**Attendance system with face recognition**

**REPORT**

SUBMITTED BY

Anmolpreet Singh 1803651

Devesh 1803661

Laksh Chanan 1803675

Radhika Sharma 1803689



**Department of Computer Science & Engineering**

**DAV Institute of Engineering & Technology**

Jalandhar, India

**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.

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Anmolpreet Singh

Devesh

Laksh Chanan

Radhika Sharma

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**Chapter 1. Introduction**

* 1. **Introduction to Project**

According to the previous attendance management system, the accuracy of the data collected is the biggest issue. This is because the attendance might not be recorded personally by the original person, in another word, the attendance of a particular person can be taken by a third party without the realization of the institution which violates the accuracy of the data. For example, student A is lazy to attend a particular class, so student B helped him/her to sign for the attendance which in fact student A did not attend the class, but the system overlooked this matter due to no enforcement practiced. Supposing the institution establish an enforcement, it might need to waste a lot of human resource and time which in turn will not be practical at all. Thus, all the recorded attendance in the previous system is not reliable for analysis usage. The second problem of the previous system is where it is too time consuming. Assuming the time taken for a student to sign his/her attendance on a 3-4 paged name list is approximately 1 minute. In 1 hour, only approximately 60 students can sign their attendance which is obviously inefficient and time consuming. The third issue is with the accessibility of those information by the legitimate concerned party. For an example, most of the parents are very concerned to track their child’s actual whereabouts to ensure their kid really attend the classes in college/school. However, in the previous system, there are no ways for the parents to access such information. Therefore, evolution is needed to be done to the previous system to improve efficiency, data accuracy and provides accessibility to the information for those legitimate party.

* 1. **Project Category**

The project category of this project is desktop application. A desktop application is a software program that can be run on a computer to perform a specific task by an end-user. The examples of some of the popular desktop applications are, word processing applications such as Microsoft Word and WPS Office which are designed to edit the textual content, gaming applications such as Minesweeper and Solitaire which are used for entertainment, web browsers such as Internet Explorer, Chrome and Firefox which help you to connect to the Internet from your computer, media player applications such as iTunes, Windows Media Player, and VLC media player which let you listen to music, watch videos and movies and create collections of media content.

Updates to the desktop applications should be installed by the end-users. The updates may be published through the Internet, but the installation is usually a manual process done by the end-user. The desktop applications are designed to run in an isolated environment hence they have

fewer security issues. The ability to work without an Internet connection is another common characteristic of desktop applications.

* 1. **Objectives**

The following are objectives of the project:

▪ To develop a portable Smart Attendance System which is handy and self-powered.

▪ To ensure the speed of the attendance recording process is faster than the previous system which can go as fast as approximately 3 second for each student.

▪ Have enough memory space to store the attendance.

▪ Allow students to store their faces by using a GUI.

▪ Able to show an indication to the user whether the face- recognition process is successful or not.

* 1. **Problem Formulation**

Attendance is an important part of daily classroom evaluation. At the beginning and ending of class, it is usually checked by the teacher, but it may appear that a teacher may miss someone, or some students answer multiple times. Face recognition-based attendance system is a problem of recognizing face for taking attendance by using face recognition technology based on high-definition monitor video and other information technology.

* 1. **Existing System**

Existing system is a manual entry for the students. Here the attendance will be carried out in the handwritten registers. It will be a tedious job to maintain the record of the user. The human effort is more here. The retrieval of the information is not an easy as the records are maintained in the handwritten registers.

This application requires connect feed on input into the respective field. Suppose the wrong inputs are entered, the application resist to work. So the user find it difficult to use.

* 1. **Proposed System**

In order to solve the drawbacks of the previous system stated in 1.5, the existing system will need to evolve. The proposed system will reduce the paperwork where attendance will no longer involve any manual recording. The new system will also reduce the total time needed to do attendance recording. The new system will acquire individual attendance by means of facial recognition to secure data accuracy of the attendance.

* 1. **Unique Features of the System**

The followings are the features of project:

▪ The targeted groups of the attendance monitoring system are the students of an educational

institution.

▪ The facial recognition process can only be done for 1 person at a time.

▪ An excel sheet is created which contains the student attendance.

**Chapter 2. Requirement Analysis and System Specification**

1. **Feasibility study**

Three key considerations are involved in the feasibility analysis:

1. Economic Feasibility

2. Technical Feasibility

3. Social Feasibility

Considering the above keys, feasibility of this project can be understood from the following points:

1.Reduces manual effort.

2.Keeps track of a student’s attendance correctly and gives the result.

3.Implementation of camera and sensors make this project totally automated.

4.Easy to be implemented in educational or commercial institutes.

5.Real time operations are done.

6.Images that are to be compared with the snaps taken by the camera can be easily stored in the excel sheet.

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1. **Software Requirement Specification Document**

* **Functional Requirement**

System functional requirement describes activities and services that must provide.

* A user must be able to manage student records.
* An only authorized user must be able to use the system.
* A system must have camera so face recognition should be smooth.
* The administrator or the person who will be given the access to the system must login into the system before using it.
* The information must be entered and managed properly.
* **Non-Functional Requirement**

Non-Functional Requirement are characteristics or attributes of the system that can judge its operation. The following points clarify them:

1. Accuracy and precision: the system should perform its process with accuracy and precision to avoid problem.
2. Flexibility: the system should be easy to modify any wrong should be correct.
3. Security: the system should be secure and saving student’s privacy.
4. Usability: the system should be easy to deal with and simple to understand.
5. Maintainability: the maintenance group should be able to cope up with any problem when occurs suddenly.
6. Speed and Responsiveness: Execution of operations should be fast.

Non-Functional Requirements are as follow:

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

**Chapter 3. Implementation, Testing and Maintenance**

1. **Introduction to Language, IDE, Tools and Technologies used for Implementation.**

**3.1.1 Language**

**Python**

Python is a general-purpose, versatile, and powerful programming language. It’s a great first language because it’s concise and easy to read. Whatever you want to do, Python can do it. From web development to machine learning to data science, Python is the language for you. some of the key advantages of learning Python:

Python is Interpreted − Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is like PERL and PHP.

Python is Interactive − You can sit at a Python prompt and interact with the interpreter directly to write your programs.

Python is Object-Oriented − Python supports Object-Oriented style or technique of programming that encapsulates code within objects.

Python is a Beginner's Language − Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

**3.1.2 IDE**

**PyCharm**

PyCharm IDE is primarily used in web and application development using Python. It helps programmers develop applications efficiently in less time. Some of the common benefits of using it are:

* Auto-completion of code
* Excellent debugging
* Project navigation
* Database tools
* Support for web development

**3.1.3 Tools and Technologies**

1. **OpenCV**

OpenCV (Open-Source Computer Vision Library) is an open-source software library for computer vision and machine learning. OpenCV was created to provide a shared infrastructure for applications for computer vision and to speed up the use of machine perception in consumer products. OpenCV, as a BSD-licensed software, makes it simple for companies to use and change the code. There are some predefined packages and libraries that make our life simple and OpenCV is one of them.

Gary Bradsky invented OpenCV in 1999 and soon the first release came in 2000. This library is based on optimized C / C++ and supports Java and Python along with C++ through an interface. The library has more than 2500 optimized algorithms, including an extensive collection of computer vision and machine learning algorithms, both classic and state-of-the-art. Using OpenCV it becomes easy to do complex tasks such as identify and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D object models, generate 3D point clouds from stereo cameras, stitch images together to generate an entire scene with a high-resolution image and many more.

1. **Haar Cascade**

Haar cascades, first introduced by Viola and Jones in their seminal 2001 publication, Rapid Object Detection using a Boosted Cascade of Simple Features, are arguably OpenCV’s most popular object detection algorithm. Sure, many algorithms are more accurate than Haar cascades (HOG + Linear SVM, SSDs, Faster R-CNN, YOLO, to name a few), but they are still relevant and useful today. One of the primary benefits of Haar cascades is that they are just so fast — it is hard to beat their speed. The downside to Haar cascades is that they tend to be prone to false-positive detections, require parameter tuning when being applied for inference/detection, and just, in general, are not as accurate as the more “modern” algorithms we have today.

Haar cascades are:

* An important part of the computer vision and image processing literature
* Still used with OpenCV
* Still useful, particularly when working in resource-constrained devices when we cannot afford to use more computationally expensive object detectors.

1. **Tkinter**

Python offers multiple options for developing GUI (Graphical User Interface). Out of all the GUI methods, tkinter is the most used method. It is a standard Python interface to the Tk GUI toolkit shipped with Python. Python with tkinter is the fastest and easiest way to create the GUI applications. Creating a GUI using tkinter is an easy task.

To create a tkinter app:

* Importing the module – tkinter
* Create the main window (container)
* Add any number of widgets to the main window.
* Apply the event Trigger on the widgets.

1. **NumPy**

NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, Fourier transform, and matrices. NumPy was created in 2005 by Travis Oliphant. It is an open-source project, and you can use it freely. NumPy stands for Numerical Python.

Why Use NumPy?

In Python we have lists that serve the purpose of arrays, but they are slow to process. NumPy aims to provide an array object that is up to 50x faster than traditional Python lists. The array object in NumPy is called ndarray, it provides a lot of supporting functions that make working with ndarray very easy. Arrays are very frequently used in data science, where speed and resources are very important.

Data Science: is a branch of computer science where we study how to store, use and analyze data for deriving information from it.

NumPy arrays are stored at one continuous place in memory unlike lists, so processes can access and manipulate them very efficiently. This behavior is called locality of reference in computer science. This is the main reason why NumPy is faster than lists. Also it is optimized to work with latest CPU architectures.

NumPy is a Python library and is written partially in Python, but most of the parts that require fast computation are written in C or C++.

1. **Pandas**

Pandas is a Python library used for working with data sets. It has functions for analyzing, cleaning, exploring, and manipulating data. The name "Pandas" has a reference to both "Panel Data", and "Python Data Analysis" and was created by Wes McKinney in 2008.

Why Use Pandas?

Pandas allows us to analyze big data and make conclusions based on statistical theories. Pandas can clean messy data sets and make them readable and relevant. Relevant data is very important in data science.

What Can Pandas Do?

Pandas gives you answers about the data. Like:

Is there a correlation between two or more columns?

What is average value?

Max value?

Min value?

Pandas are also able to delete rows that are not relevant, or contains wrong values, like empty or NULL values. This is called cleaning the data.

1. **Coding standards of Language used.**

* **Limited use of global:**  
  These rules talk about which types of data that can be declared global and the data that cannot be.
* **Naming conventions for local variables, global variables, constants and functions:  
  Some of the naming conventions are given below:**
* Meaningful and understandable variables name help anyone to understand the reason of using it.
* Local variables should be named using camel case lettering starting with small letter (e.g., localData) whereas Global variables names should start with a capital letter (e.g., GlobalData). Constant names should be formed using capital letters only (e.g., CONSDATA).
* It is better to avoid the use of digits in variable names.
* The names of the function should be written in camel case starting with small letters.
* The name of the function must describe the reason of using the function clearly and briefly.
* **Indentation:**  
  Proper indentation is very important to increase the readability of the code. For making the code readable, programmers should use White spaces properly. Some of the spacing conventions are given below:
* There must be a space after giving a comma between two function arguments.
* Each nested block should be properly indented and spaced.
* Proper Indentation should be there at the beginning and at the end of each block in the program.
* All braces should start from a new line and the code following the end of braces also start from a new line.
* **Avoid using a coding style that is too difficult to understand:**  
  Code should be easily understandable. The complex code makes maintenance and debugging difficult and expensive.
* **Code should be well documented:**  
  The code should be properly commented for understanding easily. Comments regarding the statements increase the understandability of the code.
* **Length of functions should not be very large:**  
  Lengthy functions are very difficult to understand. That is why functions should be small enough to carry out small work and lengthy functions should be broken into small ones for completing small tasks.

**Chapter 4. Results and Discussions**

**4.1 Snapshots of system with brief detail of each**

1. **Home Page**

**Diagram

Description automatically generated**

* This is the home page of our project.
* Here we can add user’s face or mark attendance of existing user.

1. **New User Page**

**Graphical user interface, application

Description automatically generated**

* After clicking “Add new user” we will be redirected to this page.
* This page asks the user to enter their name.

1. **Add Data Set**

**A picture containing graphical user interface

Description automatically generated**

* On adding user’s name, we will be redirected to this page.
* This page will start capturing the data set once the user clicks “Capture Data Set”.
* This page also provides option to mark attendance once the dataset have been captured.

1. **Instruction page**

**Graphical user interface, text, application

Description automatically generated**

* After clicking “Capture Data Set” on the previous page we will get this message box.

1. **Camera Frame**

**A picture containing text, person, indoor

Description automatically generated**

* This will capture the several images of user’s face.
* The images which are captured will be stored in the form of “.npy ” file.
* This file is stored in directory named “data”.

1. **Add Data Set after capturing face**

**Graphical user interface, text, application, chat or text message

Description automatically generated**

* Once the data set has been captured and stored in the “data” directory popup message appears “Data has been successfully saved”.
* The “Add Data Set” page will display the total number of images captured.

1. **Attendance Page**

**Graphical user interface, text, application

Description automatically generated**

* This page will appear when we will click “Mark Attendance” on “Home Page” or “Add Data Set” Page.
* On clicking next we will be redirected to the page where the app will open the camera for attendance.

1. **Mark attendance**

**A person wearing a hat

Description automatically generated with low confidence**

* After clicking “Next”, the software opens webcam to mark attendance.
* The software recognizes the person using the KNN algorithm.
* The name of the person is displayed on the leftmost corner of the box.
* Attendance is marked in a “csv” file in the format name , date and time of arrival.

1. **Another Attendance**

**![Graphical user interface, text, application

Description automatically generated]()**

**Graphical user interface, text, application

Description automatically generated**

* Once the attendance is marked, success message will be displayed on the screen.
* After the success message app prompts the user to exit or mark another attendance.

1. **NumPy array files**

**Text

Description automatically generated**

* These are the files containing images captured of various users so that the software can recognize their facial features.

1. **Excel file**

**Graphical user interface, application, table, Excel

Description automatically generated**

* This excel file contains the attendance of the users.
* Data contains the name of user and the date and time.

**4.2 Conclusion**

In this approach, a face recognition based automated student attendance system is thoroughly described. The proposed approach provides a method to identify the individuals by comparing their input image obtained from recording video frame with respect to train image during the respective semester’s registration process. This proposed approach can detect and localize faces from an input facial images present in the database, which is obtained from the recording video frame. From the challenges we faced, it can be concluded that the use of ordinary generic cameras for video replay attacks in a non- intrusive technique may lead us to some cost-effective face anti-spoofing systems. As a conclusion, this proposed system replaces the manual system with an automated system which is fast, efficient, cost and time saving as it replaces the stationary material such as bulky registers and the paperwork.