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SMART COLLEGE MANAGEMENT SYSTEM

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A B S T R A C T

Our project aims to make a smart college management system that connects everything in our college. This system will have many advanced features like communicating with each other online anytime, exchanging study materials and all college-related news, attendance system with an AI facial recognition technology, updated student records, feedback from/to students, giving reviews about students' & staffs' works, adding notices and posts to groups or forums, paying fees by major payment methods including cryptocurrencies. This system will have local backups and the main database will be maintained on cloud services and A separate blockchain with apps for all kinds of devices (Progressive Web App, Android App, iOS App) and some embedded devices.

This system will have a few types of accounts like Admins, Staff, and Students. The student accounts can have money deposited in the system. They may use their system ID/ for purchasing items in-store or paying fees.

Keywords: *Embedded and Real-Time Systems, IoE, AI, Blockchain, dApp, DAO, Web & Mobile App Development, Cloud Computing.*

1. INTRODUCTION

Considering the average college in our country we already have a website just to showcase some photos of events conducted on our campus and photos of students working in labs. We can make a social media-like app for students by modern Javascript frameworks like React and make it a Client-Server model-based web app.

There are many cameras on our campus like a camera for every corner. We just store recent recordings on a hard disk for now. They can be used for recognizing different people like students, staff, officials, and outsiders.

The traditional method of attendance marking is a tedious task in many schools and colleges. It is also an extra burden to the faculties who should mark the attendance by manually calling the names of students which might take about 5 minutes of the entire session. This is time-consuming. There are some chances of proxy attendance. Therefore, many institutes started deploying many other techniques for recording attendance like the use of Radio Frequency Identification (RFID), iris recognition, fingerprint recognition, and so on. However, these systems are queue-based which might consume more time and are intrusive in nature. Face recognition has set an important biometric feature that can be easily acquirable and non-intrusive. Face recognition-based systems are relatively oblivious to various facial expressions. The face recognition system consists of two categories: verification and face identification. Face verification is a 1:1 matching process, it compares face images against the template face images and is a 1:N problem that compares a query face image. One of the purposes of this system is to build an attendance system that is based on face recognition techniques. Here the face of an individual will be considered for marking attendance. Nowadays, face recognition is gaining more popularity and has been widely used. In this paper, we proposed a system that detects the faces of students from live streaming video of the classroom, and attendance will be marked if the detected face is found in the database. This new system will consume less time compared to traditional methods.

And most importantly we are entering into Web 3.0 which is the decentralized web that challenges the dominance of tech giants by giving the power and data to the hands of the internet users rather than big tech corporations. To just start adding this tech to the college management system we can add some of our college certificates to the Ethereum blockchain initially. And anyone can view the certificate detailed from the blockchain using our dApp.

2. LITERATURE SURVEY

In [1] Fuzail, Muhammad & Noman, Fahad & Mushtaq, Muhammad Omer & Raza, Binish & Tayyab, Awais & Talib, Muhammad introduce a new approach to automatic attendance management systems, extended with computer vision algorithms. We propose using real-time face detection algorithms integrated into an existing Learning Management System (LMS), which automatically detects and registers students attending a lecture. The system represents a supplemental tool for instructors, combining algorithms used in machine learning with adaptive methods used to track facial changes during a longer period of time. This new system aims to be less time-consuming than traditional methods, at the same time being nonintrusive

and not interfering with the regular teaching process. The tool promises to offer accurate results and a more detailed reporting system that shows student activity and attendance in a classroom.

In [2] Hameed, Bushra & Khan, Muhammad Murad & Numan, Abdul & Ahmed, Muhammad & Talib, M & Ashfaq, Faiza & Usman, Hafiz & Yousaf, M. conclude that there is a need for conducting a systematic literature review. This study reviews the artistic gap between these two based on educational projects. So, the paper focuses on exploring some block-chain based projects and protocols that are used in these projects. It also analyses the block-chain features that are being used and the services offered by the existing educational projects using block-chain features to improve the execution of this technology in education.

In [3] Hang, Lei & Kim, and Do-Hyeun propose an integrated IoT platform using blockchain technology to guarantee to sense data integrity. The aim of this platform is to afford the device owner a practical application that provides a comprehensive, immutable log and allows easy access to their devices deployed in different domains. It also provides characteristics of general IoT systems and, allows for real-time monitoring, and control between the end-user and device. The business logic of the application is defined by the smart contract, which contains rules and conditions. The proposed approach is backed by a proof of concept implementation in realistic IoT scenarios, utilizing Raspberry Pi devices and a permissioned network called Hyperledger Fabric. Lastly, a benchmark study using various performance metrics is made to highlight the significance of the proposed work. The analysis results indicate that the designed platform is suitable for the resource-constrained IoT architecture and is scalable to be extended in various IoT scenarios.

In [4] Shubhangi Kamble, Muhibullah Borkar, Aqsa Nakhwa, Saifa Mukadam, Siddhesh Mayekar. did a project that uses multiple sensors, some sensors like ultrasonic sensor and IR sensors are connected to the main processor which is Raspberry Pi, and remaining application sensors like IR sensors mic and others are connected to the Arduino processor, the sensors will send a message to the main processor for its proper working at the power-up stage and processor will acknowledge its presence. Each sensor sends the information to the main module which either saves the information into a database or it simply proceeds with the required action, information to be saved is sent to the Cloud/Local server and the appropriate action or functions are carried out is also saved depending on the type of the data. The functions like Smart canteen and Smart library which can be accessed by students will be operated using a smartphone application. The device that connects the android application and cloud will Raspberry Pi's function known as FLASK. Each time students' requests will be processed and updated in the database.

In [5] Smitha, & Hegde, Pavithra & Afshin. built an attendance system that is based on face recognition techniques. Here the face of an individual will be considered for marking attendance. Nowadays, face recognition is gaining more popularity and has been widely used. In this paper, they proposed a system that detects the faces of students from live streaming videos of, the classroom, and attendance will be marked if the detected face is found in the database. This new system will consume less time than compared to traditional methods. All the students of the class must register themselves by entering the required details and then their images will be captured and stored in the dataset. During each session, faces will be detected from a live streaming video of the classroom. The faces detected will be compared with images present in the dataset. is If a match found, attendance will be marked for the respective student. At the end of each session, a list of absentees will be mailed to the respective faculty handling the session.

In [6] Vincent Tabora. applied face detection to some photos he took using OpenCV with Python. The results lead to no close conclusion. The code does not automatically detect the faces since the values used for the parameters must be set by the user. Everybody will not get consistent results, they will all depend on the parameter values set for scaleFactor, minNeighbors, and minSize. There is no exact value to detecting the number of faces. The user will have to use arbitrary values to come up with face detection. The code can detect faces, but it would still require verification from the user. This is therefore not a fully intelligent system since it requires interaction from the user.

3. PROPOSED SYSTEM

The objective is to make a system with a controller that controls the IoT devices and monitors who are all in every place on the campus and to make a Progressive Web App that can control this device remotely and can act as a social media for the students, staff, and admins.

3.1 Block Diagram of the System

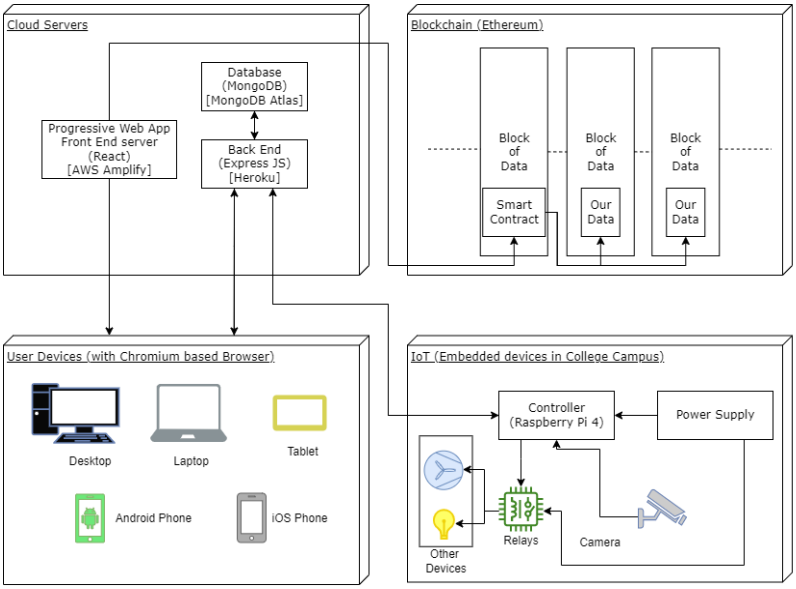

Fig. 1 - Block Diagram of the System

Our system apps will be deployed on cloud servers. The blockchain smart contract will be deployed on the Ethereum blockchain. The apps can be accessed properly from any type of smart device if it has a chromium-based browser installed. We use Raspberry Pi 4B 4GB model as our campus system controller. The controller and the IoT devices and relays will be connected to the power supply.

3.2 App Functions

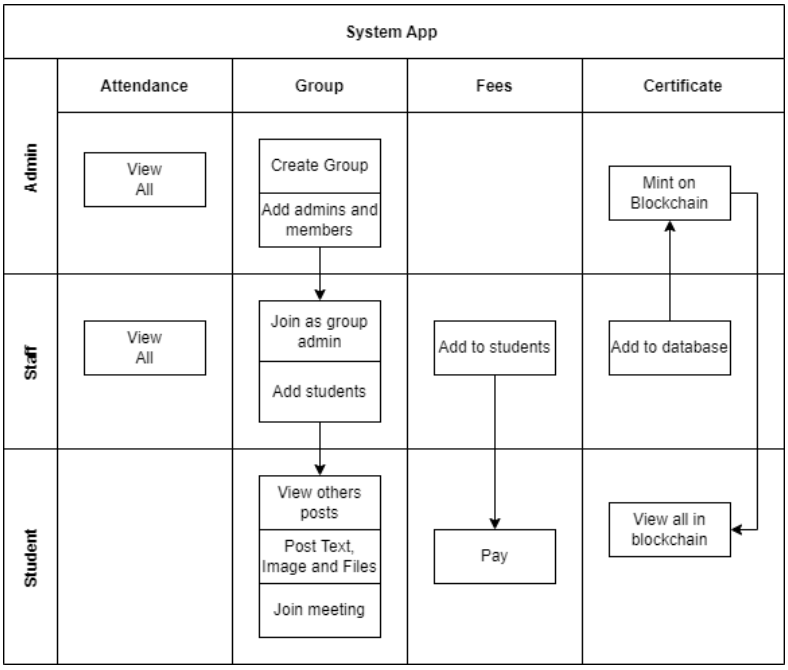

Fig. 2 - Functional Flowchart of the App

Dataset Creation:

Images of students are captured using a webcam. Multiple images of a single student will be acquired with varied gestures and angles. These images undergo pre-processing. The images are cropped to obtain the Region of Interest (ROI) which will be further used in the recognition process. The next step is to resize the cropped images to a particular pixel position. Then these images will be converted from RGB to grayscale images. And then these images will be saved as the names of respective students in a folder.

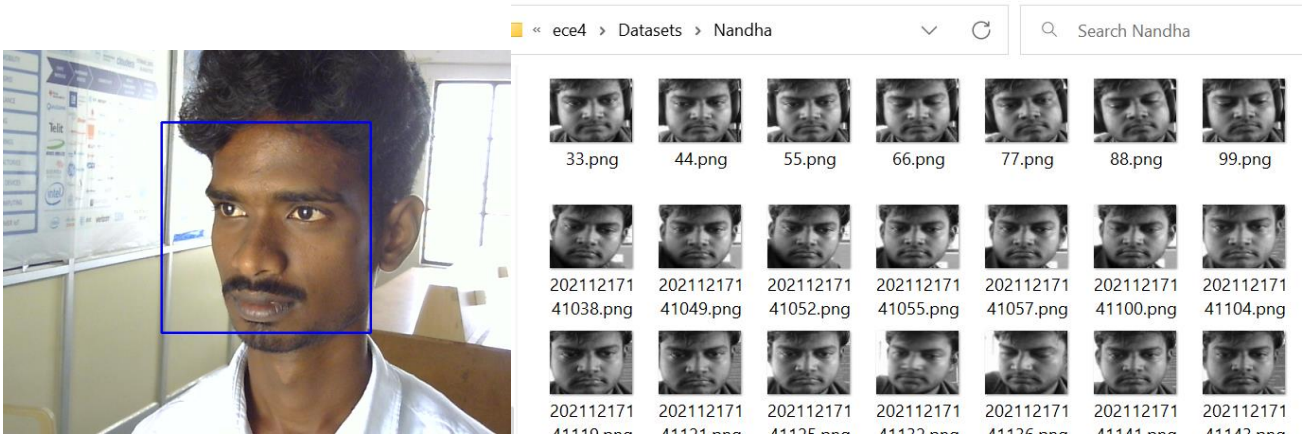

Fig. 3 - (a) Creating user face data; (b) Local database of Face details

The system will have features like AI attendance, online groups, group meeting, posting in groups, online fees payment gateway, IoT control over the internet, informing absence and few extra more

3.2.1 Posting Text, Image, File, and Link

Any user that has registered in the app can post text, image, or files to their profile using the client PWA app. But to post anything in any group, they should have been added to the group by the group admin. Text in the post is stored in the database and the images and files are being stored in AWS S3. To open the files the server will give a link for the file via the client app. AWS CloudFront service.

3.2.2 Group Meeting

In group pages there will be a button called “Meet”. By clicking the button users in the group can join the meeting the group. This meeting feature is integrated from the third-party service Daily. Group members can join immediately but only group admins can allow others to the meeting.

3.2.3 Fees Payment

We use the third-party service Razorpay for the payment gateway. When the user clicks on “Pay fees”, the app will open a window of the Razorpay payment gateway. After the user successfully completes the transaction, the transaction details the app gets from the Razorpay API will be stored in our database.

3.2.4 Face Recognition

Face Detection here is performed using Haar-Cascade Classifier with OpenCV. The Haar Cascade algorithm needs to be trained to detect human faces before it can be used for face detection. This is called feature extraction. The haar cascade training data used is an XML file haarcascade_frontalface_default. The haar features will be used for feature extraction.

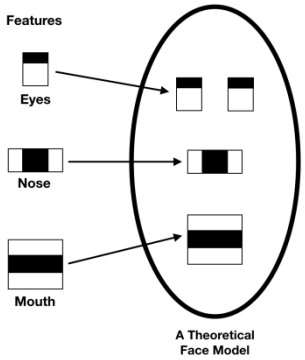

Fig 4 - Haarcascade Frontal face Modal

Here we are using detectMultiScale module from OpenCV. This is required to create a rectangle around the faces in an image. It has got three parameters to consider- scaleFactor, minNeighbors, minSize. scaleFactor is used to indicate how much an image must be reduced in each image scale. minNeighbors specify how many neighbors each candidate rectangle must have. Higher values usually detect fewer faces but detect the high-quality

image. minSize specifies the minimum object size. By default, it is (30,30). The parameters used in this system are scaleFactor and minNeighbors with the values 1.3 and 5 respectively. Face Recognition Face recognition process can be divided into three steps: prepare training data, train the face recognizer, and predict. Here training data will be the images present in the dataset. They will be assigned an integer label of the student it belongs to. These images are then used for face recognition. The face recognizer used in this system is the Local Binary Pattern Histogram. Initially, the list of local binary patterns (LBP) of the entire face is obtained. These LBPs are converted into a decimal number and then histograms of all those decimal values are made. In the end, one histogram will be formed for each image in the training data. Later, during the recognition process histogram of the face to be recognized is calculated and then compared with the already computed histograms and returns the best-matched label associated with the student it belongs to.

3.2.5 IoT Functions

The python program in the controller device will continuously do the following and save the result in memory. Checking for faces in front of the camera and if any save them in the local storage. Check if any face is similar to the faces in the database. Check if any commands are given in the app and do them or decide if any of the electrical devices have to be switched state according to the persons in the room and switch the state immediately. These states are continuously synced with the room data in the database via the backend (server) of the app.

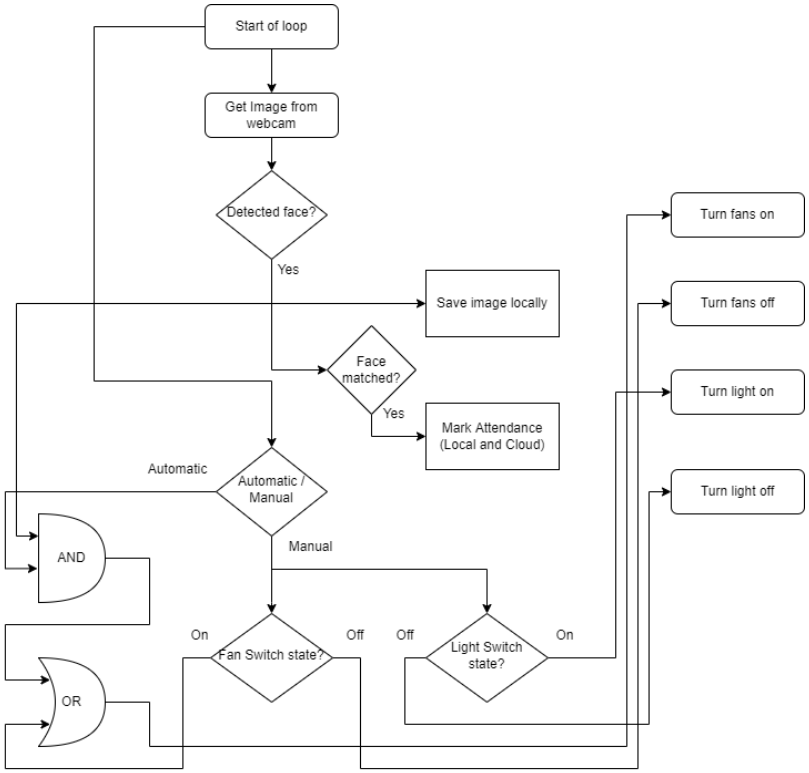

Fig 5 - Room Controller Algorithm

3.2.6 Blockchain

Staff users can add certificates for students in the database using the app. But only the Admin users can mint the certificates in the Ethereum blockchain due to the cost considerations. Anyone can view any certificate from our smart contract by entering the certificate id in our app. This is because the certificates should be verifiable for all.

4. RESULTS

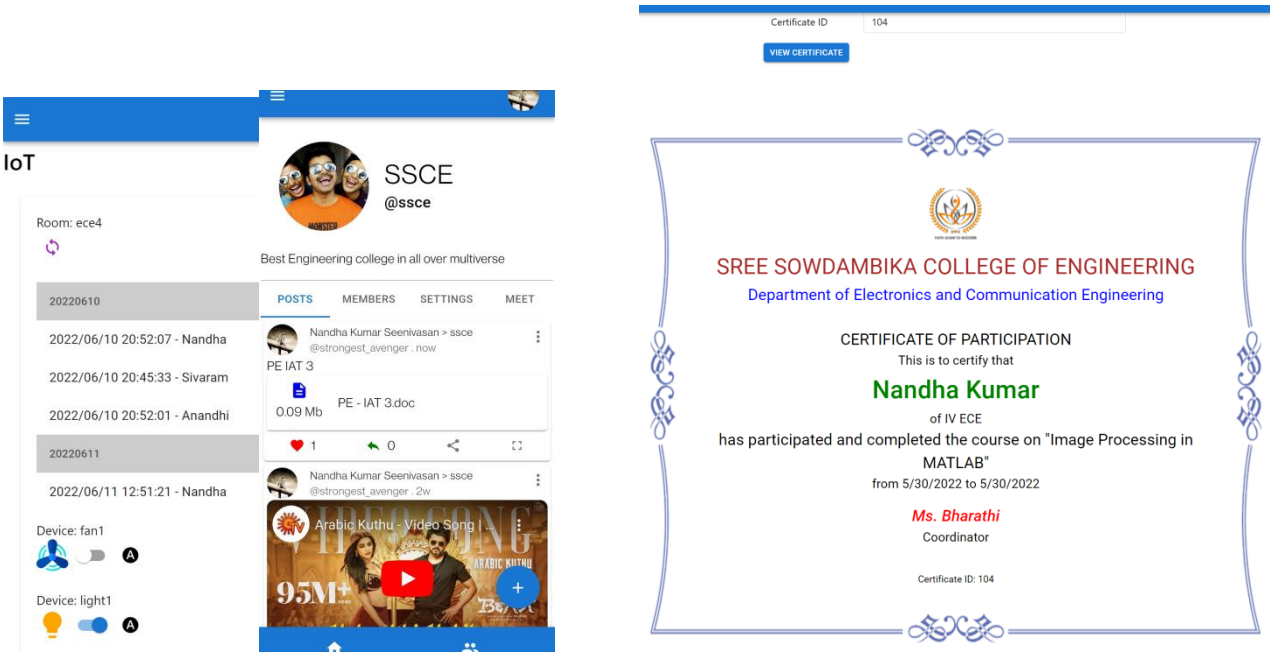

Fig 6 - (a) IoT Control Panel in the app; (b) Posting in the online group; (c) Viewing a certificate data from blockchain

After the testing we know that the main features like attendance system using, AI Face Recognition Technology, creating group, joining and posting text, images, and files adding fees and paying via payment gateway, minting certificate in Ethereum blockchain and viewing by id are working fine and now the system can be implemented.

5. CONCLUSION

This system aims to build an effective class management system using modern technical features. The proposed system will be able to mark the attendance via face recognition and can control IoT and we can share things online via the app. But the technology world developing exponentially. So, we have to constantly upgrade our system so that it will be the most efficient and effective for future generations, especially our students.

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