A Project Report on

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

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Engineering

in

Information Technology

by

Sindura Rajendra Dasi(19104015)
Ekta Shantaram Gujar(19104026)
Abdul Samad Mohd. Islam Ansari(19104022)

Under the Guidance of

Prof. Yaminee Patil

Department of Information Technology
NBA Accredited
A.P. Shah Institute of Technology
G.B.Road,Kasarvadavli, Thane(W), Mumbai-400615
UNIVERSITY OF MUMBAI

Academic Year 2022-2023

Approval Sheet

This Project Report entitled ***"Developing Real-time and Secure Attendance Management System using Blockchain & ML"*** Submitted by ***"Sindura Rajendra Dasi(19104015), Ekta Shantaram Gujar(19104026), Abdul Samad Mohd. Islam Ansari(19104022)"*** is approved for the partial fulfillment of the requirenment for the award of the degree of ***Bachelor of Engineering*** in ***Information Technology*** from ***University of Mumbai***.

(Prof. Yaminee Patil)
Guide

Dr. Kiran Deshpande
Head Department of Information Technology

Place:A.P.Shah Institute of Technology, Thane
Date:

CERTIFICATE

This is to certify that the project entitled ***"Developing Real-time and Secure Attendance Management System using Blockchain & ML"*** submitted by ***"Sindura Rajendra Dasi (19104015), Ekta Shantaram Gujar (19104026), Abdul Samad Mohd. Islam Ansari (19104022)"*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***Information Technology***,to the University of Mumbai,is a bonafide work carried out during academic year 2022-2023.

(Prof. Yaminee Patil)
Guide

Dr. Kiran Deshpande
Head Department of Information Technology

Dr. Uttam D.Kolekar
Principal

External Examiner(s)

1.

2.

Place:A.P.Shah Institute of Technology, Thane
Date:

Acknowledgement

We have great pleasure in presenting the report on **Developing Real-time and Secure Attendance Management System using Blockchain & ML.** We take this opportunity to express our sincere thanks towards our guide **Prof. Yaminee Patil** Department of IT, APSIT thane for providing the technical guidelines and suggestions regarding line of work. We would like to express our gratitude towards his constant encouragement, support and guidance through the development of project.

We thank **Dr. Kiran B. Deshpande** Head of Department,IT, APSIT for his encouragement during progress meeting and providing guidelines to write this report.

We thank **Prof. Sonal Jain** BE project co-ordinator, Department of IT, APSIT for being encouraging throughout the course and for guidance.

We also thank the entire staff of APSIT for their invaluable help rendered during the course of this work. We wish to express our deep gratitude towards all our colleagues of APSIT for their encouragement.

Sindura Rajendra Dasi
19104015

Ekta Shantaram Gujar
19104026

Abdul Samad Mohd. Islam Ansari
19104022

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

_____

(Sindura Rajendra Dasi - 19104015)

_____

(Ekta Shantaram Gujar - 19104026)

_____

(Abdul Samad Mohd. Islam Ansari - 19104022)

Date:

Abstract

In a vast majority of fields, the use of facial recognition for authentication is expanding. In this information age, authentication has become vital, and the need for faster and more secure methods of user authentication has been on the rise. The introduction of image processing technologies such as OpenCV has increased society's reliance on face recognition. Using blockchain, information could be stored in blocks throughout the blockchain network. Blockchain is an extremely secure means for storing and protecting data from intruders. It is a highly disruptive technology that has the ability to alter every plane of society. This paper intends to implement open-source computer vision (OpenCV) to construct a facial detection model that will be employed in a blockchain-secured Attendance Monitoring System. It will not only automate the attendance procedure but also give the system unassailable security. This system will take a live video feed from a camera using OpenCV and identify the faces of students and record their attendance along with the entry time. The data will be kept in a distributed way over the blockchain network that will be accessible to everyone but data cannot be manipulated.

Contents

List of Figures

List of Abbreviations

OpenCV	Open Computer Vision
RFID	Radio-Frequency Identification
DSRM	Design Science Research Methodology
AMS	Attendance Management System
LBPH	Local Binary Pattern Histogram
KNN	K-Nearest Neighbors
XML	Extensible Markup Language

Chapter 1

Introduction

Most organizations need a way to keep track of their students' attendance but every organization uses their own methods to do so like calling out the names and manually taking it down, some have opted for more efficient and accurate biometric systems like fingerprint [1], RFID card readers and iris systems. Although the most commonly used method of taking down the attendance manually is extremely inefficient and inaccurate. Even in systems like RFID, since each student is given a card corresponding to their unique IDs but there is no real way of knowing if the card is being used by the individual it was assigned to, there may be cases where one student is using the cards of multiple people to mark everyone's attendance while in reality only one of them was present. Other means of biometric IDs like fingerprinting, voice recognition or iris scans are not entirely feasible to use, have their drawbacks and don't provide idea performance. A system that could match a human face to a digital image could prove to be highly efficient and practical to use.

Attendance is a common part in all educational institutions. The problem of forging attendance can be reduced using blockchain technology. There are several institutions using original documents to a person, who has never been to the university before and never participated in any of the academic activities. To prevent the fake attendance and fake certificates issued by the educational institutions blockchain technology finds a solution here. A blockchain is a chain of blocks, which records all recent transactions and completed transactions are stored permanently as database. A new block is created for every new transaction. Blockchain is famously known for its features, it is constantly growing ledger, where all the transactions are permanently recorded that turn up in chronological, secure and immutable way. The need of blockchain is for its security, time reduction,unchangeable transactions, collaboration, reliability and its decentralized nature[8].The blocks in the blockchain consists of multiple blocks and the first block is capped as genesis block where each block has three basic components:

- Data: The data present or stored in the block.
- Nonce: A nonce is a 32-bit whole number. A nonce is generated randomly when a block is created and then later it generates a block header hash [8].
- Hash: A 256-bit number present in the nonce. It usually starts with many number of zeroes which is extremely small.

The solution aims in using blockchain technology in recording attendance of the students, since the data present in the blockchain is immutable and unchangeable, it is difficult to forge the attendance or to add any other fake student to the previous academic years and it can be easily identified by others whether the student is real or fake and issuing of fake certificates can be controlled easily. Here the blockchain technology is used for storing and securing attendance and web application is created for taking attendance and a dashboard for both teachers and for students to see the simultaneous results. And also sending an alert message if the student is absent for any lecture and indicates the students whoever are having lesser attendance percentage than a certain allotted point.

The ever-growing count of students increase the pressure of professors to monitor and control the attendance. One emerging problem among various countries is the falsification of graduation document falsification. This could be solved by using blockchain technology to store the attendance records on a decentralized distributed ledger that is publicly available for everyone to see. Since records stored on the blockchain network is immutable in nature, the authenticity of the records is guaranteed. Using blockchain also ensures that unauthorized access and tampering[5] of the records is avoided. This project aims to solve the problems of inaccuracy, inefficiency and unauthentic records.

The project would use OpenCV[4] to identify all the students present in a class and use blockchain to maintain the records securely. The system will reduce the amount of manual work needed, improve accuracy, and save time which could prove to be beneficial for an organization. Since the system is automated, it would also reduce the risk for human error. Every block in a blockchain network can be tracked which reduces risk in the network. Since data stored on the network is immutable in nature, once data is stored on it, the data cannot be manipulated again. Even if the stored transaction contains an error, it cannot me edited. A new transaction should be made that reverses the previous one and both the transactions should be made public. The shared ledger in a blockchain network takes care of removing the duplication of work effort and transactions are recorded once and only once. Transactions to stored data are executed using specially designed smart contracts.

Smart contracts are basically applications that execute automatically once a specific set of conditions are met. The system also has an authentication step to make sure unauthorized users are not permitted access to the data. OpenCV has several algorithms to detect and recognize faces each of which uses different facial points and gathers different measurements. This project uses face recognition algorithm for detecting and recognizing faces. The measurements are used to create unique facial signatures which are then compared with the facial data stored in our database.

This well-ordered writing of paper starts with an abstract, introduction, literature, methodology, result, and conclusion. The research stages can be seen in fig.1 below.

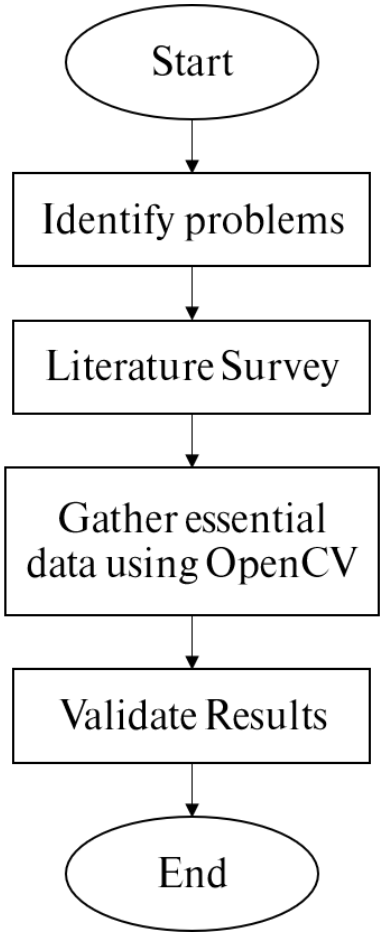


Figure 1.1: Research Stages

Chapter 2

Literature Review

The purpose of literature review is to gain an understanding of the existing research on attendance management system relevant to area of study.

- In paper[1] written by Mayank Srivastava, etdl a system has been designed that analyzes facial images and calculates eigenfaces which are faces consisting of eigenvectors. A comparison of the eigenface is used to detect the facial and nodal points present. With the help of OpenCV, a system has been developed that provides simple-to-use computer vision which facilitates the development of effective vision applications.

- In paper[2] written by Hasna Ardina, etdl by using DSRM methodology, this system is used to manage attendance transactions which was designed so that the stored data is expected to attend transaction history to maintain reliability and integrity. With the consensus mechanism in the blockchain network, only parties who have been given permission to enter the blockchain network can change, delete or renew data. Any changes in data on the blockchain network will be known by all participants involved in it.

- In paper[3] written by Jingyao Tu, etdl consists basic functions of an attendance management system based on blockchain are demonstrated that uses blockchain to prevent attendance data from altering. The design of AMS is a four-layered structure including a data layer, consensus layer, network layer, and application layer. Further, a supervisory module has been developed to assist the AMS supervision.

- In paper[4] written by Naman Gupta, etdl the system has been designed to improve the adaptability and performance of the attendance system procedure besides reducing the long-term time load, work, and disposables used. The system uses the LBPH technique of OpenCV and the KNN algorithm. The system can add and manipulate attendance records of an individual,automatically calculate the number of present and absent students based on the affability and subject of the class, and then generates the automated document or spreadsheet.

- In paper[5] written by LIXIANG LI, etdl the facial recognition technology development phases and associated technologies are presented.They gave an overview of the research on face recognition for real-world scenarios, generic assessment metrics, and general face recognition databases. In order to distinguish faces using various vectors, they employed deep learning and the Support Vector Machine (SVM).

- In paper[6] written by Setia Budi, etdl consists of a budget-friendly solution for maintaining student attendance records. Attendance is noted on basis of students' images. Students' faces are detected automatically using facial recognition techniques, and then the registered student's attendance is marked by simply identifying their faces on the records. Mobile applications were developed for both students and lecturers as the primary interfaces to interact with the system.

- In paper[7] written by Muthunagai R, etdl the system rectifies the problems in marking the student's entry as absent even if they are inside the classroom. The implementation procedure includes facial recognition,identification, and automatic attendance marking depending on whether or not the student is there. In this study, an automated attendance management system is developed using Principle Component Analysis (PCA),Eigen face value identification, and Convolutional Neural Networks (CNN). This model is successfully done in comparison with a database of students' faces to control the movement of people with a predefined protocol.

- In paper[8] written by Siddharth Rajput, etdl contains the evolution of bitcoin, and some reviews. It also discusses issues like a lack of in-depth coverage; blockchain as a management innovation; clever contracts; plans of action; innovative probabilities and obstacles; and blockchain as a universally useful invention. This paper delineates a circulation of e-money that will enhance online sectors to be sent in a significant manner starting with one collection and then onto the subsequent while not encountering a fund association.

- In paper[9] written by Zibin Zheng, etdl there is a thorough discussion of blockchain technology. They have also examined several popular consensus algorithms used in various blockchains and first offered an outline of the blockchain architecture. Furthermore briefly discussed are technological difficulties and recent advancements. They have also outlined potential directions for blockchain in the future. Additionally, they reviewed some current methods for resolving some of the issues they identified as obstacles to blockchain development.

- In paper[10] written by Raaj Anand Mishra, etdl the government agency develops distinctive identities for each stakeholder. For all other stakeholders, accounts are made based on their identities. There is a list of enrolled pupils that the school must give and distribute credentials. On the other hand, a new school may want to check a student's credentials that were previously provided by the old school when the student applies for admission there. The desire of students to see their academic qualifications. Also,

students must be given their current credentials throughout the admissions process. Businesses request access to an applicant's credentials during the hiring process. As an alternative, a business could award diplomas to students once they complete their training or internship. Professors must do background checks on applicants or workers much like businesses do when hiring for various positions inside an institution.As an alternative, educators could need to provide their students with a letter of reference or an internship certificate.

Objective

Objectives refer to specific goals which are aimed to achieve within a given period. These goals are usually specific, measurable, achievable, relevant, and time-bound and serve as a guide to focus efforts and resources towards a desired outcome. They provide direction and a clear sense of purpose for individuals and teams, and are used to evaluate progress and success towards achieving a desired outcome.

We intend to do this project implementation to meet following objectives:

- To implement a real-time Attendance Monitoring system using OpenCV:
  To facilitate the faculty with an automated system that will seamlessly monitor the attendance of a given time period for them by using a web-camera and feeding the video to a trained facial recognition model identifying the student. Basically, the faculty will select time-slot for particular period, then faces of students will be detected using OpenCV and these data will be saved as .csv file.

- To secure the attendance records using blockchain technology and Solidity:
  To create a database storing the attendance records in a distributed fashion on the blockchain network so as to avoid intrusions and unauthorized access. The data generated by using OpenCV module will be sent to Ethereum blockchain with the help of smart contract. As Blockchain is based on Peer-to-Peer network the data becomes immutable and provides unassailable security to the data.

- To create a dashboard for the faculty to monitor the records using Flask:
  To create a user-friendly interface for the faculty to add the records stored on the blockchain network. These will be done using flask framework and web designing technologies like HTML and CSS. Routes in the flask can be used to redirect users to their desired pages and provide utmost usability of the interface to them. With the help of interface, it would become easier for the user to explore various functionalities in an easy manner.

Chapter 3

Project Design

The project's key features, structure, criteria for success, and major deliverables are all planned out in this steps. The aim is to develop design in a way so that it can differ from existing system that can be used to achieve the desired project goals.

3.0.1 Existing System

- The traditional system for attendance monitoring involves using a physical attendance sheet, which contains a list of the students enrolled in a class, and marking attendance manually using a pen and paper[3].
- Manual attendance recording can be time-consuming and attendance data is only available after the class or session is over, making it harder to track attendance in real-time.
- Organizations face various challenges with traditional manual attendance tracking systems, including the possibility of errors, manipulation, and lack of transparency.
- The traditional method of storing the attendance is not secure.Their is a risk of high securities issues like manipulating the attendance.
- Some use RFID technology to mark the attendance which is also not secure. Anyone can falsify while marking the attendance.

3.0.2 Proposed System

- Requirements Gathering:
  The initial step is to gather the requirements for the system. This includes determining the specific use cases, the functional and non-functional requirements, and the desired user experience. The information gathered is used to define the scope and specifications of the system.

- System Design:
  Once the requirements have been gathered, the next step is to design the system. This involves creating a high-level architecture of the system,including the components, how

they will interact with each other, and the data flow. This stage also involves determining the technology stack that will be used to build the system, such as the programming languages,databases, and blockchain platform.

- Facial Recognition Development:
  This stage involves developing a facial recognition model that can be trained on the images dataset and tested on the video feed captured through the camera using OpenCV. The facial recognition model must be designed to accurately recognize faces in different angles, and poses. This stage is critical in ensuring that the attendance monitoring system can accurately track attendance.

- Blockchain Integration:
  In this stage, the blockchain platform is integrated into the system. This involves defining the data structure for the blockchain, setting up the consensus mechanism, and implementing the smart contracts that will be used to automate the process of tracking attendance.

- User Interface Design:
  The next step is to design the user interface for the system. This involves creating a user-friendly interface that allows the employees to initiate the attendance monitoring process and check the attendance records.

- Testing:
  Once the system has been developed, it needs to be thoroughly tested to ensure that it is reliably recognizing faces and storing the records securely on the blockchain network.

- Deployment:
  Once the system has been tested and any necessary changes have been made, the system can be deployed. This involves setting up the necessary infrastructure, databases, cameras, and configuring the system to work in the desired environment.

- Maintenance:
  The final step is to maintain and support the system over time. This involves fixing any bugs,updating the system as needed, and providing technical support to users.

3.0.3 System Diagram

- Activity Diagram

The figure shown is the complete system diagram of the proposed system.First the user will sign-up by entering the user information.The mark attendance page would be displayed. By selecting the subject and date time period click on the mark attendance. The live faces of students are detected using the OpenCV. This data will be stored on blockchain to avoid the falsification of records. Later on go back and click on the check button to view the marked attendance. The stored attendance list will be displayed on the web page.

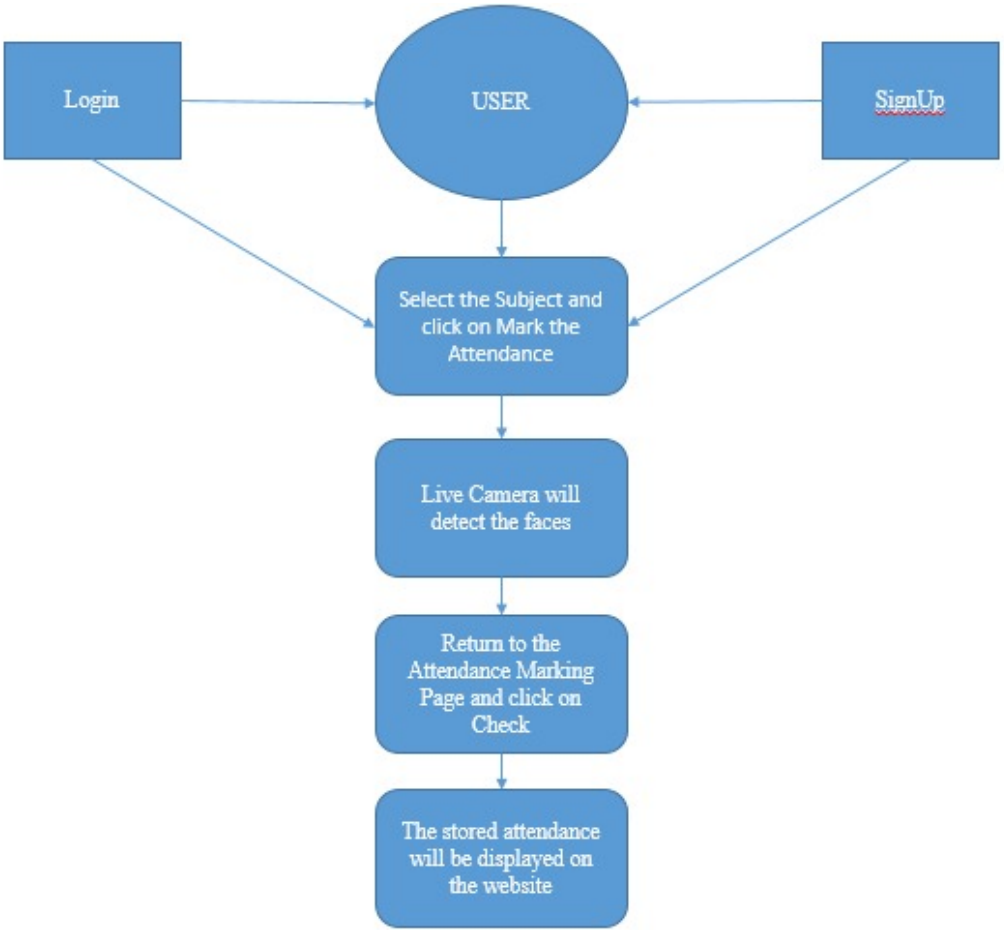


Figure 3.1: Activity Diagram

- Use Case Diagram

  The Use Case Diagram below shows different actors as Admin and User. The relation between actors and what they can do with the system. The Admin will train the model using OpenCV and user will the portal in order to capture the attendance and then check it. A use case diagram shows various use cases and different types of users the system has and will often be accompanied by other types of diagrams as well. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements.

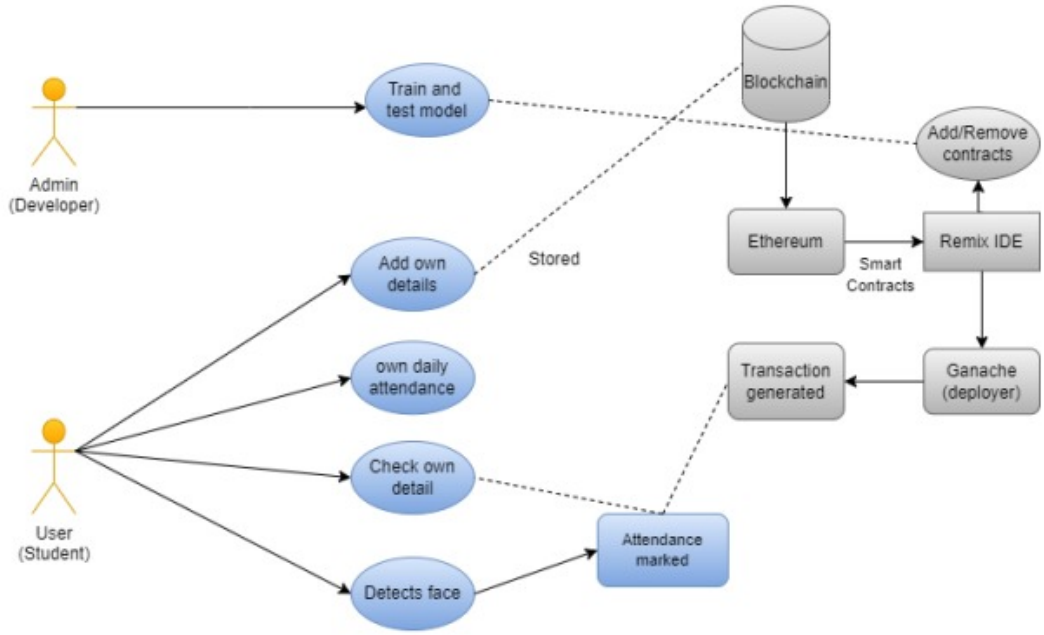


Figure 3.2: Use case Diagram

- Sequence Diagram

  The sequence diagram shows the entire sequence of flow of the data in the system. In the initial step the camera will be opened to detect the live data of the students. Then the detected images will be compared will the images of the students stored in database. The images will be be detected using Open-CV. The fetched images is now stored on the blockchain network. For this we converted the images data in .csv format.Then uploaded that file on blockchain and mark the attendance.

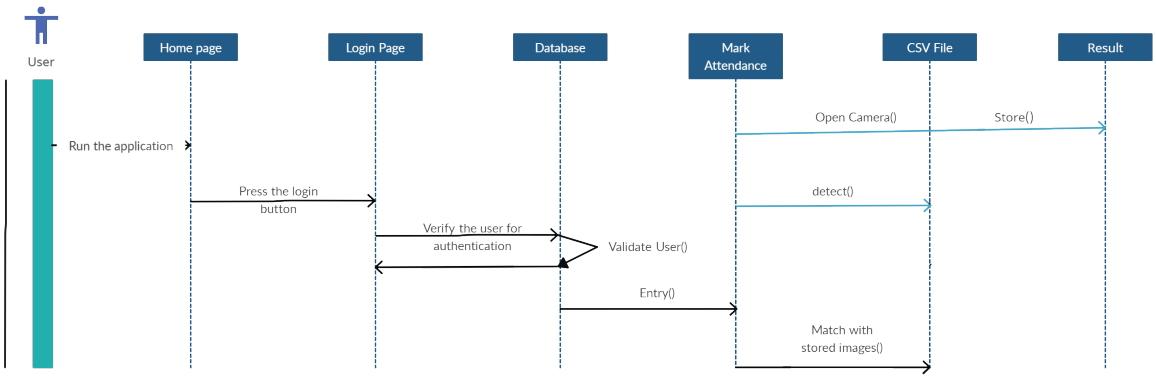


Figure 3.3: Sequence Diagram

Chapter 4

Project Implementation

Project implementation consists of visions and plans with which we are supposed to build the end product. This includes the logical conclusion, after evaluating, deciding, visioning, planning and finding the other resources for the project. Technical implementation is one of the major aspects of executing a project.

All imported modules like cv2, pandas, numpy, flask, web3, etc., required by model in Fig. 4.1.

```
from flask import Flask, render_template, redirect, url_for, request, Response
import cv2
import numpy as np
import face_recognition
import os
from datetime import datetime
import time
import imutils
from web3 import Web3
import pandas as pd
from flask import Flask, render_template, request, redirect, url_for, session
```

Figure 4.1: Imported Modules

Here, the face_recognition library is used to extract facial encodings for all faces present in the dataset in Fig 4.2

```
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")
```

Figure 4.2: Facial encoding extraction from all images present in dataset

Here, a function is created to mark the attendance using OpenCV and facial recognition Fig 4.3

```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()
```

Figure 4.3: Capturing attendance records

Here, the smart contract is created in solidity language in Fig 4.4

```
// 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;
    }
}
```

Figure 4.4: Smart Contract for storing records

Here, the web3 library is used to connect to the blockchain network and the smart contract is instantiated in Fig 4.5

```
web3 = Web3(Web3.HTTPProvider('http://127.0.0.1:8545'))
with open('contract_abi.json', 'r') as f:
        contract_abi = json.load(f)

# Define contract address and instantiate contract
contract_address = '0x19CF0AdfC679891a597436076C425b500a98e854'
contract = web3.eth.contract(address=contract_address, abi=contract_abi)
```

Figure 4.5: Connecting to the blockchain network and instantiating smart contract

Here, the data stored in .csv file is added on the blockchain in Fig 4.5

```
#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)
```

Figure 4.6: Publishing records on the blockchain network

Here, is the home page of the attendance system as shown in Fig 4.7

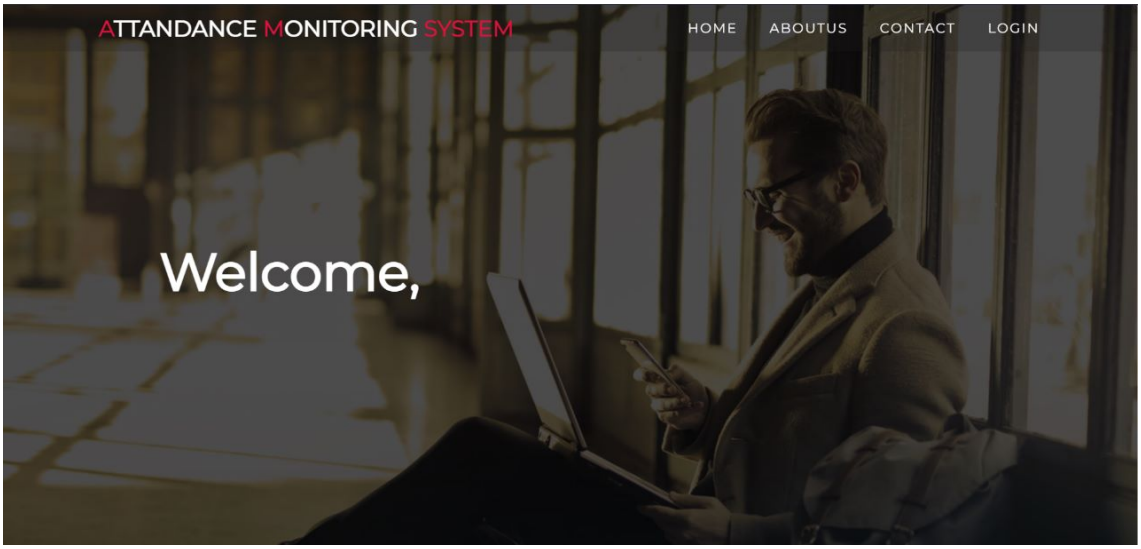


Figure 4.7: Home Page

This is the login page where in user can use valid credentials and access the system as shown in Fig 4.8.

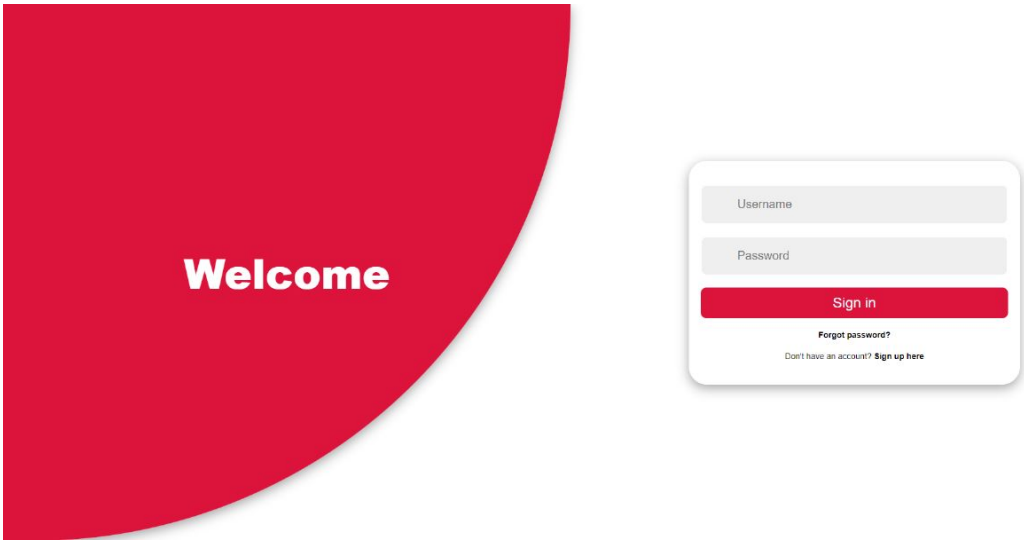


Figure 4.8: Login Page

This is the attendance marking page which will be displayed after logging in using valid credentials. Users can select the subject and date and click on the mark button.

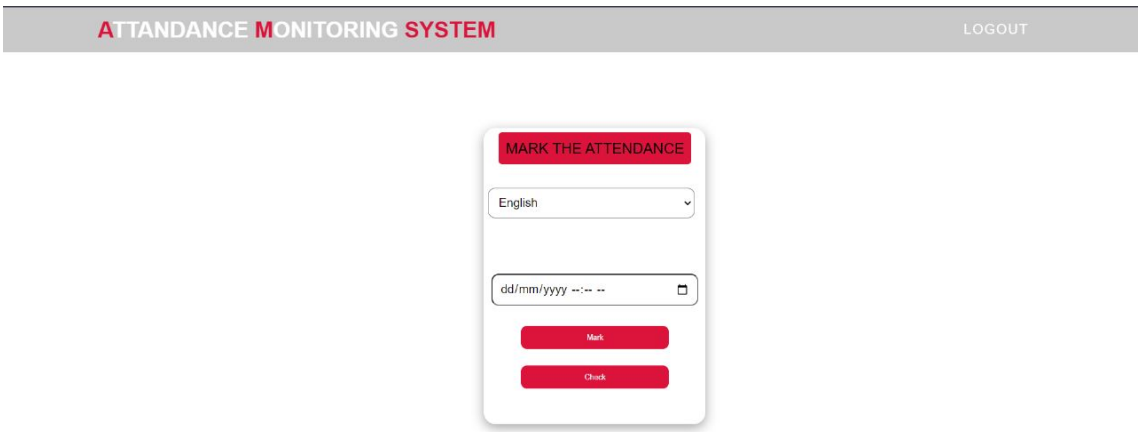


Figure 4.9: Mark Attendance Page

The video feed page will be displayed after clicking on the mark button. The camera will detect the face.

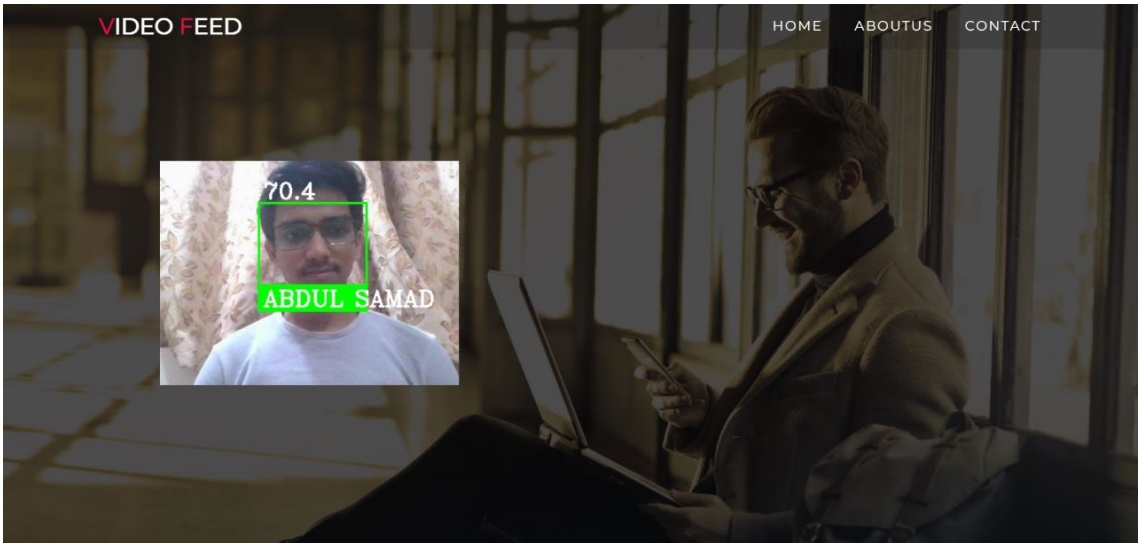
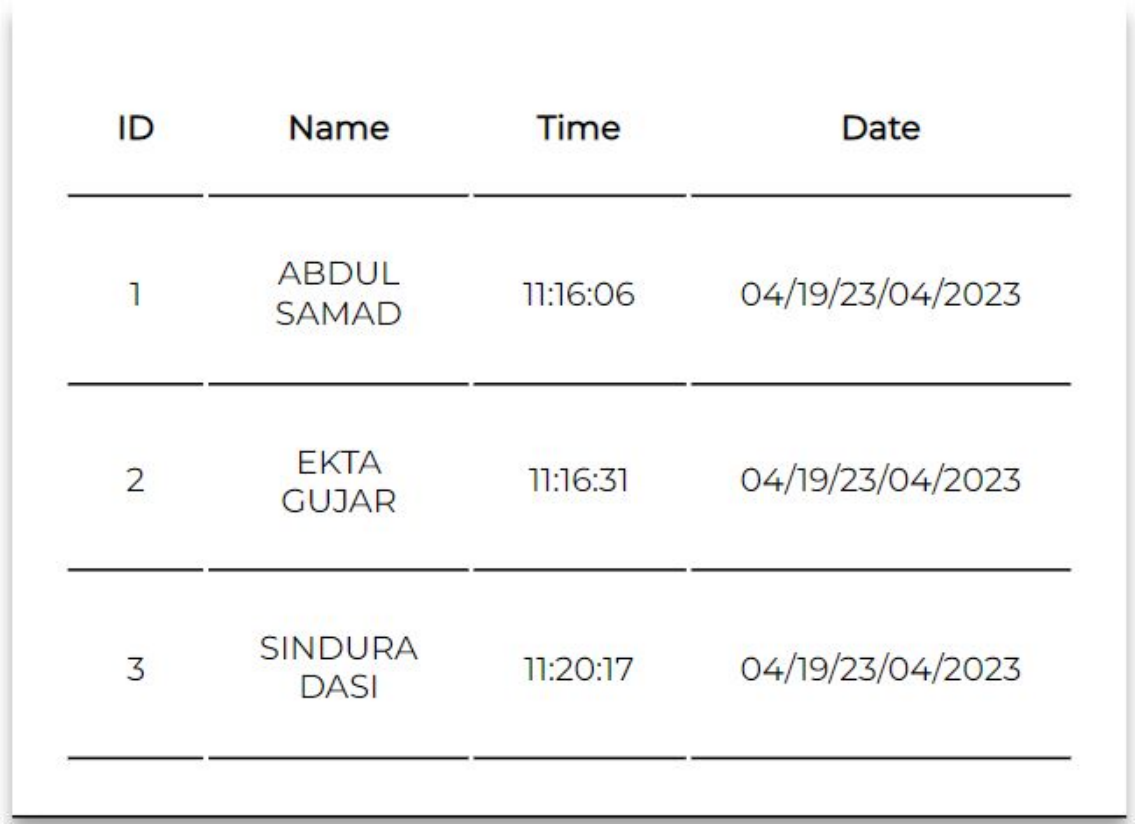


Figure 4.10: Video Feed Page

This is the result page which will contain the result of the marked attendance.



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

Figure 4.11: Result Page

Chapter 5

Testing

Testing is an organized summary of testing objectives, activities, and results. It is created and used to help stakeholders (product manager, analysts, testing team, and developers) understand product quality and decide whether a product, feature, or a defect resolution is on track for release. Test documentation includes all files that contain information on the testing team's strategy, progress, metrics, and achieved results. The combination of all available data serves to measure the testing effort, control test coverage, and track future project requirements.

5.1 Functional Testing

5.1.1 Unit Testing

Unit testing is the first level of testing, which is typically performed by the developers themselves. It helped us understand the desired output of each module, which we had broken down into separate units and in classifying the faces of users on the basis of algorithm that we have used.

5.1.2 Various Testcases

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

Figure 5.1: Testcases

Chapter 6

Result

6.0.1 Face Detection

OpenCV plays one of the most prominent roles in detecting the faces. With the help of OpenCV we have build an effective facial detection system to gather facial data. Almost 300 images are used as a database. These data is further divided as 80% training set and 20% testing set.There are more than 700 different vision-related functions in this technique. The user's face is detected through the front camera at a maximum distance of 50-60cm. The face detection can also occur with certain elevation as shown in fig. below

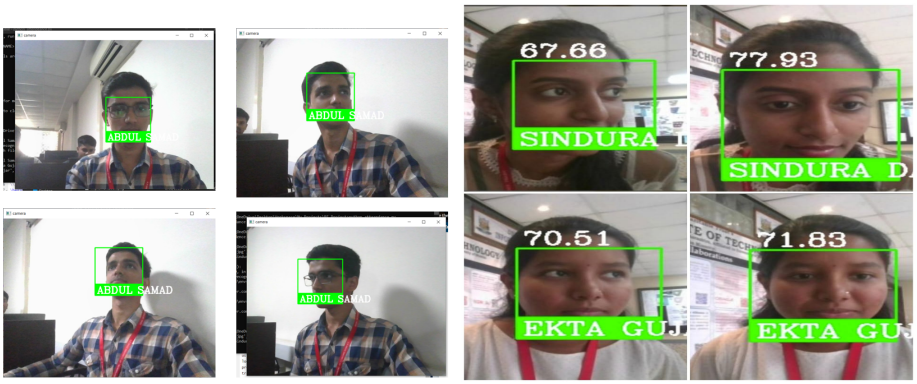


Figure 6.1: Face Recognition

6.0.2 Smart Contract

After accumulating face recognition, the data generated is sent on to the Ethereum blockchain using smart contracts. Smart Contracts in Blockchain are the program files that are used to build the conditions for the program in order to run the system. Smart Contracts are written in solidity language which is set up and compiled on platforms like Remix IDE. In this system, smart contracts are used for initializing the series of transactions to be performed between all the entities. The contracts would be defining the attendance records for the particular class. After the contracts are designed, they are compiled and tested using any faucet and in this case which is Ether. Ganache is used for testing smart contract locally. The deployment of smart contract on Ganache can be seen in fig. below

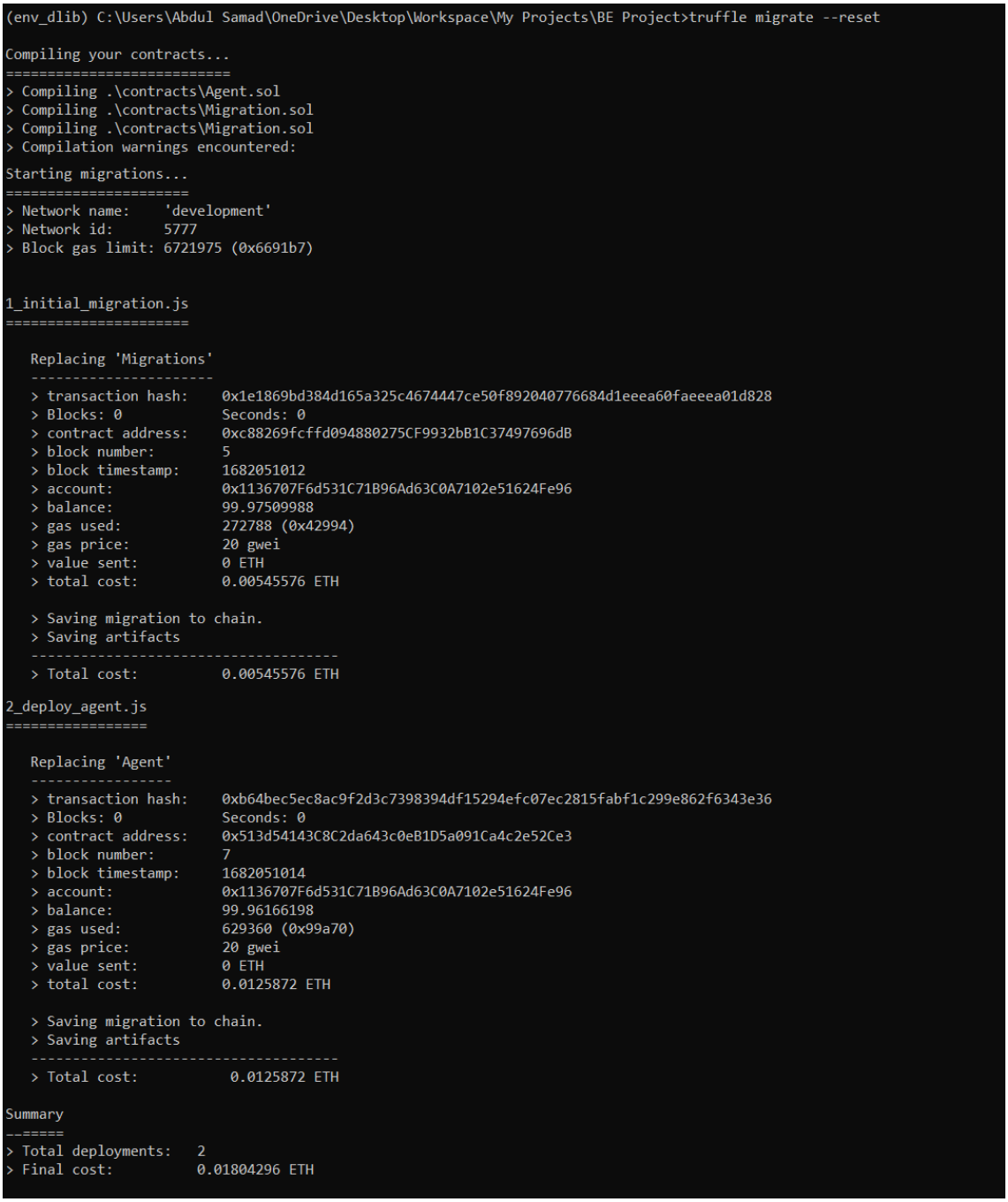


Figure 6.2: Deploying smart contract on the blockchain network

6.0.3 Blocks

After a successful deployment of smart contract over ganache, blocks are being generated. In a blockchain database, blocks are data structures where transaction data is permanently stored. Blocks are incredibly important in determining transaction parameters as data stored on the blocks is immutable under any circumstances. All the information is securely saved in a block and kept up to date. The block's data, hash value, and block size is also provided to the peers. Blocks general characteristics can be seen in fig. below

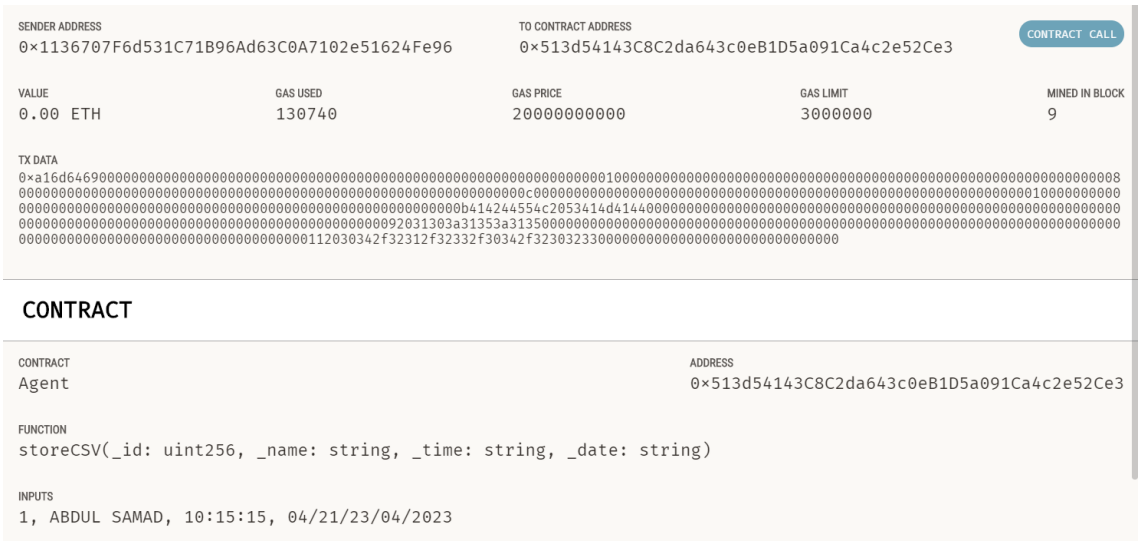


Figure 6.3: Records uploaded on local blockchain

Deploying an attendance monitoring system using Truffle and Ganache involves several steps. Firstly, the Truffle framework needs to be installed on the local machine, along with Ganache, which is a personal blockchain for Ethereum development. Once the installation is complete, a new Truffle project can be initialized, and smart contracts can be written to define the attendance system's functionality. After compiling and testing the smart contracts, they can be migrated to Ganache to create a new blockchain network. The Ganache GUI can be used to interact with the smart contracts and simulate transactions, which can be used to test the attendance system's functionality. Finally, the attendance monitoring system can be integrated with a user interface, such as a web application, to allow users to interact with the system and record their attendance. Overall, deploying an attendance monitoring system using Truffle and Ganache requires a good understanding of blockchain development and smart contract programming, but it offers a secure and transparent solution for monitoring attendance.

Finally, Attendance Management system is built using OpenCV and the recorded data is stored on blockchain. The home page contains the information of the website with different sections.The login page is used to access the website further to mark the attendance. After logging in mark the attendance page is displayed which is used to mark attendance. By clicking on the mark button the camera will fetch the live images of the students. The live detected images are then matched with the stored images. Later after clicking on the check button the detected images are displayed on the web page. This list cannot be manipulated and also registered users have the right to access the website.

Chapter 7

Conclusions and Future Scope

The integration of blockchain technology with facial recognition-based attendance recording systems 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. However, the implementation of the technology also faces several challenges and limitations, including privacy concerns, implementation costs, and accuracy issues. Therefore, it is important to consider these challenges and limitations when implementing the technology and to evaluate and optimize the performance of the system to ensure that it provides accurate and reliable results.

In future work, it would be interesting to explore ways to overcome the challenges and limitations associated with the integration of blockchain technology with facial recognition-based attendance recording systems. This may include new algorithms to be developed in order to increase the accuracy and efficiency of the system. Implementation of privacy-enhancing technologies in order to provide security to collected data for bio-metrics which is also stored by the system. Furthermore, it would be interesting to study the impact of the technology on various organizations, including small and large businesses, government agencies, and educational institutions, and to evaluate its potential for widespread adoption and implementation.

Bibliography

[1] Mayank Srivastava, Amit Kumar, Aditya Dixit, Aman Kumar, "Real Time Attendance System Using Face Recognition Technique", 2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), 28-29 February 2020.

[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] Jingyao Tu, Zhenhua Duan(B), Cong Tian(B), Nan Zhang(B), and Ying Wu, "A Blockchain Implementation of an Attendance Management System", International conference on Structured Object-Oriented Formal Language and Method, 09-10 February 2019.

[4] 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.

[5] LIXIANG LI1, XIAOHUI MU1, SIYING LI, HAIPENG PENG, "A Review of Face Recognition Technology", IEEE Access (Volume: 8), 21 July 2020.

[6] Setia Budi, Oscar Karnalim, Erico D. Handoyo, Sulaeman Santoso, Hapnes Toba, Huyen Nguyen†, Vishv Malhotra, "IBAtS - Image Based Attendance System: A Low Cost Solution to Record Student Attendance in a Classroom", 2018 IEEE International Symposium on Multimedia (ISM), 10-12 December 2018.

[7] Muthunagai, Muruganandhan, Rajasekaran.P, "Classroom Attendance Monitoring Using CCTV",IEEE International Conference on System, Computation, Automation and Networking (ICSCAN), 3-4 July 2020.

[8] Siddharth Rajput, Archana Singh, Smiti Khurana, Tushar Bansal, Sanyukta Shreshtha, "Blockchain Technology and Cryptocurrenices", 2019 Amity International Conference on Artificial Intelligence (AICAI), 04-06 February 2019.

[9] Zibin Zheng, Shaoan Xie1, Hongning Dai, Xiangping Chen, Huaimin Wang, "An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends", 2017 IEEE 6th International Congress on Big Data, 25-30 June 2017

[10] Raaj Anand Mishra, Anshuman Kalla, Nimer Amol Singh, Madhusanka Liyanage, "Implementation and Analysis of Blockchain Based DApp for Secure Sharing of Students'

Credentials", 2020 IEEE 17th Annual Consumer Communications & Networking Conference (CCNC), 10-13 January 2020.

[11] Kaneez Bhatti, Laraib Mughal, Faheem Khuhawar, Sheeraz Memon, "Smart Attendance Management System Using Face Recognition", European Union Digital Library, 31 July 2019.

[12] Sudhir Bussa, Ananya Mani, Shruti Bharuka, Sakshi Kaushik, "Smart Attendance System using OpenCV based on Facial Recognition", INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 09, Issue 03, 11 March 2020.

[13] Samridhi Dev, Tushar Patnaik, "Student Attendance System using Face Recognition", 2020 International Conference on Smart Electronics and Communication (ICOSEC), 10-12 September 2020.

[14] A Arjun Raj, Mahammed Shoheb, K Arvind, K S Chethan, "Face Recognition Based Smart Attendance System", 2020 International Conference on Intelligent Engineering and Management (ICIEM), 17-19 June 2020.

[15] Kolipaka Preethi, Swathy Vodithala, "Automated Smart Attendance System Using Face Recognition", 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), 06-08 May 2021.

[16] Naveed Khan Balcoh, M. HaroonYousaf, Waqar Ahm and M. IramBaig, "Algorithm for efficient Attendance Management: FaceRecognition Based approach", International Journal of Computer Science, vol. 9, Issue 4, July 2014.

[17] Samuel Lukas, Aditya Rama Mitra, Ririn Ikana Desanti, Dion Krisnadi, "Student attendance system in classroom using face recognition technique", 2016 International Conference on Information and Communication Technology Convergence (ICTC), 19-21 October 2016.

[18] Podapati Asmitha, Thella Sunitha, "Student Attendance using Face Recognition Technology", 2022 International Conference on Intelligent Controller and Computing for Smart Power (ICICCSP), 21-23 July 2022.

[19] Hao Yang, Xiaofeng Han, "Face Recognition Attendance System Based on Real-Time Video Processing", IEEE Access (Volume: 8), 10 July 2020.

[20] Marko Arsenovic, Srdjan Sladojevic, Andras Anderla, Darko Stefanović, "FaceTime—Deep learning based face recognition attendance system", 2017 IEEE 15th International Symposium on Intelligent Systems and Informatics (SISY), 14-16 September 2017.

Appendices

Appendix-I: Installation of libraries

1. Install CMake from its official website https://cmake.org/download/
2. **conda create –name env_dlib python==3.6.13**
3. **conda activate env_dlib**
4. **pip install cmake**
5. **pip install dlib**
6. **pip install flask**
7. **pip install opencv-python**
8. **pip install numpy**
9. **pip install face_recognition**
10. **pip install os**
11. **pip install imutils**
12. **pip install web3**
13. **pip install pandas**
14. **nvm install 18**
15. **npm install -g truffle**
16. **truffe init**
17. **truffe compile**
18. **truffe migrate**
19. **python app.py**

Publication

Paper entitled **"Real-time Attendance Monitoring System using Machine Learning and Blockchain"** is presented at **"11 th International Conference on Emerging Trends in Engineering & Technology Signal and Information Processing(ICETET SIP-23)"** by **"Sindura Rajendra Dasi, Ekta Shantaram Gujar, Abdul Samad Mohd. Islam Ansari and Prof. Yaminee Patil".**