CIS 5900

Capstone Project

SMART FACE RECOGNITION
ATTENDANCE SYSTEM USING PYTHON

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1.Executive Summary

In this era, student attendance plays a major role in the education institute. Their main concern is to track the records of the student's regularity. During the pandemic, it is still the major issue for the university or schools. There are two primary ways to record attendance: calling out the roll call or having students sign a paper. Both required more time and effort. Therefore, a computer or digital-based student attendance management system is necessary, as it will help the faculty to maintain attendance records automatically. Before we implemented this project, we conducted a survey quiz with many students to get to know about their views regarding smart attendance. Based on the results of the survey, we analyzed that more than 50% of students want this system to be implemented in any campus or area to support the faulty and management of the institute. We are using Qualtrics platforms to make the survey query for our project. We got a positive output from the students to motivate and implement of this smart attendance system using python.

Before we started our project, we created project milestones to track the project progress. In this project, we implemented the contactless automated attendance system using the camera feature of the laptop and python packages. We have planned to implement our main goal as "Smart Attendance System Using Python". The application of this project requires face identification for the attendance purpose, which is user-friendly and saves time. It also eliminates the paperless and is environment beneficial because of the software-based system attendance. Moreover, this system has completely removed the possibility of proxy attendance due to facial recognition as a biometric verification. As a result, this technique can be used in any sector where attendance plays a vital role. This suggested attendance system is built on the anaconda of PyCharm platform and supported by python packages, script, and a SQL database. The approach performed in the system is based on image comparison using the recorded data of the face from the database image and the image captured by the system in real-time. The system produces outcome as a student list in the excel sheet format of the attended students of the class in the university.

To summaries, we initially stored the student's pictures in the local file in the system. Then, we implemented smart attendance project in the PyCharm platform using python language. Students must be looking in-front of the camera. Once a face is detected, and recognition technique has been applied to the image where the student images stored under the local folder in the system, students who have been identified are marked as present, and their attendance is updated with the

appropriate time, date, and the name of the student in the excel sheet. Afterwards, the report will automatically have generated in the local files in the laptop in the Microsoft excel form. In other words, Professor will get the attendance report in the excel form. On the other hand, if the face did not match in the system, then the system rejects that student attendance. This project is fruitful for any university as well as organizations.

2. Introduction

Attendance is significant in any organization, whether educational institutions or companies (Dr.v suresh,2019, Pp. 18-29). So, it is important to keep a record of attendance. This is a project about a Facial Recognition Smart Attendance System using Python for Educational Institutions and Companies to track the attendance of Students and Employees. The old system had a lot of ambiguity that caused inaccurate and inefficient attendance taking. The main problem was when one must manually take the attendance, which was not only time-consuming but also exhausting. The main purpose of this project is to build a face recognition-based attendance monitoring system for educational institutions to enhance and upgrade the current attendance system to be more efficient and effective as compared to before. The technology behind it will be the face recognition system, and we are using Python programming language for this project. The human face is one of the natural traits that can uniquely identify an individual. During the attendance-taking session, faces will be compared against the database to seek identity. When an individual is identified, attendance will be taken down automatically, saving necessary information into an excel sheet. The excel sheet containing attendance information regarding all individuals is mailed to the respective faculty (Dr.v suresh,2019, Pp. 18-29).

2.1 Problem Statement and Motivation

According to the previous attendance management system, the accuracy of the data collected is the biggest issue. The main reason is that attendance might not be recorded personally by the correct person, in other words, a third party can only take attendance if they realize the institution, which violates the accuracy of the data. The second problem of the previous system is that it is

time-consuming. For example, a student signing his/her attendance on a 3-4-paged name list is about 1 minute. In one hour, only 60 students can sign their attendance. Which is inefficient and time-consuming. The third issue is the accessibility of that information by the legitimately concerned party. For example, most parents are concerned and want to track their child's actual performance to ensure their kid attends the classes in college/school. However, in the previous system, there were no ways for the parents to access such information.

2.2 Research Objectives

To solve the drawbacks of the previous system as stated in 2.1, the existing system will need to evolve. The proposed system will reduce the paperwork, and attendance will no longer involve manual recording. The new system will also reduce the total time needed to do attendance recording. The new system will acquire individual attendance by facial recognition to secure data accuracy of attendance (Dr.v suresh,2019, Pp. 18-29).

The following are the objectives of the project:

- To develop a portable Smart Attendance System which is handy and self-powered.
- To ensure the attendance recording process is faster than the previous system, which can go as fast as about 3 seconds for each student.
- Have enough memory space to store the database.
- Able to recognize the face of an individual accurately based on the face database.
- Allow parents to track their child's attendance.

2.3 Project Scope and Direction

The main intention of this project is to solve the issues encountered in the old attendance system while reproducing a brand new innovative smart system that can provide convenience to the institution. In this project, an application will be developed which can recognize the identity of each individual and eventually record the data into a database system. Apart from that, an excel sheet is created which shows the students' attendance and is directly mailed to the respected faculty (Dr.v suresh,2019, Pp. 18-29).

The followings are the project scopes:

- The facial recognition process can only be done for 1 person at a time.
- An excel sheet is created containing student attendance and mailed to the respected faculty.
- The project must work under a Wi-Fi coverage area or under Ethernet connection, as the system must constantly update the attendance system database.
- The device on which the application is running is powered up by the power bank to improve the portability of the application.

2.4 Impact, Significance, and contributions

Many attendance management systems exist nowadays. Therefore, in this project, those limitations will be overcome and further improved and are as follows:

- Students will be more punctual in attending classes. This is due to a student's attendance can only be taken personally where any absentees will be noticed by the system. This can not only train the student to be punctual as well as avoids any immoral ethics such as signing the attendance for their friends.
- The institution can save a lot of resources as enforcement is now done by means of technology rather than human supervision which will waste a lot of human resources for an insignificant process.
- The application can operate on any device at any location if there is Wi-Fi coverage or Ethernet connection which makes the attendance system to be portable to be placed at any intended location. For example, the device can be placed at the classroom entrance to attend.
- It saves a lot of money in the sense that it has eliminated the paperwork completely. ▪ The system is also time effective because all calculations are all automated. In short, the project is developed to solve the existing issues in the old attendance system.

3. Methods

3.1 Tools and Technologies Used:

1. Computer with 16 GB Ram for faster processing.
2. Power Supply Cable.
3. Computer Camera or Web Camera with good megapixels.
4. MS Excel for storing output files.
5. Language- Python.
6. IDE- PyCharm.

3.2 Packages Used:

NumPy: NumPy is a python library used for working with arrays. It also has functions for working in the domain of linear algebra, Fourier transform and matrices.

Open CV: Open CV stands for Open-Source Computer Vision, a library of programming functions mainly aimed at real-time computer vision. cv2 is the module name for OpenCV- python.
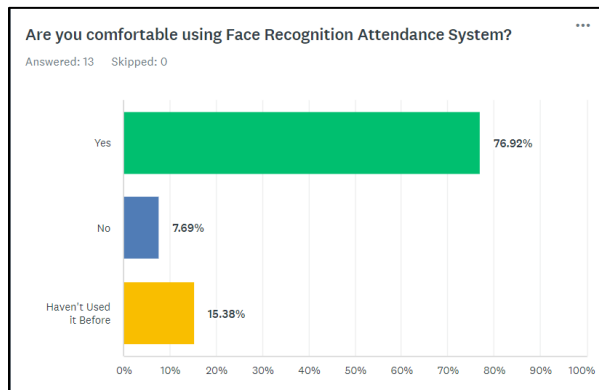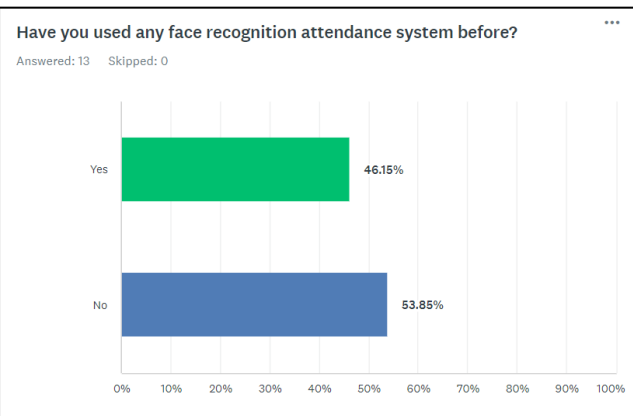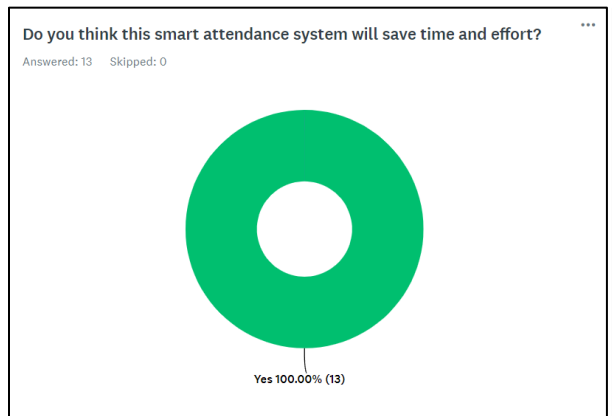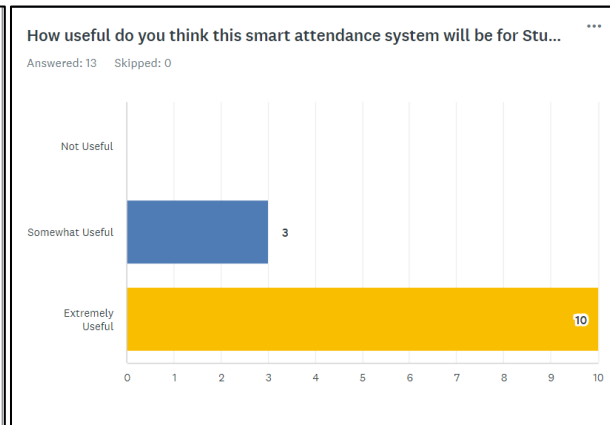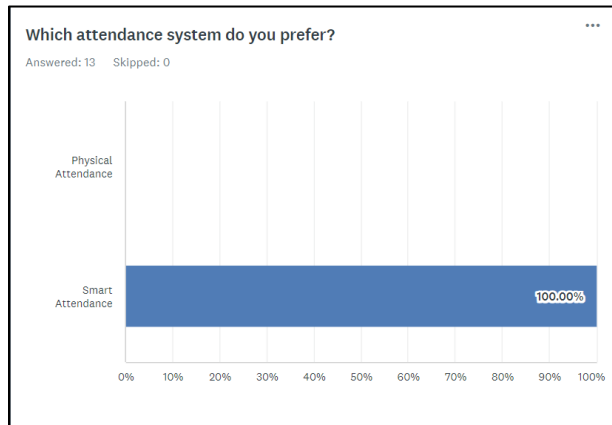
Face recognition: The face recognition package helps recognize the face and manipulates faces from the editor or command line with the simplest face recognition library.

3.3 Survey:

Before starting brainstorming on the project. We sent out a survey to our classmates to get their input, so that we could make the most out of this project. A free platform called SurveyMonkey was used to design the survey and analyze the results. Simple questions were asked in the survey to analyze how familiar our classmates with the Smart attendance system were. Below is the list of questions we sent out in our survey form.

1. Which attendance System do they prefer?
2. How useful do you think this smart attendance system will be for Students?
3. Do you think a smart attendance system will save time and effort?
4. Have you used any face recognition systems before?

5. Are you comfortable using the Face Recognition Attendance System?

Which attendance system do you prefer?
Answered: 13   Skipped: 0

- Physical Attendance
- Smart Attendance — 100.00%

How useful do you think this smart attendance system will be for Stu...
Answered: 13   Skipped: 0

- Not Useful
- Somewhat Useful — 3
- Extremely Useful — 10

Do you think this smart attendance system will save time and effort?
Answered: 13   Skipped: 0

Yes 100.00% (13)

Have you used any face recognition attendance system before?
Answered: 13   Skipped: 0

- Yes — 46.15%
- No — 53.85%

Are you comfortable using Face Recognition Attendance System?
Answered: 13   Skipped: 0

- Yes — 76.92%
- No — 7.69%
- Haven't Used it Before — 15.38%

3.4 Risk and Opportunities:

A risk is basically something that is unplanned that might happen that could have a negative impact on your project. An issue is something that is currently happening and having a negative impact on your project. An opportunity is something unplanned that might happen that you could exploit to have a positive impact on your project. In our project, we have identified some risks, which are mentioned below.

Risk	Description of risk	The probability of the risk happening	Effect of the risk on the project	Total	Owner of the risk	Response
Resource sick	Any resource can be sick anytime, which can impact the timelines.	40%	$4000	160000	Rashmi, Shailja, Pooja, Anusha, Pratiksha, Surya	Reallocate the tasks to the Resources
Resource shortage due to comp exam	2 of the resources in the team were occupied with Comprehensive exam preparation and could not devote time to the project.	20%	$2000	40000	Rashmi, Shailja	Move Resource around. Additional work by other resources.

| Data corrupted	Data can be corrupted for the Developer due to Laptop Malfunctioning.	10%	$1000	10000	Developer	Need to keep backup of the Data.
Tool get Priced	The tool PyCharm may not remain Open Source throughout the Project	10%	$1000	10000	PyCharm	Look for alternative open-source tools.
The camera functionality is not working.	The laptop Camera can be corrupted for the Developer due to Laptop Malfunctioning.	15%	$1500	22500	Developer	Try to fix the Camera. Use of external Web Camera

3.5 Workflow Architecture:
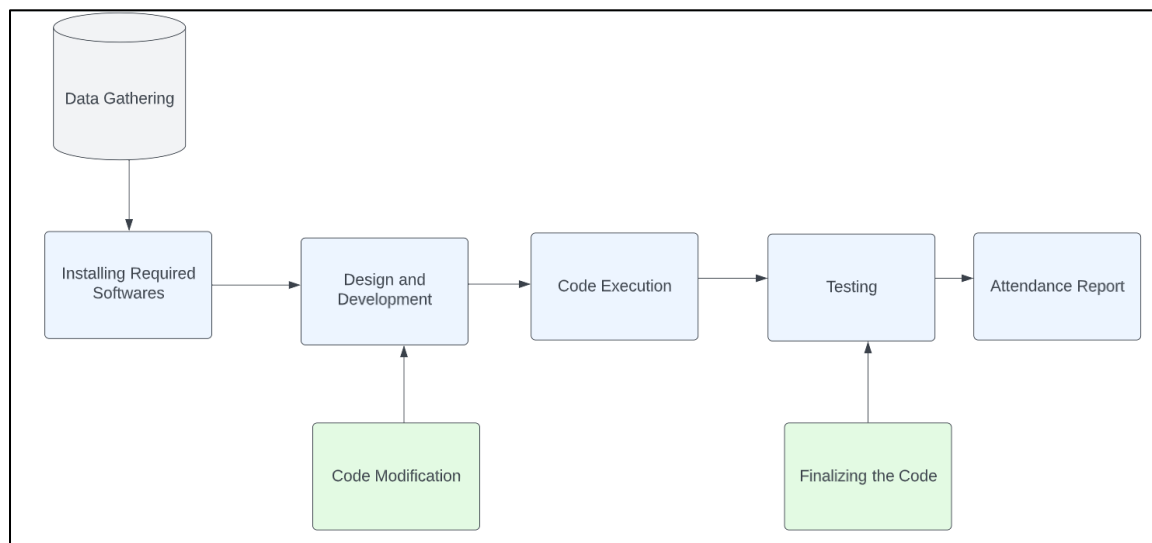
In the data-gathering phase, we initially gathered all the images of the teammates and stored them in the local folder. Further, we have installed PyCharm software to write the code for the project. Initially, the libraries are installed and use the editor PyCharm and the developer creates the project which specifies the path of the code which has images stored in it. Whereas during this development phase there are a couple of problems encountered we were unable to store multiple names in the file and the images were not in the correct format. The code was modified which enabled multiple-face recognition. The developer then modified the code, which enabled multiple face recognition. Also, all the pictures were stored in jpeg format to avoid discrepancies. All the pictures were stored in a single folder, and the issue was resolved. Furthermore, we executed the finalized code, and we had the face recognized using the webcam. The attendance report was created with the date and time, and name of the student.

We have used this workflow architecture with different phases to implement our prototype.

In the data-gathering phase, we initially gathered all the images of the teammates and stored them in the local folder. Furthermore, we have installed PyCharm software to write the code for the project. In the development and design phase, the developer installs the required libraries and uses the PyCharm editor to create the project, specifying the path of the code with images stored in it. Whereas during this development phase, there were a couple of problems encountered. We could not store multiple names in the file, and the images needed to be in the correct format. The code was modified, which enabled multiple-face recognition. The developer then modified the code, which allowed multiple face recognition—also stored all the pictures in jpeg format to avoid discrepancies. The local file stored all the photos in a single folder, and the developer resolved the issue. Moreover, we executed the code. The software tester tests the code in the next phase and gets any bugs. Then the developer fixed the code, and the issue is resolved. Then we re-executed the finalize the code laptop camera will enable, the student will come in front of camera and after that student face will automatically capture, once we will close the camera, we got final output as MS excel created the attendance report with the date, time, and student name.

3.6 Context Level Diagram:
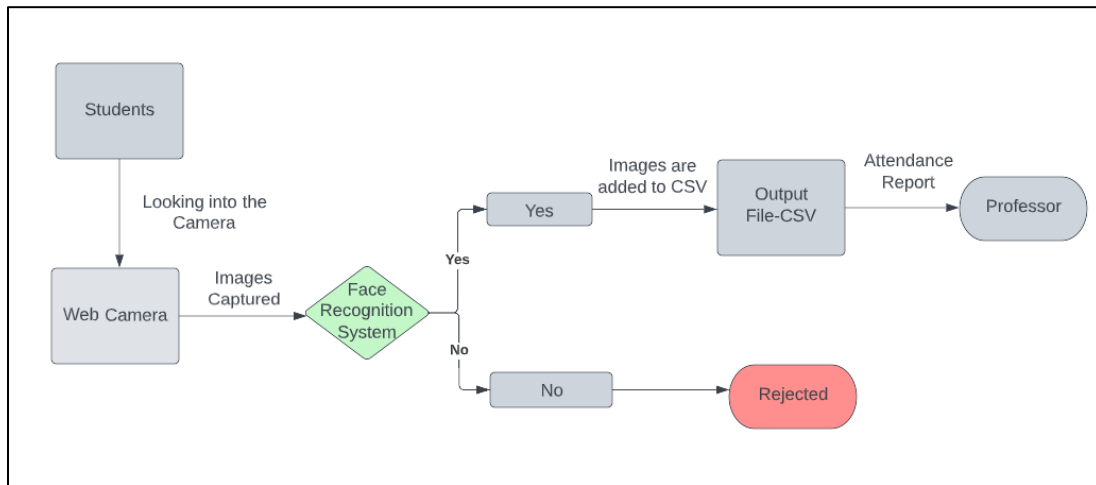
Web camera is fixed outside the classroom. While entering the classroom students will use the camera to scan their faces, then web camera scans their faces and match the faces which are stored in the database. when the scanned face matches with the database image and they can see their picture along with the green rectangle frame and the name under the picture. If the scanned face is not matched with the stored database images the face recognition system doesn't show any name or green rectangle around the picture. When the face recognition system detects the face from the web camera matches with database images it takes the name from the database along with the entered time, copy it into an excel sheet. Likewise, it forms an attendance report. If the face is not matched with the database but they belong to that classroom, they must have to reach the professor and ask to enter their name in the database otherwise they will get absent.

3.7 Quality Management:

For now, the scope of the project is the use of Laptop Camera, but we can use webcam or bigger camera so that it can capture distant faces. The face recognition model can be done more precisely so that maximum accuracy can be achieved. The marked attendance is stored in only one excel,

rather different excels for different date can be created. Below are some of the examples for the future scope of the project

- Today, one of the fields that uses facial recognition the most is security. Facial recognition is a very effective tool that can help law enforcers recognize criminals and software companies are leveraging the technology to help users access their technology. This technology can be further developed to be used in other avenues such as ATMs, accessing confidential files, or other sensitive materials. This can make other security measures such as passwords and keys obsolete.

- Another way that innovators are looking to implement facial recognition is within subways and other transportation outlets. They are looking to leverage this technology to use faces as credit cards to pay for your transportation fee. Instead of having to go to a booth to buy a ticket for a fare, the face recognition would take your face, run it through a system, and charge the account that you've previously created. This could potentially streamline the process and optimize the flow of traffic drastically. The future is here.

- In all the biometric modalities — fingerprint, expression, gait, behavioral, DNA, and others — face is gaining adoption faster. Because it is not only convenient for almost all to use, but a face provides a sensor (here, camera) and device with too much "signal" or data as any other tool. For example, fingerprints cannot suit the many differences in the forms, sizes, distinctive marks, and other distinguishing features of a qualified A.I. program, for all their simplicity and apparent sophistication.

4. Results

In our prototype, initially, we used face encoding. The student will look in front of the camera, then the face is detected on the camera. The code will search for the face available in the faces stored folder in the local system. If the student's face gets recognized in the system, it collects the face's name from the folder and copies it to the CSV file. Moreover, we are encoding an array of the assembled faces into strings to generate the output .csv file as an attended student report. However, if the system matches the student's look in the face folder, it will take attendance. Also,

the student's name needs to be reflected in the generated attendance report. The CSV file captures the name, time, and date of the student in real time.

▲	A	B	C	D	E	F	G
1							
2	ANUSHA	16:22:06	6/12/2022				
3	POOJA	16:22:11	6/12/2022				
4	STEVEJOBS	16:22:13	6/12/2022				
5	RASHMI	16:22:23	6/12/2022				
6	PRATIKSHA	16:22:32	6/12/2022				
7							

5. Discussions

1. **What have you achieved from this project?**

The traditional attendance system consists of a lot of registered work marked by the teachers, which may lead to human errors and a lot of maintenance, and huge time consumption. We have thought of revolutionizing it using digital tools in this modern era. i.e., Face Recognition Attendance System. Our project will ensure accuracy and negligible manual work. Our motivation is to overcome the problem of conventional systems. The initial phase of the project targets Face recognition and then marking attendance. The database of all the students in the class is stored in a folder, and when the individual student matches with one of the faces stored image, attendance is marked else. The face is ignored, and attendance is not marked.

2. Why is the result important?

The proposed approach in our project identifies an individual by comparing their input image to the stored image in the folder. From this model, we can successfully recognize the faces of students and can mark their attendance automatically in real-time without human intervention. This tool will eliminate the tedious work, despite having precision to it. It saves time and effort, especially if many students are in the lecture.

3. Problems encountered?

Unable to store multiple names in the file at the beginning stage of the project. It scans multiple pictures in the camera it shows the first scanned person's name from that file. When storing multiple pictures in a particular folder for scanning, all the pictures should be in the jpeg format. Initially, we had five names in the file. We added a few more, then got the error for running the code. We then checked the name format of the picture in jpeg format.

4. What was the resolution technique?

The code was written for single-face detection by default, which means it has single-person detection. The developer then modified the code, which enabled multiple face recognition. Also, all the pictures were stored in jpeg format to avoid discrepancies. All the pictures were stored in a single folder, and the issue was resolved.

5. Time and resources are required to complete the project.

A total of six resources was required for the project, and the entire project was completed in 4.5 months. The project Deliverables included a Working Code, Presentation, and the Project report.

6. Conclusion

Before the development of this project, there were many loopholes in the process of taking attendance using the old method, which caused many troubles to most of the institutions. Therefore, the facial recognition feature embedded in the attendance monitoring system can ensure attendance is taken accurately and eliminate flaws in the previous system. Using technology to conquer defects cannot merely save resources but also reduces human intervention in the entire process by handling all the complicated tasks to the machine. The only cost to this solution is to have sufficient space to store all the faces in the database storage. In this project, the face database is successfully built. Apart from that, the face recognition system is also working well. In the end, the system not only resolves troubles that exist in the old model but also provides convenience to the user to access the information collected by mailing the attendance sheet to the respected faculty.

7.Acknowledgment

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8.References

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