Team Members

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Project Synopsis

Face Detection and Recognition Student Attendance System

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Abstract

The main purpose of this project is to build a face recognition-based attendance monitoring system for educational institution to enhance and upgrade the current attendance system into more efficient and effective as compared to before. The current old system has a lot of ambiguity that caused inaccurate and inefficient of attendance taking. Many problems arise when the authority is unable to enforce the regulation that exist in the old system. The technology working behind will be the face recognition system. The human face is one of the natural traits that can uniquely identify an individual. Therefore, it is used to trace identity as the possibilities for a face to deviate or being duplicated is low. In this project, face databases will be created to pump data into the recognizer algorithm. Then, during the attendance taking session, faces will be compared against the database to seek for identity. When an individual is identified, its attendance will be taken down automatically saving necessary information into a excel sheet. At the end of the day, the excel sheet containing attendance information regarding all individuals are mailed to the respective faculty.

Keywords- Smart Attendance System, OpenCV, NumPy

1. Introduction

1.1 Project Definition

Design of an automatic class attendance system using face detection algorithm of OpenCV module. The system requires a video capture device and the face_recognition library to be implemented successfully. It detects the faces and mark attendance accordingly. This system will prevent unnecessary wastage of time of classes that is usually wasted in form of class roll calls.

1.2 Project Objectives

1. Reducing time wastage during conventional class attendance.
2. Utilizing latest trends in machine vision to implement a feasible solution for class attendance system.
3. Automating the whole process so that we have digital environment.
4. Preventing fake roll calls as one to one attendance marking is possible only.
5. Encouraging the use of technology in daily lives.

1.3 Project Specifications

a. Uses Pattern Matching algorithm for face detection.
b. Score of minimum 600 required to perfectly match a face.
c. Metric: Camera Resolution.
d. For prototype fixed to 10 users only but scalable design.
e. Requires good lighting condition for better camera capture capability.
f. Attendance sheet is .xlsx format and can be digitally distributed and maintained.

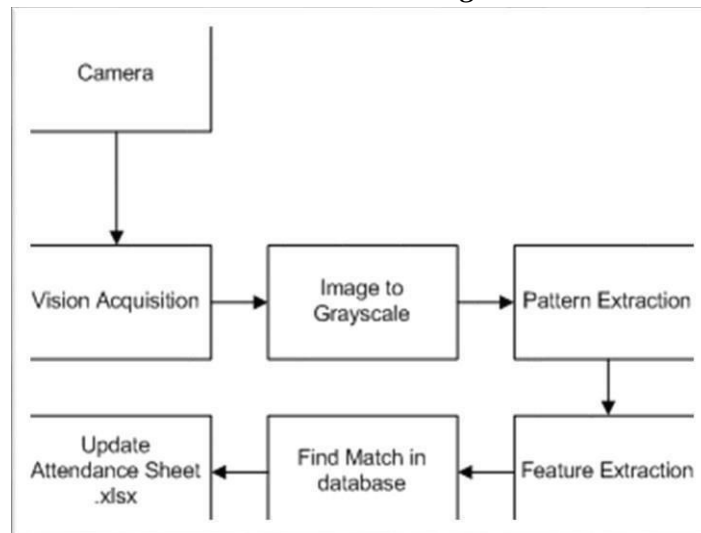## 1.4 Product Architecture and Components

1.4.1 Functional Diagram

FIGURE 1.1: BLOCK DIAGRAM OF THE SYSTEM

The subsystem description is as follows:

Camera: The camera is the only hardware component required to capture live video feed of class.

Vision Acquisition: This module allows image to be captured by camera into OpenCV for facial detection

Image to Grayscale: This process is performed using face_recognition library to convert a 32/16bit image to 8bit image. This is a requirement for our pattern matching algorithm to work completely.

Feature Extraction: This feature is used to extract important features out of image. It compares them with templates, saves in folder and provides a score of comparison.

Find Match in folder: Our database has preserved templates or images of students which we aim to recognize and mark attendance. This database can be updated or appended according to

requirement. This folder is used for comparison with extracted feature of image to confirm a successful hit.

Update Attendance Sheet.xlsx: If match is found our algorithm updates the attendance of user corresponding to his/her name in excel file of format .xlsx. If not, the system marks absent in front of his/her name in the same excel file.

1.5 Applications

a. Large application in institute attendance system where multiple attendances are carried out for different classes. The attendance will be short timed and reduce manual errors.
b. Large application of computer vision in field of Communication, Biomedical, Automatic Product Inspection.

2. Literature Review

2.1 Project background

In the face detection and recognition system, the process flow is initiated by being able to detect the facial features from a camera or a picture store in a memory. The algorithm processes the image captured and identifies the number of faces in the image by analyzing from the learned pattern and compare them to filter out the rest. This image processing uses multiple algorithm that takes facial features and compare them with known database.

The motivation behind this project is to simplify the means by which attendance is taken during lectures and how much time it takes. The use of ID cards or manually calling out attendance and writing it down on sheets is not productive and efficient. This system will detect the number of faces on the class and will also identify them from the store database. With the face detection and recognition system in place, it will be easy to tell if a student is actually present in the classroom or not.

2.2 Previous Work

PROJECT # 1

This is a project done by students as a 3rd year students of Chandigarh University

The system will be presented an image either via camera or from memory and it must detect the number of faces on it automatically. After identifying faces, the system should crop the faces from the image and store them in memory for image recognition which will be done in the second step. The system should be able to automatically count the number of faces detected on the image.

The second step will be the recognition part where the system will be able to match faces from the stored dataset and compare it to the input data from the first step. A software will be used for this system which automatically sorts out the faces. The software will be inter-active so to facilitate interaction between multiple tasks as required. Because the system has two steps, the second phase of the system will involve the training of images on a dataset that are to be used for recognition.

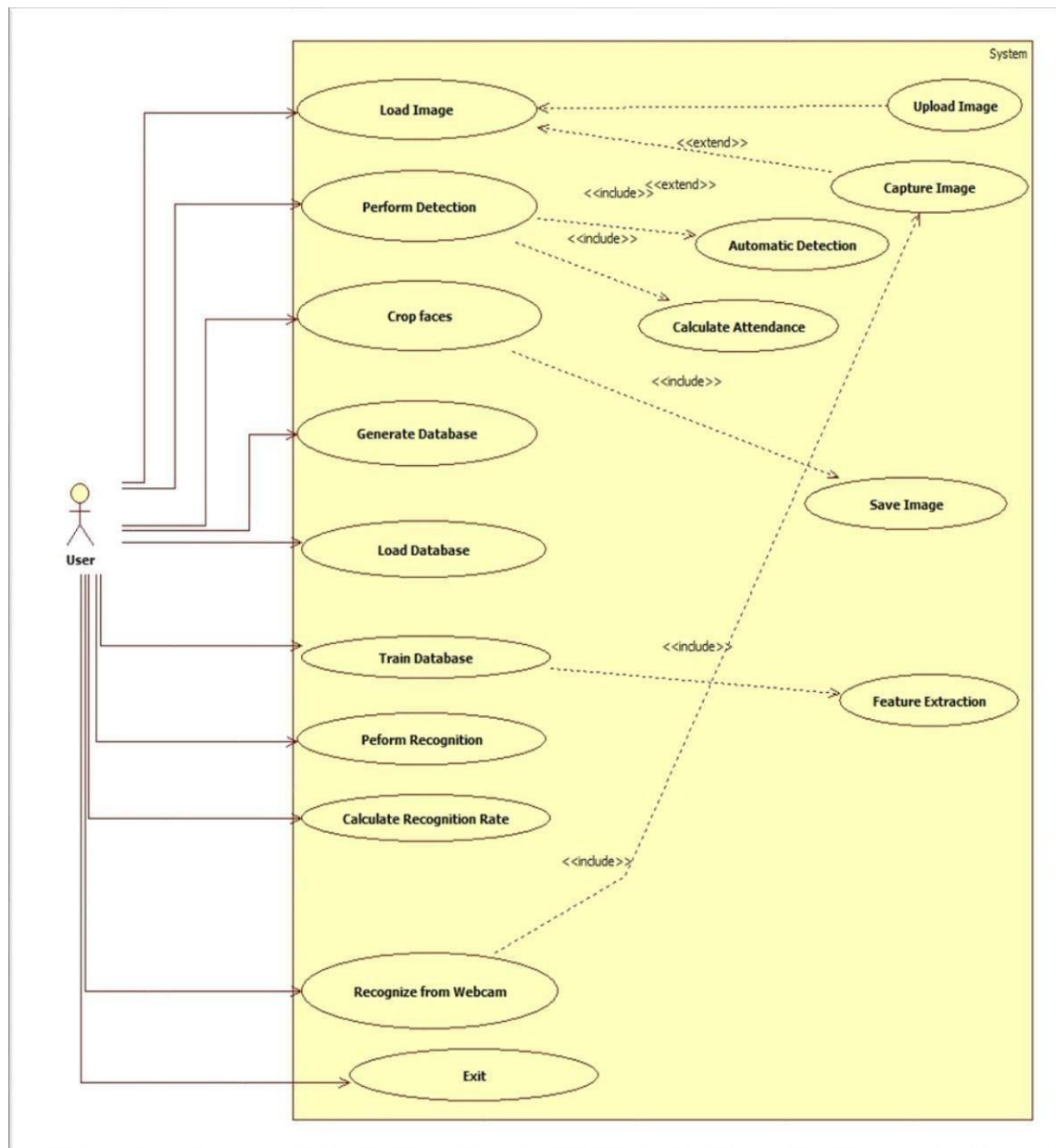The system behavior has been explained in the following flowchart

FIGURE 2.1: BLOCK DIAGRAM OF PREVIOUS PROJECT #1

Technology Used

- face recognition library, NumPy and OpenCV libraries.

Following flowchart explains the process of the flow of information throughout the process.
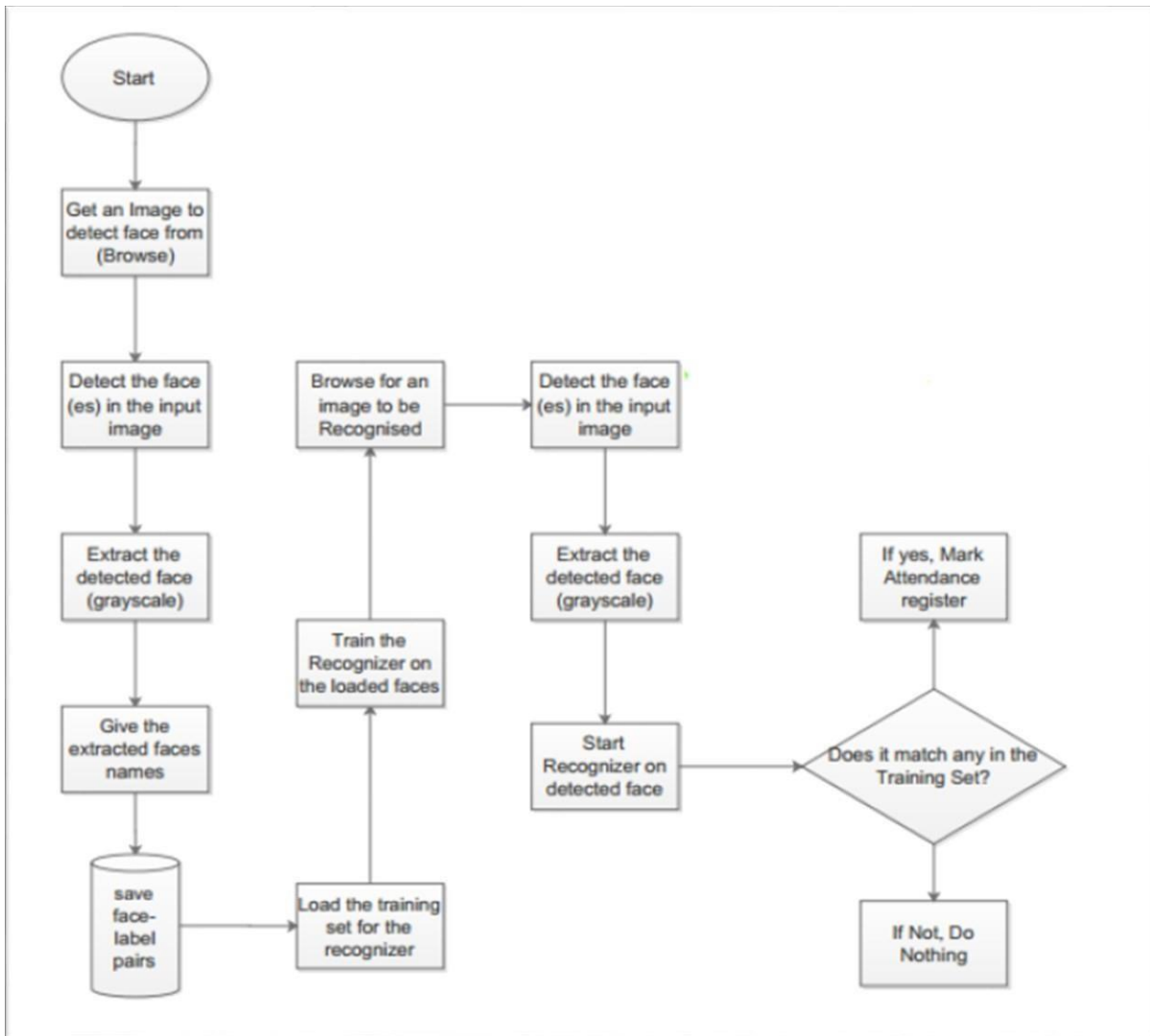

FIGURE 2.2: BLOCK DIAGRAM OF PREVIOUS PROJECT #2

Technology Used

The following tools will be used in the implementation of the designed system. Desktop tools.

OpenCV - (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision.

- **Desktop Tools**

Visual Studio - Visual Studio is able to build and run the solution examples after a proper configuration of OpenCV. The desktop software will implement the two sub-systems (Training set manager and Face recognizer) together with face detector in windows form.

PROJECT # 2

The approach performs face recognition-based student attendance system. This method is also similar to others and begins with the input of an image loaded from camera. Then it pre-processes the facial features and extracts it followed by subjective selecting and then the recognition of the facial images from known database.

The project is completely built in python with OpenCV libraries implemented in it.

Comparative Study

Our project is different than all the previous projects made and mentioned above. They have purely used the core of machine vision to implement a face detection mechanism. None of the above-mentioned projects have realized the power of LabVIEW programming and LabVIEW Vision modules in which not only pattern matching but other machine vision algorithms like edge tracking, geometric matching can be implemented with ease.

Though the general mechanism and flow of events is similar in above projects and our current project however, the mechanism of face detection is completely unique and different.

FIGURE 2.4: COMPARESSON BETWEEN ALL PROJECTS

3.   System Design

3.1 Design Constraints

The constraints which were considered while designing on project are following.

3.1.1 Design Constraint: Engineering Standards

The samples for database should be increase, as to increase the efficiency of detection. Also, the more the expensive the camera, the easier its algorithm is likely detecting the person.

3.1.2 Design Constraint: Environmental

The camera should capture all the students present in the class. Each student present should be seated such that it is visible to camera, so that his/her attendance gets marked easily.

3.1.3 Design Constraint: Ethical

 The second limitation which is faced include the person appearance by face, which a person changes his/her look and looks different from the picture in the database of the attendance system, then it may be difficult for his/her attendance to be marked.

3.2 Design Methodology

As we mentioned before in (Figure 1.1). The project process is:

- A camera will take continuous stream.
- In Python OpenCV library for vision will be used.
- Convert the RGB image to grayscale image.
- Then perform Machine Vision Algorithm and match with patterns stored in our folder.
- If pattern matches based on the score of how successful, decide to mark attendance or not. • Update the marked attendance in a measurement file.

3.3 Product Subsystems and Components

3.3.1 Product Subsystem1: Vision Acquisition

This subsystem is used to acquire continuous stream of video from attached camera. It starts a camera session from desired camera and transmits its image feed to further processing. The feed captured is inline processed and then the next feed is captured as shown in (Figure 3.1).

4.2 Overall Results, Analysis and Discussion

4.2.1 Objective

Verify that the spreadsheet is updated to corresponding present as soon as image is detected. The "Present" should be marked against the person detected only.
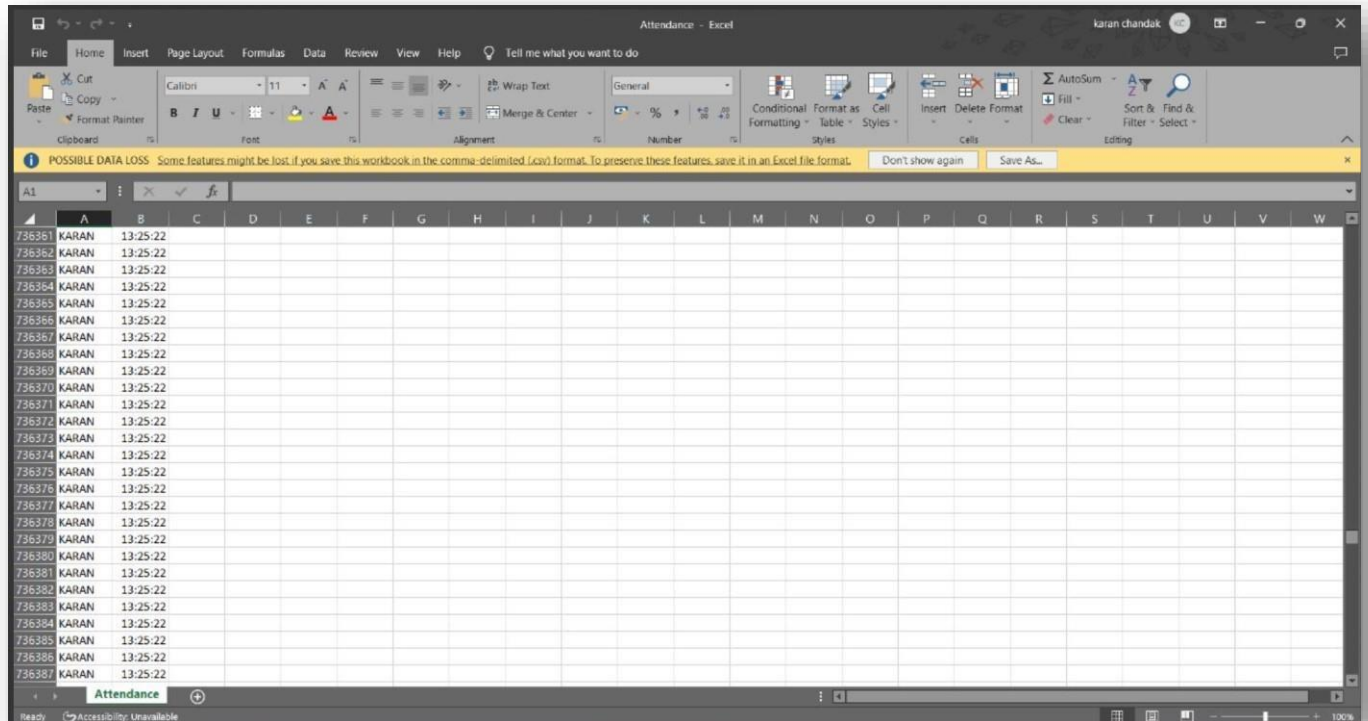
4.2.2 Results

We were successfully able to detect face and change the value of corresponding face from "Absent" Before to "Present" After as shown in (Figure 4.4).

<u>BEFORE:</u>

FIGURE 4.3: ATTENDANCE BEFORE FACE DETECTION

AFTER:

When we opened the attendance sheet on excel, we saw the file was updated correctly and completely as shown in (Figure 4.4).

FIGURE4.4: ATTENDANCE AFTER FACE DETECTION

3.4 Contribution of Team Members

As group, we managed to divide the work between us as shown in (Table 1). We were collaborating and meeting with each other before the COVID-19, however after the pandemic we were doing virtual meetings in order to try our best to work on the project despite what is happening.

TABLE 1: CONTRIBUTION OF TEAM MEMBERS

1. Aryan: Program Designing
2. Karan Chandak: Program Developer
3. Siddharth Singh: Program Developer
4. Sonu Saurav: Documentation
5. Sushant Bisht: Report

3.5 Project Execution Monitoring

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3.5.1 Team Meeting

All members discuss their respective progress in their part in daily meeting and prepare a final sheet for the meeting with the advisor.

3.5.2 Testing

After completion of each part mentioned in project plan, proofreading and testing was done for successful verification of the part.

3.5.3 Progress Discussion Meeting

An overall progress discussion meeting was held once a month where current standing of the project is presented to the advisor and everyone including members share their opinion and discuss them, and what amendments are necessary to be added.

8. References

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  https://www.researchgate.net/publication/326986115_Face_Detection_and_Recognition_Student_Atten dance_System • www.ineuron.com