

Geofencing Based Attendance Monitoring System

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ABSTRACT

INTRODUCTION

Student attendance is an integral part of performance assessment in many universities, however managing attendance becomes a problem when the population of students is large. Several approaches have been proposed but major constraint includes time taken in completing the attendance systems. Standard biometric approaches like fingerprint and iris require several devices including backup servers which are often expensive in terms of cost and management(Cheng etal, 2012, Jamilet al. 2017)

AIM:

The aim of this research is to develop and implement a model for monitoring and tracking attendance of students essentially in large classes using geofencing.

METHODOLOGY

GPS coordinates are required for the program to determine the student's current location. The coordinates, x- and y-coordinates up to 6 (10,6) decimal points, obtained are then mapped with the standard coordinate in the system database defined by the instructor. To interpret the coordinates, the program, developed in php/mysql is integrated with Google Maps APIs so that users can view the visual location of the coordinates received. The information updates the student name, x-coordinate, y-coordinate, classroom and timestamp. A credential is required to use the Google Maps APIs service, which can be obtained by placing a request through Google console. Attendance is then calculated as a summation of the output of the Haversine formula.

CONCLUSION

The smart, geofencing based attendance monitoring system has performed optimally in the test cases carried out especially in taking attendance for classes. It will improve both the process of taking attendance and also can track students on campus.

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I. INTRODUCTION

Student attendance is an integral part of performance assessment in many universities, however managing attendance becomes a problem when the population of students is large. Several approaches have been proposed but major constraint includes time taken in completing the attendance systems. Standard biometric approaches like fingerprint and iris require several devices including backup servers which are often expensive in terms of cost and management(Cheng etal, 2012, Jamilet al. 2017)

Automated attendance system provides many benefits to organizations most especially in the educational sector. This reduces the need of pen and paper based manual attendancesystem.

Following this thought, we have proposed a geofencing (geolocation) based attendance monitoring system which is implemented as a web application reducing the need of additional biometric scanner device. The location of an organization, a school for instance has a specific longitude and latitude which make up the desired location, this can be determine by the GPS. Each student location can be determined by the GPS using either a computer or smartphone during or at the beginning of each lecture which is then stored in the database to compare the lecture room coordinated. This location is defined as a key of time and attendance monitoring in our paper.

II. PROBLEM STATEMENT

Biometric recognition system is an exact case to address this problem, which includes finger print or iris recognition. Many systems have been proposed and implemented using this technique without considering it limitation in terms of efficiency and failure where thousands of users are applicable, which is exactly what our system planned to eliminate. Unlike fingerprint, iris is more preserved from the external environment. But both the fingerprint and iris recognition based approach needs some extra devices or scanner which can be connected to the server computation system. In our work, we addressed the problem utilizing internet connectivity for

monitoring the presence or attendance of an individual. Geofencing based attendance monitoring system reduces the surplus cost of additional scanning device because now a day almost each student possesses a smartphone of their own.

III. RELATED APPROACHES

More than a few techniques and approaches have been implemented to effectively monitor students' attendance. Shoewuet al.[1]proposed a cost-effective computer-based embedded attendance management system that allowed the electric monitoring of attendance using an electronic card. These cards, which contain all necessary information on their individual, are inserted into a machine that records the time and other information to a server.In another example, Cheng etal. [2] designed and implemented a system that applies user identification and a password for authentication.However, the issue with these electronic card or password-based systems is that they do not actually authenticate who the user appears to be but to monitor if the electronic card is in class.Jamilet al. [3]also proposed that software to be installed in the instructor's mobile telephone. It enables it to query students' mobile telephone via Bluetooth connection and, through transfer of students' mobile telephones' Media Access Control (MAC) addresses to the instructor's mobile telephone; presence of the student can be confirmed.

On the other hand,Saraswatet al. [4] presented his technique, the proposal uses fingerprint verification technique. They propose a system in which fingerprint verification is done by using extraction of minutiae technique and the system that automates the whole process of taking attendance. Since biometrics are concerned with the measurements of unique human physiological or behavioral characteristics, the technology has been used to verify the identity of users. It is becoming critical to be able to monitor the presence of the authenticated user throughout a session. Thus, another proposal by Qinghan Xiao [5], discusses a prototype system that uses facial recognition technology to monitor authenticated user or students.A neural network-based algorithm was implemented to carry out face detection, and an eigenface method was employed to perform facial recognition. The experimental results demonstrate the feasibility of near-real-time continuous user verification for high-level security information systems.However, both fingerprint- and iris-recognition-based approaches require extradevices and scanners,usually connected to a server.

Geo-fencing based attendance monitoring system is proposed to address pre-existing problems using geolocation to track the presence or attendance of an individual. Geo-fencing based attendance monitoring system reduces the surplus cost of additional scanning device, taking advantage of this present generation (21th generation) where almost each student possesses a smartphone of his own. A lecture room is fixed for every lecture, when a student is within the area fixed by the lecturer by determining the coordinate (longitude and latitude) of that area with time range. The student will only have the access to submit attendance if within the mapped area with timestamp.

IV. METHODOLOGY

The prime goal of the system is to be able to take attendance using the web as an advantage without inaccuracy. To justify this, GPS coordinates are required for the program to determine the student's current location, based on the coordinates received. The coordinates obtained are then mapped with the standard coordinate in the system database defined by the instructor in charge. Using GPS, we can obtain both x- and y-coordinates up to 6 (10,6) decimal points with the help of ground and space satellites. To interpret the coordinates, the program is integrated with Google Maps APIs so that users can view the visual location of the coordinates received. A credential is required to use the Google Maps APIs service, which can be obtained by placing a request through Google console.

ANALYSIS OF THE DESIGN

The proposed system provides a solution to manual attendance taking problem. This system is a location-based attendance tracking system based on the concept of web services which can be realized on any internet and GPS enabled device. At first it is important to save the office or lecture room coordinates by entering the latitude, longitude and radius of area. The proposed approach uses two techniques, the very first method is using the geolocation, the second technique on the other hand is by using a system generated OTP. Either of the two techniques can be chosen and determined by the instructor. This geo-fencing based attendance monitoring system locates users' position which is then mapped to the specified coordinate by the instructor. The system automatically updates attendance in the database for any student's coordinate that falls in the range of the specified instructor's longitude and latitude for that course. The information updated is student name, x-coordinate, y-coordinate, classroom and timestamp. In addition to registering attendance, the application allows students to access their attendance record. The x- and y-coordinates stored during attendance registration can also be retrieved to show the location on Google Maps. The workflow for this program is outlined in figure 2. Users of the system are grouped into two categories;

- **Instructor:** The category of user in charge of scheduling the attendance system, oversee submitted attendance and activate submission method as shown in figure 1.
- **Student:** This group of users that takes full advantage of the scheduled attendance, whose duty is to signify his appearance to the system by submitting attendance as specified by the instructor in charge.

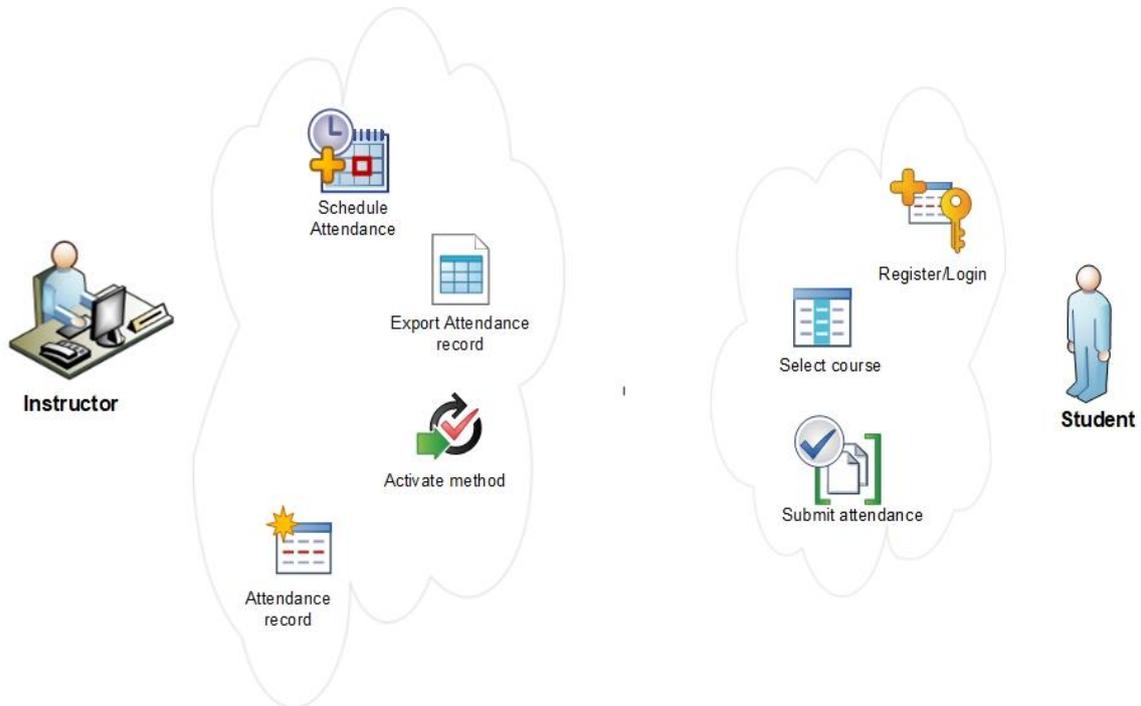


Figure 1: Entities and features of the Geo-fencing based attendance monitoring system.

Overall workflow of program

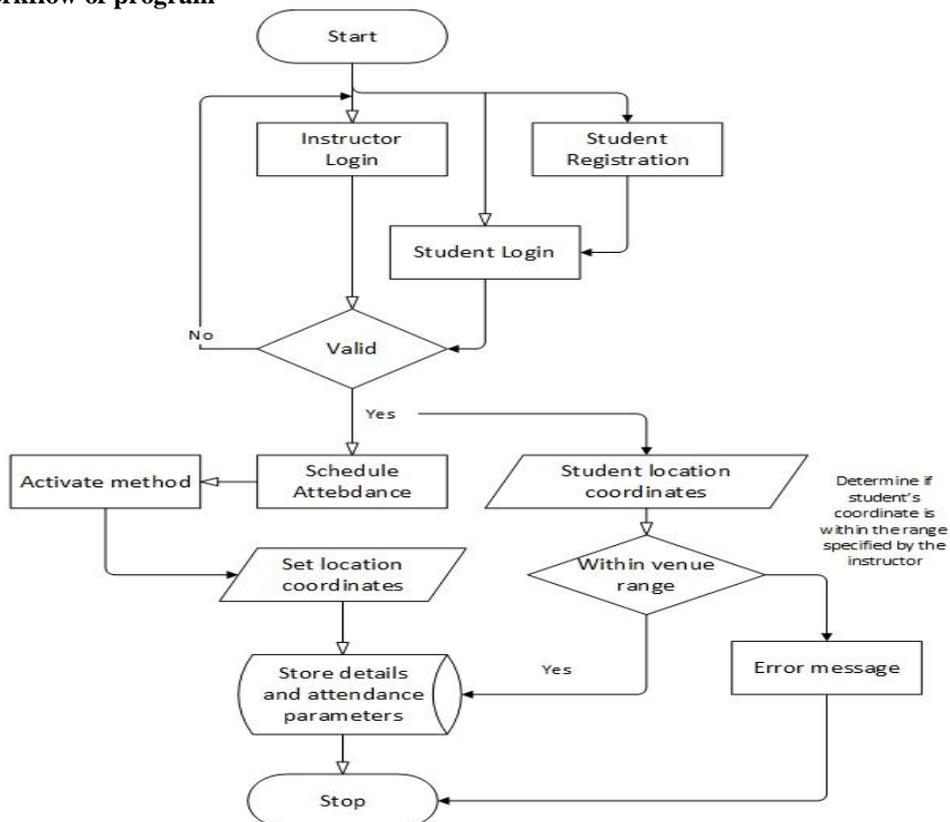


Figure 2: Attendance system overall workflow

E. GPS

Mobile phones equipped with a GPS receiver are readily available on the market. The General Packet Radio Service (GPRS) is currently one of the best and cheapest communication modes available. The attendance system can be deployed on this kind of mobile phone, laptop and other related devices, which is supported to perform all required operations. When the application is started on a user's mobile phone for the first time, they are prompted to register. Thereafter, the user opens the software by entering their username and password. When the user enters their matriculation number and password, these are checked for authenticity. If not authenticated, the user is prompted with a message of wrong matriculation number or/and password and may re-enter their log in details.

On an attempt to submit attendance the location information is sent to the server, the center of class will be calculated for all the smart phones locations received until the scheduled time closes. The coordinates of each Smartphone will be recorded, this will allow the instructor to do a check on the awkward positions of the phones during class. In other words, the following information will be communicated to the server per transaction:

- Student ID
- Course code and class
- Realtime attendance submission
- Smartphone location from device

Figure 3 shows an example of how the system obtain student information.

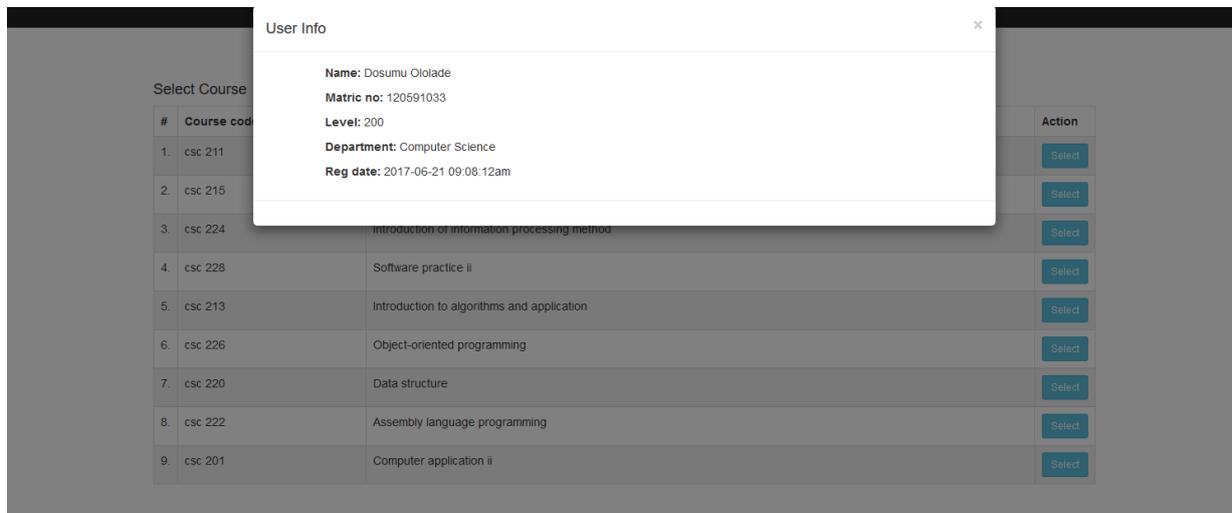


Figure 3: Student information on the attendance system.

V. RESULT

The outcome of the research is the development a geofencing based attendance monitoring system to improve the efficiency of the attendance-taking process, introducing concurrency without considering the number of users at hand, and to reduce the rate of errors in managing attendance records. PHP was used as a preferred programming language to accompany the Google Map API embedded in JavaScript, and MySQL for its backend.

Schedule attendance

Figure 4: Instructor's current location on map, the coordinates and date/time range to schedule an attendance.

Figure 4 above is the instructor's interface showing all parameters required to schedule an attendance. It displays the location on map along with the x and y coordinate of the area with the upper boundary (Max range coordinate) and the duration. Once the attendance is activated for that class, student can only mark attendance within the specified range and duration.

VI. CONCLUSION

This paper introduces a smart, geofencing based attendance monitoring system which use location as the core component of attendance monitoring. The area is set for tracking using GPS coordinate inside the area border depicts where lecture is to take place. We developed this system for web platform, but we are focusing on developing this system for Android platform as well in near future.

REFERENCES

- [1]. Shoewu, O. O. M. Olaniyi, and Lawson, "Embedded Computer-Based Lecture Attendance Management System", African Journal of Computing and ICT (Journal of IEEE Nigeria Computer Section), 4(3):27 – 36, 2011.
- [2]. Cheng, K., L. Xiang, T. Hirota, and K. Ushijimaa (2005), "Effective Teaching for Large Classes with Rental PCs by Web System WTS", Pro. Data Engineering Workshop (DEWS2005), 1D – d3 (in Japanese).
- [3]. Jamil, T. ; Dept. of Electr. & Comput. Eng., Sultan Qaboos Univ., Al Khod, Oman, Automatic attendance recording system using mobile telephone , Telecommunications Forum (TELFOR), 2011 19th 1297 - 1299.
- [4]. Saraswat, Chitresh; Kumar, Amit, An Efficient Automatic Attendance System using Fingerprint Verification Technique. International Journal on Computer Science & Engineering . 2010, Vol. 2 Issue 2, p264-269
- [5]. QinghanXiao ; Interdept. Biometrics Working Group, Gov. of Canada, ON ;Xue Dong Yang, A facial presence monitoring system for information security, Computational Intelligence in Biometrics: Theory, Algorithms, and Applications, 2009. CIB 2009. IEEE Workshop on, March 30 2009-April 2 2009 , 69 - 76

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