A Review of - Smart Attendance Monitoring System using Raspberry Pi

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Abstract— **Every organization requires mandatory attendance. Daily attendance registration is a difficult and time-consuming undertaking. There are numerous automated techniques for the same, including biometrics, speech recognition, RFID, and iris recognition. This article offers a quick, clever way to record attendance. Face recognition offers an accurate approach that eliminates uncertainties like fraudulent attendance, high cost, and time consumption because it is well recognized that a person's face acts as their primary form of identification. This system stores attendance data and recognizes faces using the face recognizer module. The employer or parents of the absentee are informed through email of their employee's or ward's absence and their attendance percentage. This project aims to bring new features to existing projects, such as large data storage and quick computation while using fewer instruments.**

Keywords – Facial recognition, OpenCV, the Raspberry Pi 3, a smart attendance system, and SMTP

INTRODUCTION

To track employees' and students' attendance, every organization requires an attendance system. They have a special technique for carrying out the same task. Both manual and automated attendance systems are used by some. Pen and paper are included in the manual method, which is time- and resource-intensive. There is also a chance for proxy attacks and human error. The automated attendance system uses various techniques, including-

I.I RFID - One technique for keeping track of attendance is RFID or Radio Frequency IDentification. An individual using this technology must carry a personal RFID card. Because anyone without authorization can use the card to fake attendance, this approach is both cost-effective and vulnerable to fraud.

I.II Biometric - Voice, iris, and fingerprint recognition are all used by this system. The accuracy of biometric authentication systems varies. Fraud may come from both false acceptance and misleading rejection.

I.III Face recognization – It is the most effective system for identifying people currently in use is face recognition. Any organization, including schools and colleges, can use it. To prevent the problem of recording the attendance of a large number of persons, an attendance tracking system that is quick and reduces the potential of fraudulent attendance is required. An easy and secure method of recording attendance has been developed using this technology. By continuously identifying the faces of workers or students entering the classroom via a camera, this attendance is recorded. The computer program first recognizes the faces before comparing them to the predefined database.

The methods currently used in this field are described in Section II. The proposed method for face recognition and the creation of attendance reports is described in Section III of the paper. A description of the hardware used in the suggested work is provided in Section IV. The outcome is displayed in Section V. Section VI is where the conclusion is discussed.

I. EXISTING TECHNIQUES

The RFID (Radio Frequency IDentification) device's first patent was held by Charles Walton, who is best known for this. Additionally, he was granted a patent for a passive transponder that opens doors without a key. A reader close to the door received a signal from a card with an embedded transponder. The door was unlocked when the reader found a legitimate identity number kept on the RFID tag.[1]

A concept for an attendance tracking system was presented in 2006 by Michael Dobson, Douglas Ahlers, and Bernie DiDario. Each potential attendee will receive an identification tag with wireless communication capabilities as well as scanners to detect the tags as they enter a specific room. [2]

Development of an Attendance Management System Using Biometrics by O. Shoewu and O.A. Idowu. With the aid of a fingerprint device, attendance is electronically taken, and the records are kept in a database. Once students have been identified, attendance is recorded. [3]

The concept of using principal components to represent human faces was created by Sirovich and Kirby in 1987[4] and applied to face detection and recognition by Turk and Pentland in 1991[5]. It tracks a person's face and then recognizes them by contrasting facial features with those of well-known people. PCA is used to first determine an "eigenvector," or principle component factor, and then to find an "eigenface," or set of characteristic features.

Automated Attendance Management System Based on Face Recognition Algorithms: Using algorithms for face detection and recognition, this system tracks each student's attendance by automatically identifying them as they enter the classroom. [6]

Using a computer vision system to monitor driver distraction in real time: This article describes a real-time, non-disturbing drowsiness monitoring system that makes use of the driver's facial expression to recognize and alert tired drivers. This recently published work used the Viola-Jones algorithm to determine the driver's facial features. [7]

The concept of Implementation of IOT based attendance management system on Raspberry Pi was created by Ruhitha, V., Raj, V. P., & Geetha, G., in the 2019 International Conference on Intelligent Sustainable Systems [8].

II. METHODOLOGY

The OpenCV library is used by the proposed methodology. It is a computer vision library that is open-source and free and can be used for both commercial and academic purposes. It works with Windows, Linux, MacOS, iOS, and Android and has interfaces in C++, Python, and Java. It is strongly focused on apps that run in real time. More than 2500 efficient algorithms are included in the collection; these algorithms can be used to find items, recognize faces, and more.

OpenCV has a Face Recognizer class library for face recognition. This uses the command line or Python to recognize and manipulate faces. It is a cutting-edge face recognition library created with deep learning that is very simple and clear. Across numerous computing platforms, the dlib cross-platform, open-source software library is used. The accuracy of the model is 99.38%. This gives you access to a simple and direct face recognition command line tool that enables you to recognize faces from the command line on a folder of images. Figure 3. 1 Flowchart of the Project's Proposed Methodology.

This developed system demonstrates the key steps in building a database of each student enrolled in the course, the recognition mechanism for additional attendance tracking, and the comparison of the results with the specified database for accurate output. Any student who was in the database but not present for the recognition procedure will be considered to have missed that class. The day's attendance data will be created in an excel sheet. The absent parent will receive an email informing them of their child's attendance.

III.I Establishing a Database – Before the recognition procedure, a database of students is created, which contains one image of each person. Through the admin panel, the respected teacher performs this. The administrator will concurrently enter the names of the students as well as the parent's email addresses during this process. A database of all the students will be created in an excelsheet following the use of a camera to capture images.

III.II Face Recognition – The key component of the proposed methodology is this. The teacher will turn on the camera as the students enter the room, and it will continuously identify and detect faces. An excel file containing the attendance of the class along with the date is created after all the students who were present in the class have been identified.

III.III Sending Email – When the attendance sheet is complete, an email notifying the absentee's parent or employer that their child or employee will not be participating in today's class or job assignment will be sent to them within a minute.
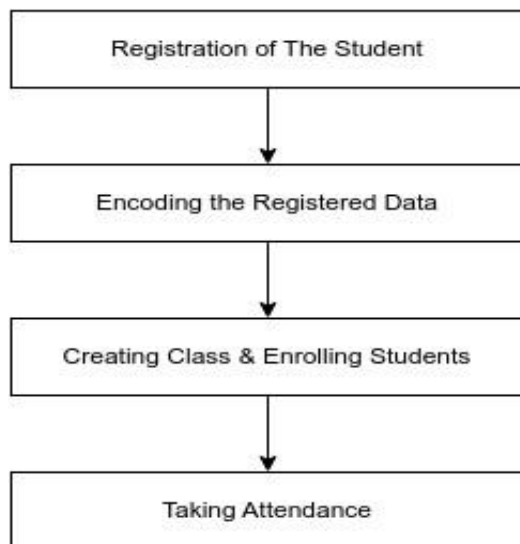

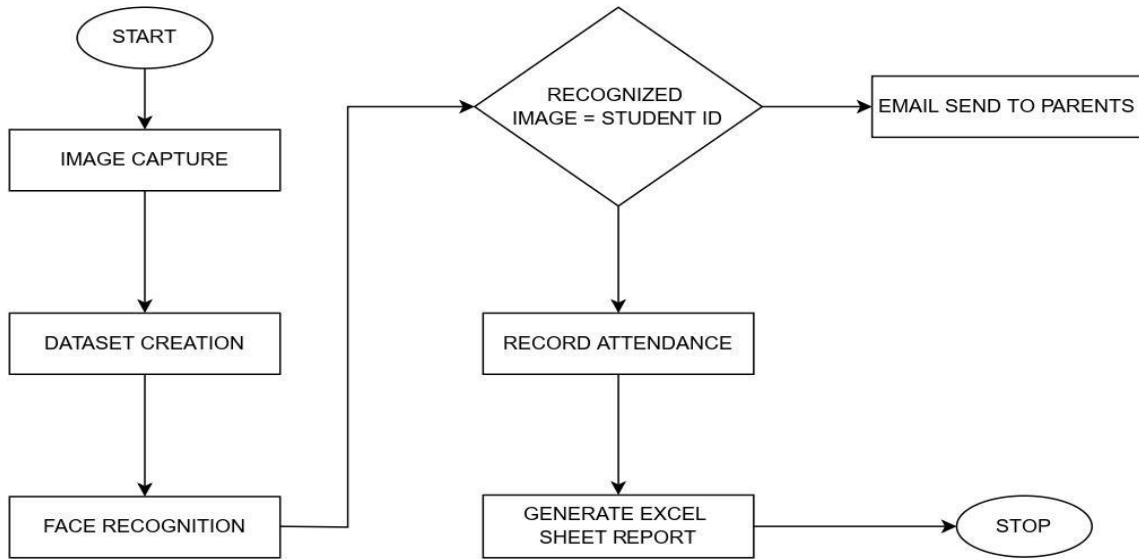Figure: 3.1 Flow Chart Methodology

Figure:3 .2 Flow Chart

III. HARDWARE SETUP

The system's hardware includes the following:g:

IV.I RaspberryPi-3 - The Raspberry Pi is a credit-card-sized, low-cost computer that connects to a computer's screen or television and uses a standard keyboard and mouse to operate. It can perform all tasks that you would perform on a desktop computer. The Raspberry Pi can communicate with the outside world and has been used in a huge variety of digital maker projects.

IV.II Webcam - A webcam is a video camera that feeds or streams its video in real time to or through a computer to a computer network. The video stream can be "captured" by the computer and then saved, viewed, or transmitted to other networks using platforms like the internet and emails

IV.III Display Unit – Screen real estate that can be utilized to show a picture, video, or workspace, as opposed to a two with attachments.

-dimensional display device like a computer monitor.

The system's brain, the Raspberry Pi, is a key component. Utilizing external batteries, power is provided. The tasks carried out by this credit-sized computer include processing, data creation, and result generation. As part of the database creation and recognition processes, a webcam is used to take pictures. SD card is used as external storage and is connected. Pi is linked to a display unit using an Ethernet cable.

Figure 4.2 Illustrates all configurations and necessary components for the suggested model.
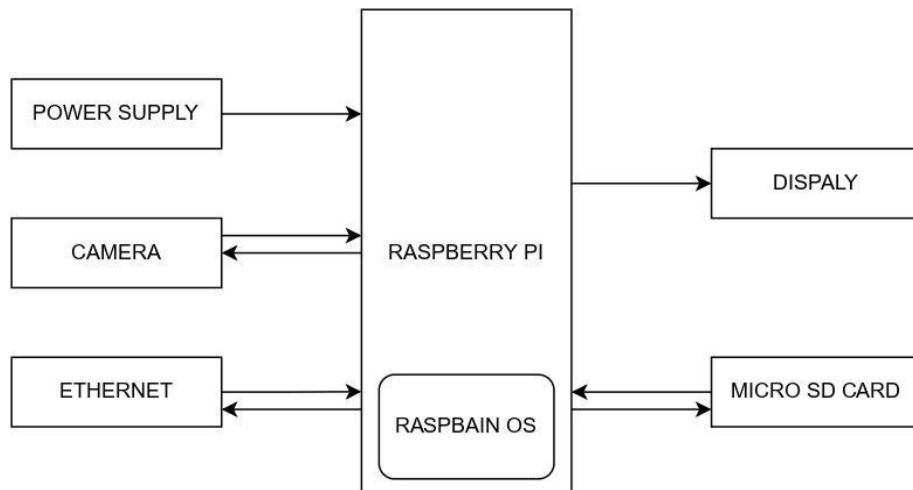
Figure: 4 .1 The Block Diagram

Figure: 4.2 Schematic for hardware

IV. RESULT

The following figures illustrate the model's outcomes.
Figure: 5.1.: Building a database on each student in the class. Each student is only captured once by the webcam, which is saved for subsequent use.
Figure: 5.2: When creating the database, the name of the student and the parent's email address is entered. Figure: 5.3: A database records excel spreadsheet is created. containing each student's name, picture, and email address for their respective parent.

Figure: 5.4: Face is Recognized for recording attendance.
Figure: 5.5: The attendance record is generated as an excel sheet.
Figure: 5.6: To inform absentee parents of their child's attendance in the specific class, an email is sent to their address using the concerned faculty member's ID.

Figure: 5.1 Creating a database

Figure: 5.2 Created a database with parents' email

Figure: 5.3 Spreadsheet of a newly built database

Figure: 5.4 Face Is Recognized

Figure: 5.5 Creating an attendance record

Figure: 5.6 Sending E-mail with Attendance Percentage

V. CONCLUSION

Our project illustrates the importance of automation in the present world using the concept of face recognition. As weall know, a person's face plays a significant role in establishing their identity. This project consists of OpenCV algorithm modules running in Python. This effort also gives people hope for greater improvisation and fresh thinking in light of impending advancements in hardware and technology. The model has a 99.38% accuracy rate and offers a straightforward command line utility for face recognition. This tool is superior to generic algorithms because it just requires one image to work with and does not require grayscale conversion. Thousands of samples are required for the Haar cascade, LBPH, and Eigenfaceface algorithms to determine the distance between points and pixels in an image. The Raspberry Pi's built-in email functionality is used to utilize IOT. We're helped in this via SMT Protocol. There may be plans for the project to boost model accuracy and speed in the future.

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