Geo-fenced smart attendance system with timing and face recognition

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ABSTRACT

The study proposes a student attendance system for colleges and universities that combines Face Recognition capabilities, Geo Fencing using the geofencing API from Google Play services, Google location services dependencies, and Firebase and Geofire dependencies. This is accomplished by getting students' real-time whereabouts and setting up a geo-fence around the classroom. The system also runs face recognition on preregistered students, and when they spend more than 80% of their time inside the geo-fence, attendance is automatically taken (Classroom). The Android Studio Integrated Development Environment (IDE), which is used to create native Android applications, was utilised to create this system.

Keywords: Attendance, Geo-fencing, Facial Recognition, GPS, Barcoding, Database

I. INTRODUCTION

An important factor in determining the success of a project is the quality of the project team. Regular attendance demonstrates that students are less likely to participate in mischievous or harmful activities. The likelihood of failing a class or leaving school early rises with repeated absences. Being present at a location, especially an institution, is the state of attendance. In a school, attendance is very significant since it shows how punctual a student is. Due to attendance by proxies or impersonations, manual attendance maintenance is ineffective. Academic performance is significantly impacted by attendance in class. As a result, in order to take an exam, most educational institutions require that students have a particular level of attendance. This is because it's thought that students will perform better academically if they attend class more frequently than normal.

Prior to the invention of computers and mobile devices, using a pen and paper was the most typical way to take attendance in classrooms at our institutions. The traditional method of taking attendance in a classroom involves calling out students' names or passing an attendance sheet around the group, where each student is required to sign the page to attest to their physical presence. Nevertheless, this extremely common way of recording attendance, for instance in Nigeria, presents difficulties, particularly for classes with a big number of students, as keeping track of these students' records is a very important and crucial responsibility for Lecturers. Also, this attendance tracking technique greatly increases the possibility of having inaccurate attendance records, manipulated data, attendance fraud, etc.

Several mobile-based attendance management systems have been suggested and implemented in recent years to address the issue of attendance; techniques to address the issue may be divided into RFID/NFC-based and visual-based approaches. Using technologies like facial recognition, fingerprint-based attendance, Bluetooth-based attendance, and others, smartphones have been utilised to track student attendance. Students may commit fraud while using cellphones as an attendance and monitoring tool, such as documenting attendance at a place other than the one indicated, having someone else record their presence, or leaving campus after recording their presence. The method of recording attendance may be made more safe and effective by combining fingerprint, Secure user ID, and GPS location as authentication elements. The Mobile Attendance System would be more secure if the attendance application was protected against emulators and false location modules.

However certain colleges and educational institutions in Nigeria and elsewhere are introducing and using electronic attendance management systems, for instance in all accessible biometric systems, which engrosses more prolonged period with exceptional subsistence of their design. For instance, utilising RF cards for classroom attendance creates issues with recognition distance and the requirement for a check procedure where students must scan the card

each time using a reader to verify attendance. Moreover, because it is employed throughout the lecture period for just one topic and the record is only examined once, a real-time response to the midterm situation is not conceivable.The many mobile attendance methods suggested to address these issues are likewise unable to fundamentally address issues like interim and proxy attendance since they check attendance using merely a smartphone application.

This study focuses on the usage geofencing technology, which is a positioning-based technology that detects the entry and exit of people, objects, etc. in regions divided by virtual boundaries. By instructing the student to use a smartphone to automatically record the access record when entering and departing the classroom that has been set up as a geofence, the suggested method addresses the issue of intermediate attendance and alternate attendance. A sophisticated time management technique called geofencing allows for the real-time tracking of student attendance. It enables businesses to track worker attendance and educational institutions to control student attendance from any place.In order to reduce the incidence of absence fraud, the system uses geofencing to offer a spatial boundary where students may validate their presence and face using facial recognition. Each student in the proposed system has to have a student ID, a login password, and to register a face photo before they may use the current mobile application for attendance.

The format of this essay is as follows. The paper's introduction is included in Section 1. The second section summarises the body of research. Our suggested mobile-based attendance system approach was discussed in Section 3. The system testing and validation are described in Section 4.
The study is concluded in section five, which also identifies workable directions for the future.

II.   METHODOLOGY
Algorithms and Description
In this part, a full explanation of the design and development of the automated mobile based student attendance system will be provided. In this suggested system, a hybrid method is used, with a location-based surveillance system utilising geo-fencing and a face recognition strategy that uses an Android-based software development framework for real-time face detection and identification using the OpenCV library. The method proposed in this study is to employ face recognition technology for authentication and geofencing technology to track student presence for

attendance utilising real-time presence inside the predetermined perimeter for up to 90% of the lecturer's total class time.

After being originally registered, the programme detects faces in picture format using recognised facial cues, such as the eyes and nose, which are already connected to the student database.

So, if a student's GPS position is within the geofence for up to 90% of the time during a lecture for a certain course, attendance will be recorded. In order to reduce the likelihood of fraud while students are absent, the system uses geofencing to offer a geographic boundary where students can declare their presence for the duration of their stay inside the geofence. It also uses facial recognition to validate students.

The suggested system which is meant to deliver a superior and probable breakthrough in the Attendance Monitoring System, provides a Mobile-based Attendance Monitoring System employing the \sWinding Number technique for the deployment of the Geofence. In essence, a geofence technology is a positioning-based system that recognises when people, objects, etc. enter and leave regions that are divided by virtual borders. Since it can properly identify if a point is inside a non-simple closed polygon, the Winding Number Algorithm was chosen. By counting the number of times the polygon winds around the spot, it achieves this.In order to identify someone, the system compares their image to every record in the database, i.e., each person is identified by comparing their image to the image recorded in the database across their matric number. Enrollment and Authentication are the first two (2) phases of the image identification process. At the enrollment stage, students enter all of their information into the application, including their face being photographed and all of their personal information being stored, whereas at the authentication stage, faces are first taken with a camera, and the detected image is then compared with the database for confirmation. Summarily, before a student would be allowed to utilise the suggested system, the student is required to have a student ID,\slogin password and registered a face photo into the database.

The architecture of the proposed system is shown in Figure 1, where the application accepts the geo-fence coordinates as input along with the enrolled data (i.e., ID, face, etc.), with the information collected being saved to the backend. The collected face landmarks are matched to data contained in the repository. The face is matched with the data source when the students are inside

the geo-fence that the lecturer has specified, and attendance is correctly recorded after taking into account the time spent inside the geo-fence.
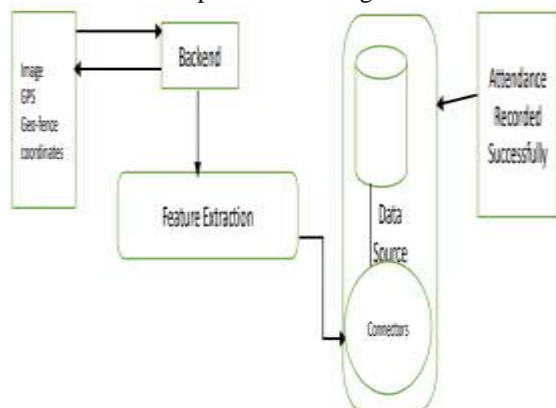

Figure 1: Proposed System Architecture Diagram

III.   DESCRIPTION FOR MODULE
Phase of Face Detection
The method of detection involves searching the input image (picture) for any faces. After a face is located, the image is cleaned up through image processing to make it easier to recognise the face. To detect faces, a convolutional neural network technique was used.

Phase of geofence design
Geofencing: Geofences are virtual perimeters or borders around actual physical locations built with the assistance of software or hardware . The suggested application would employ geofencing to create virtual borders around each lecture hall that the speaker would use. The lecture hall would then be activated for each lecture in a course, and all enrolled students may then record attendance. The geofencing API leverages the Google Play services and Google location services dependencies along with Firebase and Geofire requirements. The student's current location is stored by the location service using the Geofire service of Google Firebase, a no-SQL real-time database that is updated each time a new location is requested.
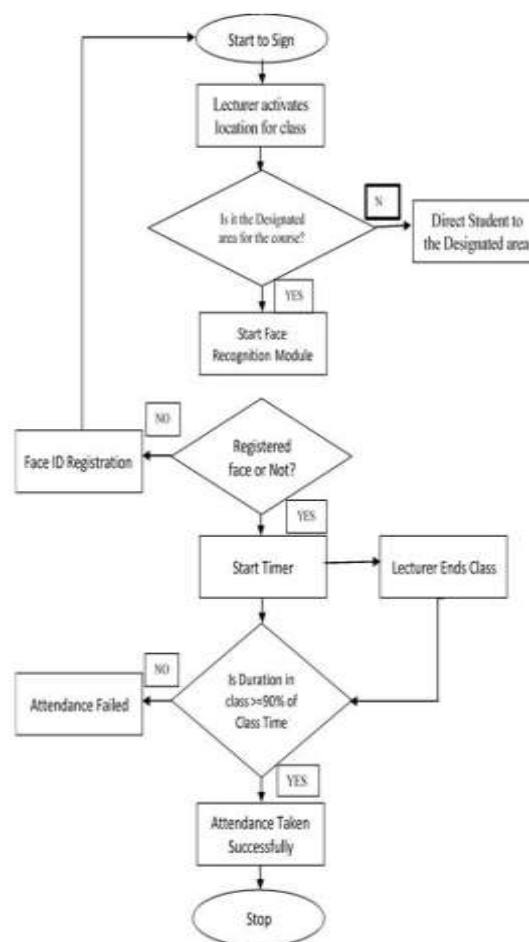

Figure 2: Flowchart for the attendance system

IV.   CONCLUSION
The goal of the automated attendance system is to decrease the mistakes that frequently occur with the conventional (manual) attendance taking method. The goal is to automate and create a system that is beneficial to the institution or other entity. This The android-based mobile application for students' attendance at a university was created as part of the development of this system. In this project we created a smartphone application for taking students attendance at Kwara State University, Malete. The built programme has been shown to address the issue of manually recording attendance, and it includes a suggestion to incorporate entering attendance data into the CMS portal following each class.

There are various modifications that might be recommended in boosting the mobile applications. By making the notice from the professors available to the attendance application, it may be made better administrator. This might be

incorporated with additional study improvement of the system for the administrator. By adding more symbols, colours, and menus, the graphical user interface of the Attendance App may also be enhanced.The capability to inform lecturers, such as a notice in the status bar of a smartphone or the ability to set an alarm sound, might also be added to the attendance app to improve it. The system was created using the Android Studio Integrated Development Environment (IDE), which uses XML for the frontend design and the Java programming language for the backend design, despite the fact that the amount of recorded sentences in the Firebase database is rather small.

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