

Automatic Attendance and Mobile Learning System in Sensor-Enabled Heterogeneous and Dynamic University Environment.

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2Abstract.

Many questions come up when we think about the academic performance of students and the ways and means to ameliorate that. In today's digital era we can use latest technologies to improve student performance and attendance. Class attendance, quizzes and assignments play a key role in academics. In this paper, we have defined a framework for improving class attendance based on GPS and face detection, and new learning environment where students can use devices like enabled devices, iPad, Tab, iPhone, blackberry, laptop etc. for class quizzes and assignments. We proposed an online as well off-line model for quizzes that will run on platform independent applications.

Keywords: *Heterogeneous, face recognition, GPS, Platform Independent application, mobile learning*

1.0 Introduction

The adoption of information and communication technologies in education has exponentially increased the use of mobile technologies in learning¹. During the last decade, reference to the propagation of several types of electronic devices and their steadily decreasing prices, many learners are now equipped with powerful mobile devices, ranging from common laptops to tablet PCs². Mobile devices have become integral part of the society. Everyone is familiar with the use of it. It does not require any preparation to practice. It is very common for students to bring personal mobile devices to universities which are their first choice for using internet and for communication purpose. Higher quality cameras, their positioning technologies and other sensors as well as internet access have become standard characteristics of modern mobile devices⁵. Although there are many benefits of mobile devices, but a major challenge in developing an application for such devices is heterogeneity in these devices in terms of their screen size, operating system, input methods, communication capabilities. The rapid and constant evolution of web and mobile technologies brings new opportunities

for developers and researches in the process of creating new mobile application¹⁴

Given the wide variety of mobile devices available, the challenges developing innovative mobile learning solutions for class quizzes and assignments arose.

Projects like^[16] and^[12] presents the use of mobile devices, cameras and other sensor devices like RFID for attendance, quizzes, assignments and feedback. The most widely used location technologies are GPS, WI-FI, Cellular, Bluetooth, Infrared, and Radio Frequency Identification (RFID)^[3]. Student attendance is one of the cumbersome task lecturer's face when as the numerical strength of students increases. To check student location in a university premises, coordinates of university and student can be squared up by the help of GPS. But an important challenge here is to confirm time, place and person for presence of students in class. A manual attendance, taking fingerprints or capturing students' photos by student standing in front of camera confirms the presence of the student. But during the lectures, teachers give a short break so keeping an attendance record after the break is another tedious task for teachers as well for students. A classroom equipped with sensing

cameras that automatically capture students' photos without student involvement with continuous observation can effectively solve attendance related problems. In attendance we are also concerned with the techniques of face detection and recognition to detect faces from an image captured by camera.

There are a few philosophies of not using mobile phones for education purpose, but nevertheless there are several reasons that encourage the integration of the mobile learning into the formal education. This paper presents a proposal on use of mobile phones in universities.

2.0 Literature Review

Since the focus of this research is on class attendance, quizzes and assignments, a brief overview of previous work done in the areas is mentioned in subsequent paragraphs.

a. Electronic Attendance System

Attendance is a very basic task. When the numerical strength of the students is more, it is very cumbersome and time consuming. But with the advent of the electronic attendance system, it has become easy and fast. Still researches are going on to make it more efficient. Here we will discuss and compare some of the techniques being used for electronic attendance.

For marking attendance⁶, student during class using mobile send teacher's photo through email and teacher check email and mark attendance of the student. The picture of teacher and time for email ensures the presence of students in the class. An authentication algorithm⁷ that scans the surrounding Smart phone through Wi-Fi allow student to confirm attendance within active attendance time by sending scanned area of Wi-Fi Ap's MAC address list and phone number to server. Thus, checking attendance at any time in the class of vicarious attendance. RFID tag, RFID reader and PDA are proposed collectively for portable examination attendance system^[8] and an interface with GSM network system and mobile phone for the RFID based attendance through SMS¹⁵. A sending camera and capturing camera with face detection technique can effectively work for student attendance if no two students sit on the same chair and student

not frequently move to different seats^[9]. A web camera takes pictures, detect faces and compare with reference image for attendance¹⁰. For detection it uses all the results of continuous observations and has the same conditions as mentioned before. A roll call system with web can uses 10 training and 10 test samples of each student for face detection based on chin information^[5].

b. Mobile learning System

Many web based application have been introduced for quizzes and assignments on mobile to get student response and instant feedback. Some of them are mentioned in this paragraph. Votapedia¹¹ a Wikipedia like web based interface is used in audience response system where respondents vote by cost free dialing. It is accessible to users on PDA and smartphones. Wikimedia and Mediwiki are used for quiz and survey creation. An academic kit¹⁶ includes teaching materials for Java ME and Blackberry applications and uses blackberry API's for creating multiple choice based assignments and games in Blackberry.

A smart response website with a smart response quiz¹², students can access on their personal mobile or any devices with internet connectivity. In indoor quizzes result appears on smart board after the quiz and in the outdoors after the quiz students get results in their system. Quiz comprises of multiple choice questions, multiple answers and true false. Acme¹ a platform independent mobile learning system is a web based application and it provides a test quiz tool which is a mobile implementation of student response system provide a quick feedback to teachers about students' performance.

Teachers use Hot Potatoes for creating of the quiz which comprised of multiple choice questions and questions that require numerical answers.

From the literature review usage of electronic devices and latest software practice in teaching and learning is quite obvious. But all of them pose to certain imitations like in the electronic attendance system in case of RFID its major limitations are mentioned in^[7]. Similarly, if mobiles are used for attendance they do not support the presence of student as someone else can bring mobile to class or can

apply the other student ID hence provide then an attendance problem can happen. If sensing and web cam are use, fake attendance problem is solved, but if two students sit on the same seat as on a bench or student frequently changes seat than accuracy of face detection and identification are affected moreover a large number of training samples of each student highlight a major problem of memory requirement. In case of mobile learning systems that are implemented as web based application even for a class quiz internet is required for teachers as well as for students and¹⁶ is just defined for blackberry therefore if a student has not this device he or she cannot participate in course activities

Motivation and Research Questions

Computerized record of attendance, quizzes and assignments not only help teachers and students, but also higher management to check progress of student in different courses. The use of mobiles devices and all other latest technologies of the current digital era for teaching, learning and attendance can improve student participation and cut down chances of mistakes in records. One of the major objectives of this research is to implement the system with the minimum possible cost and use tools and techniques that are effortlessly available. But to achieve our targets we mention here some research questions.

- How many training images, samples and input images per person will be enough for effective face detection and face recognition?
- Which face recognition technique will be suitable under constant changing status of a single person like hair styles, with or without glasses, covered or uncovered head and changes in seating position?

- Which methods or protocols are required for communication between server / database, build-in GPS receiver or Wi Fi capabilities of end use devices (Smartphone, tabs, and laptop)?
- Do different types of database and query Language required to store and process heterogeneous real time dynamic data and retrieve information.
- Which software architecture technique and programming language are required for development of platform independent applicant and effective visualization of information to different users of the system on their respective devices?

Framework Of Academic Management System

We define here a framework of our proposed system that we will follow during implementation of the system. We have considered two modules and our research questions are based on these two modules. Here we discuss them briefly with their flow charts that are subject to modification for implementation.

a. Attendance module

- Stopping vicarious attendance
- Preventing attendee's departure at intervals
- Locating student in the university premises at any time

In order to achieve our target we will focus on two techniques GPS and face detection. We will use GPS for locating student position as usually student give excuses of being late through his/her personal smart phone and information will be updated in database as shown in Figure 1. By locating the student position we can validate excuse reason.

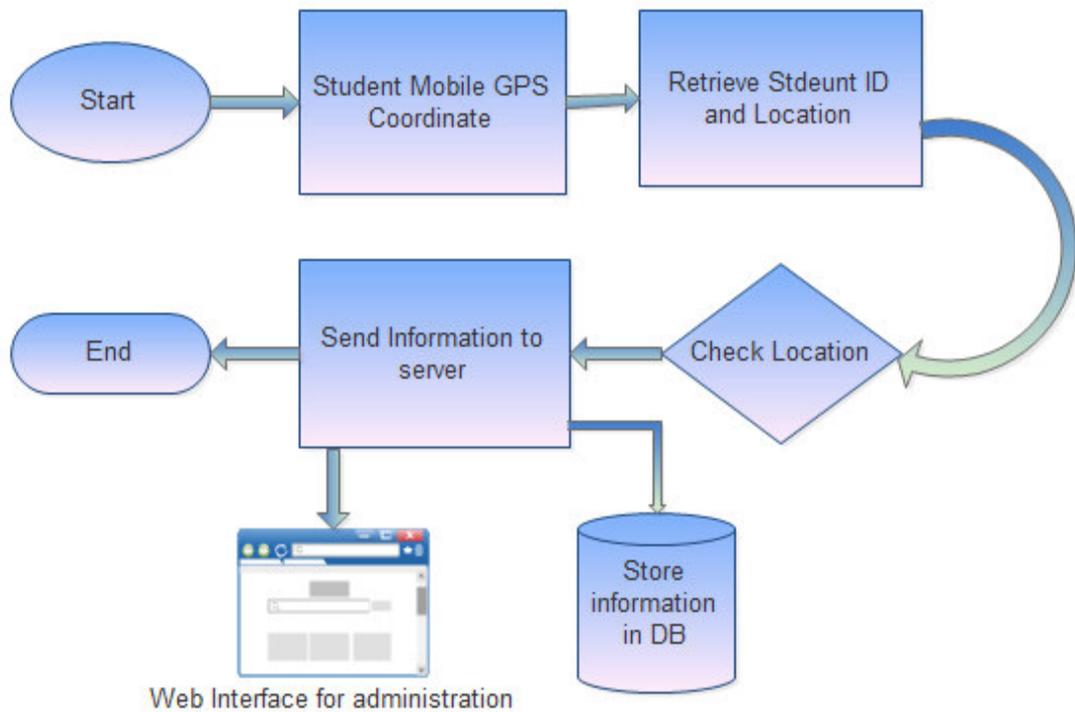


Figure 1: Students location tracking using GPS

For class attendance, it is important to confirm the student presence in class so will focus on face detection techniques. Therefore cameras will be used for automatically capturing images in class at any time without student involvement. Input images when

compared with training sample will provide face recognition and mark attendance. Attendance can be viewed by student and teacher on the web based system as show in **figure 2**

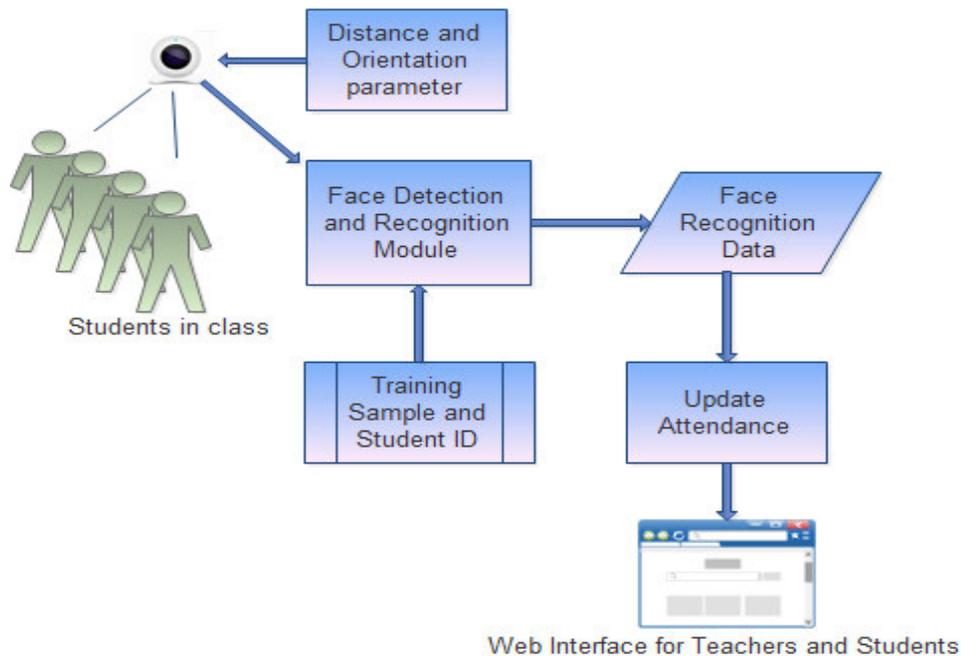


Figure 2: Flow of data for class attendance

3.0 Mobile Learning Module

The mobile learning module is proposed for conducting class quizzes and assignment submission. Both quizzes and assignment will work under time constraint. Quizzes can be conducted even if internet is not available, but for assignments, internet is required. For quizzes or assignments generation instructors will create content, set time(s) and create

answer key (see figure 3) and that content is generated for various target devices with a click of a button. The system will be able to track learners and evaluate their progress. It will be done by analyzing and grading their course work, and sending the results to the instructor and by providing answer key to students.

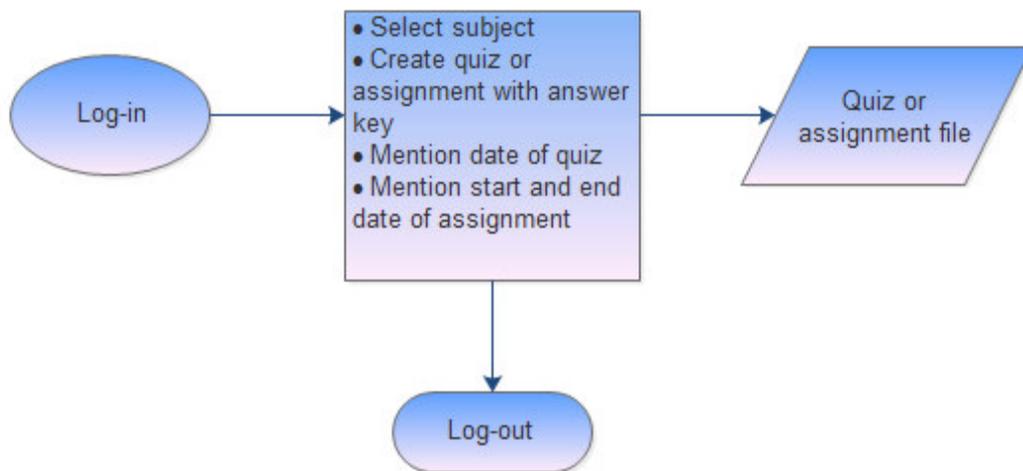


Figure 3: Quiz and assignment generator

If internet is available during the quiz, server will be used for quiz retrieval, time check, and display of answer key and calculation of

results. The flow of information in online approach for quizzes is given in Figure 4.

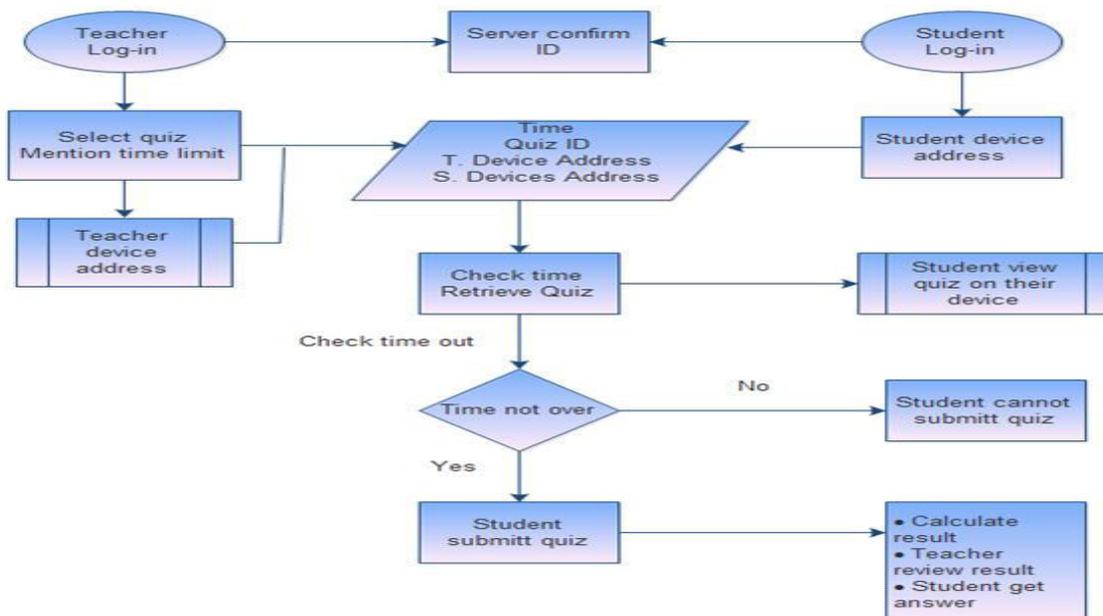


Figure 4: Class quiz using on-line approach

For off-line approach of quizzes it is assumed that quiz and answer key will be there on teacher's devices, hence no need for sever connectivity. When instructors will declare start of quiz his device will scan student devices and send quiz to all student devices. Student log in through their ID's can access the quiz and should complete the quiz in the time limit. The quiz will be submitted back to the instructor's device and after valid time will not be accepted.

Assignments will be web based which student can access on their device and should submit within due date. The server will automatically send assignment to students on start date.

For implementation of framework, different tools and techniques would be considered according to the research question. For information retrieval of GPS based attendance and routing of location information we will explore further ¹⁷ and ¹⁸. Face recognition based attendance pose to certain research question, in order to get their solution we will investigate ¹⁹⁻²³, that will help us in making a decision for camera and face detection technique. Different devices have different operating system, screen size, input method, communication capabilities etc. Design and capabilities of mobile operating system is very much different than general purpose operating system running on desktop computers.

In order to provide an application the work in heterogeneous devices environment and applicable for heterogeneous and dynamic data, we will consider the XML. File format and Java (APIs) modules, components add-ons) . K.,

“Research on an Authentication Algorithm for an Electronic Attendance S. K., “ “Research on an Authentication Algorithm for an Electronic Attendance Sfor server /client applications and database access. Particular focus we will be on^{1, 14} and²⁴. For off-line quizzes we will use Bluetooth technique for scanning student devices. Oracle database and MySQL will be considered to store data and query processing as they both support different operating system and data types. In implementation our focus will be on user interface also but its tools techniques and guidelines are not mentioned in this paper.

4.0 Conclusion

The high propagation of Smart phone and handheld devices leads to the new research ground in the acceptance of such technologies in learning processes. The integration of mobile learning activities in a real context by converting variety of academic activities is not so simple. In this paper, we have proposed a framework of an academic system to help universities worldwide in integrating mobile devices in their academic activities. The framework features student attendance and students assessment through quizzes and assignments with face recognition and mobile learning techniques respectively.

Our future work includes implementation of our platform independent framework. If possible, we like getting more academic activities in application like getting student feedback for course evaluation and university services

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