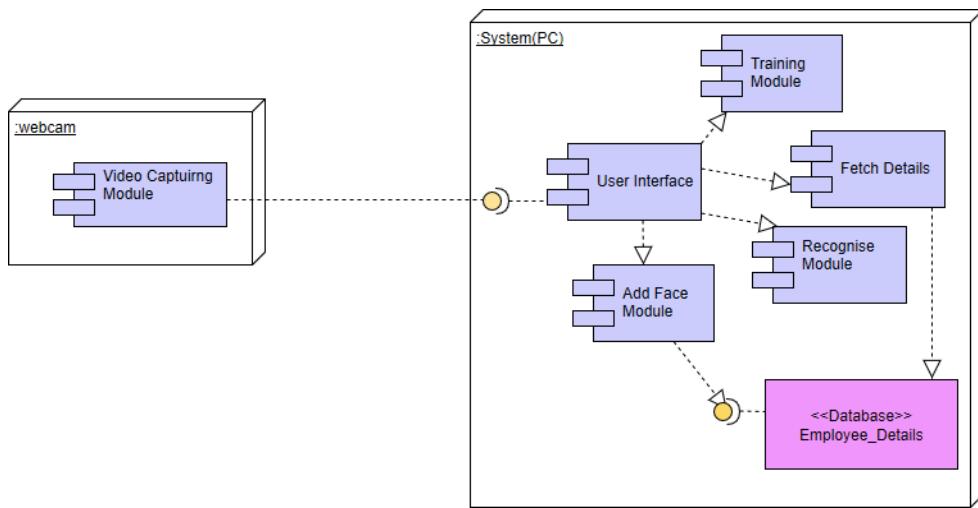


Fig 6: Deployment Diagram for Face Recognition System

2.8.4) Data Flow Diagram

2.8.4.1) 0 Level

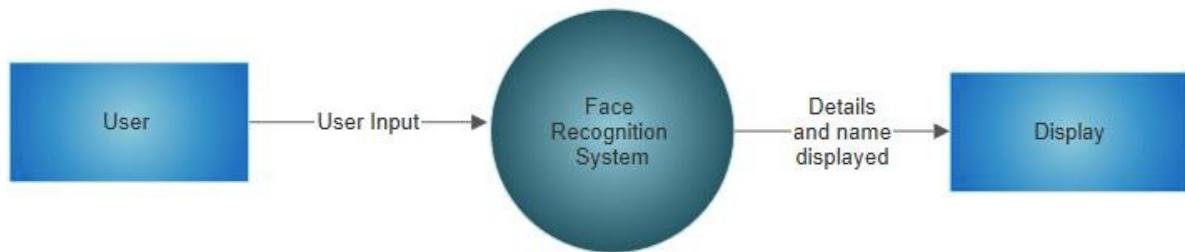


Fig 7: DFD level 0

2.8.4.2) 1 Level

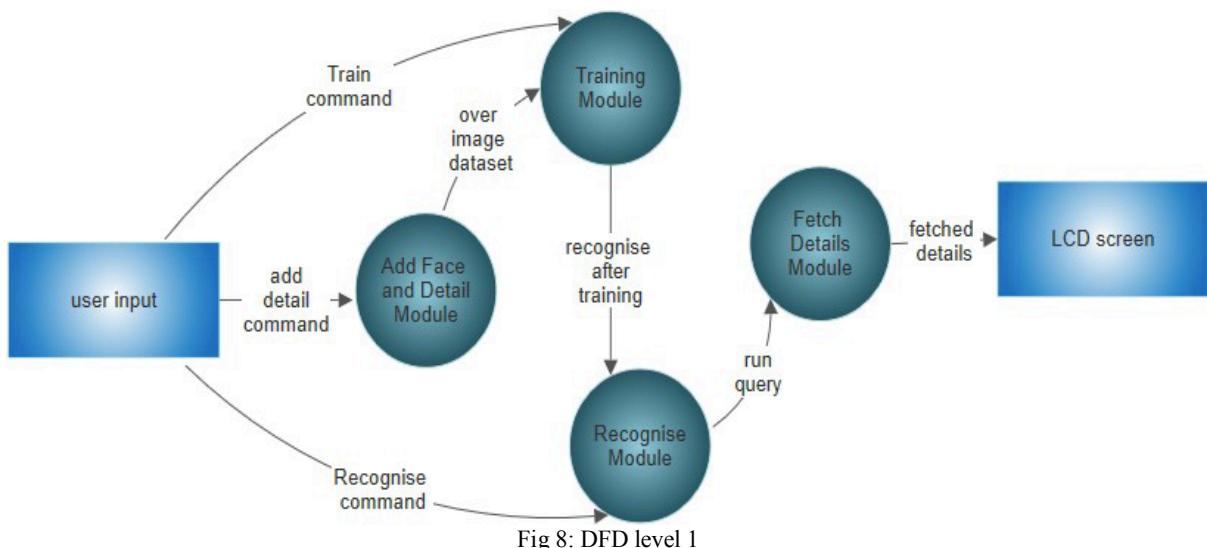


Fig 8: DFD level 1

2.8.4.3) 2 Level

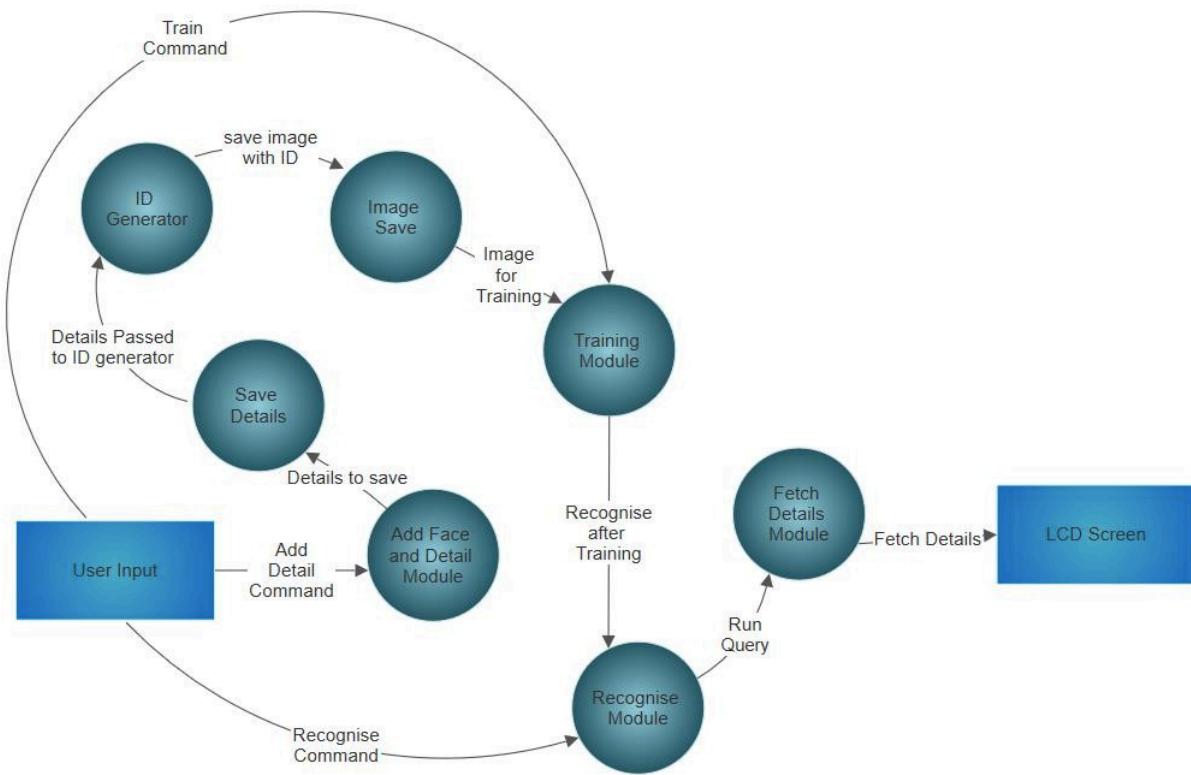


Fig 9: DFD Level 2

2.8.5) Flowchart

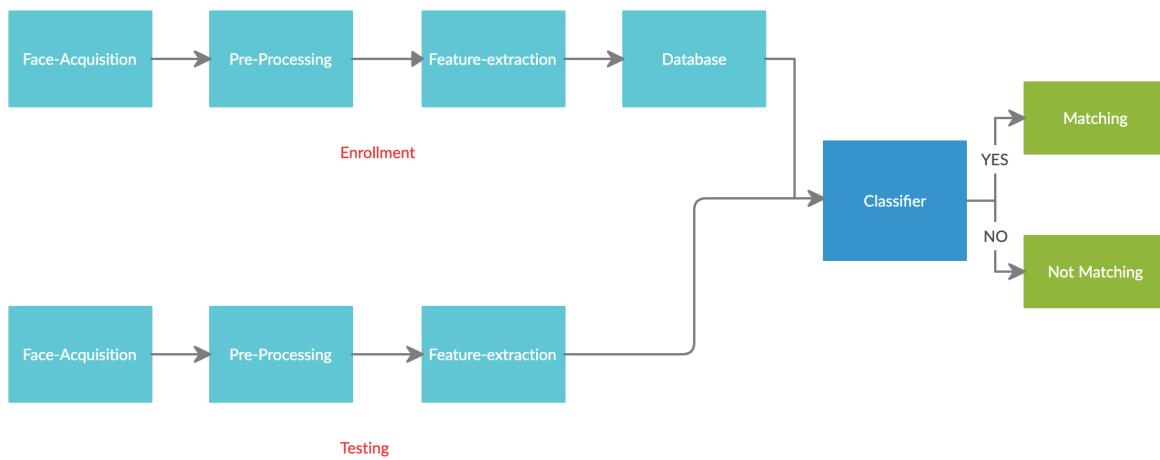


Fig 11: Diagram of enrollment and testing

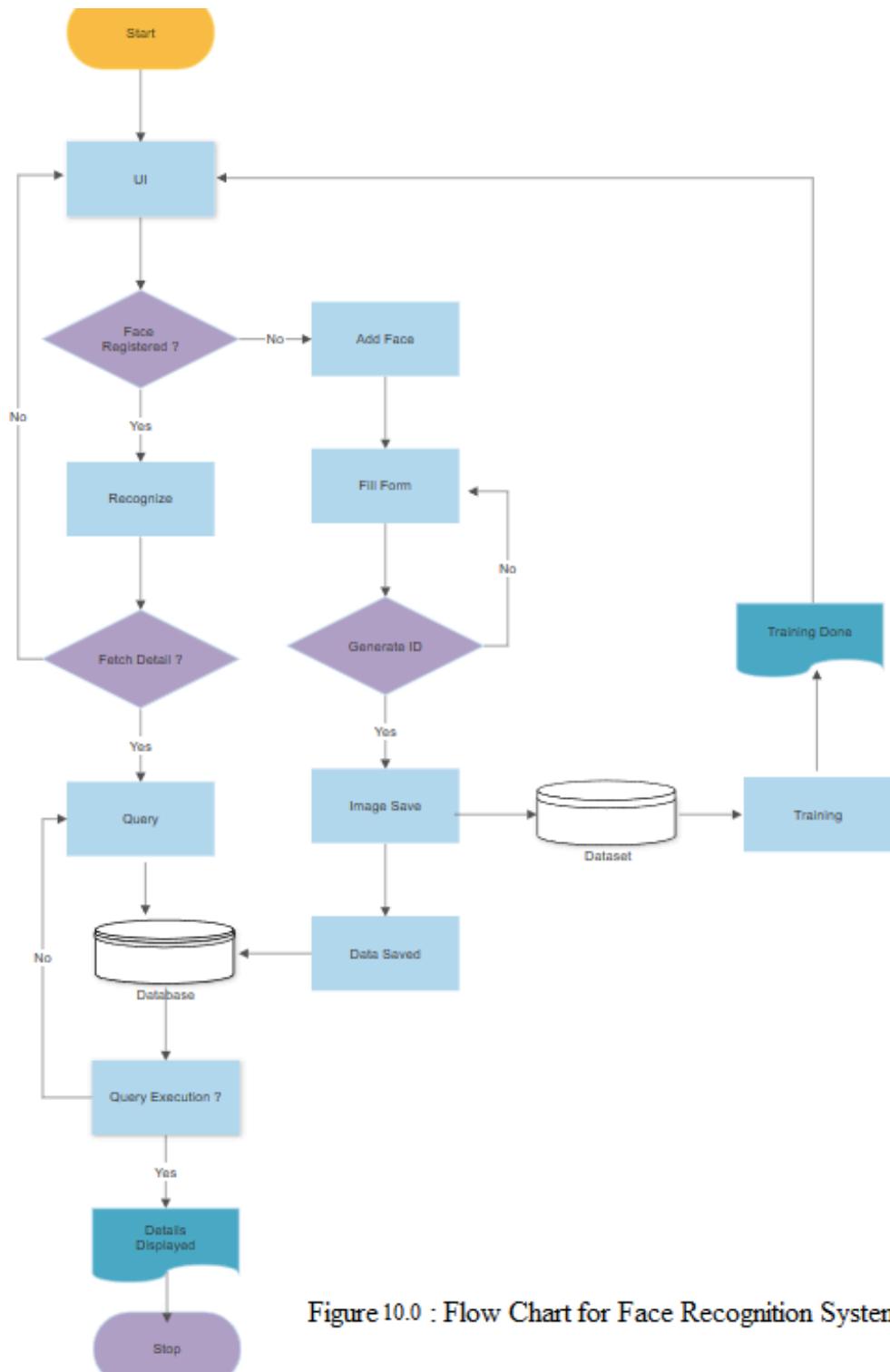


Figure 10.0 : Flow Chart for Face Recognition System

2.9) Methodologies and Working Modules

2.9.1) User Interface

In information technology, the user interface (UI) is everything designed into an information device or say a system with which a person may interact. This can include display screens, keyboards, a mouse and the appearance of a desktop and associated use of other connected devices. It is also the way through which a user (considering an inexperienced person) interacts with an application or a website. The growing dependence of many companies on Information and technology for the applications and their development has led many companies to place increased priority on UI in an effort to improve the user's overall experience and make applications or say program self-sufficient in terms of interactivity. So, the level of interactivity that the project offers is reflected in the image of the UI (User Interface) namely :

1. Add Face
2. Train
3. Recognise

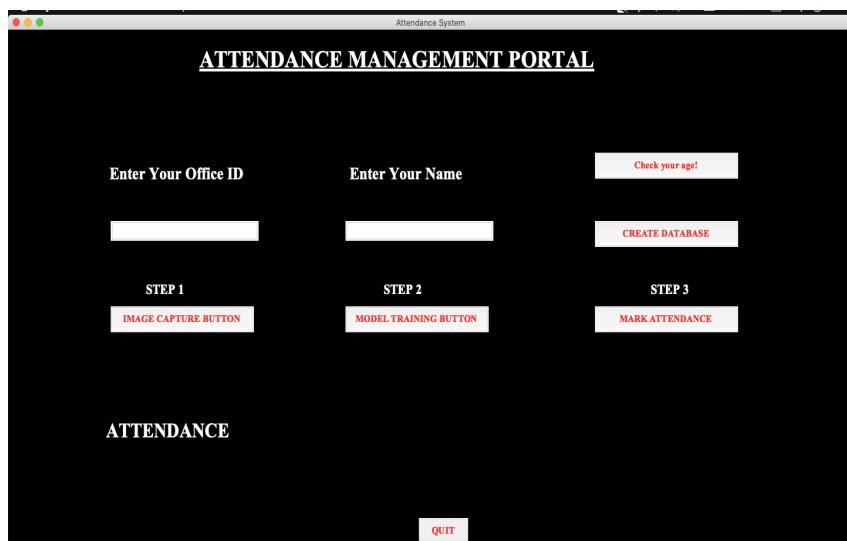


Fig 12: User Interface

2.9.2) Registering Faces

The project here plays a very crucial role in today's environment where the things are modernising and there a wave of technology overtaking every miniature aspect of human living, just to impart them a more comfortable and technologically sound life. This all is based on the science behind developing AI (Artificial Intelligence) and implementing using the tools provided by components like neural networks, machine learning, regressions and statistics. As, computer is not a self-intelligence machine rather it has to be made such by humans those who are bestowed with this intelligence. So, in order to achieve the aim of making our system intelligent we are using a model which is to be trained on the associated dataset, which will make the model actually learn what we intend to it to learn.

Here it is achieved by making the dataset of the person whom the system should recognise and the dataset as mentioned should contain a good number of images say, roughly about 20 or so will do good work.

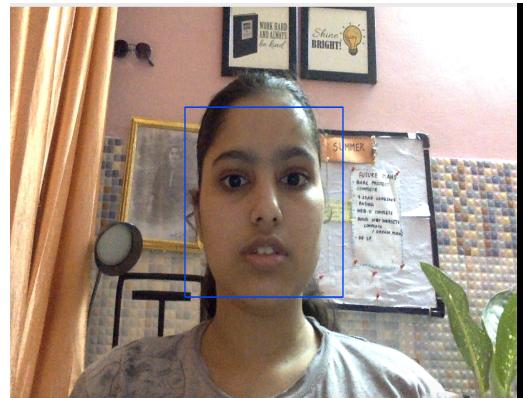


Fig 13: Registering Faces

2.9.3) Training

In Machine Learning and neural network building, the basic aim is to create a model to predict on the test data. So, the use of training data to fit the model and testing data to test it. The models generated are to predict the results which are unknown and which is named as the test set. So, basically speaking the dataset is divided into train and test set in order to check accuracy, precision by training and testing it on it but in our case, we are training the model on dataset and testing it on live data.

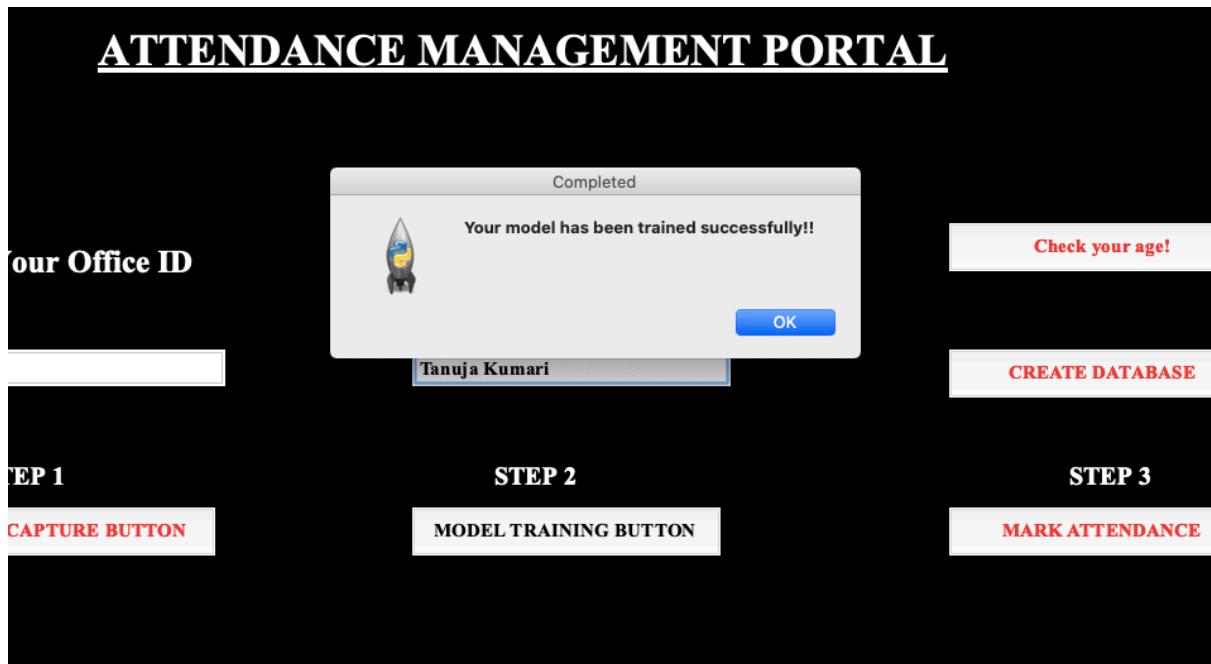


Fig 14: Trained Model

2.9.4) Video Capturing and Recognition

The video capturing module of the program is basically implemented and utilised using the OpenCv library in python. This library of OpenCv is called by the name of Computer Vision and does the work as name suggests because this helps the individual interact with the inbuilt camera or secondary camera (USB camera) with few lines of code instead of doing a tedious task of writing big codes. Moreover, using this technology along with python makes it more flexible and brings about effective accessing and attraction.

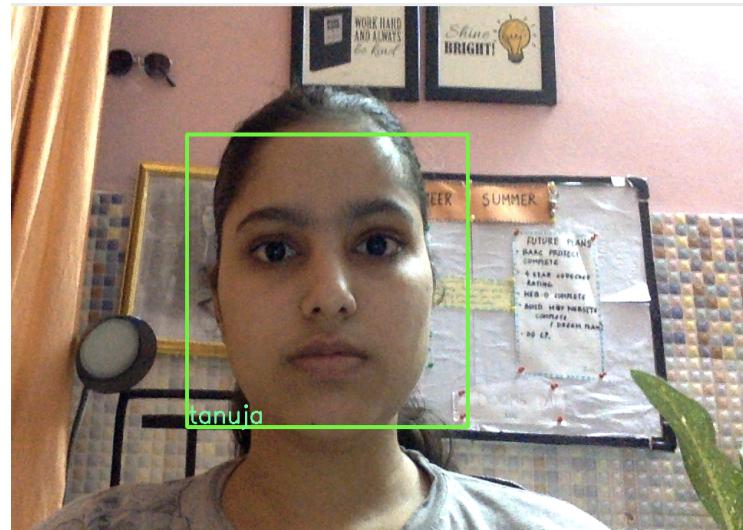


Fig 15: Video Capturing and Recognising

2.10) Database Table build using SQLite for maintaining information

Field	Data type	Default	Key	Extra
Code	INT(11)	Not Null	Primary	Auto increment
Bookname	VARCHAR(255)	Null		
Author	VARCHAR(255)	Null		
Publication	VARCHAR(255)	Null		
Subject	VARCHAR(255)	Null		
No of copies	INT(10)	Null		

Fig 16: Book Table for Keeping track of books

Field	Data type	Default	Key	Extra
libid	INT(11)	NOT NULL	Primary key	Autoincrement
regno	INT(10)	NULL		
branch	VARCHAR(255)	NULL		
section	VARCHAR(255)	NULL		
semester	VARCHAR(255)	NULL		
section	VARCHAR(2)	NULL		
yearofadm	INT(5)	NULL		

Fig 17: Student Table for Student Information

Field	Data Type	Default	Key	Extra
Loginid	INT(11)	NOT NULL	Foreign key	References teacher
Username	VARCHAR(255)	NULL		
Password	VARCHAR(255)	NULL		

Fig 18: Librarian Acces/Login Table

2.11) Functional Requirements of Library Management System

Functional requirements basically defines what the system will do .It deals with the behaviour of the system.

Following are some functional requirements associated with our implemented library management system:

1. Issue book : In this requirement , a student can issue a book from the library.
2. Return book : Through this a student can return a book easily from the library.
3. Update book : Students must be able to update the number of books.
4. Search book : System must be able to search if a book is available .
5. Delete book : In this requirement, students can delete the specific book if it is not required.
6. Fine on a book : If book is delayed aur return after the deadline/ last date then we have to pay fine for that on that specific book

2.12) Non Functional Requirements of Library Management System

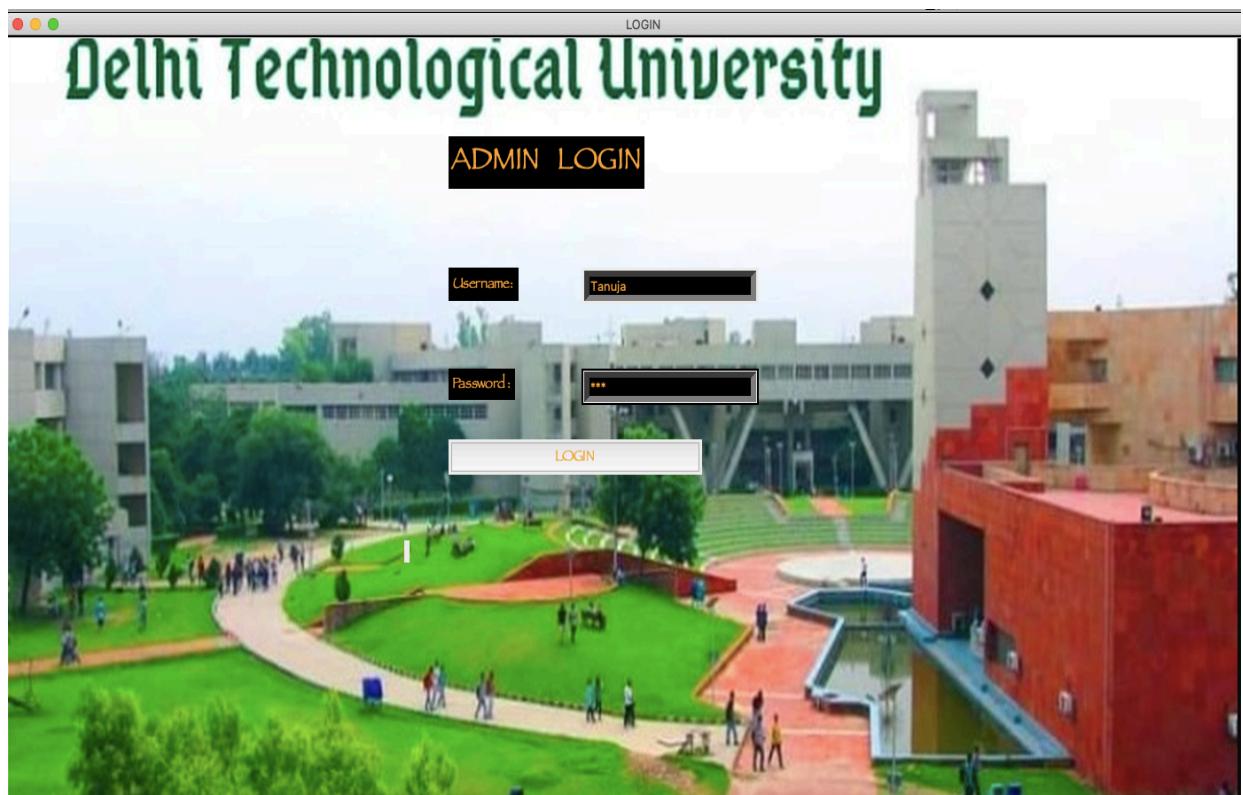
It gives us criteria through which we can judge the operation of the system. It specifies the quality attribute of the system. Following are some non functional requirements:

1. EFFICIENCY REQUIREMENT: When a library management system will be implemented librarian and user will easily access library as searching and book transaction will be very faster.
2. RELIABILITY REQUIREMENT: The system should accurately perform member registration ,member validation ,report generation, book transaction and search.
3. USABILITY REQUIREMENT: The system is designed for a user friendly environment so that student and staff of library can perform the various tasks easily and in an effective way.
4. IMPLEMENTATION REQUIREMENTS: In implementing whole system it uses html in front end with php as server side scripting language which will be used for database connectivity and the backend i.e. the database part is developed using mysql.
5. DELIVERY REQUIREMENTS: The whole system is expected to be delivered in six months of time with a weekly evaluation by the project guide.

2.13) SYSTEM IMPLEMENTATION

2.13.1) Screen Shot of Various Modules of the Library Management System





The image displays two side-by-side screenshots of a library management system's book management interface, set against a background of a traditional library interior with wooden bookshelves filled with books. The left screenshot shows a form for adding new books. It includes fields for 'Book ID', 'Title', 'Author', 'Genre', 'Copies', and 'Location', each with a corresponding black input box. Below the form are two yellow buttons labeled 'Add' and 'Back'. To the left of this form is a vertical menu bar with buttons for 'Add Books', 'Search Books', 'All Books', and '<< Main Menu'. The right screenshot shows a form for managing student activity. It includes fields for 'Book ID' and 'Student ID', both in black input boxes. Below these fields are two yellow buttons labeled 'Issue' and 'Issue'. To the left of this form is a vertical menu bar with buttons for 'Issue book', 'Return Book', 'Student Activity', and '<< Main Menu'.

This image shows a screenshot of the library management system's student activity report interface. The background is the same traditional library setting. The interface features a vertical menu bar on the left with buttons for 'Issue book', 'Return Book', 'Student Activity', and '<< Main Menu'. The main area contains a table with columns labeled 'BOOK ID', 'STUDENT ID', 'ISSUE DATE', and 'RETURN DATE'. The table body is currently empty. At the bottom of the table are three yellow buttons labeled 'Search', 'All', and 'Back'.

3) RESULTS AND DISCUSSION

3.1) Integration Testing of the Attendance System

The system was tested using the flow as :

1. The Video capturing unit is first brought together with the recognition module. These two modules were integrated and debugged to remove any error.
2. Secondly, these two units were tested with the module for the Form for registering the details of new people. Again tested, worked it out and debugging was performed to ensure error free module.
3. Thirdly the last module generated for fetching details was associated with above integrated set of modules to see its compatibility and with the slightest of changes it was incorporated without any trouble. And then the integrated units were reassembled to develop the whole system and which further was tested under system testing. After this the final and last step of testing which is system testing was explored and the complete developed was checked and verified in best possible manner.

3.2) System Testing of the Attendance System

The category of system testing implemented in this project is :

1. **Usability Testing** : Usability Testing mainly focuses on the user's ease to use the application, flexibility in handling controls and ability of the system to meet its objectives. This testing mainly focuses on the user's ease to use the application, flexibility in handling controls and the ability of the system to meet its objectives. It is also called User Experience (UX) Testing.
2. **Load Testing** : Load Testing is necessary to know that a software solution will perform under real-life loads. Load testing is a kind of Performance Testing which determines a system's performance under real-life load conditions. This testing helps determine how the application behaves when user interacts and examine this. This is done using multiple face for face recognition.

At last the result of system testing that came out, clearly indicated that the project/application is well supported by the system and the user can interact with the application in a sound and well defined manner and he has to put no extra efforts and thus, the application and code so generated for it passed in system testing.

3.3) Unit Testing of the Library Management System

- Testing admin login form-This form is used for log in of administrator of the system. In this we enter the username and password if both are correct administration page will open otherwise if any of data is wrong it will get redirected back to the login page and again ask for username and password.
- Student account addition- In this section the admin can verify student details from student academic info and then only add student details to main library database it

contains add and delete buttons if user click add button data will be added to student database and if he clicks delete button the student data will be deleted.

- Book Addition- Admin can enter details of book and can add the details to the main book table also he can view the books requests .
- Test for Student Login Form- This form is used for log in of Student. In this we enter the library id, username and password if all these are correct student login page will open otherwise if any data is wrong it will get redirected back to the login page and again ask for library id, username and password.

3.4) Discussion of the Results

With variable methods and continuous evaluation, training and testing the system that was set to a threshold of 0.82, was checked in the range of 0.43 to 0.90 i.e. 43% ranging till 90% and testing the module again and again the profitable and acceptable threshold was found out to be 0.85 i.e. 82%. Thus, for the effective face recognition and system to work properly and efficiently, it was set from 0.53 to 0.85 as well as its acceptance was tested in various conditions.

When the idea and project is based on recognition systems, the entire difficulty if arises is due to the feed that is forwarded to the recognising module/system and here these factors are hence the constraints that need to take care of and once these things are taken into consideration and acknowledged the working of the system tends to be well suited for those certain conditions. Naming those constraints that possess a risk of poor accuracy are as follows :

I. Poor Image Quality Limits Facial Recognition's Effectiveness : Image quality affects how well facial-recognition algorithms work. The image quality of scanning video is quite low compared with that of a digital camera. Even high-definition video is, at best, 1080p (progressive scan); usually, it is 720p.

II. Small Image Sizes Make Facial Recognition More Difficult : When a face-detection algorithm finds a face in an image or in a still from a video capture, the relative size of that face compared with the enrolled image size affects how well the face will be recognized. An already small image size, coupled with a target distant from the camera, means that the detected face is only 100 to 200 pixels on a side. Further, having to scan an image for varying face sizes is a processor-intensive activity.

III. Different Face Angles Can Throw Off Facial Recognition's Capabilities to some extent : The relative angle of the target's face influences the recognition score profoundly. When a face is enrolled in the recognition software, usually multiple angles.

4) CONCLUSION AND FUTURE SCOPE

This website provides a computerized version of library management system which will benefit the students as well as the staff of the library. It makes entire process online where student can search books, staff can generate reports and do book transactions. It also has a facility for student login where student can login and can see status of books issued as well request for book or give some suggestions. It has a facility of teacher's login where teachers can add lectures notes and also give necessary suggestion to library and also add info about workshops or events happening in our college or nearby college in the online notice board.

In a nutshell, it can be summarised that the future scope of the project circles around maintaining information regarding:

1. We will use **Feature Selection** since the images are captured as 28*28 metics of raw dim pixel intensities resulting in **784 features** but using Feature selection, and **feature extraction** along with optimization algorithms like **Particle Swarm Optimization (PSO)** can help to **reduce the computational time** of the model used for face recognition and increase accuracy and other performance measures.
 2. We can add a **printer** in the future for the report generation.
 3. We can give more advanced Library Management System software, including more facilities, and **fine-tune the hyperparameters** of the Machine Learning Technology used for Face Recognition.
 4. We will **host the platform on online servers** to make it accessible worldwide.
 5. Integrate **multiple load balancers** to distribute loads of the system, and this would increase reliability.
 6. Create the **master and slave database structure** to reduce the overload of the database queries.
 7. Implement the **backup mechanism** for taking backup of codebase and database regularly on different servers.
-
- As mentioned above, the points are the enhancements that can be done to increase the applicability and usage of this project and improve the face recognition-based Attendance and login system's precision. Also, as it can be seen, nowadays, the players are versatile, i.e., there is a scope for introducing a method to maintain the Library Management System. Enhancements can be done towards reliable data storage for all the Student, Books, Issues, Librarian, Member.
 - We have left all the options open so that if there is any other future requirement in the system's system for the enhancement of the system, then it is possible to implement and incorporate them.

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