UNIVERSITI TEKNOLOGI MARA (UiTM) CAWANGAN MELAKA

KAMPUS JASIN

SEMESTER 4 SESSION 2023/2024

MARCH 2024 – AUGUST 2024

ITT569

INTERNET OF THINGS

ASSESSMENT:

FINAL PROJECT REPORT

TITLE:

SMART ATTENDANCE

LECTURER'S NAME:

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1.0 Introduction

In today's rapidly evolving educational landscape, universities are increasingly embracing technology to streamline administrative processes. Among these critical areas of focus is student attendance management. Traditional manual methods, which rely heavily on human effort for data collection and analysis, are gradually giving way to smart systems that promise greater efficiency, accuracy, and convenience.

The development of information technology and the Internet of Things (IoT) has accelerated the pace of educational informatization reform. Educational institutions now seek effective ways to measure the effectiveness and rationality of daily teaching through real and scientific data. Student classroom attendance stands out as a crucial aspect of college education management [1].

One approach involves leveraging RFID technology. In this system, students carry identification cards embedded with RFID tags. When students enter a classroom, the RFID reader detects their presence, accurately recording attendance. This method offers advantages such as fast response and low cost. However, it requires students to place identification cards uniformly to ensure accurate recognition.

Another smart attendance system relies on face recognition technology. It accurately records and identifies students entering and leaving the classroom, detecting situations like lateness, early departure, absenteeism, and substitute classes. While this system demonstrates high accuracy and efficiency, it can be affected by environmental factors such as light, students' posture, and expressions [1].

Both RFID-based and face recognition-based attendance systems fulfill the requirements of universities by providing accurate and efficient real-time updates. However, challenges like privacy concerns and environmental factors persist. Thus, institutions must integrate these systems thoughtfully into their existing infrastructure. As universities adopt technology, IoT-driven smart attendance systems are crucial for shaping attendance management. Through innovative implementation, educational institutions can improve the student experience and maintain precise attendance records.

2.0 Problem Statement

The current process of student attendance is traditional attendance record monitoring, in which students are required to verify their attendance by their own signature on attendance sheet paper. The lecturer must prepare attendance sheets for each class. These sheets usually contain columns for the date, student names, student numbers, and spaces for signatures. At the beginning of class, the lecturer must distribute the attendance sheets among the students and the students need to find their name or ID on the attendance sheet so that they can verify their own attendance. After all students have signed the attendance sheets, the sheets need to be collected by the lecturer. This usually happens at the beginning, during or end of the class. There are several issues that occurred with this current process.

The first issue with the process is that it requires a lot of time. As mentioned in the paragraph above, the lecturer distributes the attendance sheets among the students and collects them back. But, in a larger classroom, it could be slower because of the larger number of students that need to verify their own attendance. Despite that, when the students need to sign their names, there can be delays due to obstruction, when the sheets are passed around or students queue to sign. Then, the lecturer collects the sheets and manually enters the student's attendance verification into a computer. It could take a lot of time because of their sloppy handwriting or mistakes. Futhermore, managing records of student attendance with the physical sheets is really time consuming.

Although the current system consumes a lot of time, it can cause overhead in administrations. Monitoring students' attendance using paper sheets requires administrative effort, which leads to an increase in workloads for lecturers and staff, especially in large classes. This workload can also lead to stress and reduce job satisfaction, as lecturers and staff spend valuable time on repetitive and often frustrating tasks instead of focusing on educational goals. However, this system monitoring introduces significant administrative overhead, reducing the efficiency and effectiveness of educational processes.

The system may also lead to security and confidentiality risks. These attendance sheets often contain sensitive information like student names, student numbers, and possibly other data, making them vulnerable to unauthorized access, loss, or theft. If left unattended, anyone

could read or copy this information, leading to privacy breaches. Physical storage systems are generally less secure than digital ones, which can result in tampering or loss of records. There is also the risk of sheets being stolen, misplaced, or damaged, which could compromise the integrity of the attendance records.

In addition, this current system carries a high risk of forgery or manipulation. Since the process involves students physically verifying their attendance, there's a chance that one student might sign in for another, leading to false attendance records. This problem is particularly prevalent in large classes where instructors cannot easily verify each student's identity against their signature. This issue is particularly prevalent in large classes where the lecturers cannot easily verify each student's identity against their signature. Furthermore, students might alter or tamper with the sheets, further complicating accurate record-keeping.

This current method of monitoring student attendance using paper-based sign-in sheets shows several significant challenges. First, this process is time-consuming, involving the distribution and collection of attendance sheets, along with manual data entry into digital systems. These steps become even more inefficient in larger classes, leading to delays and inefficiencies. Second, the system creates administrative overhead, increasing workloads for lecturers and staff, which can reduce their focus on educational goals and lead to stress and decreased job satisfaction. Additionally, the paper-based system exposes student information to security and confidentiality risks, as these sheets are prone to unauthorized access, theft, or loss, compromising the privacy of sensitive data. Lastly, there's a high risk of forgery or manipulation, as students can sign in for others or tamper with the sheets, undermining the reliability of attendance records.

3.0 Solution

An automated student attendance system using an Arduino card scanning mechanism is a sophisticated solution that modernizes the traditional roll-call process. It employs RFID technology, where each student is assigned a unique RFID tag. When the tag is scanned by an RFID reader connected to an Arduino board, the system captures the student's attendance data. This data includes the student's unique identifier, the date, and the time of the scan.

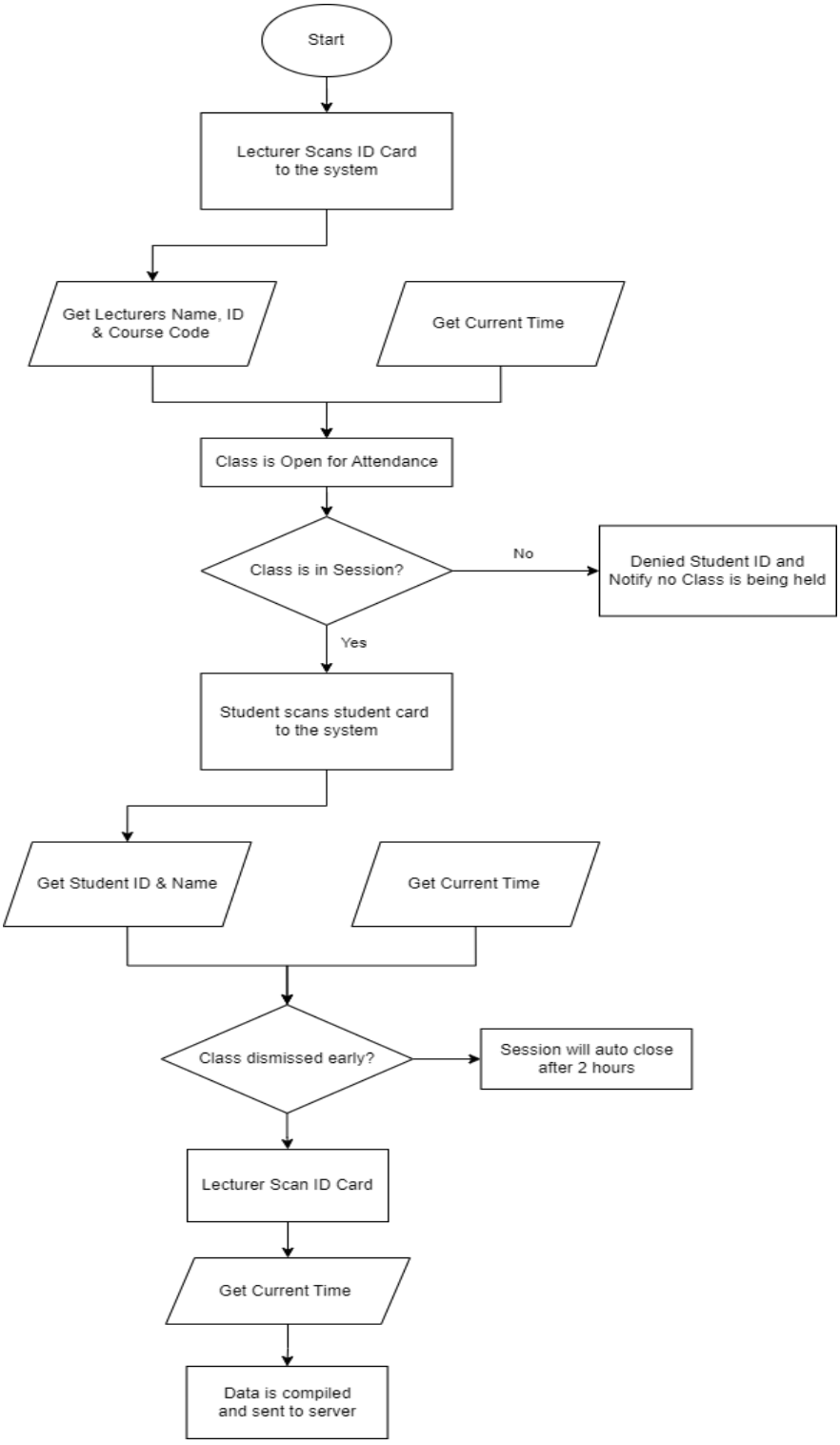
The Arduino board serves as the central processing unit of the system. It is programmed to read the RFID tags, validate the student's information, and record the attendance in real-time. An LCD display connected to the Arduino board provides immediate visual feedback by showing the student's name or ID number, confirming that their attendance has been logged.

For data storage and management, the system incorporates an SD card module where all attendance records are saved. This allows for easy retrieval and analysis of attendance data, which can be crucial for tracking student participation over time. Additionally, a real-time clock (RTC) module ensures that each attendance entry is timestamped accurately, providing a reliable record of student attendance.

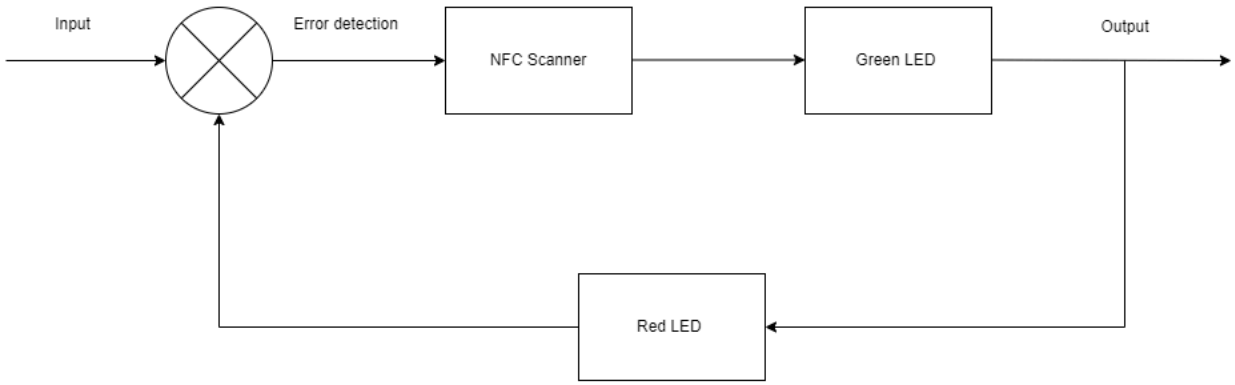
Feedback mechanisms such as buzzers or LEDs are integrated into the system to give students instant confirmation of their successful check-in. This feature enhances the user experience by providing clear and immediate communication. The system can also be connected to a central database, enabling administrators to access and manage attendance records from a central location.

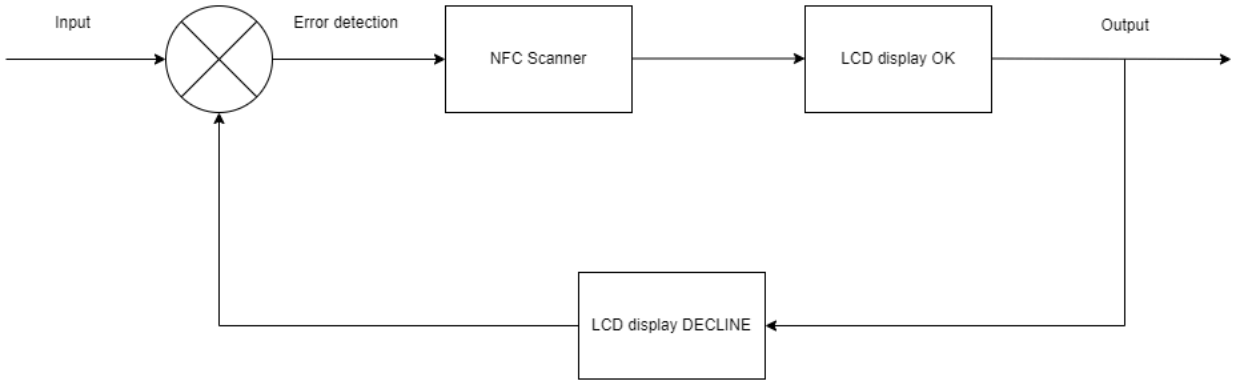
In conjunction, the solution of this new attendance system is an efficient, reliable, and user-friendly solution that organizes the attendance-taking process. It replaces manual methods with a digital approach, ensuring accuracy and saving time. By automating attendance recording, educational institutions can focus more on teaching and learning without wasting time that is just for attendance, while also benefiting from improved data management and analysis capabilities. This system also could prevent risks of security and confidentiality, also high risks of forgery or manipulation.

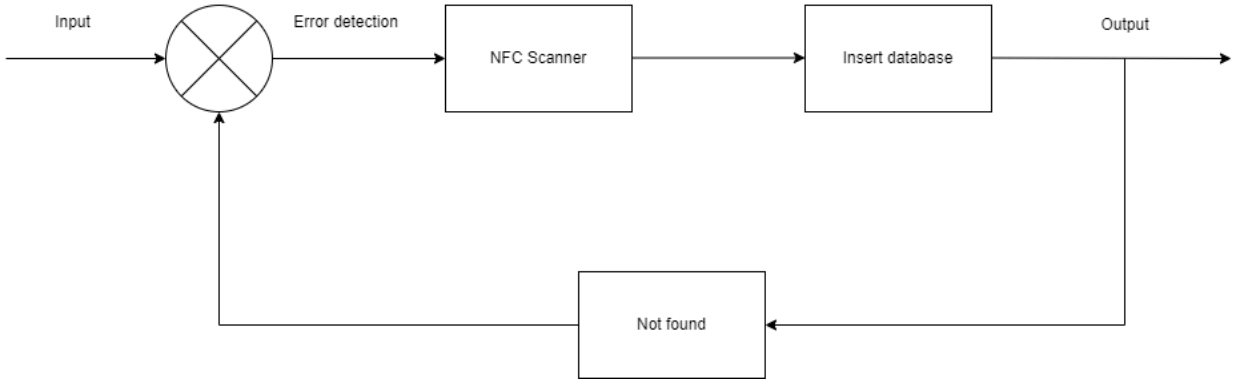
4.0 System Flowchart



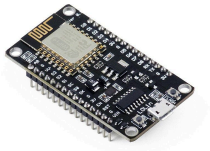
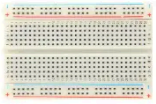
5.0 Control System Diagram

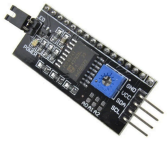




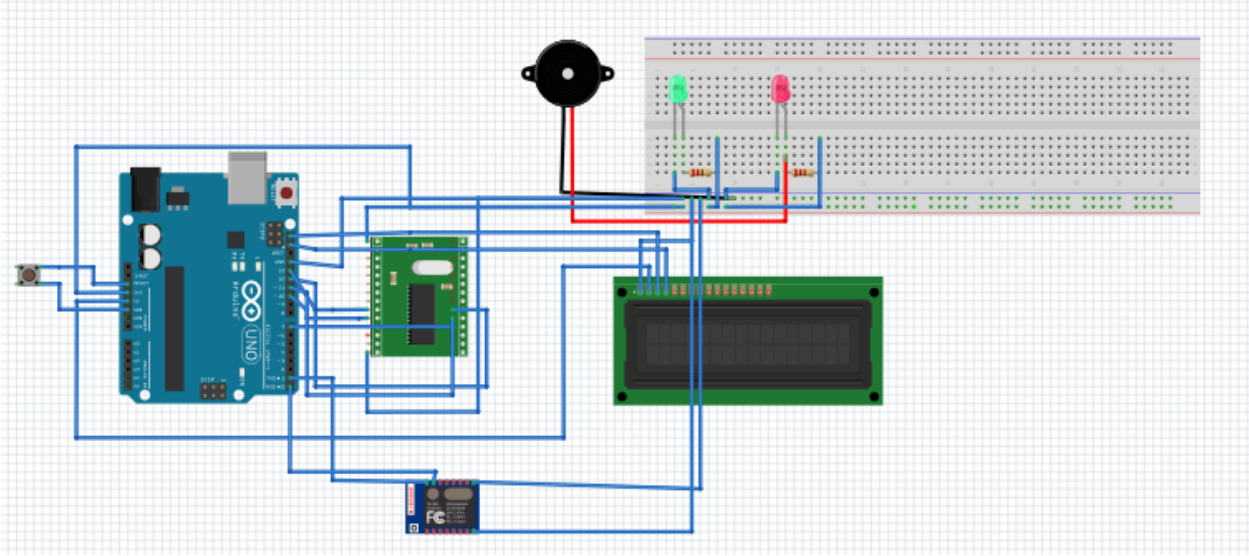


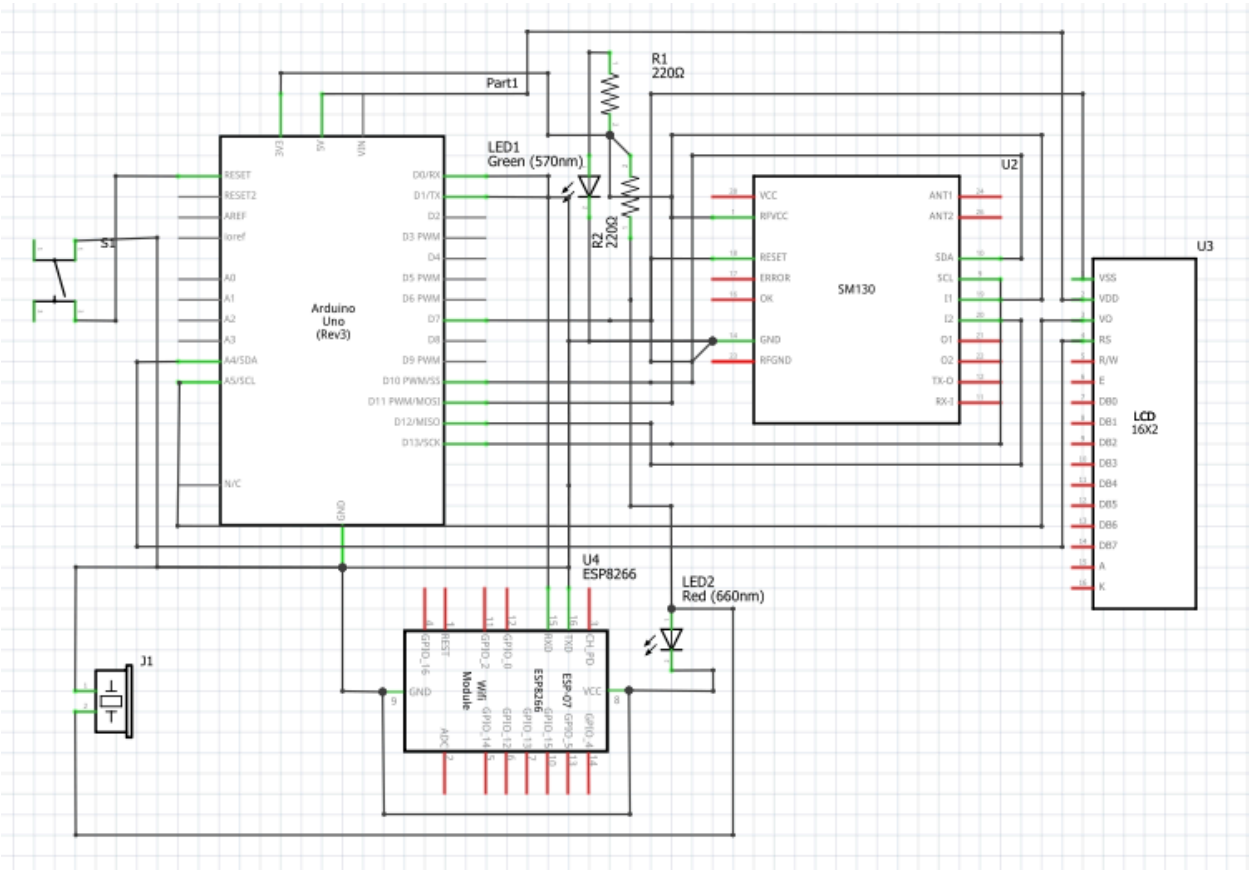
6.0 List of Hardware

Hardware	Quantity	Description
Arduino Uno 	1	Microcontroller board for controlling and programming the attendance system.
MFRC522 RFID Module 	1	This module enables RFID card reading, allowing students to tap their NFC cards for attendance.
NFC Cards 	2	These cards are used by students to register their attendance by tapping them on the RFID module.
LED Light 	2	An LED can be used to provide visual feedback to students, indicating whether their attendance has been successfully recorded.
NodeMCU WiFi Module 	1	This module enables connectivity to the internet, allowing attendance data to be transmitted to a cloud server or database.
Breadboard 	1	A breadboard provides a platform for connecting and prototyping the various electronic components.

Passive Buzzer 	1	A buzzer can be used to provide audio feedback or alerts, such as indicating an error in attendance registration.
LCD Module 	1	Displays attendance information or system status.
I2c Module 	1	The component used to interface the LCD module with the main microcontroller board.
9V Battery 	1	Provides power to the system.

7.0 Circuit Design Diagram





8.0 List of Hardware (with Description)

The smart attendance system is designed to automate the attendance tracking process for both students and lecturers in an educational institution. By leveraging RFID (Radio Frequency Identification) technology, the system efficiently records and manages attendance data, providing real-time visibility and seamless integration with a centralized management platform..

8.1 Arduino Uno

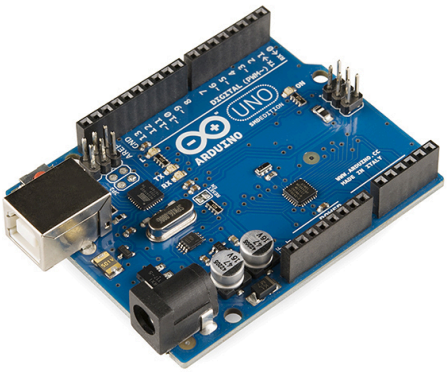


Figure 1: Arduino Uno

- Based on Figure 1, the Arduino Uno serves as the central microcontroller board, coordinating and controlling the overall attendance system.
- It processes the RFID data, manages the LED feedback, and communicates with the NodeMCU WiFi module to transmit attendance records.
- The Arduino Uno's robust processing capabilities and extensive I/O pins make it well-suited for this IoT-based attendance system.

8.2 MFRC522 RFID Module

Figure 2: MFRC522 RFID Module

- Figure 2 shows the MFRC522 RFID module is responsible for detecting and reading the NFC (Near-Field Communication) cards presented by both students and lecturers.
- It utilizes RFID technology to identify the unique ID associated with each individual's NFC card.
- When a student or lecturer taps their card on the RFID module, the module captures the card's ID and relays the information to the Arduino Uno for further processing.

8.3 NFC Cards

Figure 3: NFC Cards

- These cards are used by both students and lecturers to register their attendance by tapping them on the RFID module.
- Each card has a unique ID that is associated with a specific individual in the attendance system.

- The tapping of the NFC card on the RFID module triggers the attendance registration process.

8.4 LED Lights

Figure 4: LED Lights

- The system uses two LED lights: a green LED and a red LED.
- The green LED illuminates when an attendance is successfully registered, providing visual confirmation to the student or lecturer.
- The red LED turns on when there is a failure to register the attendance, alerting the individual to try tapping their card again.
- The LED lights offer immediate feedback on the status of the attendance registration.

8.5 NodeMCU WiFi Module

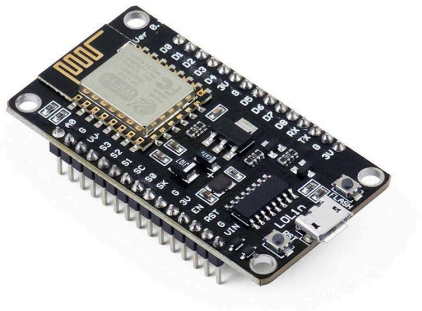


Figure 5: NodeMCU WiFi Module

- The NodeMCU WiFi module enables the attendance system to connect to the internet, allowing the recorded attendance data to be transmitted to a cloud server or database.
- The built-in WiFi capabilities of the NodeMCU facilitate seamless data communication, making it easier to integrate the attendance system with a centralized management platform.
- This allows administrators to access and analyze the attendance data in real-time, enabling better monitoring and reporting of attendance patterns for students and lecturers.

8.6 LCD Module

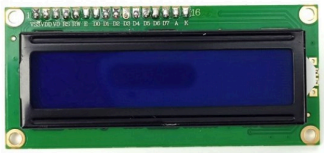


Figure 6: LCD Module

- The LCD (Liquid Crystal Display) module displays the student/staff ID and name of the individual who has tapped their NFC card.
- The LCD module allows for real-time monitoring of the attendance status and individual identification, making it easier for administrators to oversee the system.

8.7 I2C Module

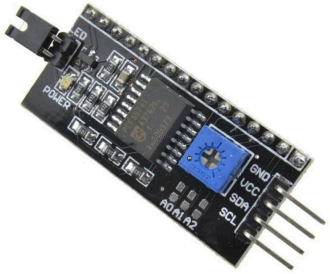


Figure 7: I2C Module

- The I2C protocol allows for efficient communication between the microcontroller and the LCD, using only two data lines (SDA and SCL) to transmit data and control signals.
- The component used to interface the LCD module with the main microcontroller board.
- The I2C module simplifies the wiring and reduces the number of pins required on the NodeMCU board to connect the LCD module, making the overall system more compact and easier to implement.

8.8 Other Components

Figure 8: Passive Buzzer

- The passive buzzer is used to provide audible feedback to the user when there is an error in the attendance registration process, such as when the NFC card fails to be successfully scanned.
- The buzzer will emit a short beep to notify the user about the failed attendance registration, allowing them to try tapping their NFC card again.
- The buzzer will not be used to provide feedback for successful attendance registrations, as the LCD module will handle the visual display of the student/staff ID and name.

Figure 9: 9V Battery

- The 9V battery is used to power the overall system.
- It provides the necessary electrical power to ensure the continuous operation of the smart attendance system.

Figure 10: Male-to-Female Jumper Wires

- These jumper wires are used to connect the various hardware components.
- The male-to-female configuration allows for easy and flexible connections between the development board and the other peripherals.

Figure 11: Male-to-Male Jumper Wires

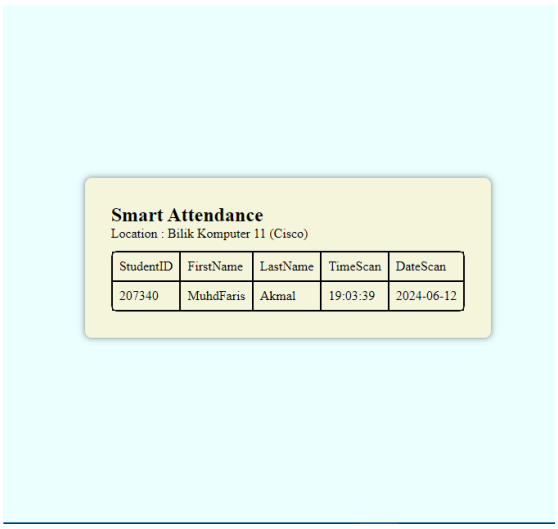
- The male-to-male jumper wires are used to interconnect the different components on the breadboard, such as connecting the pins of the MFRC522 RFID module to the NodeMCU board.
- These wires provide the necessary electrical connections between the various components on the breadboard, enabling the smart attendance system to function as a cohesive unit.

9.0 Testing (screenshot with descriptions)

9.1 Attendance Scanning for Lecturer

1. The lecturer scans the card and holds the scan until it is successful.

2. When it is successful, the scanner will show the name and staff number of the lecturer and the data will be stored in the database via XAMPP



Smart Attendance

Location : Bilik Komputer 11 (Cisco)

StudentID	FirstName	LastName	TimeScan	DateScan
207340	MuhdFaris	Akmal	19:03:39	2024-06-12

3. When it is not successful, the scanner will display the error message and the red light will appear.

4. In case if the scanner has some issues, the lecturer needs to refresh the scanner by pressing the yellow button.

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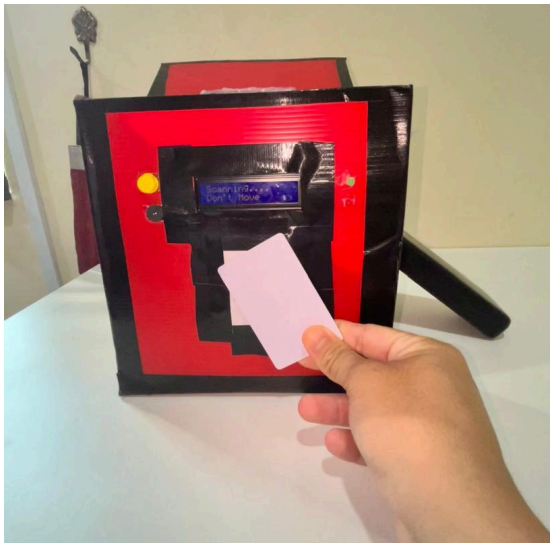
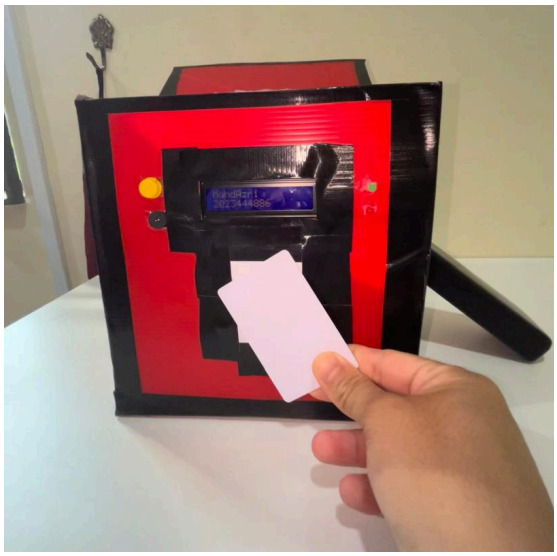
9.2 Attendance Scanning for Student

1. The student scans the card and holds the scan until it is successful.



2. When it is successful, the scanner will show the name and number of the student and the data will be stored in the database via XAMPP



Smart Attendance

Location : Bilik Komputer 11 (Cisco)

StudentID	FirstName	LastName	TimeScan	DateScan
207340	MuhdFaris	Akmal	19:03:39	2024-06-12
2023444886	MuhdAzri	Mokhzani	19:05:11	2024-06-12

3. When it is not successful, the scanner will display the error message and the red light will appear.

4. In case if the scanner has some issues, the student needs to refresh the scanner by pressing the yellow button.

10.0 Project Significant

Smart Attendance systems are rapidly becoming a favored initiative in educational institutions worldwide, and Malaysia is no exception, with several Smart Attendance projects already operational. Smart Attendance is an accessible solution for schools and universities that wish to harness the power of IoT to deliver substantial benefits to their students and faculty due to its adaptable, scalable, and easy-to-deploy nature. But why should educational authorities prioritize Smart Attendance, and why should they take action immediately?

One of the advantages of Smart Attendance systems for educational institutions is the significant time saved. Students are swiftly checked in upon arrival, which is what is meant by saving time. As a result, they don't waste precious minutes at the start of the day waiting in line to be manually marked present. Additionally, Smart Attendance systems help reduce administrative costs. Evidently, by streamlining the attendance process, universities can allocate resources more efficiently instead of dedicating them to manual attendance tracking. This results in more time and funds available for educational purposes.

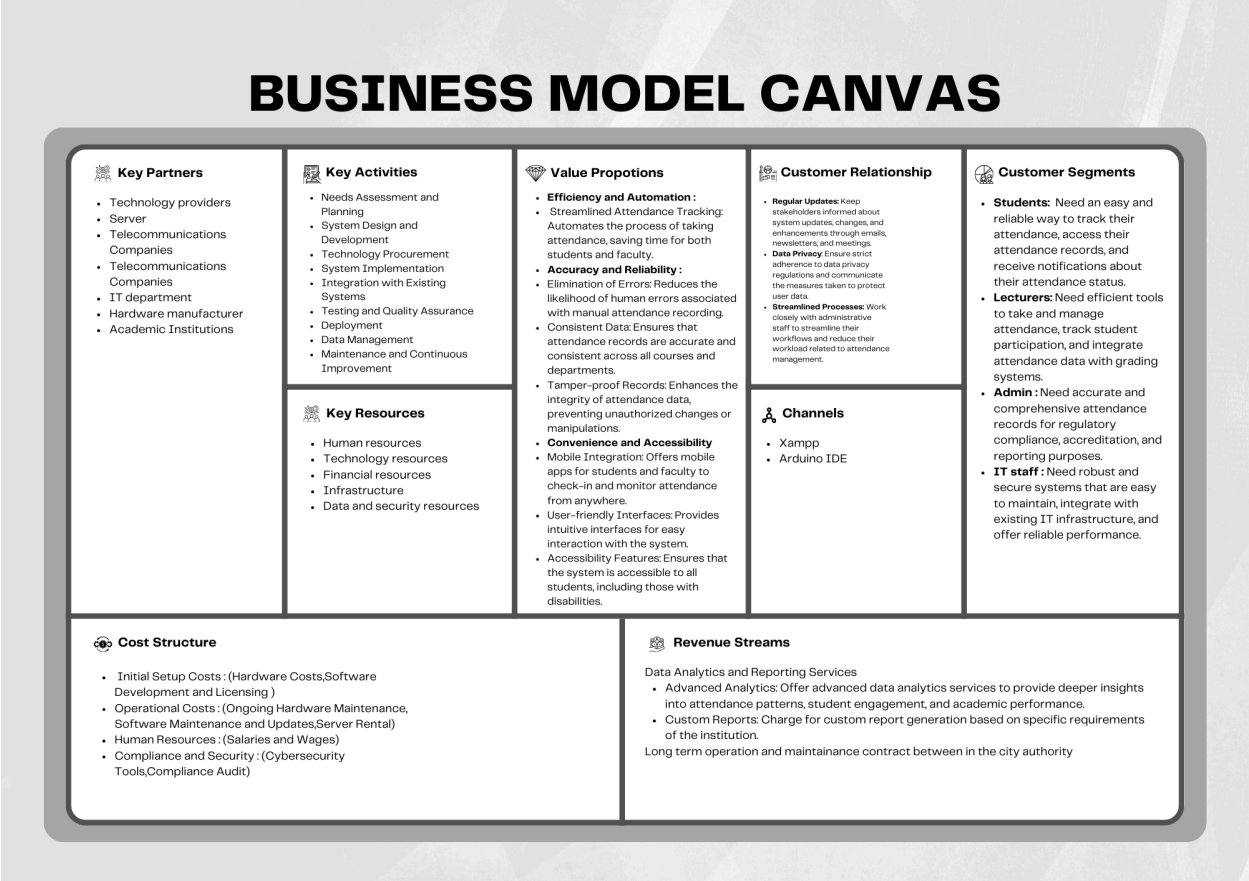
Smart Attendance systems can also reduce the environmental footprint of educational institutions. By minimizing the need for paper-based attendance records, universities can significantly cut down on paper usage, thereby reducing tree harvesting and the associated carbon emissions from paper production. Moreover, these digital attendance systems eliminate the need for students to travel just to submit attendance-related documents.

The need for efficiency in student attendance management is becoming increasingly clear due to the rise in student populations and the existing administrative challenges. Even though online learning platforms are becoming more prevalent, physical attendance still remains crucial for many educational settings. Educational institutions must now manage the potential impacts of any changes the future may bring. By utilizing a Smart Attendance system to collect and analyze attendance data, this can be achieved, ultimately resulting in a more effective educational environment.

11.0 Future Works / Recommendation

The smart attendance system can be further enhanced and expanded upon in future iterations. Integrating the system with mobile applications would enable students to conveniently access their attendance records and receive real-time notifications on their smartphones. Transitioning to a cloud-based data management platform would facilitate centralized storage, secure data transmission, and advanced analytics capabilities for administrators. Exploring the feasibility of incorporating facial recognition technology could potentially streamline the attendance process without relying solely on RFID tags. Addressing scalability and reliability concerns, such as accommodating growing student populations and implementing failover mechanisms, would ensure the system's robustness. Continuous user experience improvements, based on feedback from students and faculty, would enhance the system's ease of use and seamless adoption. Furthermore, implementing robust security measures and aligning with data privacy regulations would safeguard the integrity and confidentiality of attendance records. Lastly, integrating the attendance system with the institution's existing information systems would optimize administrative workflows and promote overall operational efficiency.

12.0 Business Model Canvas (BMC)



13.0 Conclusion

The IoT smart attendance system for universities offers a comprehensive solution that enhances efficiency,accuracy and security in attendance tracking through automation and advanced data analytics.By catering to diverse customer segments such as students,faculty,administrators and IT staff the system ensures user friendly,mobile integrated and accessible interfaces supported by robust customer relationships and strategic partnerships.It generates revenue through advanced analytics services,custom reports and long-term maintenance contracts while managing costs related to hardware,software,human resources and compliance.This well rounded approach provides significant value to educational institutions,ensuring sustainability and potential for growth.

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ITT569 - INTERNET ON THINGS

RUBRIC FOR PROJECT REPORT

CATEGORY	EXCELLENT (5)	GOOD (3 – 4)	SATISFACTORY (2)	NEED IMPROVEMENT (1)
Problem Statement, Objective, Scope, And Requirement of The Project	Clearly understand and describe the problem statement, objective, scope, and requirement of the project. Discusses possible solution of the problem and the idea.	Adequately describes the problem statement, objective, scope, and requirement of the project. Does not discuss possible solution of the problem and the idea.	Describes the objectives of the problem statement, objective, scope, and requirement of the project but some details are lacking. Does not discuss any possible solution of the problem or the idea and their likely effects.	Does not adequately describe the problem statement, objective, scope, and requirement of the project, what was learned or any possible solution of the problem or the idea.
Detailed Design of The Project	All detailed design of the project has been done properly and completely.	Most of the detailed design of the project has been done but not completely done.	Almost 50% of the detailed design of the project has been done but some details are lacking.	Incomplete detailed design of the project and some details are lacking incorrect.
Component Definition and Planned Build.	All components have been implemented and connected properly and completely.	Most of the component have been done implemented and connected but not completely done.	Almost 50% of the component have been implemented and connected but have errors on the certain devices.	Incomplete component implemented and connected and some of it is incorrect.
Testing & Result	Adequately detailed results are shown. 90-100% of the testing working properly.	Adequately detailed results are shown. Almost all (70 – 89%) of the testing working properly.	Result is shown but some details are lacking. Most (50-69%) of the testing have no errors.	Result is lacking for some procedure. More than 30% of the testing have errors.
Accomplishment, Issue and Conclusion	Clearly describes the accomplishment, issue, and conclusion. .	Adequately describes the accomplishment, issue, and conclusion but may leave some unanswered questions.	Unclearly describes the accomplishment issue and conclusion. Able to suggest how to modify and use efficient strategy but does not do it consistently.	Does not adequately describe the accomplishment issue and conclusion. Has no ability to suggest any relevant solution and rarely uses an effective strategy to solve problems.

ITT569 - INTERNET ON THINGS

RUBRIC FOR PROJECT REPORT

ASSESSMENT CRITERIA	WEIGHT (W)	SCORE (S) [1-5] (Refer to rubric)	MARK (W*S)
Problem statement, objective, scope, and requirement of the project	4		
Detailed design of the project	3		
Component definition and planned build.	5		
Testing & Result	3		
Accomplishment, issue, and conclusion	2		
TOTAL			

Comments:

ITT569 - INTERNET ON THINGS

RUBRIC FOR PRESENTATION AND DEMO

ASSESSMENT CRITERIA	WEIGHT (W)	SCORE(S) [1-5] (Refer to rubric)	MARK (W*S)
Structure (Demonstration is well organized and easy to understand)	3		
Language Usage (Grammar) (Correct grammar and usage that is appropriate during demonstration)	3		
Content (Importance of topic, relevance, well elaboration on most questions asked)	5		
Delivery (Well prepared, good ideas, accuracy of facts, eye contact and gesture; personal appearance)	3		
Oral Skills (Elocution & Pronunciation) (Adequate voice volume, clear pronunciation)	2		
TOTAL			

Comments:

ITT569 - INTERNET ON THINGS

RUBRIC FOR PRESENTATION AND DEMO

CATEGORY	EXCELLENT (5)	GOOD (3 – 4)	SATISFACTORY (2)	NEED IMPROVEMENT (1)
Structure	The introduction and actual demonstration were exceptionally well-organized and easy to understand.	Student gave a clear and concise introduction of the lab activities. The flow of the demonstration was clear, concise, and easy to follow.	Student gave a clear and concise introduction of the lab activities but some of the lab activity part/steps was somewhat unclear and confusing to follow.	Student did not give a clear and concise introduction of the lab activities. The flow of the lab activity part/steps was somewhat unclear and confusing to follow.
Language Usage (Grammar)	Demonstration contains no grammar errors; sentences are free of jargon, complete and easy to understand	Demonstration has no serious grammar errors; sentences are mostly jargon-free, complete, and understandable	Demonstration may contain some grammar or sentence errors; sentences may contain jargon or are too long or hard to follow	Demonstration contains several major grammar/usage errors; sentences are long, incomplete or contain excessive jargon.
Content	Student demonstrates full knowledge, able to answer and elaborate on most/all questions asked	Student is at ease with information and answers questions satisfactorily, but fails to elaborate.	Student is comfortable with information but is only able to answer simple questions.	Student does not appear to have a grasp of information; cannot answer questions about subject.
Delivery	Student is VERY WELL prepared and delivers ideas in a clear and concise manner without depending too much on notes. Good eye contact and gestures contribute maximally to the demonstration; professional appearance.	Student was well prepared and delivered ideas with lots of eye contact. Gestures supported the overall demonstration; professional appearance	Student was somewhat prepared. Delivery of the demonstration was made but with strong dependence on notes and hesitation. Some eye contact; adequate appearance. Some appropriate gestures that supported the overall demonstration.	Student was clearly unprepared to demonstrate the lab activities. Inappropriate gestures which detracted from the demonstration; unprofessional appearance.
Oral Skills (Articulation & Pronunciation)	Student uses a clear voice, rhythm, and tone, so that all audience members can hear presentation. Pronunciation mostly everything clearly and correctly.	Student's voice is clear, and most of the audience members can easily hear the presentation. The tone used changes. Pronunciation is good, but some constructions and terms are incorrect.	Student's voice is low medium, but part of the audience still has some difficulty hearing presentation. Tonality barely changes. Pronunciation incorrectly some terms, mostly vocabulary of the unit.	Student frequently mumbles, very low voice and do not use any tonal differences. Student does not do any effort regarding pronunciation.