Implementation of Assignment Box for Data Safety System (Report Submission) Using Conceptual Arduino Logic Gates

Koh Foo Hin [*1], Badrul Sakinah Binti Sanusi [2], Nik Norazilah Binti Nik Abdullah [3] and Mohammad Najib Bin Ramli [4]

[1,2,3,4] *Department of Mechanical Engineering, Politeknik Seberang Perai, 13500 Permatang Pauh, Pulau Pinang, Malaysia*

*Abstract-*The title of this project was 'Implementation of IoT for Data Security System (Report Submission) using Conceptual Arduino Logic Gates'. The purpose of this project is to help to send notifications to the lectures when the assignment submission, to manage the assignment submissions for both student/lecturer and to use fingerprint to detect lecturer's thumbprint to open the designed box. Students nowadays are terrified of missing assignments, misplacing assignments, and stealing personal information from them. Thus, the problem can be handled by developing a system assignment receiving box, an assignment submission mechanism that substitutes the pigeon hole and is more secure, effective, and prevents such problems. Since the box uses a microcontroller, lecturers can receive notifications on their smartphones by scanning the motion of the assignment using an IR sensor. Additionally, the box includes a fingerprint sensor. When the lecturer wants to collect the assignment, he/she should scan the registered fingerprint to open the box's door and if an unregistered fingerprint tries to access it, the lecturer will receive an alarm signal. The outcome is to reduce the time spent by both lecturers and students managing assignment submissions. As a conclusion, this innovative method of resource management and information dissemination has altered how lecturers and students interact with their learning environment.

Keywords: *IoT, Data Security System, Arduino Logic Gates.*

I. INTRODUCTION

The system assignment receiving box is an innovative concept that integrates technology, organization, and accessibility. Envision an internal organization system that effectively distributes and manages work, data, notifications, and even physical resources. For data security purposes, the box incorporates the power of a microcontroller to provide robust control and communication. Bluetooth and Wi-Fi connectivity can be established between the microcontroller and other systems. Optical fingerprint identification, which guarantees the highest level of privacy and security for the contents and ensures that only authorized lecturers may access their designated box. The incorporation of IR sensors enhances the responsiveness of the system to recognize and detect when a student turns in an assignment, and it notifies the lecturers. A rapid and informative user experience is ensured by an LCD display that is easy to use and concurrently provides important information and the type of documents or assignments received. Furthermore, a silent but efficient warning alerts the lecturers when someone tries to open the box without the lecturer being present nearby. The solenoid mechanism also enables controlled and smooth access to the box.

Objectives

Through this study, the following three objectives can be achieved:

(i)   To help to send notifications to the lectures when the assignment submission;

(ii) To manage the assignment submissions for both students/lecturers; and

(iii) To use fingerprint to detect lecturer's thumbprint to open the designed box.

II.   METHODOLOGY

According to research and observations primarily focused on the targeted area, such as higher education institutions, all students face the same issues, including misplacing assignments like reports and assignments and fearing that their peer colleagues will steal private information like student records when they are not around. This occurs as a result of students without any technology or advice that may actually assist them in overcoming these kinds of challenges.

Students' time and energy are essentially wasted by the conventional technique, such as the manual pigeonhole system, which requires them to go the entire length of campus to the designated departments in order to assign their course work. Additionally, this pigeonhole is not secure enough, it's more like an open shelf where some students can take assignments from other students and some attempt to forget to put the completed assignments back on the shelf after completing them. As a result, when a lecturer's expectations for performance are declining, they punish assessment marks because they believe that the students were not turning in their course work. Overall, the existing state of assignment submissions does not correspond with the implementation of a manual pigeonhole system. Furthermore, when private documents like their student records are taken, students get frightened and angry.

Whatever the issue, it promotes development to conduct research and create the system assignment receiving box. For both lecturers and students, this box is incredibly useful and appropriate. The design of the "IoT for Data Security System (Report Submission) using Conceptual Arduino Logic Gates" is depicted in Figure 1.
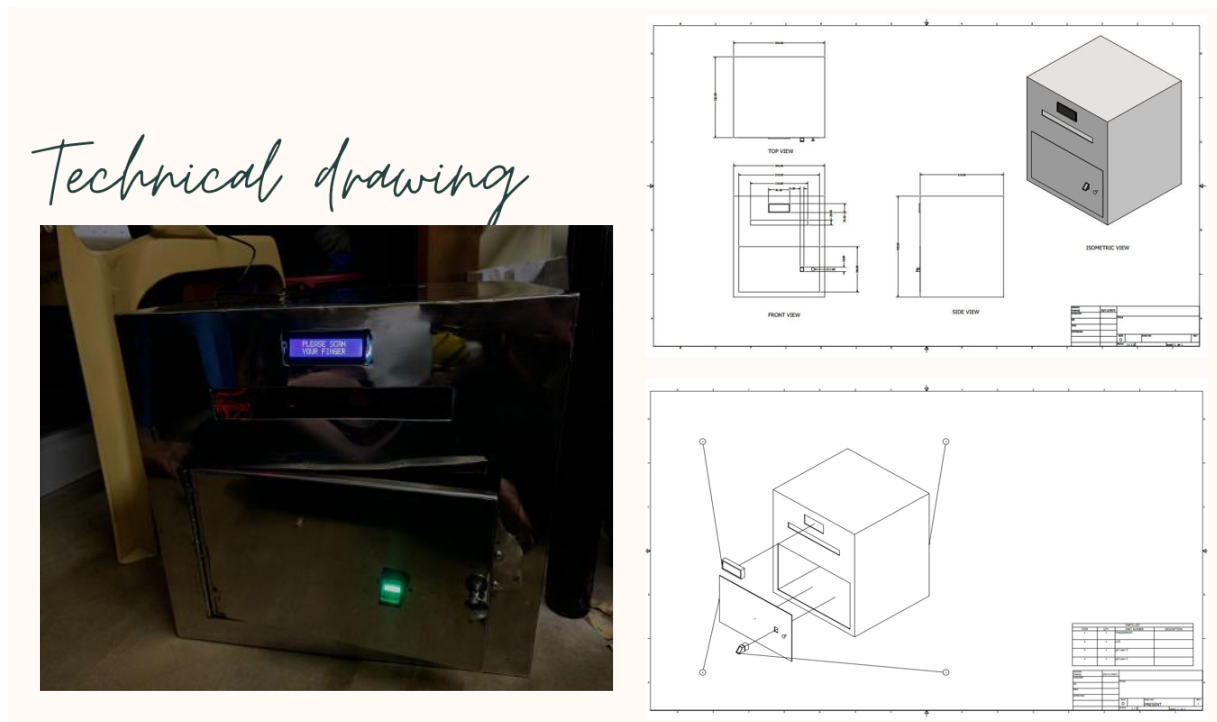

Figure 1: Project Design and Dimensions

i.   Details of Content:
     (Please use additional A4 paper, if necessary. Maximum of 4 additional pages only).

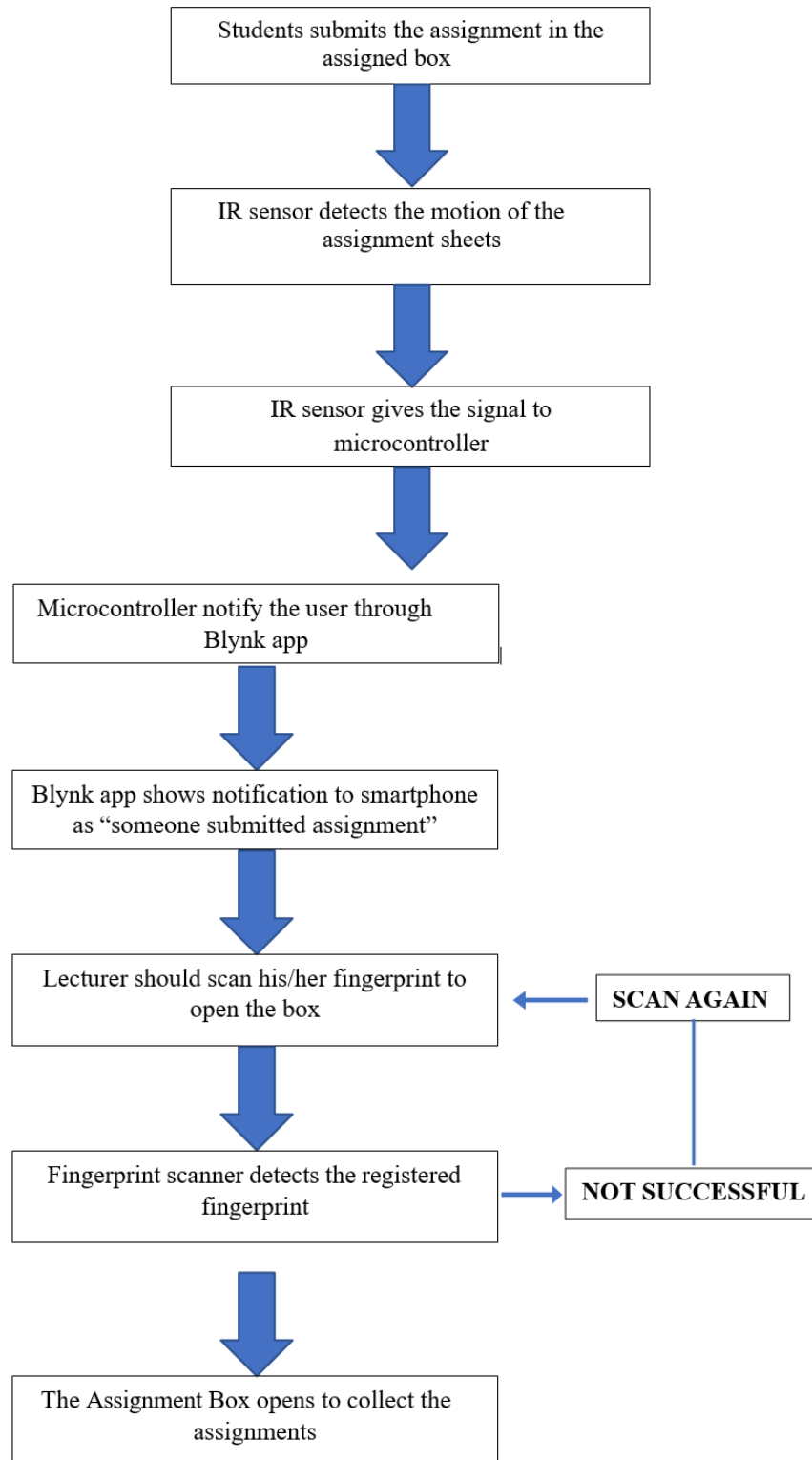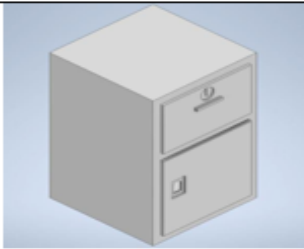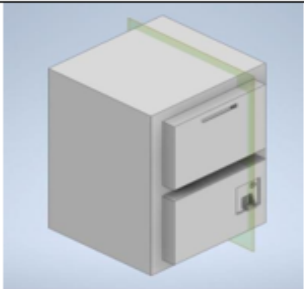This project was completed according to the design process flow shown in Figure 2.
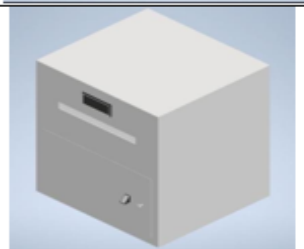

Figure 2: Design process flow

The microcontroller receives a signal from the Assignment Box's IR sensor when a student places their assignments inside of it. The sensor detects movement in the assignment sheets. The user will then receive a notification via the smartphone Blynk app indicating "someone submitted assignment." The instructor must register the fingerprint in order to scan, open the box when it is time to collect the assignments. The buzzer sounds briefly when an attempt is made to open with a fingerprint that is not registered. The user will be alerted by receiving a warning that "warning !! someone tries to open !!" if this activity is repeated three times. Several designs were put forward to realize the idea. Subsequently, a design analysis was conducted to test the appropriate and safe design. In this part, Autodesk Inventor software was used and successfully decided the most suitable and safe design to use as shown in Table 1 below.

Table 1: Assignment Box design selections (*isometric drawings*)

	First concept is based on the design of a secure box. The design includes a few contemporary locks, like fingerprints. Following further discussion, this form of pigeon hole is not ideal for institutions because it is simple for a criminal to smash the box and steal whatever is within.
	The design was then modified to be slightly higher and contain two compartments, with non-owners only being able to open the top half. To turn in their work, students simply need to access the upper container. The design was not chosen because the top compartment has a huge opening, which makes it insecure.
	Another alteration has made the top compartment half-open with a barrier in the middle to prevent anyone from stealing the contents of the mailbox. A small key lock has been added to the bottom section. If there are any problems with the fingerprint, the owner can just use the usual key to open the box. The size of this clever box is rather huge; hence the design has not been selected.
	The following is the design. When the top section of the compartment is opened, a barrier inside the mailbox immediately seals the bottom part of the compartment to prevent anything in the bottom part from being stolen. When the top compartment is closed, the barrier opens, allowing the parcel to fall to the bottom. The size is rather large for an institution; hence the design has not been selected.
	This is the finished design of the quick-witted box. It is rather convenient because the package is neither too little nor too large. Students don't have to worry about assignments being stolen when they turn them in. When students turn in their assignments in the box, lecturers will get in touch with them right away.

2. Implementation of the Teaching/Guidance Methods, etc :

2.1 Basic Equipment of Assignment Box:

In order to keep costs under control and reduce manufacturing costs, the material selection procedure is crucial. To prevent system or project failure, the components should be chosen in accordance with the specifications. The components used to build system in the Assignment Box are listed:

Table 2: Components for building Assignment Box

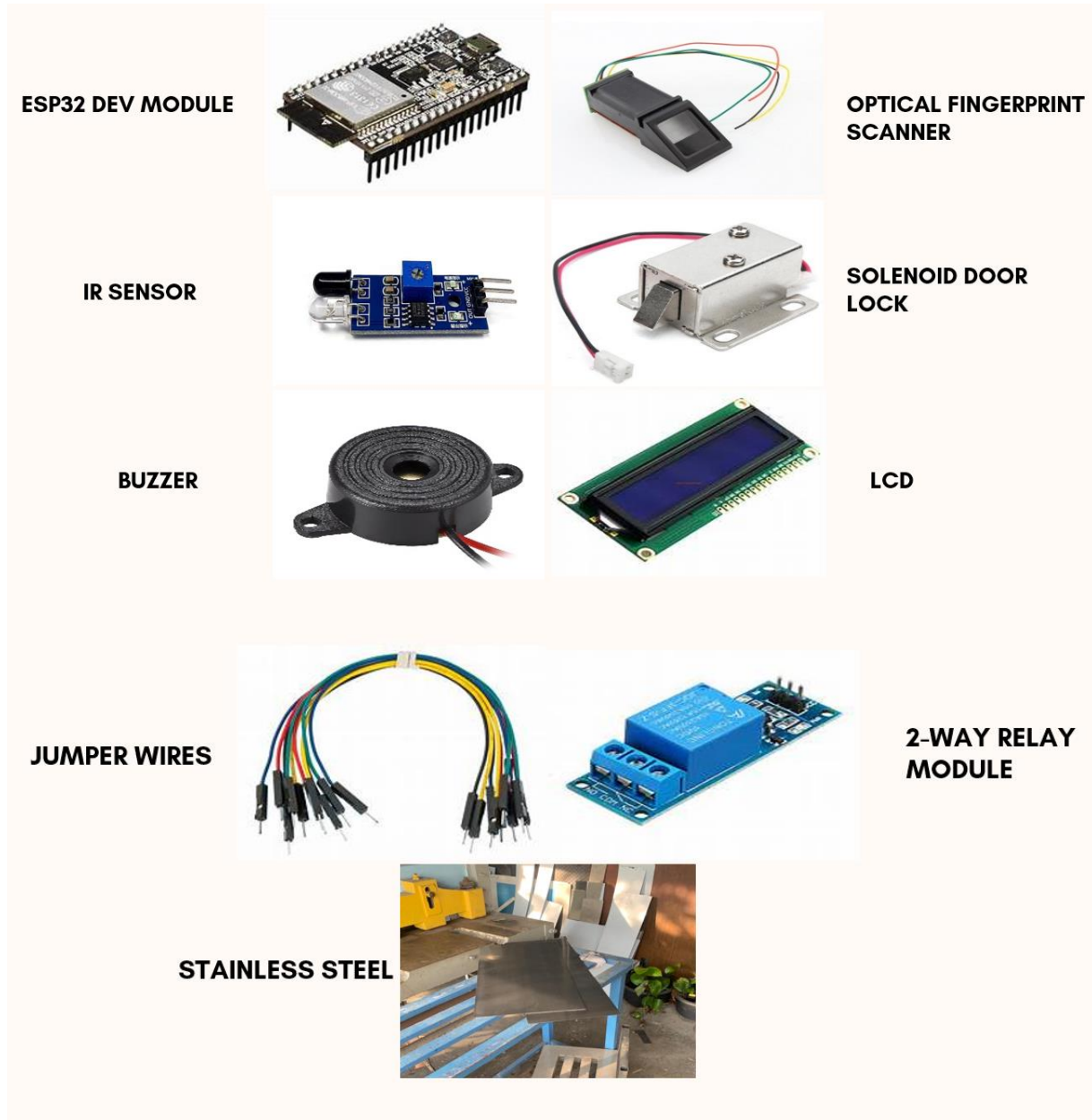|	
	Argon Welding Machine Two material surfaces that must be joined together are combined with this machine.
	Hand drill Using these hand tools, holes are drilled or screws are installed in the correct locations.
	Grinder Machine Stainless steel is cut with this equipment to the required length of material.
	Measuring tape The box is measured with a measuring tape.

Figure 3: Components used in Assignment Box

2.2 Description

Figure 4 depicts the schematic circuit and the port-to-port connection of each component. Firstly, the microcontroller receives signals from the IR sensor in order to transmit messages to users via the Blynk application. If users are notified, they must scan their registered fingerprint on the fingerprint scanner, which sends a signal to the microcontroller and transmits it to the solenoid door lock to gain access to the box. If an unregistered fingerprint attempts to access the box three times, the microcontroller sends a notification to the users and the buzzer sounds for a few seconds to inform them. The 2-way relay module is linked to the solenoid because it requires 12 V or higher to work and because excessive voltage can damage the microcontroller, which requires voltage within 5 V. The LCD is linked to the microcontroller to display information to users.
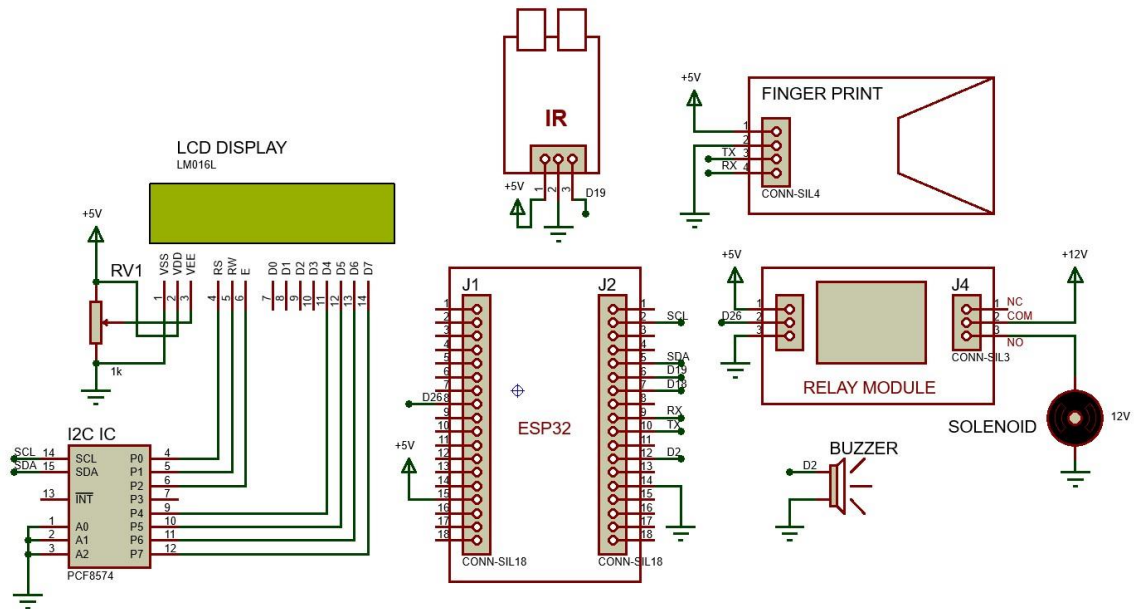
Figure 4: Schematic Diagram

2.3 Procedures
  i.   Student submits assignment in the Assignment Box.
  ii.   IR sensor detects the motion of the assignment sheets/papers.
  iii.   IR sensor gives signal to the microcontroller.
  iv.   Microcontroller notifies the user through Blynk app.
  v.   Blynk app shows notification to smartphone as "someone submitted assignment".
  vi.   Lecturer should scan his/her fingerprint to open the box.
  vii.   Fingerprint scanner detects the registered fingerprint.
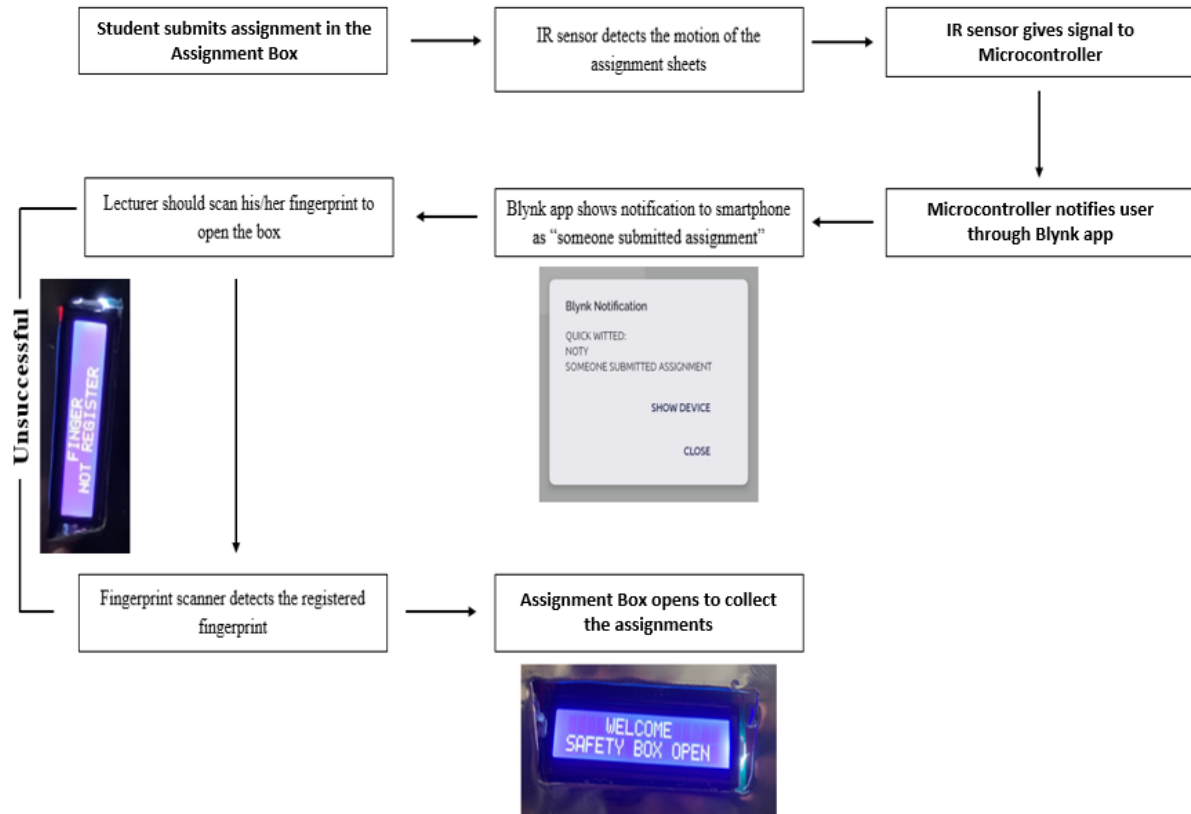 viii.   The Assignment Box opens to collect the assignments.

Figure 5: Working Procedures

III. RESULTS AND DISCUSSIONS

The Assignment Box project must be tested in order to ensure its efficacy, dependability, and performance. These trial runs offer a comprehensive evaluation of the system's performance across various scenarios and configurations. The primary objectives of these tests are to identify and address any potential issues or flaws in the functioning, integration, or design of the component. Through systematic testing, the team can confirm the accuracy of assignment identification, evaluate sensor response, and assess overall system resilience. By thoroughly testing the Assignment Box, the project team may make design improvements, fix any issues, and ensure that the final product meets the intended objectives. This will give the Assignment Box a strong basis on which to automate the process of turning in assignments in school environments.

Table 3: Test run and observations

Test sequences and observation	Evaluating and observation			
	1	2	3	4
Date	13 May 2024	14 May 2024	15 May 2024	16 May 2024
Prospect	Student 1	Student 2	Student 3	Student 4
Time	12.30 A.M.	11.00 A.M.	2.00 P.M.	4.00 P.M.
Evidence				
Remark	Worked well. The Sensor picked up motion, and the Blynk app notified me that "someone submitted assignment."	Worked well. The Fingerprint scanner's sensor functioned, but the excessive number of fingerprints prevented it from detecting registered fingerprints. However, after using tissue to clean the scanner, I tried the fingerprint again and it worked this time. Received notification in the Blynk app.	Successfully worked. Sensor worked, three attempts at testing an unregistered fingerprint before successfully registering the Blynk app's "warning! Someone tries to open" alert.	Worked well. The solenoid door lock was activated, the box was opened, the assignment was gathered, and the sensor functioned, and registered fingerprints were detected.

IV. CONCLUSIONS

This poll was designed to determine the effectiveness of the "Assignment Box." This survey received responses from 32 people.

There are 53.1% male teachers (17 lecturers) and 46.9% female lecturers (15 lecturers) among the 32 responses from Politeknik Seberang Perai. Figure 6 shows respondents-based gender.
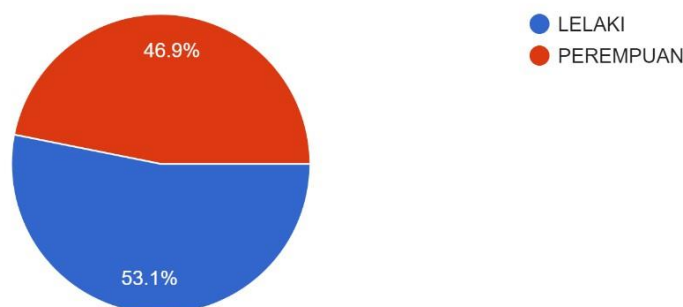

Figure 6: Respondents-based gender

The Mechanical Engineering Department had the most respondents (28 lecturers). Two respondents are from the General Studies Department, and one from each of the Computer and Information Technology Department and Electrical Engineering Departments.
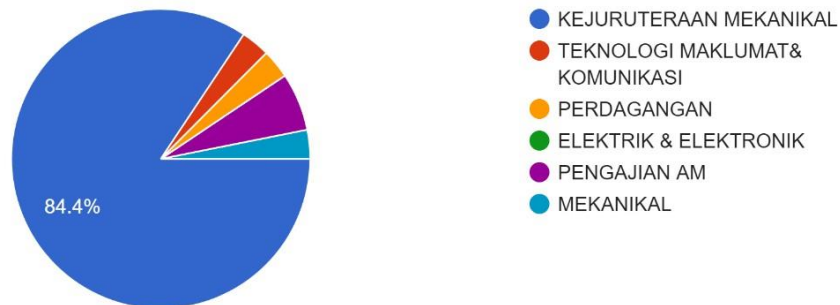
JABATAN
32 responses

Figure 7: Respondents-based departments

The diagram depicts the working hours of the institution's instructors. The majority of instructors who responded to this study have been in the profession for more than seven years. According to this survey question, the majority of respondents have been using the pigeon hole in the institution for a long time. That being said, they are aware of the effectiveness of the pigeon hole and whether or not the Assignment Box project will be advantageous to them.
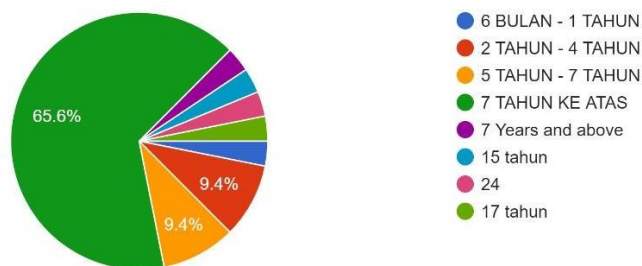
TEMPOH BEKERJA DI INSTITUSI
32 responses

Figure 8: Responses based working period at the institution

The figure indicates that the majority of lecturers use a pigeon hole to assign homework to their students. This demonstrates how valuable the pigeon hole is for professors, allowing them to pick up work whenever

they choose. Students can also submit homework without seeking for or bothering their professors if they are busy.
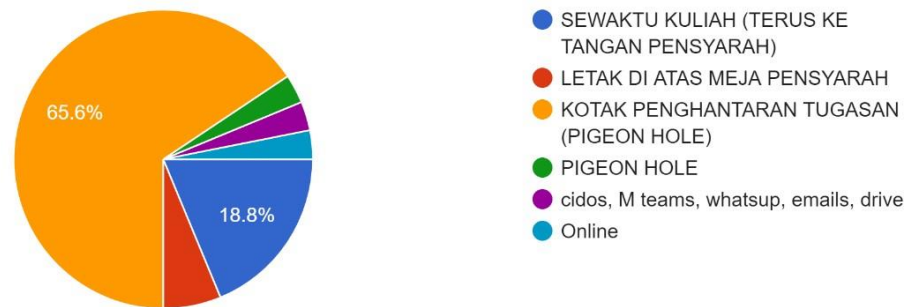

Figure 9: Responses for method of submission

After using pigeon holes for the longest time, most of the lecturers agree that pigeon holes are really beneficial for them. Therefore, they also know if the pigeon hole is really safe for them and the students. Most of the lecturers agree that pigeon holes are quite safe to use. Even so, some of them feel like it's not safe because there is always a case like a lost assignment, someone changing their name on other people's assignments, or their assignment has been stolen.
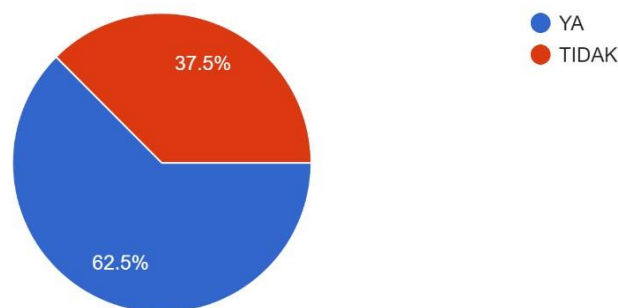

Figure 10: Responses weather the method is safety or not

This project was created to make assignment delivery easier for students and professors. When the assignment is given, lecturers will be notified, and they can collect it by scanning the lecturer's fingerprint without fear of losing it using the Assignment Box. As a result, the lecturers are being asked whether they believe this technology is safer or not. The majority of lecturers think that Assignment Box increases their safety. Only a small percentage of them oppose this invention.

ADAKAH TUAN/PUAN BERASA LEBIH SELAMAT MENGGUNAKAN QUICK-WITTED BOX INI ?
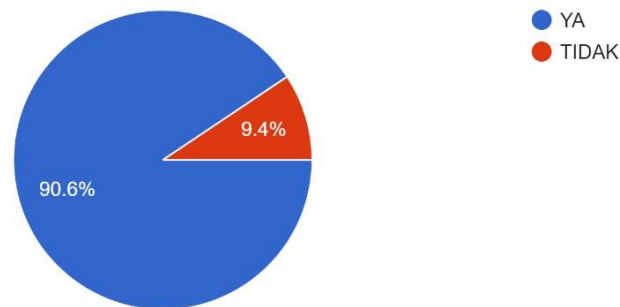32 responses

Figure 11: Responses for Assignment Box

The primary goal of this research is to assist the lecturer in notifying him or her when a student submits an assignment and to reduce the effort involved in handling assignment submissions in order to generate Assignment Box. Data gathering and information on how the system operates, as well as whether or not the professor receives notifications via the Blynk application Data from lecturers will be evaluated alongside data from site studies. Site studies are conducted to demonstrate the effectiveness and convenience of Assignment Box. In the study, 32 replies from lecturers at Politeknik Seberang Perai agreed that adopting Assignment Box would keep assignments safe. In conclusion, this box can make it easier for polytechnic institutions to use, more convenient, and safer.

Results and Benefits of Implementing the Teaching/Guidance Methods, etc:

(i) *Students will be able to learn about Logic Gates and apply it in the project.*
(ii) *Students can relate the function of sensors and logic gates in the project.*
(iii) *To assemble the use of application of Digital Systems and Arduino Programming.*
(iv) *To rebuild and improve the existing demonstration kit. such as Digital Systems and Sensors in Control System.*
(v) *Safe and ergonomic especially for teaching and learning process in Technical and Vocational Education and Training (TVET) in Polytechnic Malaysia.*

REFERENCES

Pradeep. (2014). How to fix the system with solenoid and ESP32. Retrieved from https://www.youtube.com/watch?v=dVWisvdzj5I [Accessed 24 November 2023]

Prateek Singh Raj. (2020). How to fix the system with fingerprint, solenoid and ESP32 https://youtu.be/ItpVjd6d1Is?feature=shared [Accessed 24 November 2023]

Prateek Singh Raj. (2020). Coding for the system. Retrieved from https://www.prateeks.in/2020/04/esp32-and-fingerprint-sensor- [Accessed 24 November 2023]

Massiono Banzi. (2014). Make: Getting start with Arduino. Retrieved from https://docs.arduino.cc/retired/other/getting-started-with (Accessed 15 November 2023)

Note: Due to space constraints, each applicant is allowed to submit a maximum of 20 pages ("Application Form" and "Enclosures") online. Where necessary, other documents or attachments may be produced during the interview.