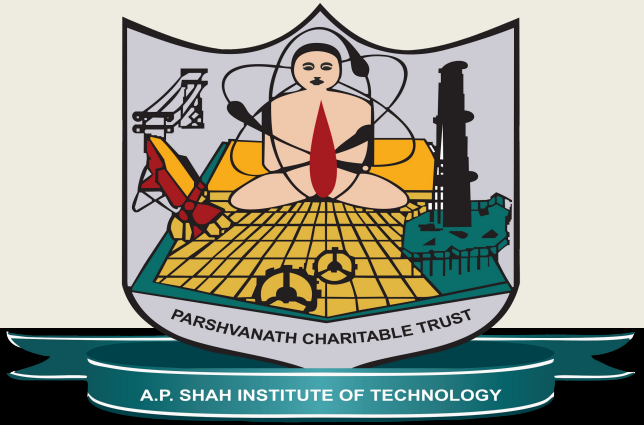

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UNIVERSITY OF MUMBAI

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A Project Report on

Developing Real-time and Secure Attendance Management System using Blockchain and ML

Submitted in partial fulfilment of the degree of

Bachelor of Engineering(Sem-8)
in
INFORMATION TECHNOLOGY

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1. Project Conception and Initiation

1.1 Abstract

- Traditional methods of conducting attendance is inefficient, inaccurate and time consuming.
- Furthermore, the data collected manually has to fed into a machine to safekeep a soft copy in case the physical one is damaged.
- So, the proposed solution is a facial detection based attendance system that automates the process and solves the issues with inefficiency and inaccuracy.
- Storing the data on a blockchain network solves the problems with security.

1.2 Objectives

- To implement a real-time attendance monitoring system using OpenCV.
- To secure the attendance records using blockchain technology and Solidity.
- To create a dashboard for the faculty to monitor the records using Flask.

1.3 Literature Review

Sr. No.	Title	Key Findings	Year
1.	Design of A Blockchain-based Employee Attendance System	The system was built in a decentralized and distributed way such that there is no central authority and stored data can be retrieved easily.	2019
2.	Real Time Attendance System Using Face Recognition Technology	The system matches input with various facial images and outputs eigenfaces that match the given input. Using OpenCV has also been beneficial to reduce the cost of the system.	2020
3.	Automated Attendance System Using OpenCV	The system makes use of the LBPH technique of OpenCV and the KNN algorithm. As an output, the system generates a spreadsheet having the names of present students.	2020

1.4 Problem Definition

- Organizations face various challenges with traditional manual attendance tracking systems .
- The ever-growing count of students increase the pressure on professors to monitor and control the attendance.
- One emerging problem among various countries is the falsification of attendance.
- Traditional methods of conducting attendance is inefficient, inaccurate and time consuming.
- To address these challenges, there’s a demand for a secure and efficient attendance monitoring system that utilizes advanced technology.

1.5 Scope

- Can be useful for teachers to monitor the attendance of students.
- Can be used to avoid the falsification of attendance.
- Can be used to save time.

1.6 Technology stack

- OpenCV (version 4.6.0)
- Solidity (version 0.8)
- Blockchain – Ethereum
- Ganache
- Flask (version 2.0)
- Web3 (version 1.9.0)
- Truffle suite

1.7 Benefits for Society

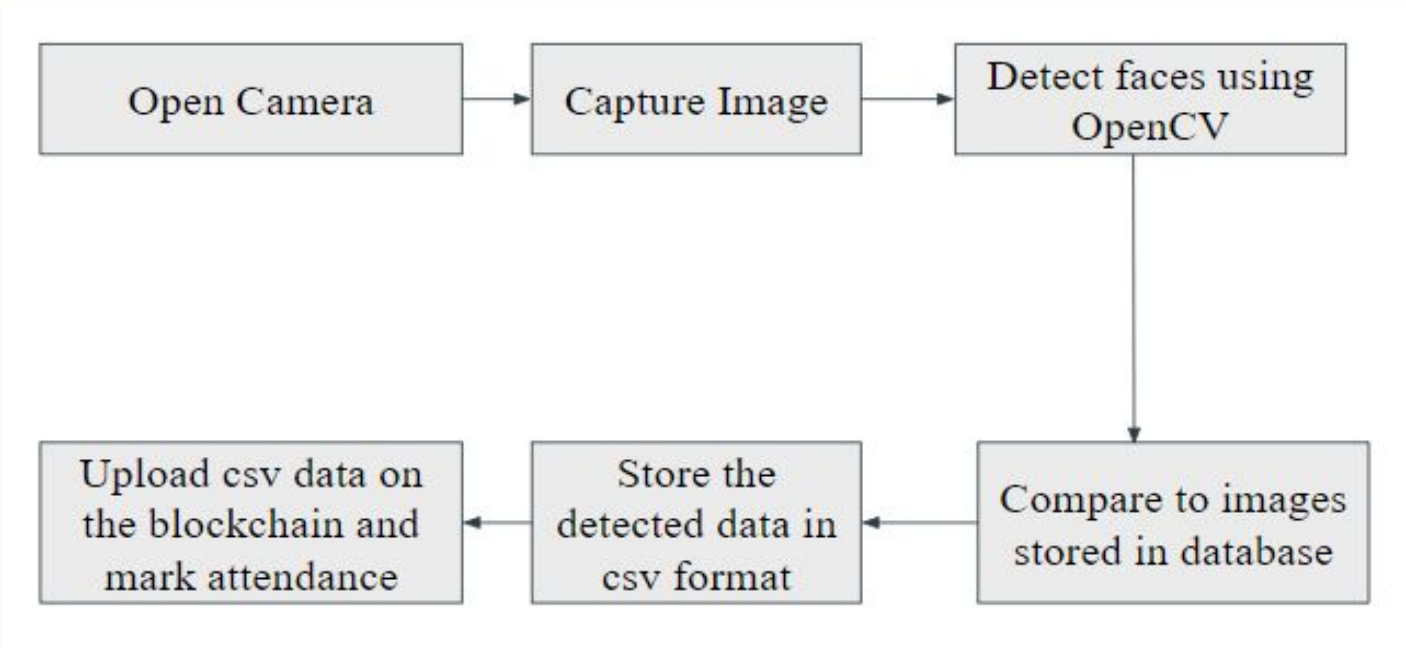
- Developing a real-time and secure attendance management system using blockchain and machine learning can improve accuracy, reduce costs, and increase efficiency.
- The system can enhance security by preventing tampering and unauthorized access.
- Transparency is also improved as all parties can access attendance records in real-time.
- The benefits can be applied to educational institutions and other organizations.

2. Project Design

2.1 Proposed System

1. Facial Recognition:
    - Facial data of students will be used to train a model and a video feed will be fed to the model to recognize the students present in a given class
2. Security:
    - Blockchain will be used to store the facial data as well as attendance record to prevent attacks.
3. Dashboard:
    - A web portal will be available to the users in order to view the data in case the system makes an error.

2.2 Design(Flow Of Modules)



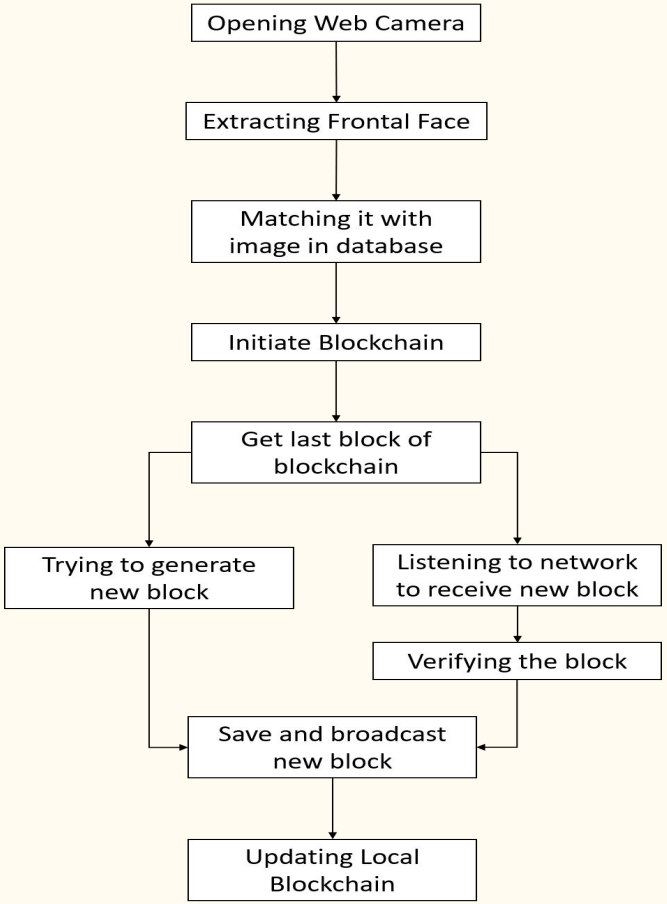
2.3 Description Of Use Case

- An educational institutes could use the system to automatically track student attendance using facial recognition technology, reducing the need for manual record-keeping and improving accuracy.

- The use of blockchain technology could ensure that the attendance records are secure and tamper-proof, preventing any unauthorized changes or deletions.

- The system could be used by large organizations with multiple locations, enabling them to track attendance across all sites in real-time and ensuring consistency in attendance management.

2.4 Activity diagram



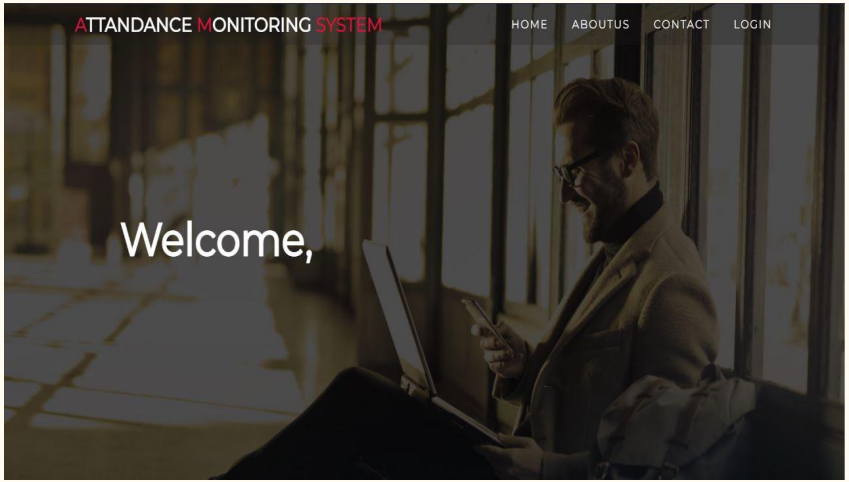
3. Implementation

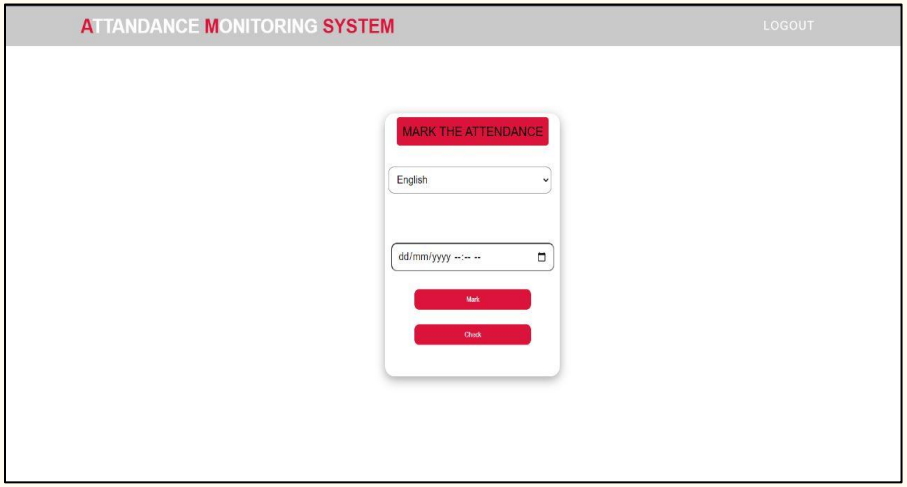
```python
path = "images"
images = []
personName = []
myList = os.listdir(path)
print(myList)
    # Retrieve names from image directories
for root, dirs, files in os.walk(path):
    for cu_img in files:
        current_Img = cv2.imread(os.path.join(root, cu_img))
        images.append(current_Img)
        personName.append(os.path.join(os.path.basename(root)))
print("personName:")
print(personName)

    # Encode images
def faceEncoding(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

encodeListKnow = faceEncoding(images)
print("All encoding complete")
```

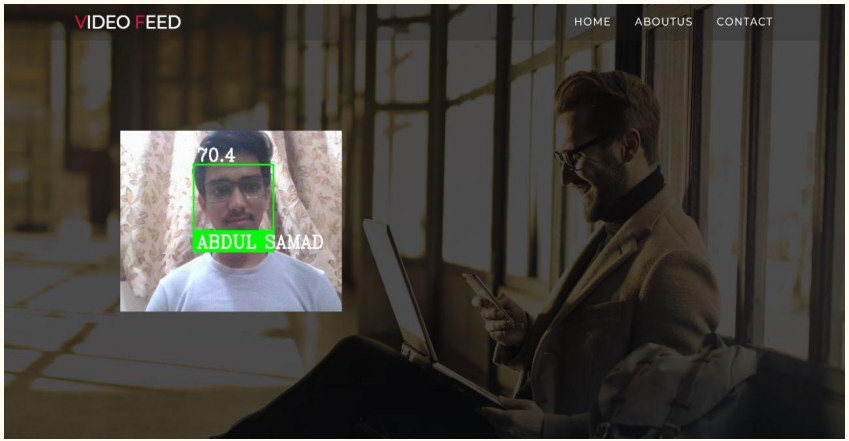
```python
def mark_attendance():
    # To access the camera
    cap = cv2.VideoCapture(0)
    t_end = time.time() + 15
    while time.time() < t_end:
    # while True:
        ret, frame  = cap.read()
        frame = imutils.resize(frame, width=400)
        faces = cv2.resize(frame, (0,0), None, 0.25, 0.25)
        faces = cv2.cvtColor(faces, cv2.COLOR_BGR2RGB)

        facesCurrentFrame = face_recognition.face_locations(faces)
        encodesCurrentFrame = face_recognition.face_encodings(faces, facesCurrentFrame)

        for encodeFace, faceLoc in zip(encodesCurrentFrame, facesCurrentFrame):
            matches = face_recognition.compare_faces(encodeListKnow, encodeFace)
            faceDis = face_recognition.face_distance(encodeListKnow, encodeFace)
            print(faceDis)
            matchIndex = np.argmin(faceDis)
            print("matchIndex:")
            print(matchIndex)

            if matches[matchIndex]:
                name = personName[matchIndex].upper()
                print(name)
                dis = str(round(max(faceDis)*100, 2))
                print("dis" + dis)
                y1, x2, y2, x1 = faceLoc
                y1, x2, y2, x1 = y1 * 4, x2 * 4, y2 * 4, x1 * 4
                cv2.rectangle(frame, (x1, y1), (x2, y2), (0, 255, 0), 2)
                cv2.rectangle(frame, (x1, y2 - 35), (x2, y2), (0, 255, 0), cv2.FILLED)
                cv2.putText(frame, name, (x1 + 6, y2 - 6), cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 2)
                cv2.putText(frame, dis, (x1 + 6, y1 - 6), cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 2)
                attendance(name)
                break
        ret, buffer = cv2.imencode('.jpg', frame)
        frame = buffer.tobytes()
        yield (b'--frame\r\n'
                    b'Content-Type: image/jpeg\r\n\r\n' + frame + b'\r\n')
        if cv2.waitKey(1) == 13:
            break
    cap.release()
    clean_csv()
```

```
// SPDX-License-Identifier:MIT
pragma solidity ^0.8.0;


contract CSVStorage {
    struct CSVData {
        uint id;
        string name;
        string time;
        string date;
    }

    CSVData[] private csvData;


        function storeCSV(uint _id, string memory _name, string memory _time, string memory _date) public {
        CSVData memory newCSVData = CSVData(_id, _name, _time,_date);
        csvData.push(newCSVData);
    }


    function getCSV(uint _index) public view returns (uint, string memory, string memory,string memory) {
        return (csvData[_index].id, csvData[_index].name, csvData[_index].time,csvData[_index].date);
    }

    function getCSVCount() public view returns (uint) {
        return csvData.length;
    }
}
```

```
#add mymodule here
with open('clean.csv', 'r') as f:
    csv_data = f.readlines()

# Loop through each row and add it to the contract
for row in csv_data:
    row = row.strip().split(',')

    # Call the contract function to add the row to the blockchain
    tx_hash = contract.functions.storeCSV(int(row[0]), row[1], row[2], row[3]).transact({
        'from': web3.eth.accounts[0],
        'gas': 3000000
    })
    tx_receipt = web3.eth.wait_for_transaction_receipt(tx_hash)

    print('Row added to blockchain:', tx_receipt)

# Call the contract functions to get data from the blockchain
csv_count = contract.functions.getCSVCount().call()
print('CSV count:', csv_count)
# Call the contract functions to get data from the blockchain
csv_count = contract.functions.getCSVCount().call()
print('CSV count:', csv_count)

for i in range(csv_count):
    csv_data = contract.functions.getCSV(i).call()
    mark_attendance.returnable_csv = []
    mark_attendance.returnable_csv.append(csv_data)
    print('records in my module', mark_attendance.returnable_csv)
```







ID	Name	Time	Date
1	ABDUL SAMAD	11:16:06	04/19/23/04/2023
2	EKTA GUJAR	11:16:31	04/19/23/04/2023
3	SINDURA DASI	11:20:17	04/19/23/04/2023

4. Testing

Test Case No.	Test Condition	Test Steps/ procedure	Test Data	Expected Results	Actual Result	Pass/ Fail
1	View Screen (index.html)	If path is "/" then index.html is viewed.	View Screen	System needs to show the home page to user.	Home page run on the user screen	Pass
2	Capture attendance (videofeed.html)	Select the slot, using OpenCV module detect faces and store the data on blockchain	.csv file	User should be able to capture the attendance	Attendance was captured and stored on the blockchain successfully	Pass
3	View attendance records & Null (table.html)	After clicking on "check" button data stored in blockchain is retrieved	Attendance records	Display attendance records stored on the blockchain.	System shows attendance records stored on the blockchain.	Pass

5. Result

- Using the Interface, the user can interact with OpenCV and blockchain modules efficiently.
- User can login using valid credentials and can select subject and time-slot to mark the attendance.
- System detects student faces with the help of OpenCV and the data is generated in .csv format.
- The generated data is stored on the Ethereum blockchain in order to provide immutability.
- The stored data can be viewed by users at any time.

6. Conclusion and Future Scope

- The integration of blockchain technology with facial recognition-based attendance recording systems has been established successfully.

- System provides a secure and efficient solution for monitoring attendance.

- The technology offers several benefits, including increased security and transparency, as well as a more efficient and streamlined process for recording and processing attendance data.

- In future work, it would be interesting to explore new algorithms to be developed in order to increase the accuracy and efficiency of the system.

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2. Hasna Ardina, I Gusti Bagus Baskara Nugraha, “Design of A Blockchain-based Employee Attendance System”, 2019 International Conference on ICT for Smart Society (ICISS), 19-20 November 2019.
3. Naman Gupta, Purushottam Sharma, Vikas Deep, Vinod Kumar Shukla, "Automated Attendance System Using OpenCV", 2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), 4-5 June 2020.

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Thank You