



“Smart attendance management system using face recognition”

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COLLEGE CERTIFICATE

Date:

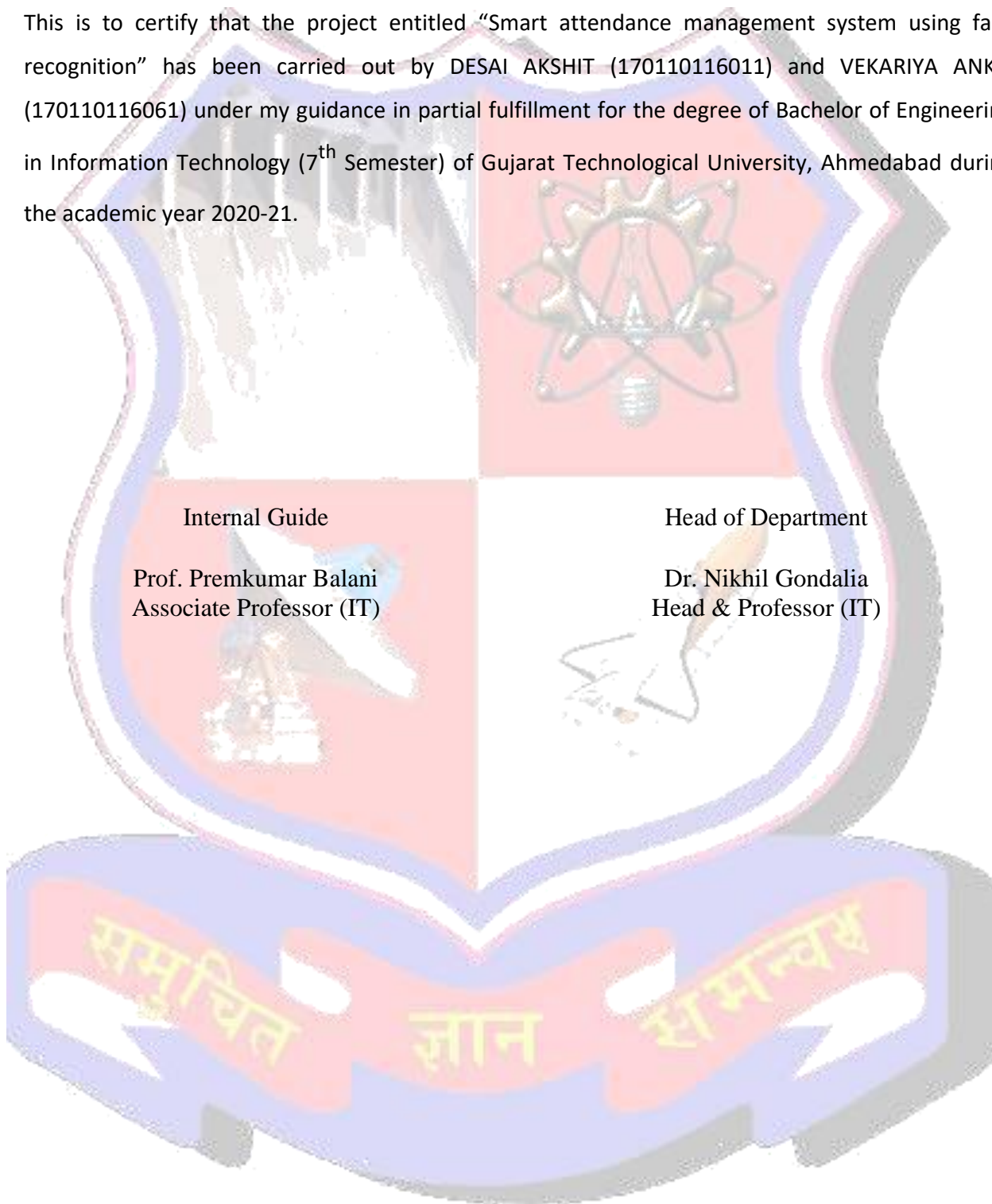
This is to certify that the project entitled “Smart attendance management system using face recognition” has been carried out by DESAI AKSHIT (170110116011) and VEKARIYA ANKIT (170110116061) under my guidance in partial fulfillment for the degree of Bachelor of Engineering in Information Technology (7th Semester) of Gujarat Technological University, Ahmedabad during the academic year 2020-21.

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Associate Professor (IT)

Head of Department

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Abstract

Automatic face recognition technologies have a lot of scope in today's changing world. Smart student attendance using face recognition is a real-world solution for handling student attendance system. Face recognition-based attendance system is a process of recognizing the students face for taking attendance by using face biometrics based on face recognition using raspberry pi computer and mini camera.

In our face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through the mini camera. Over the years, many algorithms and techniques have been developed for face detection and recognition. We are going to use Deep Learning algorithms for the same. We also store the attendance data on cloud for further processing and showing students attendance on web dashboard.

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“Smart attendance management system using face recognition”

A Project Report

Submitted By

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Enrollment No. 170110116011
Enrollment No. 170110116061

In fulfillment for the award of the degree

Of

BACHELOR OF ENGINEERING

In Information Technology



Semester 7th (4th Year)

Academic Year 2020-21

Department of Information Technology

G H Patel College of Engineering & Technology
Vallabh Vidyanagar, Gujarat

GUJARAT TECHNOLOGICAL UNIVERSITY
AHEMDABAD
November 2020

Chapter: 1

Introduction

1.1 Introduction

Automatic face recognition technologies have a lot of scope in today's changing world. Face recognition-based attendance system is a process of recognizing the students face for taking attendance by using face biometrics. In our face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through the mini camera. We have used Machine Learning techniques for training the model and have uploaded the entire database on cloud.

1.2 Purpose, Scope & Objective

Face Recognition is one of the most efficient systems of all existing ones for identification of people. It can be used in school, colleges or any organization. To avoid the difficulty of taking attendance of large number, there is a need of automated attendance system that is fast and reduces the chance of fake attendance. In this technology system is developed for deploying an easy and a secure way of taking down attendance. This attendance is recorded, by continuously detecting faces of employees or students via camera as they enter the classroom. The software first detects the faces and simultaneously compares them with the predefined database.

The primary objectives of the study are:

1. To use a powerful Machine learning algorithm which is excellent in real time to train, track and recognize face.
2. Track face in real time.
3. Recognize face and mark attendance automatically after.
4. Get students attendance graph using dashboard.

2.1 Face detection and recognition

Rapid growth in photo-taking devices is occurring today with the incorporation of digital cameras in most modern cell phones. In fact, more cameras are sold via cell phones today than all dedicated digital cameras combined.

This is causing a proliferation in the number of digital images that are uploaded and stored on home computers. Because the average number of digital images exceeds 1000 based on our surveys, the effort is too great to manually tag and properly organize the images for the majority of people.

An identification of a person may be associated with each stored face portrait in a database stored at or linked to one or more computers.

Also, It enables capturing portraits of people whose faces are located in an image. If faces are detected in an image, the computer program herein provided captures the XY coordinates of the location of the face and records this in the database. The computer program may be configured to adjust the size of the face region in order to capture and create a portrait (or thumbnail) of the person. Furthermore the computer program provided herein may automatically adjust the rotation of the face to render the face position vertically for the portrait with eyes on a horizontal plane.

2.2 Facial recognition

An example method includes receiving a first image and a second image of a face of a user, where one or both images have been granted a match by facial recognition.

The method further includes detecting a liveness gesture based on at least one of a yaw angle of the second image relative to the first image and a pitch angle of the second image relative to the first image, where the yaw angle corresponds to a transition along a horizontal axis, and where the pitch angle corresponds to a transition along a vertical axis.

The method further includes generating a liveness score based on a yaw angle magnitude and/or a pitch angle magnitude, comparing the liveness score to a threshold value, and determining, based on the comparison, whether to deny authentication to the user with respect to accessing one or more functionalities controlled by the computing device.

2.3 Image-based Face Detection and Recognition:

In the paper author evaluated various face detection and recognition methods, provided complete solution for image based face detection and recognition with higher accuracy, better response rate as an initial step for video surveillance. Solution is proposed based on performed tests on various face rich databases in terms of subjects, pose, emotions, race and light.

Author have developed the system to evaluate the face detection and recognition methods considered to be a bench mark. Some methods performed consistently over different datasets whereas other methods behave very randomly however based on average experimental results performance is evaluated, five datasets been used for this purpose.

Face detection and using Haar-like features reported relatively well but it has much false detection than LBP which could be consider being a future work in surveillance to reduce false detection in Haar-like features and for the recognition part gabor is reported well as it's qualities overcomes datasets complexity.

2.4 Research on Face Recognition Based on Embedded System

This paper introduces the specific face recognition technology which is based on embedded platform and puts forward a solution, which stresses on face detection algorithm, face recognition algorithm, and application development. This technology makes full use of the advantage of PCA algorithm on feature extraction and the advantages (such as fast detection speed and high detection rate) of AdaBoost algorithm based on Haar.

A set of embedded face recognition system based on Tiny6410 embedded platform is realized. After face recognition testing, the results showed that this system runs stably and has high recognition rate. Thus, it can be widely used in the Things of Internet that needs to verify user identification through portable and mobile methods and in Intelligent Transportation System that needs face recognition technology.

2.5 Study of Face Recognition Techniques: A Survey

In this paper, a comprehensive study was performed over different face recognition methods. After detailed analysis it revealed that PCA is best suited technique when dimension of features is higher for original face images, whereas eigen faces image features method work well for frontal face recognition.

Among face recognition methods, the most popular are Neural Networks, Support Vector Machine, Sparse Representation based Classification (SRC), Linear Regression Classification (LRC), Regularized Robust Coding (RRC) and Nearest Feature Line ((NFL). These methods provide better results when the image dimension is under 150 or more.

Furthermore, it is suggested that PCA, SVM, NN and Eigen methods still need to be researched so that more satisfactory results could be achieved for face recognition. Moreover, in this paper we also mentioned state of the art face recognition image database and face technology benefits in various applications. However, main findings of this research are:

- The development trends and achievements in the realm of face recognition shows that a lot of researchers have been carried out in last four decades.
- Currently, face recognition system has been implemented for many real-time applications, but still it suffers from several challenges that need to be addressed in order to design a well-established face recognition system.
- Developed face recognition techniques could be analyzed over varying facial expression i.e. under varying lighting conditions and pose. And evaluation could be performed using benchmark and latest face databases.
- Similarly to the face image recognition, the video image recognition is more complicated that needs to be researched

Design Engineering Canvases

3.1 AEIOU Summary:-

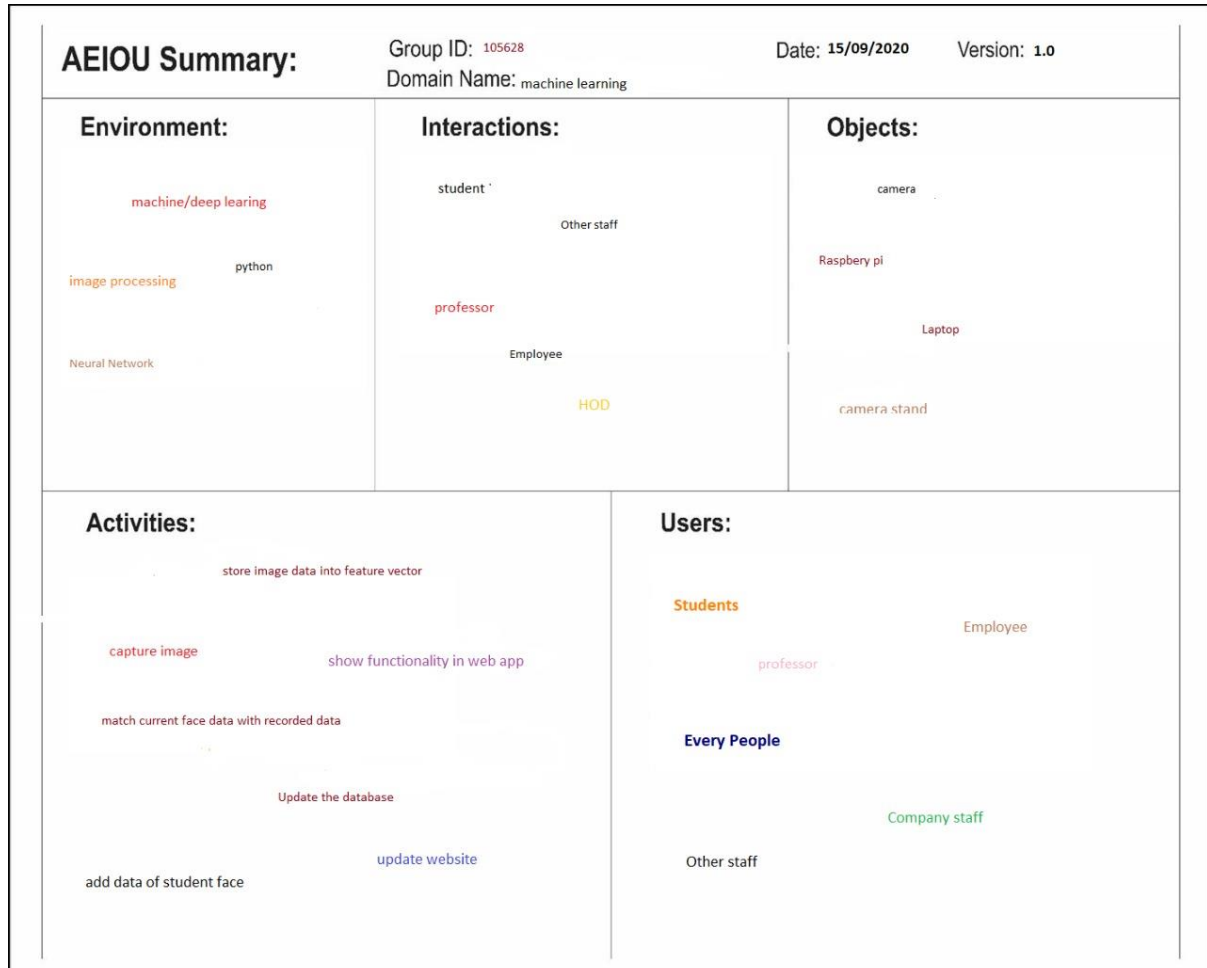


Fig 3.1 AEIOU Summary

The above canvas is an AEIOU summary about the Activities, Environment, Interactions, Objects and Users. Based on the research done we were able to conclude this summary which includes the situations and the major/minor factors that are responsible for the inactions.

3.2 Product Development Canvas

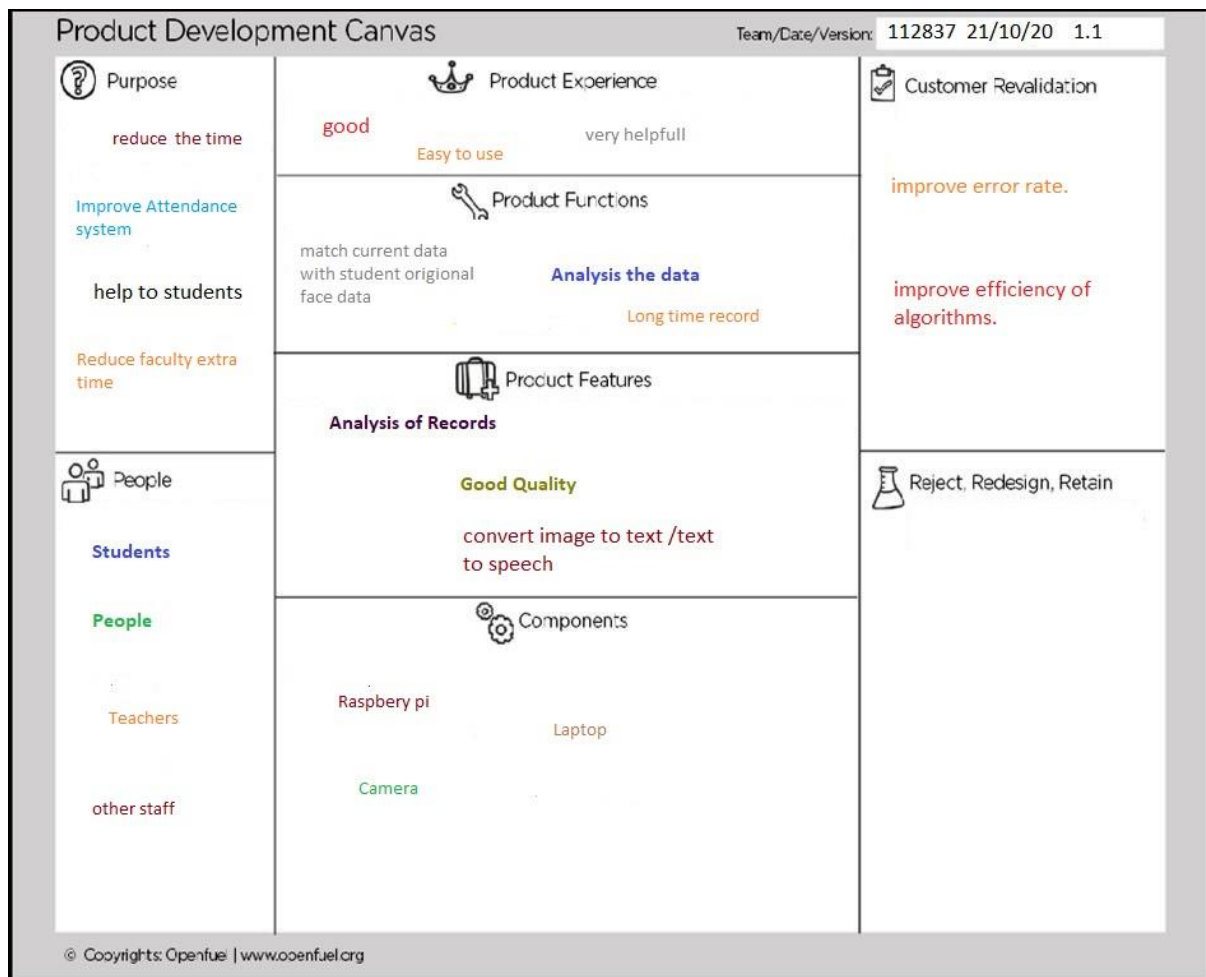


Fig 3.2 Product Development Canvas

After understanding the ideal stage of the product and going through the empathy part of the product it is time to design the final product definition, users, features, functions and components. This canvas will let us know exactly the amount of efforts and the clear idea that is to be put into this project. After that, the Customer revalidation part shows us how true we were in idealizing and creating a solution for the user. After that according to the Validations it is up to us that we reject, redesign and retain the function and features according to the feedback from the customer.

3.3 Empathy Mapping Canvas

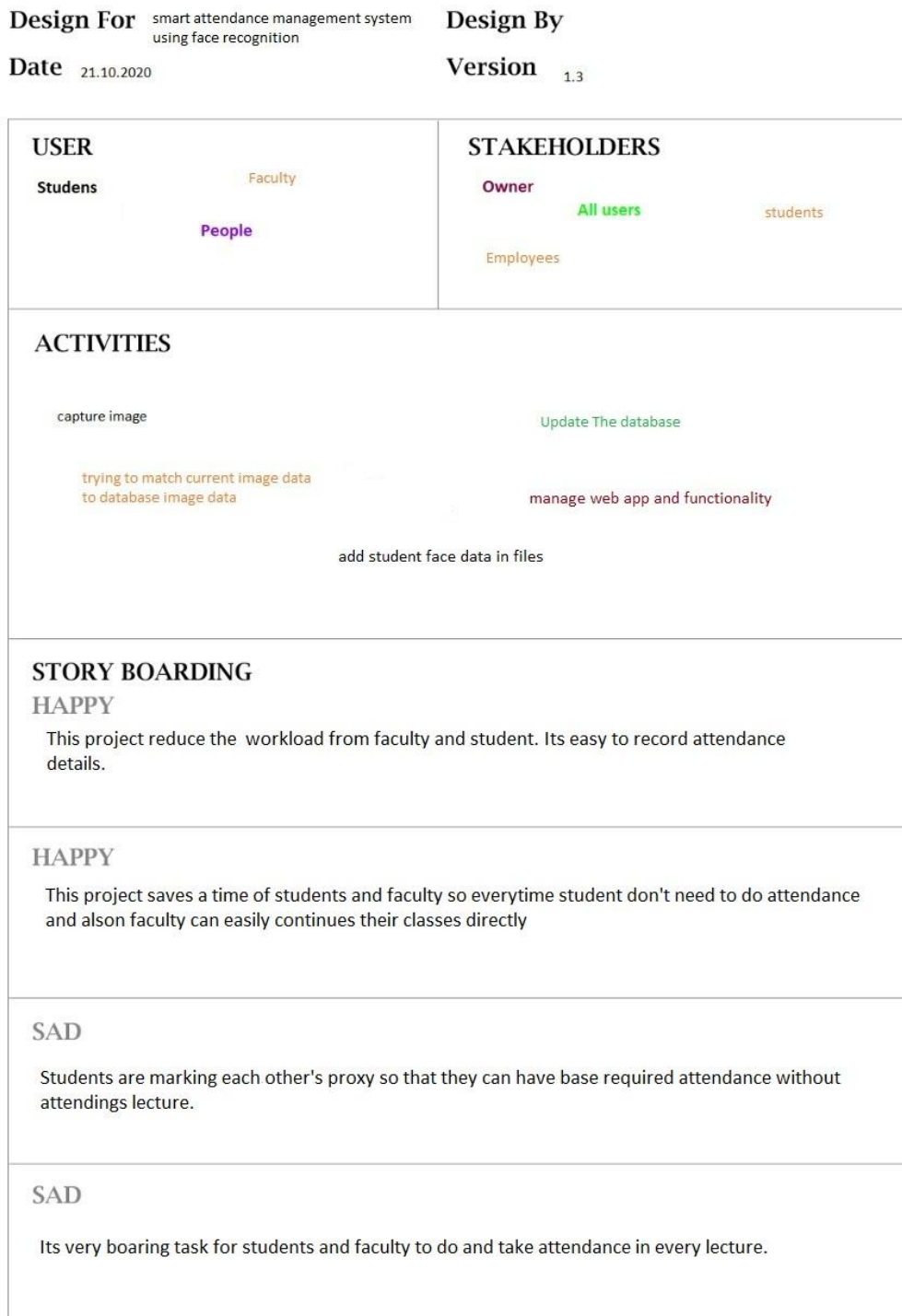


Fig 3.3 Empathy Mapping

The above canvas shows the empathy part included behind the creation of the project. The canvas includes some short stories that depict the actual case scenarios of the use and need of the product. The scenarios are best show cased using two happy and two sad stories.

3.4 Ideation Canvas:-

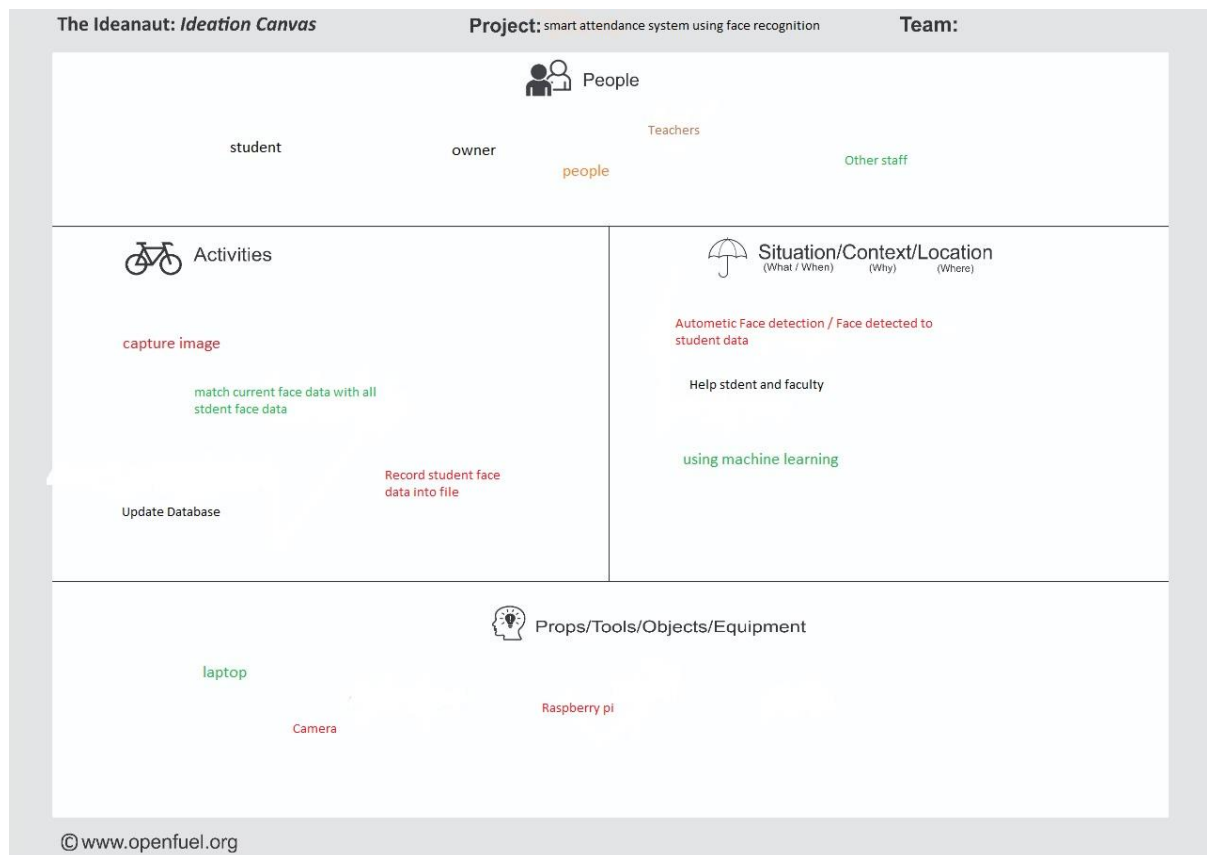
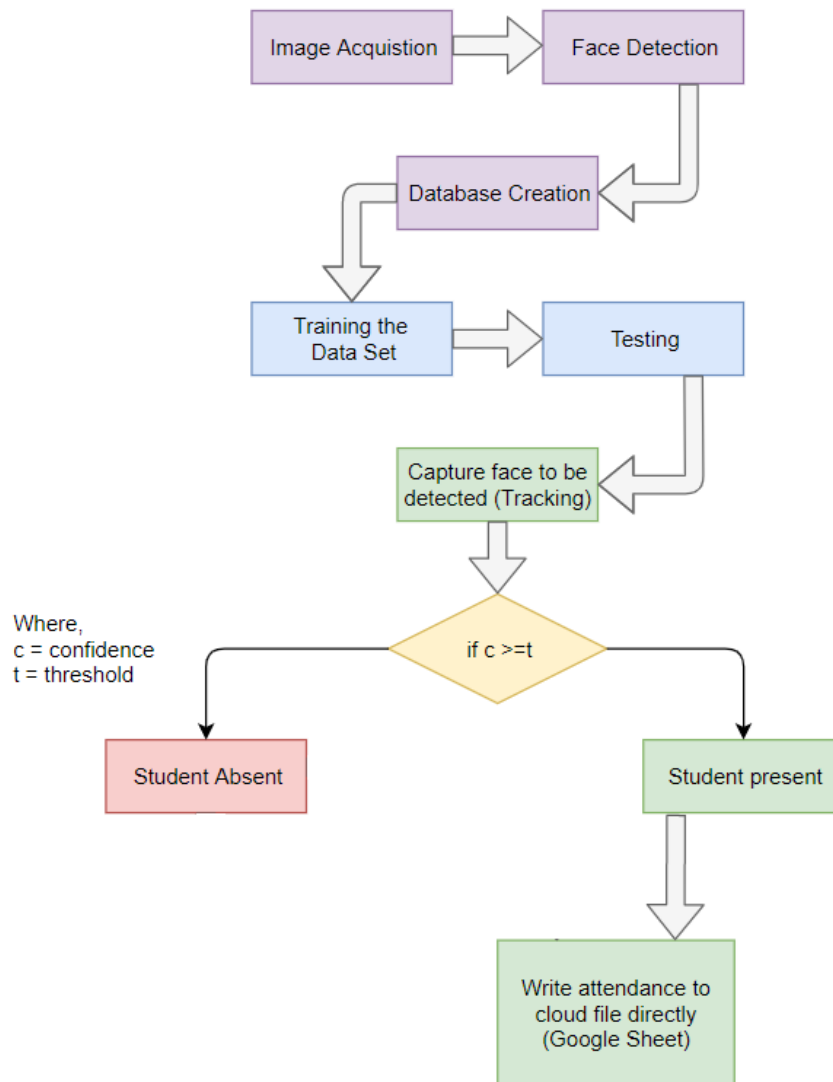


Fig 3.4 Ideation Canvas

Based on the observation in the previous AEIOU summary a particular Ideation can be derived which results into the Ideation Canvas above. This canvas shows the initial idea about the formation of the product and shows that how a particular product should be designed. The factors that will be affecting the development of the product are also included in this canvas.

4.1 Flow Chart Diagram**Fig 4.1 Flow Chart Diagram**

We will first collect images of students. After creation of database using their ID we will train images. Training of images will create feature matrix per student which will be used to recognize faces. After creating YML trainer file (which contains feature matrices for every student) it is ready to recognize faces. Then we can track and compare face with feature matrices and if face is recognized we will mark and upload the attendance.

5.1 Wireframe

The wireframe illustrates the 'Attendance Manager' web application in two states: a login page and a home/dashboard page.

Top View (Login Page):

- Browser tab: 'A Web Page' with sub-tabs 'Login' and 'X'.
- Page Title: 'Attendance Manager'.
- Form Fields: 'Email' and 'Password' (masked with asterisks).
- Action: 'Login' button.

Bottom View (Home Page):

- Browser tab: 'A Web Page' with sub-tabs 'Home' and 'X'.
- Page Title: 'Attendance Manager'.
- Navigation: 'Log out' button in the top right.
- Form Fields: 'Enrollment No.' with the value '170110116011'.
- Action: 'Show attendance' button.
- Figure: A pie chart showing attendance status. The legend indicates:
 - Absent (Pink)
 - Present (Green) The chart shows approximately 25% Absent and 75% Present.
- Action: 'Mail attendece report to parent' button.

Fig 5.1 Wireframe

5.2 Algorithm and approach

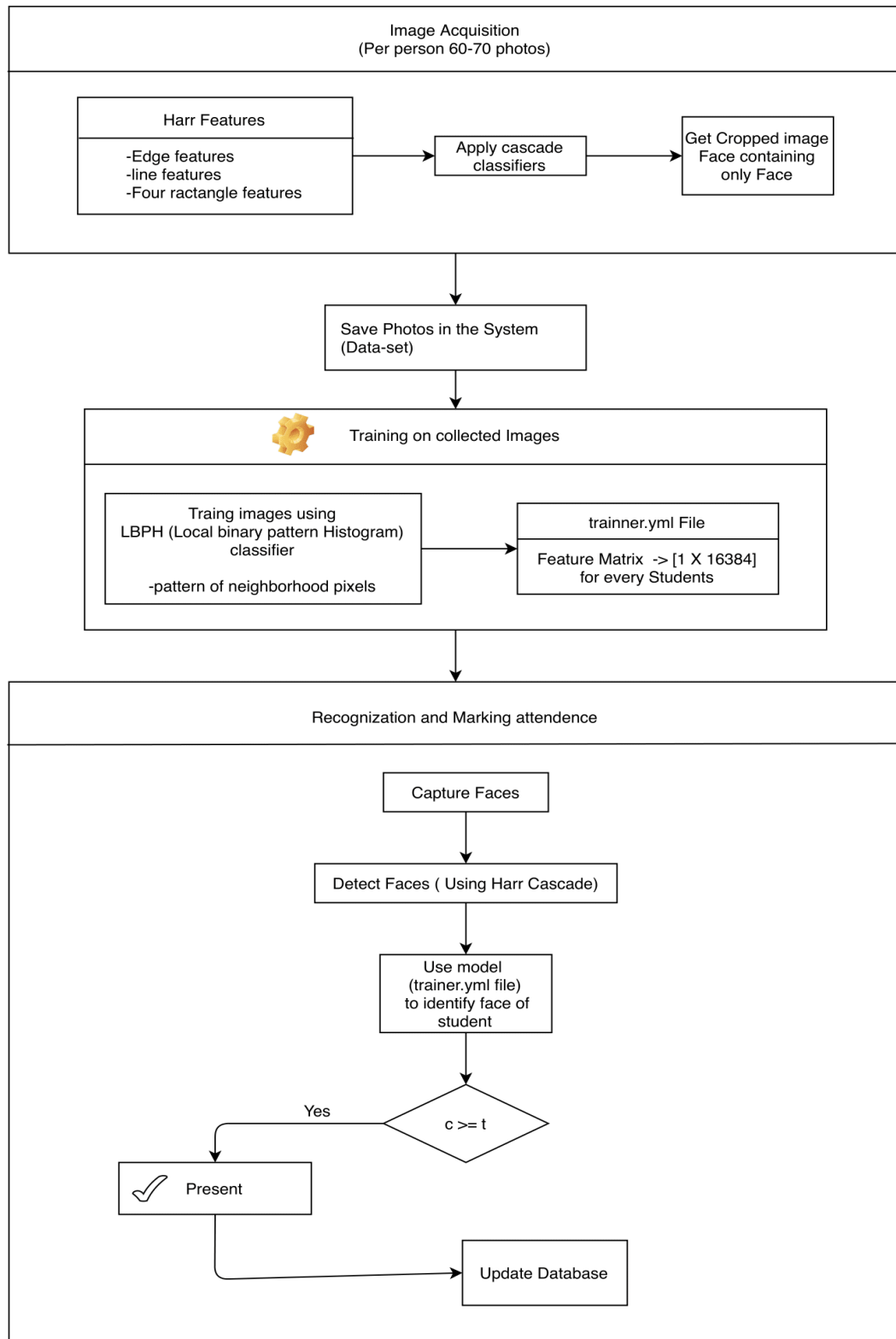


Fig 5.2 Our approach

5.2.1 Image Acquisition

- First we will acquire 60-70 images per student.
- Then we will apply **harr-cascade** classifier to track face from frame.
- After which cropped image of every face is stored with id as their name.
- These photos will work as data-set for training purpose.

5.2.2 Train images

- We will now train our data set using LBPH classifier.
- LBPH (Local Binary pattern histogram) uses pattern of neighborhood pixels for training.
- **Why we use LBPH for training and harr-cascade for tracking?**
 - Harr-cascade have high detection accuracy and have low false positive rate.
 - While LBPH is computationally fast and simple and it is robust to local illumination changes and occlusion.

5.2.3 Recognize face and mark attendance

- For recognize face in real time again we will use harr-cascade to track images.
- Now we will use our trained model to identify face. If face is identified then we will mark the attendance.

Chapter: 6

Summary

6.1 Innovation

With the help of this project, we can perform face recognition of students or person and automatic mark the attendance to database. It will reduce time for marking attendance. Instead of physical paper we will use cloud based database to store attendance track.

6.2 Future Scope

We can improve the models and reduce the false positive rate of identifying faces. We can build our own custom neural network for face recognition.

Also we can develop the algorithm that store the weekly timetable and try to recognize face for every session.

Also we can develop web dashboard that can display graphs about student's attendance and mail to their parents.

6.3 Tools and Technologies Required

- Raspberry-Pie
- USB Web-Cam
- Open CV (Computer vision python library)
- Python (Django/flask- for web dashboard)
- HTML
- CSS
- JavaScript
- Bootstrap

6.4 Summary

Smart attendance system using face recognition is one of the most effective system. It will save time and automatic process will reduce human effort.

References

- Research Advances in Face Recognition:
<https://ieeexplore.ieee.org/abstract/document/5344047>
- Image-based Face Detection and Recognition:
<https://arxiv.org/ftp/arxiv/papers/1302/1302.6379.pdf>
- Research on Face Recognition Based on Embedded System:
<https://www.hindawi.com/journals/mpe/2013/519074/>
- A Review Paper on Face Recognition Techniques:
https://www.researchgate.net/publication/270583005_A_Review_Paper_on_Face_Recognition_Techniques
- Study of Face Recognition Techniques: A Survey:
https://thesai.org/Downloads/Volume9No6/Paper_6-Study_of_Face_Recognition_Techniques.pdf

7.1 Periodic Progress Report (PPR)

Periodic Progress Report 1

PPR Details

Periodic Progress Report : First PPR

Project : Smart attendance management system using face recognition

Status : Reviewed

1. What Progress you have made in the Project ?

Done with discussing prototype and web app. And started exploring Computervision libraries for face recognition.

2. What challenge you have faced ?

Designing the flow of our project was a crucial part.

3. What support you need ?

Gone through the different projects for face detection and recognition and come up with a flow for our app.

4. Which literature you have referred ?

https://github.com/ageitgey/face_recognition/tree/master/face_recognition (For face recognition FLOW)

Fig 7.1 Periodic Progress Report 1

Periodic Progress Report 2

PPR Details

Periodic Progress Report : Second PPR

Project : Smart attendance management system using face recognition

Status : Reviewed

1. What Progress you have made in the Project ?

Studied about harr cascade and LBPH algorithms of OpenCV and Raspberry PI.

2. What challenge you have faced ?

LBPH and Harr cascade can perform with lower computing power but not accurate.

3. What support you need ?

Research about other face recognition algorithms.

4. Which literature you have referred ?

Harrcascade and LBPH algorithms

Fig 7.2 Periodic Progress Report 2

Periodic Progress Report 3

PPR Details

Periodic Progress Report : Third PPR

Project : Smart attendance management system using face recognition

Status : Reviewed

1. What Progress you have made in the Project ?

Studied about Django for Dashboard(Web app).

2. What challenge you have faced ?

Designing Models for students attendance table is quite complex.

3. What support you need ?

Need to research for making good database schema(Django Models)

4. Which literature you have referred ?

<https://www.youtube.com/watch?v=n-FTlQ7Djqc&list=PL4cUxeGkcC9ib4HsrXEYpQnTOTZE1x0uc>
(Django Tutorial)

Fig 7.3 Periodic Progress Report 3

Periodic Progress Report 4

PPR Details

Periodic Progress Report : Forth PPR

Project : Smart attendance management system using face recognition

Status : Reviewed

1. What Progress you have made in the Project ?

Expored new Face Recognition Algos. (Fisherface, HMM, PCA, Custom CNN) Explore another option of using AWS lambda if Raspberry Pie not capable for computing.

2. What challenge you have faced ?

Raspberry pie cant handle high algorithms having less RAM.

3. What support you need ?

Need to know about the required computing power for these algos.

4. Which literature you have referred ?

<https://web.stanford.edu/~jurafsky/slp3/A.pdf> <https://www.geeksforgeeks.org/ml-face-recognition-using-eigenfaces-pca-algorithm/> <https://iopscience.iop.org/article/10.1088/1742-6596/1028/1/012119/pdf>

Fig 7.4 Periodic Progress Report 4

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