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SMART ATTENDANCE SYSTEM USING FACIAL RECOGNIZA - ION

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ABSTRACT:-

The incorporation of technology into many aspects of life has become essential in the modern day. One such area is the automation of attendance tracking, which is an essential function in both businesses and educational institutions. This abstract describes a new method for creating a smart attendance system that uses Python programming and an ESP32 microcontroller to implement facial recognition technology .The suggested solution uses facial recognition technology to transform the way that attendance is taken. Utilizing the ESP32 microcontroller, which integrates Bluetooth and Wi-Fi, makes the system adaptable and simple to set up in many settings .The main purpose of the system is to use a camera module interfaced with the ESP32 to take real-time facial image captures of people. Then, using sophisticated machine learning algorithms created especially for facial recognition tasks, these photographs are processed and examined. Python is the main tool used to build these algorithms because it is a programming language that is both versatile and commonly utilized for such applications. Face detection, feature extraction, and identification modules are important parts of the system that work together well in the ESP32 environment. When a recognition is successful, the system logs the person's identity and time of attendance. The system can also have features like user interface for interaction, database administration for maintaining attendance records, and connectivity options for remote control and monitoring.

KRYWORDS:-ESP32 CAMERA, Face Recognition System , Face Detection Process, OpenCV, FTDI Module, Jumper Wire.

INTRODUCTION:-

Keeping track of who is present is a huge concern in offices, schools, colleges, and other institutions, thus it must be carried out daily. People usually have to do it one at a time by shouting out names or using roll numbers. The principal aim is to bulid an intelligent attendance system through facial recognition. We will switch from a manual to an automated process thanks to this solution. The Smart Facial Recognition Attendance System is one novel method of controlling attendance in educational settings. It keeps track of who is present and recognizes the faces of the kids.The system makes use of an ESP32 CAM Module to identify faces, using OpenCV to identify faces and record students' attendance. The project's objective is to use Python and the ESP32 CAM to develop a Smart Facial Recognition-Attendance system. Not only will this system allow us to determine who is present, but it will also allow us to record the

details of each individual we locate. This is being done in an effort to improve and streamline the attendance system. In many schools and universities, the most widely used attendance system is based on biometric technology. By recording, this method will cut down on the quantity of papers. By utilizing RFID and the Internet of Things (IoT) to automatically take attendance, we may benefit from this approach. The data is taken from the database whenever a particular student's photo is taken. The database may be updated with the student attendance .The following components are used for the Smart Attendence System.

1)IR MODULE :

An Motion detection and temperature monitoring are two functions of an infrared sensor. All things in the infrared spectrum typically release some kind of radiation with a temperature. These rays are invisible to the human eye, but an infrared sensor can detect them. An infrared photodiode serves as the detector.The resistance and output voltage of photodiodes changes with the amount of IR light they are exposed to.

2)FTDI MODULE :-

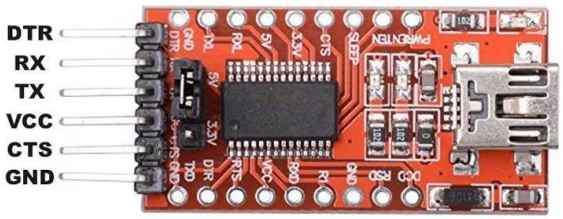


Fig no 1-FTDI Module

The FTDI module refers to hardware modules or chips produced by FTDI, a company known for its USB interface technology. FTDI's modules are commonly used for USB-to-serial communication and are popular in various electronic applications, including microcontroller programming, industrial automation, and data logging.

FTDI modules typically provide a bridge between USB and other serial protocols such as UART or SPI . They are commonly used when a device needs to communicate with a computer over USB but lacks native USB support.
Some common FTDI modules include the FT232 series and FT2232 series, which offer various features and capabilities depending on the specific application requirements. These modules often come with drivers and software libraries that facilitate communication between the device and the computer.

3)ESP32 CAMREA MODULE :

Fig no 2-ESP32 Cam Module

It is challenging to cover all of the specifications in this Getting Started with ESP32 guide because ESP32 has a lot more functionality than ESP8266. Thus, I've included a list of some of the ESP32's key specifications here. But I strongly advise you to consult the Datasheet for the full set of specifications. The ESP32-CAMERA module is a compact development board that combines an ESP32 microcontrollers with a camera modules, enables the users to create projects that involve wireless communication and image/video processing.

4)JUMPER WIRES :

Fig no 3-Jumper wires

Jumper wires has been commonly used in electronics and electrical prototyping to bulid up the temporary connections between different components on breadboard, or between a breadboard and other components such as microcontrollers, sensors, or LEDs. They typically consist of a flexible wire with metal pins or connectors at each end.

OPERATION AND WORKING:-

There are various processes involved in integrating facial recognition with an ESP32-CAM module in Python to create a smart attendance system. Let's see how such a system functions and operates:

1)Initialization:-

- Assemble and confirm that your ESP32-CAM module is linked to your local network.
- If MicroPython firmware isn't already installed on the ESP32, install it now.
- On your PC, set up a Python development environment.

2)Library Installation:-

Install the necessary Python libraries for image capture (picamera), facial recognition
(face_recognition), and ESP32 connectivity
(micropython-urllib, ampy, etc.).

3) *Image Capture*:

- To program the ESP32-CAM module to take pictures on demand or at regular intervals, write Python code.
- Using HTTP requests or other communication protocols, move the ESP32's collected photos to your computer.

4) *Facial Recognition Model*:

- Get a collection of photos with the faces of the people whose attendance you wish to monitor.
- To train a facial recognition model on this dataset, use the face_recognition package. Encoding faces and matching them to associated identities is required for this.

5) *Attendance Marking*:

- Utilize the learned facial recognition model to identify faces in newly taken pictures.
- Compare the identified faces in your dataset with the known faces.
- Mark that person's attendance if there is enough confidence that the identified face matches the known face.

6) *Attendance Storage*:

- For future use, save the attendance records in a file or database.
- Add pertinent details like the time and date as well as the identified person's identify.

SCHEMATIC DIAGRAM AND CONNECTION:-

The board doesn’t have a programmer chip. So In order to program this board, you can use any type of *USB-to-TTL Module*. There are so many *FTDI Module* available based
on **CP2102** or **CP2104** Chip or any other chip.Make a following *connection between FTDI Module and ESP32CAM* module.

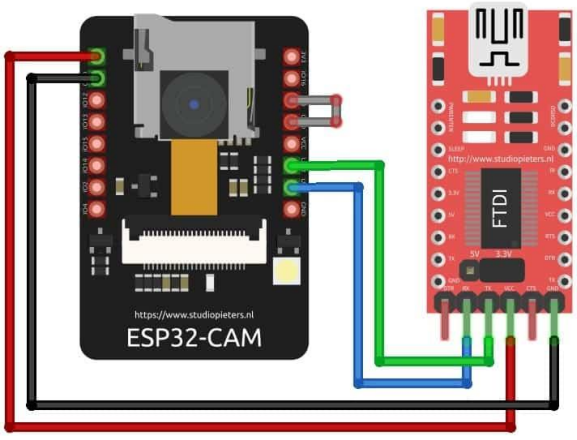


Fig no 4:-Schematic diagram.

ESP32-CAM	FTDI Programmer
GND	GND
5V	VCC
U0R	TX
U0T	RX
GPIO0	GND

Fig no 5:-Pin Connection

Connect the *5V* & *GND* Pin of ESP32 to 5V & GND of FTDI Module. Similarlv, connect the *Rx* to *UOT* and *Tx* to *UOR* Pin. And the most important thing, you need to short the *IO0* and *GND* Pin together. This is to put the device in *programming mode*. Once programming is done you can remove it.

FLOW CHART:-

Fig.no5 general flow diagram of system This flowchart outlines the sequential steps involved in the operation of the Smart Attendance Management System using ESP32- CAM. It begins with system initialization, proceeds to
image capture and facial recognition, records attendance data, stores information, and optionally provides display or notifications. This process ensures efficient and accurateattendance tracking in various environments.

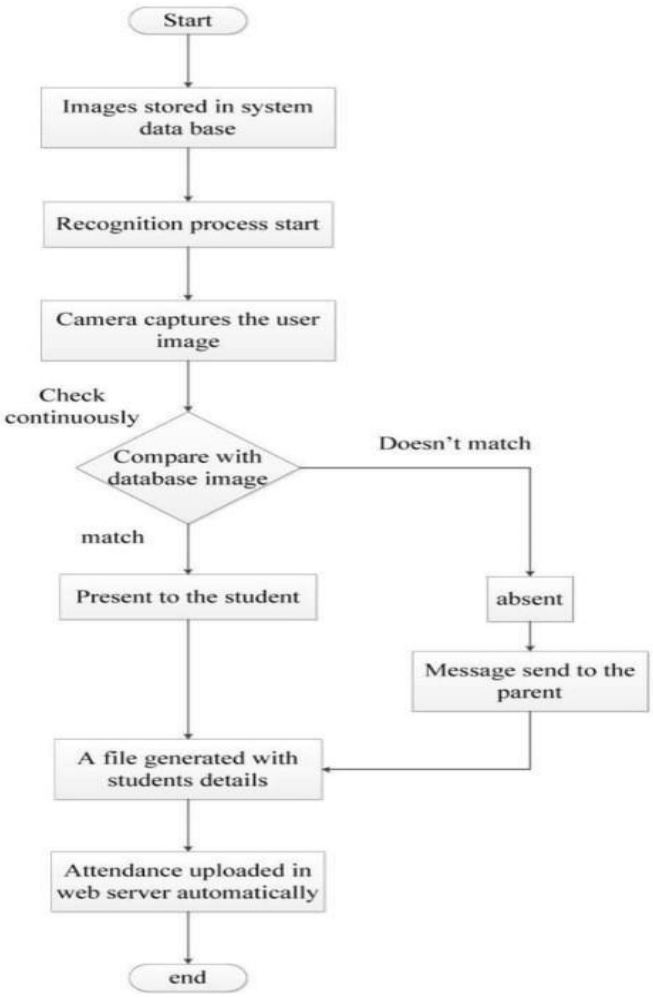


Fig no :-5 Flowchart

BLOCK DIAGRAM:-

Explanation of the block diagram:- Once an individual's samples are stored, it considers them registered. Afterwards, if the individual is already registered, the camera will recognize them and record their presence along with the time and date when they stand in front of it.

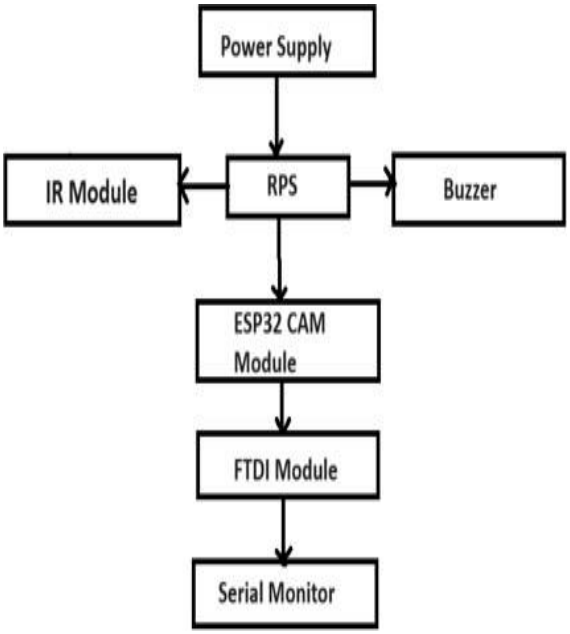


Fig no 6:-Block Diagram.

IR MODULE :-

An Infrared (IR) modules has been used in a facial recognition smart attendance system to improve performance under different lighting situations. IR sensors increase the accuracy and dependability of the system by assisting in the detection and capture of face characteristics even in dimly illuminated or nighttime environments.

RPS:-

A RSP is an electronic circuit or device which provides a constant, stable output voltage or current regardless of variations in input voltages or load conditions. Regulated power supply are commonly used in a wide scale ranges of electronic devices and systems
to ensure consistent and reliable power delivery.

BUZZER:-

An audio buzzer within a facial recognition smart attendance system can serve as a means of providing feedback regarding the success or failure of recognition.

ESP32 CAM:-

The ESP32 has integrated Bluetooth and Wi-Fi, making it simple to communicate with other devices or a central server. This makes it possible to integrate cloud services or update attendance data in real-time. The ESP32 has networking feature that make Internet of Things (IoT) integration easier. Sending attendance data to cloud servers is a simple process that allows for remote control and monitoring.

FTDI MODULE:-

Some common FTDI modules include the FT232 series and FT2232 series, which offer various features and capabilities depending on the specific application requirements. These modules often come with drivers and software libraries that facilitate communication between the device and the computer. FTDI modules have gained popularity due to their reliability, ease of use, and wide availability of documentation and support resources. They are widely used by hobbyists, electronics enthusiasts, and professionals alike in.

SERIAL MODULE:-

Developers can find and fix problems with the code or the face recognition algorithm by using the Serial Monitor to print debug messages and variables. The Serial Monitor can be used to give developers or users more information about system events or failures if the system has user interfaces like displays or LEDs.

METHODOLOGY:-

The methodology of a smart attendance system involves outlining the systematicapproach used to design, develop, implement, and maintain the system. Belowis a structured methodology for creating a smart attendance system.

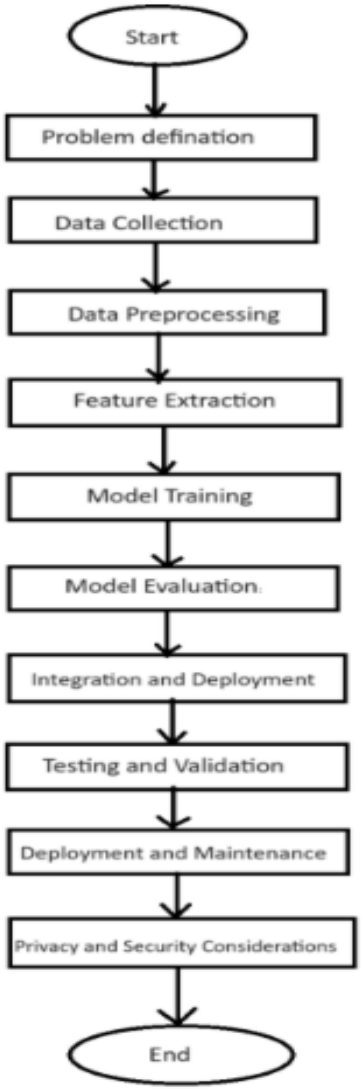


Fig no 7-Methodology

1)PROBLEM DEFINATION:

Define the requirements and objectives of the attendance system, including accuracy goals, scalability, and integration with existing systems.

2)DATA COLLECTION:

Gather a diverse dataset of facial images representing individuals expected to use the attendance system.Ensure the dataset includes variations in lighting conditions, facial expressions, poses, and occlusions.

3)DATA PREPROCESSING:

Perform preprocessing steps to enhance the quality and consistency of the facial images.
Resize images to a uniform size. Normalize pixel values. Apply techniques to enhance contrast and reduce.
Detect and crop faces from image if necessary

4) FEATURE EXTRACTION:

Extract relevant features from the preprocessed facial images to represent each individual uniquely. Common techniques include:-

- Principal Component Analysis (PCA).
- Local Binary Patterns (LBP).
- Deep learning-based feature extraction using convolutional neural networks (CNNs).

5)MODEL TRAINING:

Train a facial recognition model using the extracted feature and corresponding lables(person identies).
Choose an appropriate machine learning or deep learning algorithm

- Support Vector Machines (SVM), k-Nearest Neighbors (k-NN), or Random Forests for traditional machine learning
- Convolution Neural Networks(CNNs) for deep learning-based approaches.
- Split the dataset into training and validation sets to evaluate the model's performance

6) MODEL EVALUATION:

Evaluate the trained model on the validation set to access its accuracy, precision, recall,and other performance metrices. Fine-tune the model hyperparameter and architecture as needed to improve performance

7) INTEGRATION AND DEPLOYMENT:

Integrate the trained model into the attendance system framework.
Develop user interface for enrollment(adding new user to the system) and attendance recording
Implement real-time facial recognition functionality for attendance tracking during events or classes.

8) TESTING AND VALIDATION:

Conduct extensive testing of the complete system in various scenarios to ensure reliabllity and accuracy
Validate the system's performance against ground truth attendance records to verify accuracy and consistency.

9)DEPLOYMENT AND MAINTENANCE:

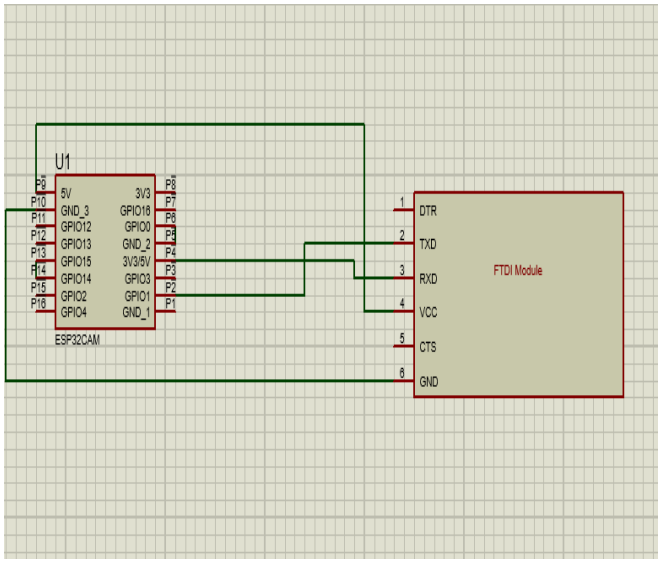
Deploy the smart attendance system in the target environment, whether it’s a classroom, office, or venue
Continously monitor and maintain the system, addressing any performance issues, security concerns, or scalability challenges

10)Privacy and Security Considerations:

Implement measures to protect user privacy and data security:

- Ensure compliance with relevant regulations such as GDPR.
- Encrypt sensitive data, such as facial images and attendance records.
- Implement access controls and authentication mechanisms to prevent unauthorized access to the system.

SOFTWARE SIMULATION RESULT:-



RESULTS:-

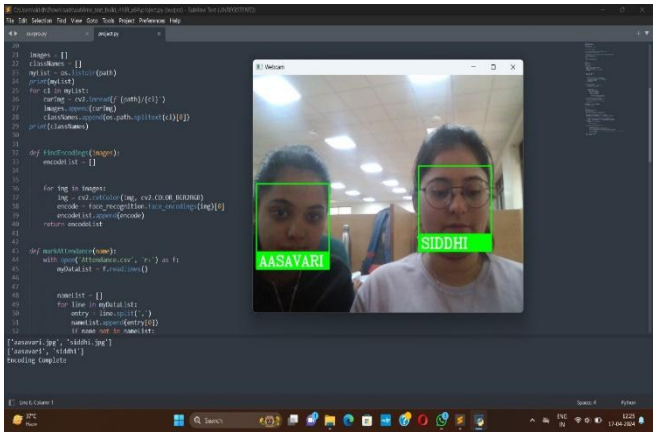


Fig no 9:-Final Result

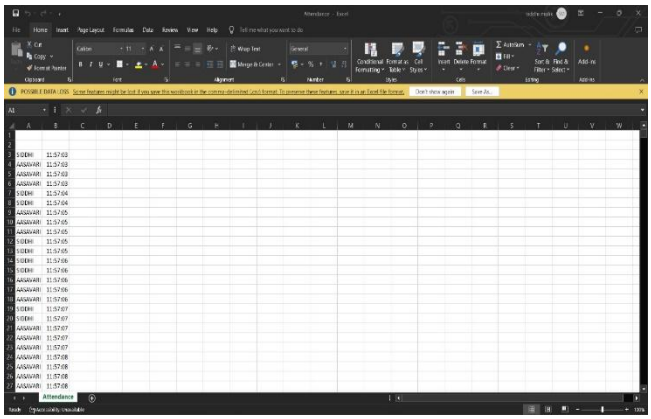


Fig no 10:Excel Sheet

CONCLUSION:-

Facial detection and identification are used in the proposed attendance system to automate the management of student attendance. The Python face recognition module's built-in capabilities are used to develop face recognition capability.The system creates attendance reports that include the recorded timings along with the names of the corresponding students. This data is also kept on file in an Excel spreadsheet for future use. Additionally, administrators and educators benefit from an additional layer of accessibility and ease thanks to the system's capacity to store this data in an Excel

sheet. Because face recognition is contactless, it complies with modern health and safety regulations, which makes it especially applicable in different workplace and educational environments.

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