

# Smart Facial Recognition Attendance System Using ESP32 Cam

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**Abstract:-** The human face holds significant importance as it is a unique identifier for each individual. Facial characteristics are used in face recognition systems. Keeping track of attendance poses a considerable challenge in educational institutions. Face recognition is a method that checks if a person's face in an image matches any faces stored in a database. The main aim of this project is to create an intelligent attendance system using an ESP32 Cam for students in an educational institution. The goal is to enhance the current attendance system's efficiency and effectiveness. To achieve this, we utilize the ESP32 Cam module for face detection and the OpenCV library for face recognition. This system is designed to manage attendance using face recognition techniques, marking a person's presence based on their face. Furthermore, the system not only detects individuals but also records their information in an Excel file.

**Keywords:-** ESP32 CAM, Face Recognition, Face Detection, OpenCV, FTDI Module, Jumper Wire.

## I. INTRODUCTIONS

In colleges, universities, organizations, schools, and offices, keeping track of who's present is a really big deal, and it must be done every day. Usually, people do it by calling out names or using roll numbers, which means they must do it one by one. The main idea of this project is to make a Smart Facial Recognition Attendance System. This system will change the way we do it from manual to automatic. The Smart Facial Recognition Attendance System is a special way to manage attendance in educational institutions. It works by recognizing

the faces of students and keeping a record of who's present. The system uses an ESP32 CAM Module to detect the faces and OpenCV for recognizing the faces and marking the attendance of students. The project's goal is to create a Smart Facial Recognition-Attendance system with the help of ESP32 CAM and Python. With this system, we won't only find out who's present, but we'll also keep a record of the information about the person we find.

The old way of taking attendance in schools and colleges can be really tiring. It's also not very easy for the teachers who have to call out the names of all the students, and it can use up about 5 minutes of the class time. This takes up a lot of time. Using this Smart Facial Recognition Attendance System, we can be able to make attendance work easier and quicker for institutions.

These days, recognizing faces is becoming more and more popular, and it's being used a lot. In this paper, we suggested a system that doesn't just find someone's face but also keeps their information in an Excel file. And we also save how long they were in the picture in another Excel sheet. A smart attendance system that recognizes faces is a new and useful way to make keeping track of attendance easier. It's made to help with attendance in different places like schools, colleges, companies, and groups.

The main purpose of this project is to create a system that uses face recognition to keep track of attendance for students in an institution. This is done to make the attendance system better and work more efficiently than it did before.

## II. LITERATURE SURVEY

Title of paper	Method/ Techniques used	Analysis and Observation
“Face Recognition Based Attendance System Using ESP32 Cam”, <i>International Journal of Research Publication and Reviews</i> ,2020.	ESP32 Cam Module FTDI Module Jumper Wire.	Independent component analysis (ICA), a generalization of PCA, was performed on face images in the FERET database under two different architectures, one that treated the images as random variables and the pixels as outcomes, and a second one that treated the pixels as random variables and the images as outcomes.
“Face Recognition Based Attendance Management System”, <i>International Journal of Engineering Research &amp; Technology (IJERT)</i> ,2020.	Face Recognition; Face Detection; Haar-Cascade classifier; Local Binary Pattern Histogram; attendance system	From this research paper, we analyze that Face detection and recognition are performed using the Haar-Cascade classifier and Local Binary Pattern Histogram algorithm. Faces are detected and recognized from live streaming video of the classroom
“Facial Recognition Attendance System Using Python”, <i>Journal of Software Engineering and Simulation</i> , 2020.	Smart Attendance System, NFC, RFID, Open CV, NumPy.	In this paper, the faces are recorded by portrait acquisition. These portraits are stored in raspberry pie storage. The image undergoes several pre-processing to obtain a grayscale image. Eigen Faces recognizer is used to recognize the faces.
“Face Recognition Based Attendance System.”, <i>International Journal of Engineering Research &amp; Technology (IJERT)</i> ,2020.	SVM, DNN, PCA, and CNN.	PCA for face recognition and other machine learning algorithms in computer vision. In the CNN approach images are fed directly to the CNN module and DNN is used for face detection. CNN calculation is executed to recognize the faces.
“Face detection-based attendance system using ESP32”, <i>Juni Khyat (UGC Care Group I Listed Journal)</i> ,2021.	Face Recognition, Face Detection, ESP32 camera module.	From this research paper we analyze that face detection and recognition was carried out by using an ESP32 cam module which captures the images of the available students in the classroom.
“Attendance Management System using Face-Recognition””, <i>International Journal of Engineering Research &amp; Technology (IJERT)</i> ,2021.	Attendance System, Tkinter, Python, Face detection.	This system is designed in the TKINTER platform supported with the script of PYTHON as well as SQL database. The algorithm used in the system is based on image comparison on the basis of the encoded values of the face from the image from the database with the image recorded by the system in run time.
“A Review Paper on Attendance Management System Using Face Recognition.”, <i>International Journal of Creative Research Thoughts (IJCRT)</i> ,2021.	Viola-Jones Algorithm, Fisher faces Algorithm.	Viola-Jones algorithm, fisher faces was used to create patterns of the faces which were caught, CNN-Convolution Neural Network algorithm is used to detect the different kinds of faces.
“Automatic Attendance Management System Using Face Recognition”, <i>International Journal of Research Publication and Reviews</i> ,2022.	ESP32, FTDI programmer, Face recognition.	This Paper, it uses an ESP32 camera module for face recognition and an FTDI (Future Technology Device International) programmer for Programming. The image is collected by the ESP32 camera module and compared in the database. If the match is found, then it marks the attendance or else it gives an intruder alert.

## III. PROPOSED METHODOLOGY

The Smart Facial Recognition Attendance System typically uses a technique called face analysis. This means it looks at facial parts like the nose length, lip size, distance between eyebrows, and forehead size. These details are kept in the system. When the system has these details in its database, it can recognize them when someone shows up in front of the camera. If the image captured by the camera is matched with the preserved database image, then it automatically marks the

attendance of that student and calculates average monthly and yearly attendance, which is used to find the eligibility criteria of that student for examination.

In this project, we're planning to make a Smart Facial Recognition Attendance System that uses ESP32 CAM and Python for recognizing faces and taking attendance. With this system, it's not only about finding the person but also keeping their details in a Microsoft Excel File. Additionally, we'll note how long they were in the picture in an Excel sheet.

#### A. Software Modules:

For this Smart Face Recognition Attendance System with the ESP32 CAM Module, we will use OpenCV and Visual Studio. OpenCV is a library that's open-source and helps with processing images. Visual Studio is an IDE, here we are writing the script for face recognition also we need to install python and the required libraries for writing face recognition code.

Our system comprises 1 major module with its sub-modules. Our major module is the admin module it comprises many sub-modules as follows:

- Register: With the admin module, we can let students register themselves. They can add information like their name, age, phone number, email address, class password, take a real-time photo, and tell us their department, course, and class.
- Login: Using this module admin is able to log in to the student self Using a username and password.
- View Attendance: Using module admin are able to see student's attendance sheets using their credentials.
- Edit Profile: Using module admin are able to edit student's profile.
- Logout: Using this module admins are able to log out of student profiles so that the integrity of student information is maintained and no one will be able to access student information.

So, the main heavy program we need to run on our computer is the main part that handles everything on the server side. And we also have to get Arduino IDE ready for setting up the ESP32CAM Module.

#### B. Hardware Requirements:

We're going to prepare the Arduino IDE for the ESP32 Camera Module. After that, we'll load the firmware and then focus on the Face Recognition part.

##### ➤ ESP32 CAM Module

The ESP32 based Camera Module, created by AI-Thinker, is powered by a 32-bit CPU and includes both Wi-Fi and Bluetooth/BLE capabilities. It also comes with 520 KB of built-in SRAM and an additional 4M of PSRAM. This module has GPIO Pins that can be used for things like UART, SPI, I2C, PWM, ADC, and DAC.

This module combines with the OV2640 Camera Module, which can capture pictures in really high quality, up to 1600 × 1200 resolution. The camera connects to the ESP32 CAM Board through a 24-pin gold-plated connector.

The board supports an SD Card of up to 4GB. The SD Card stores captured images.

##### ➤ ESP32-CAM FTDI Connection

The board doesn't come with a programmer chip. To put programs on this board, you can use any USB-to-TTL device.

Mainly here we use the FTDI module to control the board and transmit data from the cam module to the system.

## IV. CONCLUSIONS

This proposed Smart Facial Recognition Attendance system is a better model for attendance management for students in the classroom. Our system can mark when students arrive in class, save this information in an Excel sheet, and figure out their average attendance each month and year. This helps us determine if the student meets the criteria for taking exams.

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