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Implementing Student Attendance System Using Fingerprint Biometrics for Kolej Universiti Poly-Tech Mara

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Implementing Student Attendance System Using Fingerprint Biometrics for Kolej Universiti Poly-Tech Mara

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Abstract. Recording students' attendance has been a major concern at Kolej Universiti Poly-Tech Mara. However, monitoring the attendance manually is a cumbersome issue to lecturers as students tend to manipulate the attendance by signing each other's attendance. It has been found that fingerprint biometrics is capable to monitor the attendance systematically and efficiently. The aim of this study is to verify the students' attendance using fingerprint biometrics. Evolutionary prototyping model were used to develop the students' attendance system. Students are required to thumbprint using the fingerprint device installed in the classroom to record the students' attendance. Their fingerprint images were captured by the fingerprint device and the images were then registered to the server for attendance process. The implementation of fingerprint biometric has helped lecturers to monitor the attendance of the students more systematic, efficient and ethically. By using the system embedded with biometrics, reporting on absenteeism is genuine and easy. Lecturers just need to print out and do necessary action. Therefore, fingerprint biometrics is useful and helpful in keeping track and managing the attendance of the students.

Keywords: Fingerprint; biometrics; student attendance; systematic; trustworthy

1. Introduction

Recording students' attendance manually is a cumbersome issue to many lecturers at Kolej Universiti Poly-Tech Mara as they need to monitor the student attendance as well as relating it to the performance of subjects at the end of the semester. Implementing an automated system will help lecturers to ease the burden of recording and monitoring the student's attendance [1].

Student attendance system is a system that records and monitors the students' presence in each class that they attend every day. Lecturers are able to see the attendance record and analysing the data in order to produce a report at any time. There are many ways to capture data in order to record and keep it in database of a system. Data can be captured in methods such as Optical Character Recognition (OCR), Intelligent Character Recognition (ICR), barcodes and biometrics. Fingerprint biometrics is one of the ways to capture data using an automated method of recognizing a person based on the physiological or behavioural characteristic. Fingerprints are small strips and patterns at the tip of each fingers. They are formed from the pressure on the small fingertips of the growing baby in the womb. No two individuals have been found to have the similar fingerprint. The pattern enhances biometric security by authenticating the fingerprint scanner [2].

Many studies have also shown that using biometric fingerprints can help lecturers to manage and keep the attendance record systematically and efficiently. Fake attendance or the act of signing on behalf of others can be eliminated through the biometric fingerprint device that requires every student to place

his or her registered finger to the device in order to record their presence in attending classes [3], [4]. Hence, this study aims to verify the students' attendance using fingerprint biometrics. The evolutionary prototyping model is used as a methodology to develop the students' attendance system. User requirements and feedbacks will be collected and analysed in order to implement a systematic, efficient and ethical system that help lecturers in keeping track and managing the attendance of the students.

2. Research Problem

Taking student attendance manually is an inconvenient issue to lecturers at Kolej University Poly-Tech Mara. Due to audit purposes, every lecturer has to monitor their students' attendance in every subject for the whole semester. There is certain amount of percentage of absentees of the students that will be taken into account for the lecturers to produce warning letter to the students. The categories and percentages are [5]:

1. Warning letter 1 – WAR 1 (7% absenteeism)
2. Warning letter 2 – WAR 2 (14% absenteeism)
3. Warning letter 3 – WAR 3 (21% absenteeism)

For every class subject, lecturers need to print the hardcopy of students' name list from the main system (campus management system) for every slot time based on the time table. In a class, students need to sign in a hardcopy attendance sheet provided by their respective subject lecturer. At the end of the class, the lecturer will collect it and check whether the total signature in the hardcopy sheet matches with the number of the physical students attending the class that day. This practice may not allow for the lecturer to attain a genuine attendance list as students tend to fake the signatures or sign on behalf of their friends without the lecturers' knowledge.

Within a semester, the lecturer needs to monitor the attendance in order to produce warning letter (if any) to the students in the three categories as mentioned above. It is a tedious task as lecturers need to check the hardcopy list one by one weekly and there are possibilities of inaccuracy of data to occur while processing the data. Study shows that there are correlations between attendance and academic performance [6], [7]. That is why monitoring the attendance of students' is necessary and should be improved to assist the lecturers [8].

3. Methodology

The methodology selected in implementing this system is Evolutionary Prototyping. This method allows developers to continue receiving feedback and suggestions phase by phase in order to improve the system prototype. The evolutionary prototyping consists of four phases covering the initial concept, design and implementing initial prototypes, improving prototypes, and delivering complete systems.

Prototyping evolution can help developers to accelerate the development of their systems. In addition, the evolution prototype helps in improving the quality of the final product because it is necessary to undergo some prototypes and eventually to the final version after the functionality and overall requirements are met. The whole phase for evolutionary prototyping were shown in Figure 1 below.

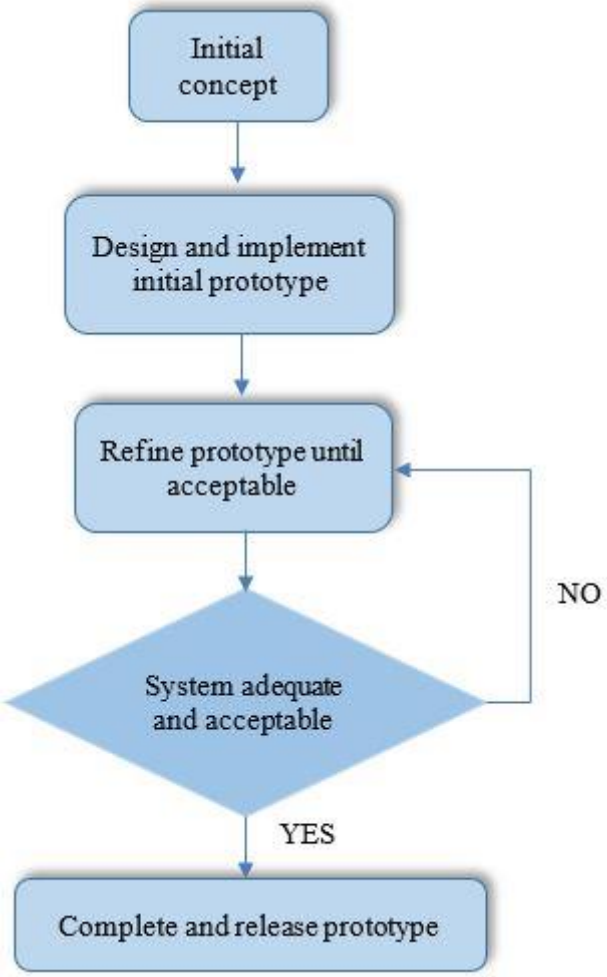

Figure 1. Evolutionary prototyping

3.1. Phase 1 - Initial concept

During this phase, developers will come out with an early concept and identify the required materials that are relevant to the system in this phase. Developers will collect requirements by conducting an interview to those who appear to be involved in the system development such as lecturers, students, and others. Based on results obtained from the interview, the developer will identify the requirement as an initial input from the user in developing this system. In addition, an established project plan will provide some information to developers which covers project schedules, clear explanations of projects, and so on. At the end of this phase, developers need to issue a business plan, project plan, and initial list of user requirements as output for this phase. Therefore, the initial concept of replacing existing student presence systems for computerized and automated student attendance systems has been stated.

3.2. Phase 2 – Design and implement initial prototype

In this phase, developers will carry out design activities and implement initial concepts in developing systems. The development of basic user interface prototypes will be published for the purpose of showing the users to ensure development is on track. The predefined user interface will include fingerprint student attendance system interface to give users a clear image for better understanding of the system. At the same time, developers will perform an initial system design analysis based on the requirements listed in this phase. After developing the interface and identifying the initial system design,

the user interface is created and shown to users for purposes of enabling users to assess the prototype of the system interface. Subsequently, the developers will then capture the feedback from the user after the evaluation and modify the requirements according to the information provided by the user in this phase. After all, the basic user interface developed in this phase is archived and will no longer be used. At the end of this phase, developers need to come out with a list of validated requirements, system designs, and ratings and feedback from users about lost needs and more.

3.3 Phase 3 – Refine prototype

In this phase, the developers will change the system design through feedbacks and ratings from users in the previous phase. In the development of the first prototype, developers will ensure that the development of the system meets the requirements that have been verified and the system designs obtained from users. In addition, the developers will also consider the system's quality while developing it as well as running operations such as system programs, performing debugging activities, and testing the system. Therefore, the first prototype of the fingerprint attendance system is created. Subsequently, the first prototype of the system specified in this phase will be shown to the user for evaluation. After the first prototype assessment, the developer will record new or modified needs specified by the user for the purpose of reviewing the subsequent development of the prototype. This phase will be repeated until the specified set of claims specified by the user is fixed. In addition, developers will need to provide with the final condition that has been confirmed.

3.4 Phase 4 – Complete and release prototype

In this phase, the developers will develop a complete student attendance system based on a set of legitimate final requirements obtained from the user. Next, the developers will execute the system and perform the test to the final system. Once all requirements are met, the system will deliver to end users as an approved system with the required functionality and built-in quality. Therefore, the overall objectives of the system will be fulfilled at the end of this phase. The current attendance system will be automatically replaced by computer attendance system and computerized at the end of this phase. Student attendance system using fingerprint will be reached at the end of this phase. The generation of reports on student attendance will be provided at the end of this phase.

4. System Design

This section describes the process of system design by describing the necessary modules, architecture, stakeholders, components, interface and data. All relevant variables are indicated and specified to meet their particular requirements. There are two types of design styles which are 1) Use Case Design - to visualize the user's practical requirement 2) Flow Chart Design - display the steps and decision making during the process.

4.1. Use Case Design

Actors involved in the system are administrators, lecturers and students. Administrators are the administration department's staff while Users are lecturers and students of KUPTM. In the use case diagram below in Figure 2, there are 7 processes involved in the system. For administrators, it will involve in registering lecturers, handling login and password, upload students confirm list and view report in the system. For users as lecturers, it will involve in completing registering process and login and changing the password in the system. The lecturers will involve in recording attendance process, managing the attendance data, update the attendance data with the latest updates from students and be able to view report provided in the system. Students on the other hand will just have to touch the fingerprint biometrics device in order to capture the image to be send in the system for verification process.

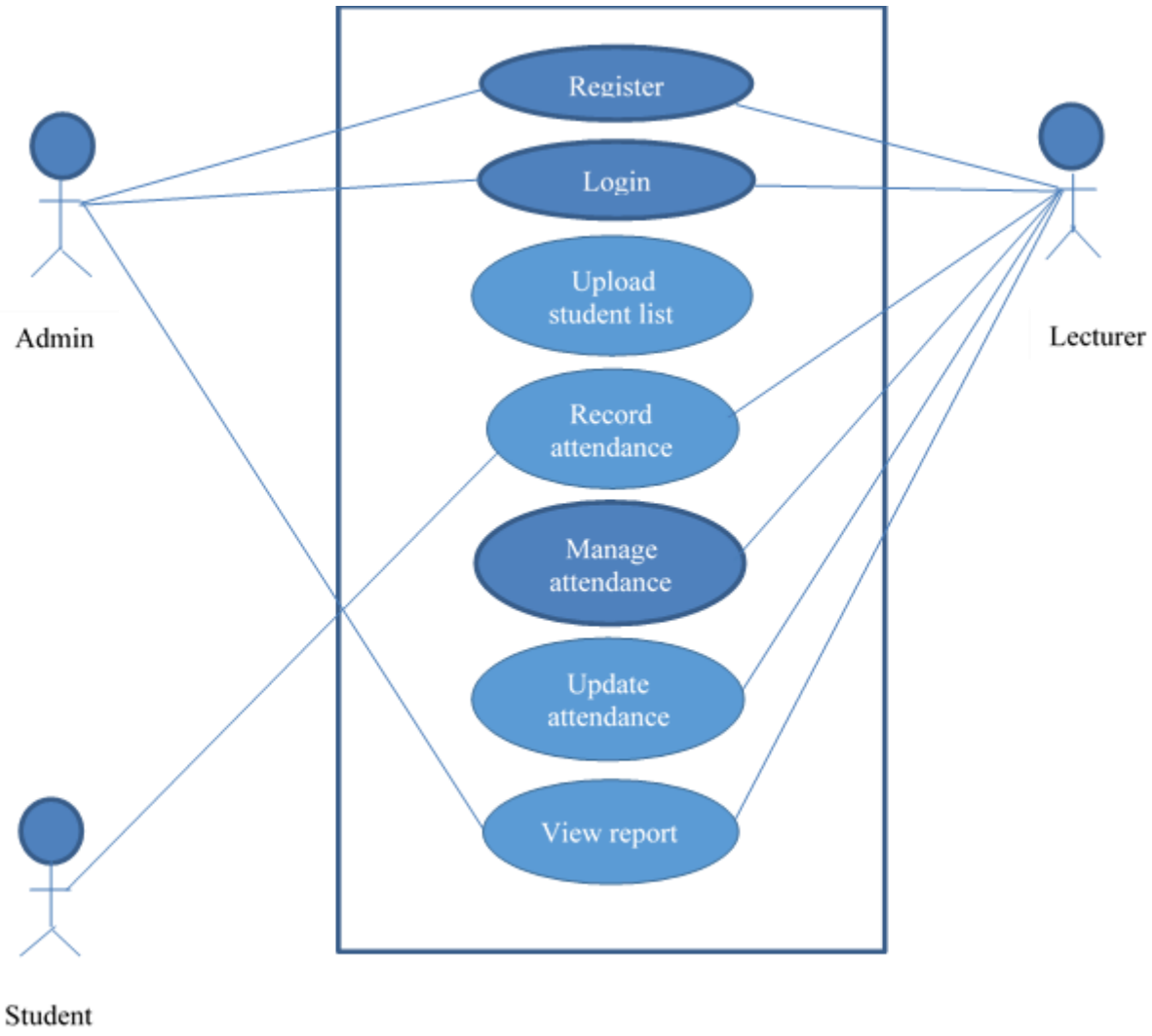

Figure 2. Use case diagram

4.2. Flow Chart Design

In the flow chart design indicated in Figure 3 below, administrators will register the lecturers in the system. Lecturers will receive username and password and need to activate using the register and login process. Once the account is active, the lecturer can start using the system.

As for administrators, he or she will upload the student list accordingly based on lecturers' workload into the system. All lecturers can start recording the attendance using the fingerprint biometrics device that is installed in each class venue. Lecturers will need to set date and duration in the system and all recorded fingerprint will be send to the system. The updated attendance list will be automatically populated in the system after the end of each class. However, the lecturers are still able to update with current status of the students for example MC or excuse letter with permission. Documents such as warning letters will be ready to be printed if needed based on the latest data.

Finally, related reports can be generated from the system at any time depending on the cumulative data recorded in the system. The report may suggest or show the performance of student in attending classes in various subjects in a semester.

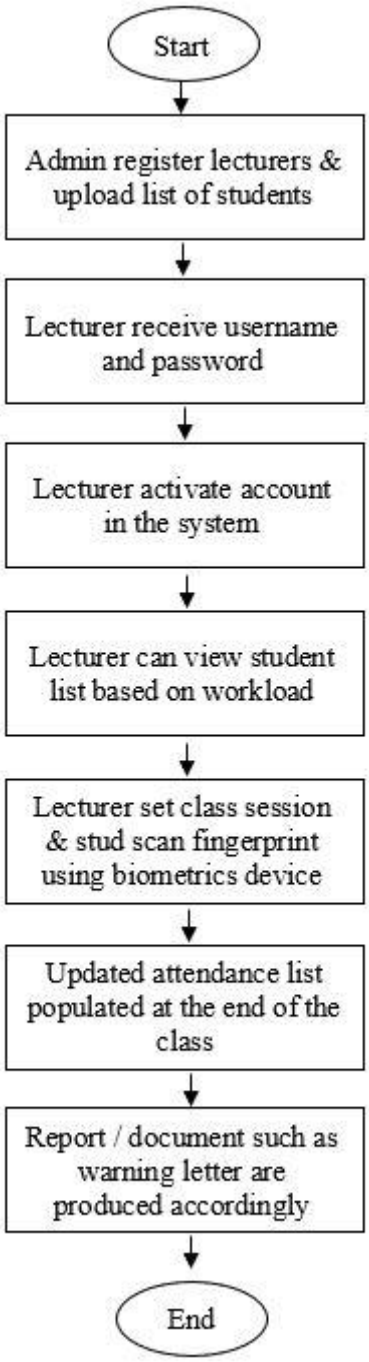

Figure 3. Flow Chart Diagram

5. The Proposed System

A prototype is an early sample of the system built. The user interface prototypes are shown to represent the flow and design of the system before the final system exists. An early user interface prototype allows all the users to visualize and understand the system. With the prototypes of the system, the system was at the final stage of the implementation phase and it will be tested to all users. The system will not be deployed yet as there may be changes that need to be done after the testing phase. The system users are in two categories:

a) Administrators
   - The function for administrators is change or reset password, register lecturers and view in list, update lecturers' data, register and update student list and information related to students.

b) Lecturers
   - The function for lecturers is change password, upload attendance list, view attendance list from device and view student details.

5.1. User interface for all users (Log in System)

Figure 4 shows the login interface for all users to log in to their own accounts. The username and password are needed in order to log in to the system. Before logging into the system, users need to enter the validation code, which is Captcha, to proceed.

Figure 4. Login interface

5.2. User interface for all lecturer (Change password)

Figure 5 below illustrated the change password interface for lectures where the user can change their current password here.

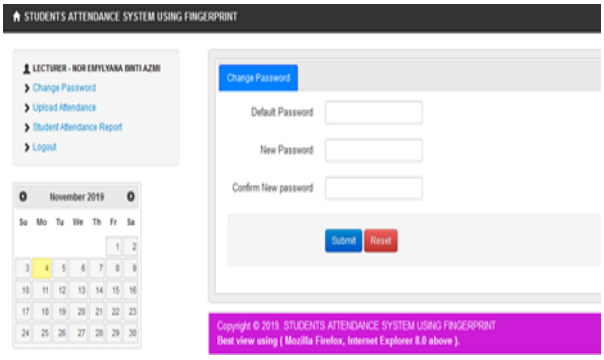

Figure 5. Change Password interface

5.3. Upload Attendance Prototype

The upload attendance file for lectures were depicted in Figure 6. The user can upload the attendance file in excel format only. Before uploading the file, users need to find the class ID then browse the attendance file to upload.

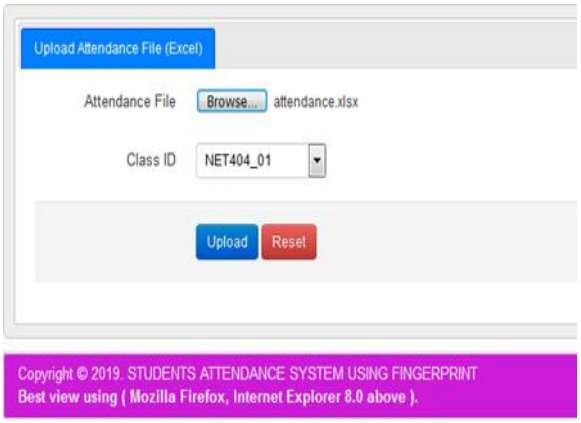

Figure 6. Upload Attendance interface

5.4. View uploaded attendance prototype

All the students' attendance report can be viewed by lectures as can be seen in Figure 7. This feature can be used after lecturers have uploaded the excel file, and users need to find course code and search by date. The report will be generated after clicking a button to display the uploaded attendance file in the system

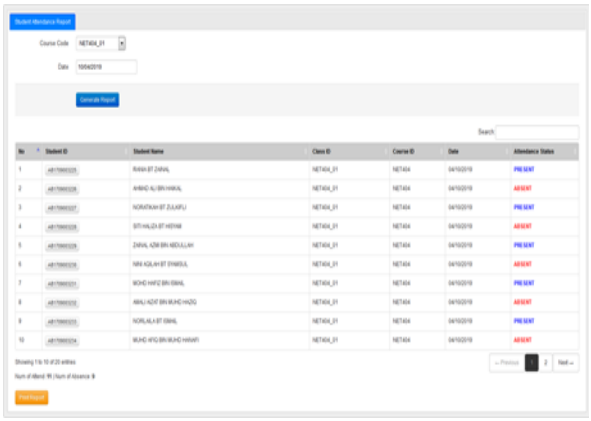

Figure 7. Student attendance report interface

5.5. Student Details

As being illustrated in Figure 8, this is the view of the student's details of prototype. This information will be released when the user clicks on the student ID.

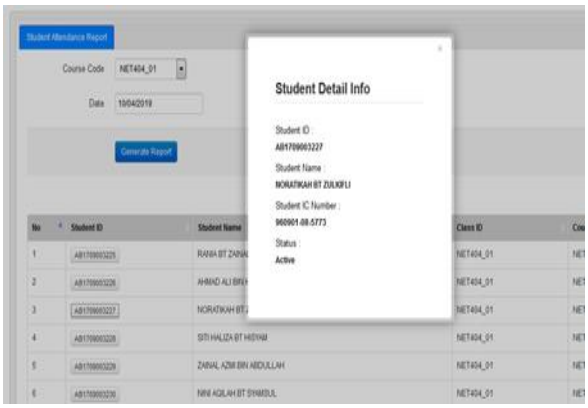

Figure 8. Student details interface

6. Conclusion and Recommendation

The student attendance system using fingerprint biometrics can improve the existing manual practice in KUPTM academics. The system will benefit the academics staff specifically lecturers in order to monitor the attendance of students more systematic, efficient and ethically. Moreover, the advantages of fingerprint biometrics will increase the security as fingerprints are much harder to fake, they also change very little over a lifetime, so the data remains current for much longer than photos and passwords. Other than that, the ease of use is simpler as fingerprints are always with us. It is also non-transferrable but also provides a higher level of accountability as a proof of student's attendance. Thus, the implementation of this system may simplify and ease the burden for the lecturers as reporting and analysing of data will improved. However, several improvements can be done for further development as follow:

1. Upgrade to mobile application:
   Mobile application will be more practical since the emergence of mobile application technology has become a bridge to communication and expand profit in more business industries [9].
2. Integrate with existing system:
   Student attendance system using fingerprint can be integrated with existing Campus Management.
   System (CMS) in providing existing database of staffs (lecturers) and students.
3. Reporting:
   More related reports should be produced to see more information about the students

References

[1] Pireva, K R, Siqeca J and Berisha S. 2013 *IFAC Proceedings* Volumes **46**(8), 137-140
[2] Ivanov V I and Baras J S 2019 *Pattern Recognition*, **94**, 230-249
[3] Banerjee, R, King E M, Orazem P F and Paterno E M 2012 *Economics of Education Review*, **31**(5), 563-574
[4] Dey I 2018 *International Review of Economics Education*, **28**, 29-40
[5] Kolej Universiti Poly-Tech MARA Kuala Lumpur. Academic Regulation Handbook for Foundation, Diploma, Degree and Professional Programmes. *www.kuptm.edu.my*
[6] Landin M and Pérez J 2015 *Currents in Pharmacy Teaching and Learning*, **7**(1), 78-83
[7] Persky A M, Kirwin J L, Marasco C J, May D B, Skomo M L and Kennedy K B 2014 *Currents in Pharmacy Teaching and Learning*, **6**(1), 1-9
[8] Rejnö Å, Nordin P, Forsgren S, Sundell Y and Rudolfsson G 2017 *Nurse Education Today*, **50**, 36-41
[9] Sunaryono D, Siswantoro J and Anggoro R 2019 *Journal of King Saud University - Computer and Information Sciences*

[10] Bhalla A 2020 *Biometric Technology Today*, *2020*(8), 5-8
[11] Biometrics for attendance and benefits face challenges in India 2013 *Biometric Technology Today, 2013*(9), 12
[12] Schools learn about the benefits of biometrics 2001 *Biometric Technology Today*, **9**(6), 7-8.