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Development of biometric attendance system using NodeMCU platforms

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ABSTRACT

The purpose of this study is to design a Biometric Attendance System that will provide lecturer and academic advisor administrators with tools for managing student attendance as well as regular users such as students. This system manages student attendance by storing student information, course information, and student attendance records at Politeknik Kuala Terengganu. The system consists of two main components : a hardware component and a web-based component. This system development model is intended to be used to design web-based systems by utilising the AGILE Model as a model of the system development life cycle. Additionally, to connect the system to the network, Network Design Diagrams are employed. Visual Basic was utilised to construct this system, while MYSQL was used to store student attendance data. Additionally, the functional framework for this system includes a Node MCU ESP8266 Wi-Fi Module, an R307 fingerprint sensor, a 0.96" OLED display, a Li-Ion battery 3000mAh (18650), a TP4056 Li-Ion Battery charger, an MT3608 Boost converter, an On/Off switch, and a breadboard and wire. It is intended that as this system develops, it will assist lecturers, academic advisors, and students in efficiently managing attendance.

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Introduction

The advancement of information technology has had an impact on societies worldwide, including Malaysia (Mariam, 2007). As a result, Malaysian society must evolve from a developing to an industrial to a post-industrial society. Developing skills and information literacy are essential for Malaysia to achieve developed country status. The information technology age has made the use of computer technology a must for an organization's functioning. For instance, a management system involving a large amount of data may be used to automate the management and recording of information without requiring manual entry. Moreover,by utilising computer technology, information may be safely and effectively preserved, which simplifies maintenance work (Murdick & Ross, 1977).

The process of recording and obtaining information on student attendance presents difficulties for lecturers and students alike, since attendance is currently recorded manually using outdated technology. Currently, the mechanism for recording student attendance is paper-based and needs signatures from all students enrolled in polytechnic courses. This manual approach is ineffective, and attendance records are tainted by fraud, since some student challenge attendance on behalf of absent classmates. Computer technology is an ideal

replacement for this manual method of maintaining student attendance since it simplifies the process. Computer technology, according to Mohd Yusri (1996), offers simple access to any information and guarantees the confidentiality of any private information.

The polytechnic's attendance monitoring system is still manual, relying on paper and signatures from each student. The current system is rife with inescapable flaws. Among the issues that may develop, such as lost records of student attendance, this approach can help eliminate fraud in attendance recording. According to a questionnaire issued to 40 respondents, including polytechnic students and lecturer, up to 70% of respondents admitted to signing attendance records on behalf of a buddy. Additionally, up to 73% of respondents express dissatisfaction with the current system. 67 percent of respondents agreed that the manual approach should be replaced with one that is more systematic and effective. Thus, at the conclusion of this project, the researcher hopes to construct a system integrated with a database to ease the administration of student attendance while also resolving issues associated with the manual maintenance of attendance records.

The objective of this project is to develop a student attendance management system using Biometric method with a combination of web -based computerized system. By using this system can solve problems related to managing student attendance records at Politeknik Kuala Terengganu. Therefore, this system has the following features, (1) ability to record student attendance information, (2) ease of finding student attendance information based on date and course name, and (3) Ability to generate reports on student attendance information.

Method

Needs Analysis Phase
According to the study of Web -Based Learning System Development Situation -Based Learning Approach for Visual Design Topic (Harun & Abdul Hadi, 2010) in this phase, website developers need to analyze the needs of a website. Developers need to do some analysis on the determination of website development objectives, lesson content as well as identify the target group.

Respondent Identification Phase
Before developing a web -based system, respondents will be identified. The main users of this system are all Kuala Terengganu Polytechnic lecturers. In addition, each student's academic advisor is also a user of the system. Lastly, the students are also users who can access this system.

Design Phase
In this phase, it clarifies the overall view of the appearance, the structure, the types of media and technology involved (Jamalludin Harun, Baharuddin Aris and Zaidatun Tasir,2001). In this phase, several steps need to be implemented as follows:

Network design
In this phase, the network design is sketched to ensure that the system can be connected to the Local Area Network of Kuala Terengganu Polytechnic and connected directly to the internet for the purpose of user access.

Figure 1: Network Design Diagram

Database Design

In this phase, Logical design is designed to integrate each of the tables in the database to produce a system that can display the desired output. All data is recorded into a database to be called when the report is printed according to user requirements.

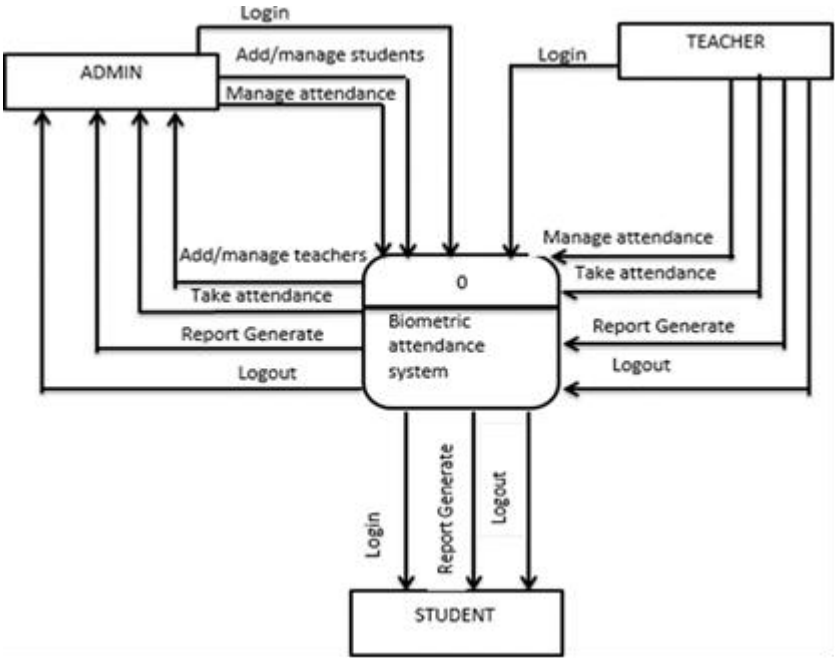

Figure 2 <Context Diagram>

Interface Design

In this phase, the interface is created by creating a form for each page in the system. The data entered in the form is based on the user's wishes and the requirements of the report to be printed. User -friendly elements are also emphasized to make it easier for users to use the system easily and quickly.

Figure 3 <Example of Biometric Attendance Management System Interface>

Development and Implementation Phase

Model System Development Life Cycle – Agile Model

In the development of this system, the AGILE Model has been used to drive the development of the system. The Agile SDLC model is a combination of repetitive and additional process models with a focus on customization process and customer satisfaction with fast -functioning software product delivery. The AGILE model involves several phases namely Planning, Requirements Analysis, Design, Coding, Deployment and Maintenance.

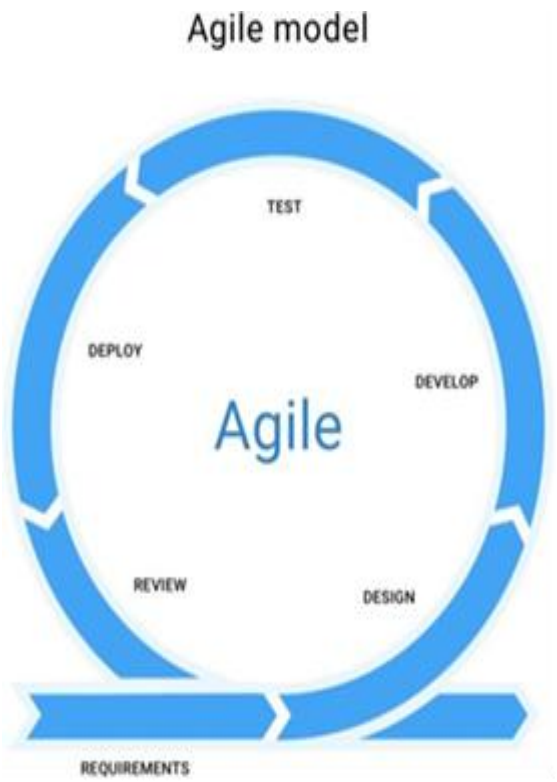

Figure 4 <Model AGILE>

Requirement Spesification

1. Hardware Requirement
   Following are the hardware requirements to build a Biometric Attendance System using IoT platforms.
   - Node MCU ESP8266 Wi-Fi Module
   - R307 f ingerprint sensor
   - 0.96" OLED display
   - Li-Ion battery 3000mAh (18650)
   - TP4056 Li-Ion Battery charger
   - MT3608 Boost converter
   - On/Of f switch
   - Breadboard
   - Connecting wires

2. Software Requirement
   Following are the software requirements to build a Biometric Attendance system

Table 4 < Software Requirements >

Software	Price (RM)
Xampp (Database)	Freeware Software
Visual Basic	Freeware Software
Sublime Text	Freeware Software

Testing phase

In the testing phase, the system will be tested to users that is to record student information data that will be registered by the academic advisor of each class. Students record attendance to class by scanning fingerprints as a method to record attendance. Lecturers will check student attendance through the system. This system will be placed in every laboratory and lecture room around the Politeknik Kuala Terengganu .Based on the

questionnaire that was distributed to 40 respondents, consisting of lecturers and polytechnic students, as many as 75% of the respondents showed a positive reaction about the Biometric Attendance System.

Table 2 <Unit Testing Plan>

No.	Test Case Name	Test Procedure	Pre Condition	Expected Result	Tester	Result (Pass/Fail)
1.	Login Page	Admin , lecturers and students required to fill the username and password to login the webpage	Create the login page	Successful created and successful login	Admin	**Pass**
					Lecturer	**Pass**
					Student	**Pass**

Table 3 <Integration Testing Plan>

No.	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1.	Fingerprint	Set up Arduino to make function the fingerprint sensor	Fix fingerprint sensor with the Wi-Fi module and with LCD screen	Successful configure the Arduino and fingerprint sensor and the screen are working	Admin	**Pass**
2.	Admin Page	Admin is required to fill up student's information	Set up Arduino	Successful add the student's information	Admin & Student	Pass

Table 4 <User Acceptance Test>

No.	Test Case Name	Acceptance Requirement	Test Result (Pass/Fail)	Tester	Comments
1.	User	Users require to scan the fingerprint sensor	Pass	Students	
2.	Lecturer	Can check student's attendance by dates	Pass	Lecturer	

Repetition Phase

In this phase, the user will make an evaluation of each page in the system. If there is feedback from users, corrections and improvements will be implemented to meet the needs of users. In this phase, there is repetition to each phase in the AGILE Model to ensure that the system meets the user's requirements

Results and Discussions

Biometric Attendance System can store the biometrics of every student, thereby making the process easier and more reliable. While enrolling the fingerprints, fingers must not be swollen and should not have scratches. Also, they should be neither damp nor dry. Student's fingerprints must be properly clean.

There are three categories of users who are allowed to access this system, namely academic advisors as system administrators, lecturers and students of Politeknik Kuala Terengganu .Students access the system using the matrix number as the username and the identity card number as the password. While academic advisors and lecturers using identity card numbers as username and password will be given.

Login interface is interface created as a platform to enter this system. This login form is different for each user category, this login form is one of the security to ensure that only users can enter this system.

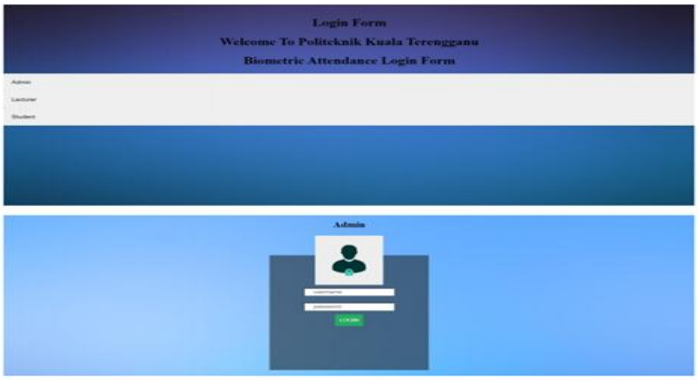

Figure 5 <Login Interface>

The admin interface is created as a medium for admins to update or control the system, in terms of data and reports.

Figure 6 <Admin Interface>

The lecturer interface was also created to allow the lecturer to check the student attendance data and apply the data for the use of the teaching and learning process

Figure 7 < Lecturer Interface>

The student interface was created to allow students to check their attendance for each course taken at the polytechnic.

Figure 8 <Students Interface>

Conclusions

The management system is no longer something new but has undergone development which is growing rapidly in all areas.The potential for computerised management systems to be used in all areas is undeniable, as they aim to assist and improve the processing of information or data. Not only does the management system provide new spaces and experiences for lecturers and students, but it has the potential to spur a revolution in the use of databases, ensuring that the data obtained is accurate and error-free. (Said & Suhaimin, 2010).

Monitoring manual attendance and maintaining student attendance is an extremely difficult, inefficient, and time-consuming process. The IoT-based biometric attendance system is equipped with biometric identification capabilities that enable the system to automate the whole procedure (Tripti , Urvashi , Umang and Swati ,2020). An attendance system that incorporates three key aspects, namely the Internet of Things (IoT), and cloud computing, provides enormous value to a variety of organisations. As a result of these factors, it demonstrates that it is extremely trustworthy and secure. Due to its simplicity, this system is user friendly.

With the development of a web -based system and the integration of hardware such as fingerprint scanners, it is hoped that this system can help and facilitate the process of managing student attendance more safely and effectively. In addition, it can save operating costs as well as time to record and manage student attendance. With the use of this system as well, it can improve the performance of politics in managing things more systematically.

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