PROJECT REPORT

FACE RECOGNITION BASED ATTENDANCE SYSTEM USING ESP32 CAM

SUBMITTED BY:

22MIS7062 - KANNELURU SAKETH

22MIC7120 - THATI GNANESH REDDY

22MIS7116 - VAGICHARLA VENKAT

22MIC7081 - GUDA ROHITH SAI

22MIS7124 - SOUMYA SHREE PANDA

22MIC7276 - MENDA AKHILA SREE

UNDER THE GUIDANCE OF:

PROF.ASISH KUMAR DALAI

(Department of Computer Science and Engineering)

UNIVERSITY: VIT-AP

ABSTRACT:

This research presents the development of a face recognition system leveraging the capabilities of the USP32 CAM (Universal Serial Port 32 Camera) in conjunction with the FTDI (Future Technology Devices International) module. Face recognition technology has gained significant attention for its applications in security, surveillance, and human-computer interaction. The integration of USP32 CAM and FTDI module offers a robust and versatile platform for implementing an efficient and reliable face recognition solution.

The USP32 CAM, equipped with advanced image capture capabilities, provides high-resolution facial images, contributing to the system's accuracy. The FTDI module serves as a bridge between the USP32 CAM and the processing unit, facilitating seamless communication and data transfer. This combination allows for real-time image acquisition, preprocessing, and feature extraction for subsequent face recognition tasks.

Key components of the proposed system include facial detection algorithms, feature extraction techniques, and machine learning models for classification. The system employs state-of-the-art methods to detect and localize faces within the acquired images. The models are trained on a data set of facial images to learn unique patterns and characteristics, enabling accurate and reliable identification of individuals. The system can be adapted for various applications, including access control systems, surveillance, and attendance management.

The proposed face recognition system offers several advantages, including real-time processing, high accuracy, and ease of integration with existing systems. The use of the USP32 CAM and FTDI module provides a cost-effective solution with minimal hardware requirements. The experimental results demonstrate the system's effectiveness in recognizing faces under different lighting conditions, poses, and facial expressions.

In conclusion, the integration of the USP32 CAM and FTDI module in a face recognition system showcases a promising solution for practical applications in security and human-computer interaction. The presented system exhibits robust performance, making it suitable for deployment in real-world scenarios.

In this pandemic rapid use of online systems and less touches system the one of the most - factor that is face attendance system which replace the finger biometric attendance, due to the increase crime in this world there is the heavily fraud with attendance in finger biometric system. The blueprint of finger can be available and due to that there is security breakdowns are mainly possible, so to minimize that face recognition system uses as the purpose of taking attendance in the offices, industries, school, colleges etc.

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INTRODUCTION:

Face Recognition System Based Attendance Using ESP32 Cam Module is one of the most important applications of biometric based authentication system in the last few decades. The earliest pioneers of facial recognition were Woody Bledsoe, Helen Chan Wolf and Charles Bisson. In 1964 and 1965, Bledsoe, along with Wolf and Bisson began work using computers to recognise the human face.

FACE RECOGNITION SYSTEM CONSTRUCTION:

It is composed on the basis of two components-

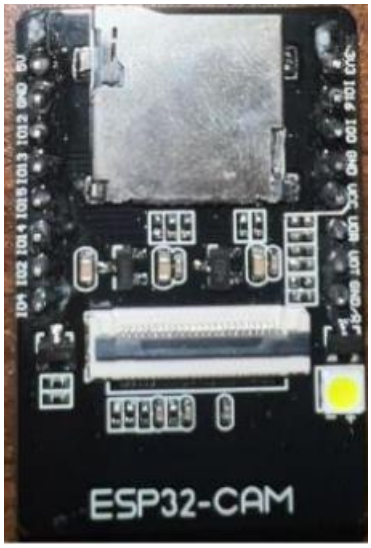
1. ESP32 Cam Module

2. FTDI Module

3. Jumper Wire

ESP32 CAM:

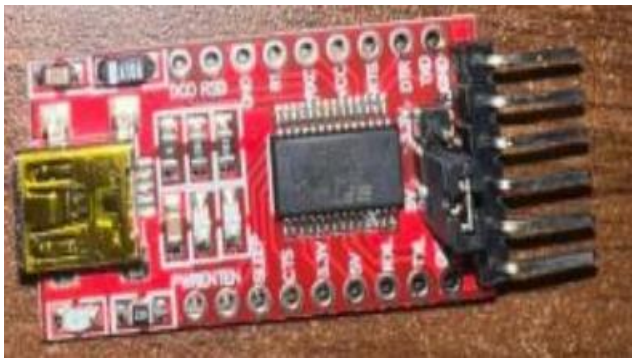
ESP32 has a lot more features than ESP8266 and it is difficult to include all the specification this Getting Started with ESP32 guide. So, I made a list of some of the important specifications of ESP32 here. But for complete set of specifications, I strongly suggest you to refer to the Datasheet. ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces.



FTDI MODULE:

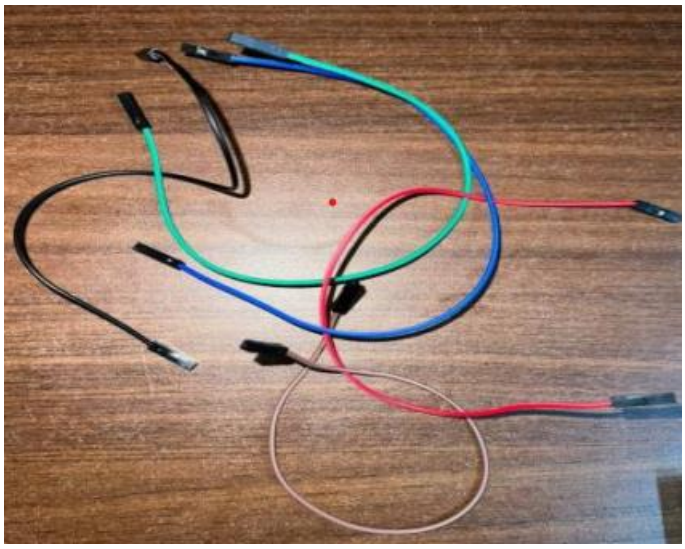
FTDI USB to TTL serial converter modules are used for general serial applications. They are popularly used for communication to and from microcontroller development boards such as ESP-01s and Arduino micros, which do not have USB interfaces. This is a USB programmer which enables you to upload new firmware for the ARPIE. This programmer can also be used with other “bare bones Arduino” projects or as a general USB- to-TTL serial interface. The FTDI USB to TTL serial converter module is a UART (universal asynchronous receiver- transmitter) board used

for TTL serial communication. It is a breakout board for the FTDI FT232R chip with a USB interface, can use 3.3 or 5 V DC and has Tx/Rx and other breakout points.



JUMPER WIRES:

The main purpose of jumper wires is to connect two points in any circuit. All electronics stocks jumper wire in a variety of lengths. These wires are generally used with breadboards and other prototyping tools and it make easy to change a circuit as needed. Jumper wires are used in our system for the connection of all the components to each other



PROBLEM DEFINTION:

Background:

With the increasing demand for secure and efficient authentication systems, the development of a robust face recognition system is crucial. The integration of the USP 32 Cam FTDI module offers an opportunity to enhance the system's capabilities. This project aims to create a face recognition system that leverages the features of the USP 32 Cam FTDI module for reliable and fast facial recognition.

Problem Statement:

Design and implement a face recognition system utilizing the USP 32 Cam FTDI module to achieve high accuracy, speed, and reliability in facial identification.

Objectives:

a. Hardware Integration:

Integrate the USP 32 Cam FTDI module into the face recognition system hardware architecture, ensuring seamless communication and compatibility.

b. Facial Feature Extraction:

Develop algorithms to extract key facial features from the images captured by the USP 32 Cam FTDI module, focusing on accuracy and speed.

c. Database Management:

Implement a secure and efficient database to store facial features and corresponding identities for recognition purposes.

d. Real-time Recognition:

Achieve real-time face recognition using the integrated system, with a focus on minimizing processing time and optimizing performance.

e. User Interface:

Design a user-friendly interface for system configuration, monitoring, and interaction, allowing users to manage the face recognition system effectively.

f. Security and Privacy:

Implement security measures to protect the system from unauthorized access and ensure user privacy in the face recognition process.

Methodology:

A. Hardware Setup:

Acquire and set up the USP 32 Cam FTDI module with the necessary components for the face recognition system.

B. Algorithm Development:

Develop and optimize facial recognition algorithms for feature extraction and matching, considering the capabilities of the USP 32 Cam FTDI module.

C. Database Implementation:

Create a secure and scalable database structure to store facial features and corresponding identities.

D. Integration and Testing:

Integrate the hardware components, algorithms, and database into a cohesive system. Conduct rigorous testing to ensure accuracy, speed, and reliability.

E. Security Implementation:

Integrate security measures such as encryption and authentication to protect the system from unauthorized access and ensure user privacy.

Expected Outcomes:

a. A fully functional face recognition system with integrated USP 32 Cam FTDI module.

b. High accuracy and speed in facial recognition.

c. User-friendly interface for system management.

d. Implementation of security measures to safeguard the system.

Significance of the Project:

The successful development of this face recognition system can find applications in various fields, including security systems, access control, and identity verification, contributing to advancements in biometric technology.

PROCEDURE:

MATERIALS USED:

1. ESP32-CAM Board AI-Thinker
2. FTDI Module
3. Micro-USB Cable
4. 10 Jumper Wires

PROCEDURE:

1.FTDI Programmer Pins:

- TX (Transmit):
  Connect this pin to the RX pin on the ESP32-CAM.
- RX (Receive):
  Connect this pin to the TX pin on the ESP32-CAM.
- GND (Ground):
  Connect this pin to the GND pin on the ESP32-CAM.
- 3.3V (Power):
  Connect this pin to the 3.3V pin on the ESP32-CAM.

2.ESP32-CAM Pins:

- TX (Transmit):
  Connect this pin to the RX pin on the FTDI programmer.
- RX (Receive):
- Connect this pin to the TX pin on the FTDI programmer.
- GND (Ground):
  Connect this pin to the GND pin on the FTDI programmer.

3. 5V or 3.3V (Power): Connect this pin to the 5V or 3.3V pin on the FTDI programmer (choose based on the ESP32-CAM's voltage requirement).

4. Once our equipment is connected, the system will open aurdino. Now, click on the serial monitor and then copy the selected IP address present in the serial monitor.

5. Now open python and replace our selected IP address with above highlighted Ip address

6. After replacing the IP address, save it and run the code. An interface will pop up by showing all the registered ID numbers.

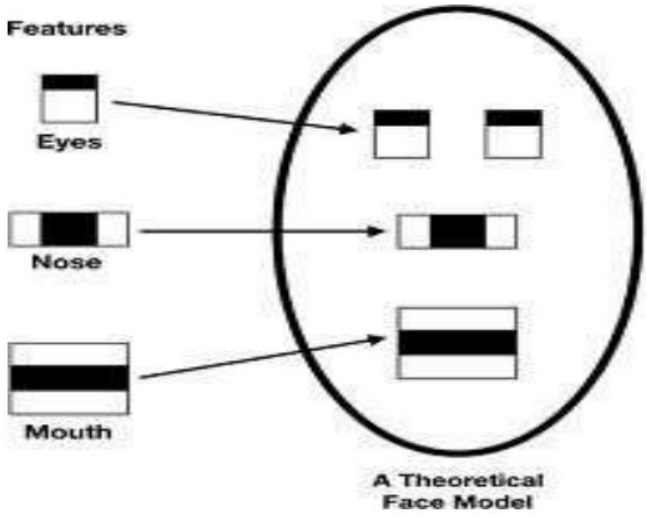
Typically the process can be divided into four stages-

1. Database creation

2. Face Detection

3. Face Recognition

4. Attendance Updation.



CODE AND RESULT:

CODE:

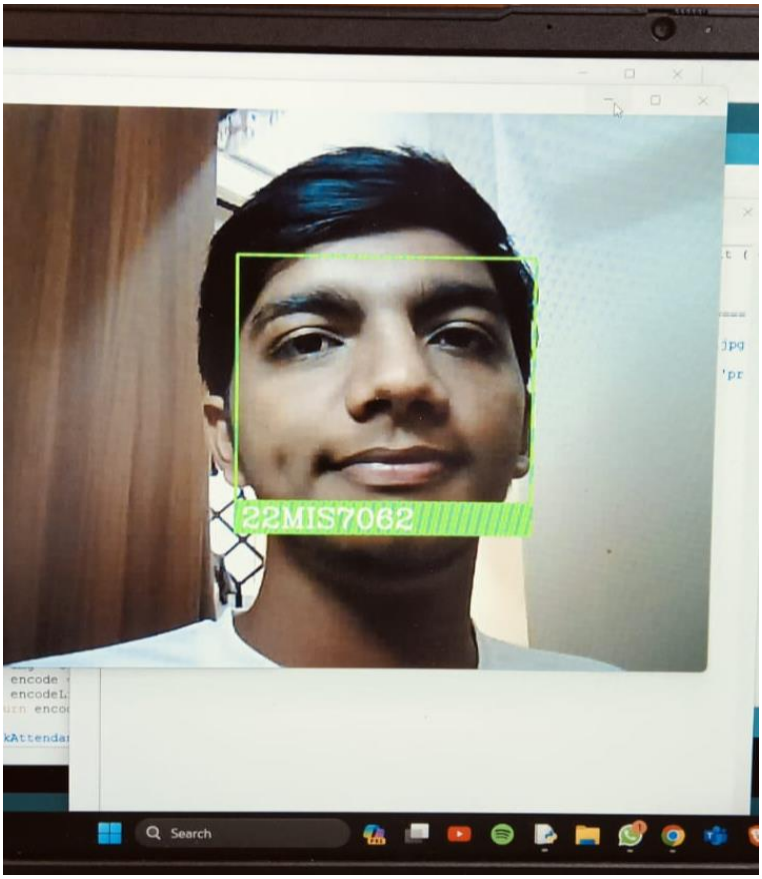
```
import pandas as pd
import cv2
import urllib.request
import numpy as np
import os
from datetime import datetime
import face_recognition
path = r'C:\Users\saket\OneDrive\Documents\ecs\ATTENDANCE\image_folder'
url = 'http://192.168.137.153/cam-hi.jpg'
##"'cam.bmp / cam-lo.jpg /cam-hi.jpg / cam.mjpeg '"
csv_file_path = os.path.join(os.getcwd(), 'attendance', 'Attendance.csv')
if os.path.isfile(csv_file_path):
    print("File exists...")
else:
    df = pd.DataFrame(list())
    df.to_csv(csv_file_path, index=False)
images = []
classNames = []
myList = os.listdir(path)
print(myList)
for cl in myList:
    curImg = cv2.imread(f'{path}/{cl}')
    images.append(curImg)
    classNames.append(os.path.splitext(cl)[0])
print(classNames)
def findEncodings(images):
    encodeList = []
    for img in images:
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        encode = face_recognition.face_encodings(img)[0]
        encodeList.append(encode)
    return encodeList
def markAttendance(name, marked_list):
    with open(csv_file_path, 'a+') as f:
        if name not in marked_list:
            now = datetime.now()
            dtString = now.strftime('%Y-%m-%d %H:%M:%S')
            f.writelines(f'\n{name},{dtString}')
            marked_list.append(name)
            print(f'{name} attendance marked at {dtString}')
```

```
marked_list = []  # List to track marked attendees in the current session
encodeListKnown = findEncodings(images)
print('Encoding Complete')
while True:
    img_resp = urllib.request.urlopen(url)
    imgnp = np.array(bytearray(img_resp.read()), dtype=np.uint8)
    img = cv2.imdecode(imgnp, -1)
    imgS = cv2.resize(img, (0, 0), None, 0.25, 0.25)
    imgS = cv2.cvtColor(imgS, cv2.COLOR_BGR2RGB)
    facesCurFrame = face_recognition.face_locations(imgS)
    encodesCurFrame = face_recognition.face_encodings(imgS, facesCurFrame)
    for encodeFace, faceLoc in zip(encodesCurFrame, facesCurFrame):
     matches = face_recognition.compare_faces(encodeListKnown, encodeFace)
     faceDis = face_recognition.face_distance(encodeListKnown, encodeFace)
     matchIndex = np.argmin(faceDis)
if matches[matchIndex]:
            name = classNames[matchIndex].upper()
            y1, x2, y2, x1 = faceLoc
            y1, x2, y2, x1 = y1 * 4, x2 * 4, y2 * 4, x1 * 4
            cv2.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 2)
            cv2.rectangle(img, (x1, y2 - 35), (x2, y2), (0, 255, 0), cv2.FILLED)
            cv2.putText(img, name, (x1 + 6, y2 - 6), cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 2)
            markAttendance(name, marked_list)

    cv2.imshow('Webcam', img)
    key = cv2.waitKey(5)
    if key == ord('q'):
        break
cv2.destroyAllWindows()
```

RESULT:

```
Edit  Shell  Debug  Options  Window  Help
Python 3.10.7 (tags/v3.10.7:6cc6b13, Sep  5 2022, 14:08:36) [MSC v.1933 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.

=============== RESTART: C:\Users\saket\OneDrive\Documents\c10.py ==============
File exists...
['22mic7081.jpg', '22mic7120.jpg', '22mis7062.jpg', '22mis7116.jpg', 'DEEPAK.jpg
', 'ellon musk.jfif', 'priyansh.jfif', 'usain bolt.jpg']
['22mic7081', '22mic7120', '22mis7062', '22mis7116', 'DEEPAK', 'ellon musk', 'pr
iyansh', 'usain bolt']
```

OUTPUT:



Possibilities Of the Face Recognition System Usings:

Face Recognition Based Attendance System ideal for patrolling the enhanced the feature of attendance. Also help in real time attendance, archaeological, advertising purpose etc. It also helps in the accuracy of,

- College
- School
- Offices
- Industry
- Government Sectors

RISKS:

The main danger is error in Open CV which may be due to following things:

1.Runtime Error
2. Implementation
3.Compile time Error

These risks can be predicted therefore, the action should be taken to prevent their uprising. The open cv status and other telemetry data, including code can be controlled remotely by the system, in case on exceeding one parameter there a system that will give a alert. This will allow take the action like emergency recall the system branch. The sensors and software that based the run path and on the detected obstacles continuously update the attendance are responsible for the avoid of any obstacles.

CONCLUSION AND FUTURE SCOPE:

CONCLUSION:

This system aims to build an effective class attendance system using face recognition techniques. The proposed system will be able to mark the attendance via face Id. It will detect faces via webcam and then recognize the faces. After recognition, it will mark the attendance of the recognized student and store it in Excel sheet with the particular date and time corresponding to their registration number.

FUTURE SCOPE:

The future scope for a face recognition system using the USP 32 Cam FTDI module can be broad and may involve enhancements, expansions, or integrations with emerging technologies. Here are some potential avenues for future development.

Deep Learning Integration:

Explore the integration of deep learning techniques, such as convolutional neural networks (CNNs), for improved facial feature extraction and recognition accuracy. Deep learning models can adapt and learn complex patterns, enhancing the system's performance over time.

Cloud Integration:

Implement cloud-based storage and processing to enable scalability and remote access. This could involve uploading facial features to the cloud for storage, analysis, and retrieval, providing a more flexible and scalable solution.

Edge Computing:

Investigate the possibility of implementing edge computing capabilities, allowing the system to perform facial recognition locally on the device. This can enhance real-time processing and reduce dependency on constant internet connectivity.

Mobile Application Integration:

Develop a mobile application that interacts with the face recognition system. This can enable users to monitor and control the system remotely, receive notifications, and access facial recognition results on their mobile devices.

Multi-Modal Biometrics:

Expand the system to incorporate multi-modal biometrics, combining facial recognition with other biometric modalities such as fingerprint or iris scanning. This can enhance security and accuracy by using multiple forms of identification.

APPLICATIONS:

The face recognition system using the USP 32 Cam FTDI module has various applications across different domains due to its potential in providing secure and efficient identification. Here are some notable applications:

1.Access Control Systems:

Implement the face recognition system for secure access control in organizations, residential complexes, or high-security areas. It provides a convenient and reliable method for granting or denying access based on recognized faces.

2.Time and Attendance Tracking:

Use the system for tracking attendance in workplaces or educational institutions. It offers a non-intrusive and efficient way to monitor attendance, reducing the reliance on traditional methods like card-based systems.

3.Biometric Security in Smartphones:

Integrate the face recognition system into smartphones for biometric security. This application allows users to unlock their devices and authenticate transactions using facial recognition.

4.Airport Security and Border Control:

Utilize the face recognition system for enhancing airport security and border control. It can streamline the check-in process, identify individuals on watchlists, and improve overall security measures.

5.Financial Transactions:

Incorporate facial recognition in financial institutions for secure authentication during transactions. This can reduce the risk of fraudulent activities associated with traditional authentication methods.

6.Healthcare Patient Identification:

Implement the system in healthcare settings for secure patient identification. This can enhance the accuracy of patient records, reduce errors, and improve overall healthcare management.

7.Education Institutions:

Use the system in educational institutions for secure access to classrooms, libraries, or sensitive areas. It can also be employed to enhance campus security.

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