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

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Abstract -- Many questions come up when we think about the academic performance of students and the ways and means to ameliorate that. In the todays 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 a 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 application.

Keywords -- Heterogeneous, face recognition, GPS, Platform independent application, mobile learning

I. INTRODUCTION

The adoption of information and communication technologies in education has exponentially increased the use of mobile technologies in learning [1]. During the last decade, referable to the propagation of several types of electronic devices and there steadily decreasing prices many learners are now equipped with powerful mobile devices, ranging from common laptops to tablet PCs, tablets and mobile phones [2]. Mobile has become integral part of the society, weather it is a teacher or student. Everyone is familiar with the use of it. It does not require any preparation to practice. It is very common for students that they bring their personal mobile devices to universities and they 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 became standard characteristics of modern mobile devices [5]. 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 researchers in the process of creating new mobile applications [14].

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

Projects like [1], [6] 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) [13]. Student attendance is one of the cumbersome task lecturer’s face when the strength of the students are more. 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 student photo by student standing in front of camera confirms the presence of the student. But these techniques are time consuming moreover usually during 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 student photo 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 the education system in universities. It can help us to minimize our problem which we are facing due to traditional education system as a lecturer. In the rest of the paper, we motivate the need of our research and proceed by presenting the different components of our framework with its integration into university activities. We explore emerging web and mobile technologies, e.g. APIs and open source for Java that can be employed to come up to the challenges cited above.
II. LITERATURE REVIEW

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

A. Electronic Attendance System

Attendance is a very basic task. When the 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 attendance [6], 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 algorithm [7] that scans the surrounding smartphone 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 numbers to server. Thus, checking attendance at any time in the class requires very less time and scales down the chances of vicarious attendance. RFID tag, RFID reader and PDA are proposed collectively for portable examination attendance system [8] and an interface with GSM network and mobile phone for the RFID based attendance, students or parents can get an update for attendance through SMS [15]. A sensing 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 attendance [10]. For detection it uses all the results of continuous observations and have the same conditions as mentioned before. A roll call system with web cam uses 10 training and 10 test samples of each student for face detection based on chin information [4].

B. Mobile learning System

Many web based applications have been introduced for quizzes and assignments on mobile to get student response and instant feedback. Some of them are mentioned in this paragraph. Votapedia [11] a Wikipedia like web based interface is used in audience response system where responders vote by cost free dialling. It is accessible to users on PDA and smartphones. Wikimedia and Mediawiki are used for quiz and survey creation. An academic kit [16] includes a teaching material 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 quiz [12] student can access on their personal mobile or any device 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. aCME [11] 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 student 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 practices in teaching and learning is quite obvious. But all of them pose to certain limitations 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 fake attendance and if a student forget to bring mobile then an attendance problem can happen. If sensing and web cam are used, 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 and [16] is just defined for blackberry therefore if a student has not this device he or she cannot participate in course activities.

III. MOTIVATION AND RESEARCH QUESTIONS

The motivation behind this research is to explore all the possible methods that can solve limitations mentioned above. Computerized record of attendance, quizzes and assignments not only help teachers and students, but also higher management to check progress of students in different courses. Considering the use of mobiles and all other latest technologies of the current digital era for teaching, learning and attendance to improve student participation and cut down chances of mistakes in records. One of the major objectives of 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 constantly 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 user devices (smartphones, tabs, laptops)?

Do different types of database and query language required to store and process heterogeneous real time dynamic data and retrieve information?

Which software architecture techniques and programming language required for development of platform independent application and effective visualization of information to different users of the system on their respective device?

IV. 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 modify during implementation.

A. Attendance module

The attendance module is proposed for

- Stopping vicarious attendance.
- Preventing attendee’s departure at intermission
- 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 to class due to some genuine problem. GPS will locate a student 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.

For class attendance it is important to confirm the student presence in class so we 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 shown in Figure 2.

B. Mobile learning Module

The mobile learning module is proposed for conducting class quizzes and assignment submission. Both quizzes and assignments will work under time constraint. Quizzes can be conducted even if internet is not available, but for assignments internet is required. For quiz or assignments generation instructors will create content, set date(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.
If internet is available during the quiz server will be used for quiz retrieval, time check, display of answer key and calculation of results. The flow of information in online approach for quizzes is given in Figure 4.

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.

VI. CONCLUSION

The high propagation of smartphones 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 covering a 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 student 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 will add more academic activities in application like getting student feedback for course evaluation and university services.

REFERENCES


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