

Development of Submission Box with Data Storage

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Abstract

Assignments delivered in universities could not be monitored properly due to the large number of people who send them, and most of them are vulnerable to physical factors such as rain, security, and so on. The main problem was the lack of a previous method to document and track submitted tasks that were harmed by weather conditions. To overcome these challenges, a submission box with internal data storage was developed using an Arduino UNO as a microprocessor. This paper describes and discusses the development of a submission box with internal data storage utilising Tinkercad Simulation and Arduino IDE. Additionally, this thesis presents the management of the submission box with internal data storage. Both modelling findings and experimental data are presented and discussed. This paper has examined both experimental findings related to the submission box prototype with internal data storage. The simulation and experiment data support the theoretical findings. The development of this system offers a solution to enhance productivity in university on work submission.

1. Introduction

During the pandemic, students were required to send their assignment through online system such as Microsoft Teams, Google Classroom [1]. Many tasks in the post-pandemic era are given in person. In this study, we strongly emphasized making things simpler for everyone. One of the problems that arise in submission activity is the absence of specific data recordings is a severe problem. To track and calculate the quantity transmitted, we plan to develop a system that is based on Arduino UNO and IR sensor [2]. This initiative was created primarily to address the issue of incomplete assignments. Additionally, the issue is open to the elements and any other potential hazards. The primary goal of this project is to address the issue that arises when a submitted item is missing [3]. We are currently in an endemic era, so students will now hand-deliver their assignments. The goal of this project is to provide a user-friendly system for both the lecturer and the student [3]. Thanks to this initiative, the student and the lecturer will be able to keep track of the number of assignments or tasks that have been turned in. Therefore, to make this project function effectively, a submission box with internal data storage was created utilizing an Arduino Uno and an IR sensor [4]. The choice has been made to concentrate on developing a submission box with internal data storage in the Arduino using the memory that the microprocessor has after making some observations.

This project aims to create a counter that will track the number of assignments that have been delivered, and the user will be able to choose the sort of assignment they want to send [5]. Users should anticipate this project to be simple to use, boost productivity, and be adaptable enough to be used by the institution in the future. This

submission box uses IR sensor as a counter placed on top of the box to count the number of objects that enter the box. In addition, 4 X 4 keypads have been used to make selections related to assignments students want to submit and to enter the unique password for each user [6]. LCD, 16x2 I2C, is used to give information to lecturers and students [7]. The information displayed is the amount that has entered the box. Based on the article [8], LCD 16X2 is an electronic device used to display data and messages known as LCD 16×2. The coding for this project will be written using the Arduino IDE. Figure 1 shows the general block diagram of submission box systems.

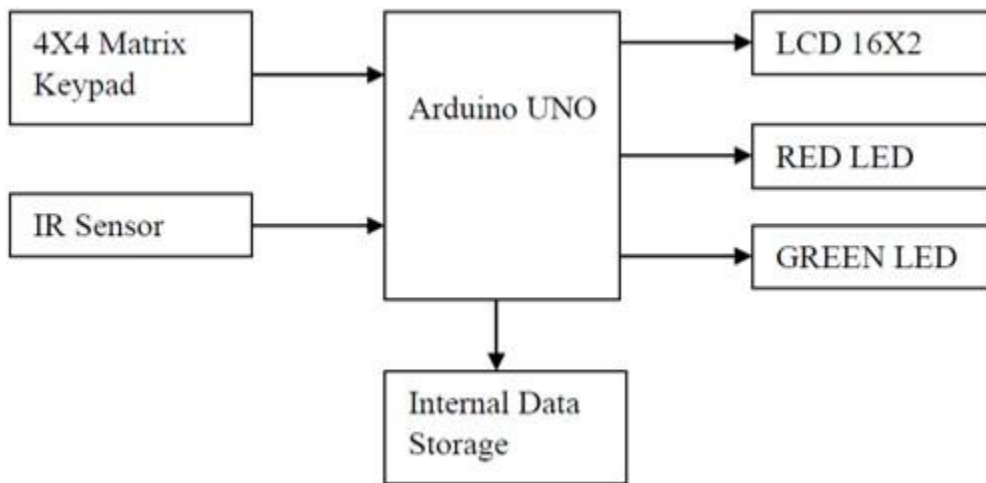


Fig. 1 Block diagram of submission box with internal data storage.

2. Materials and Methods

2.1 Block Diagram

The Arduino Uno, an open-source microcontroller board built on the Microchip ATmega328P microprocessor, are all included in this device. Fig. 1 shows the block diagram for submission box with internal data storage. The IR sensor and 4x4 matrix keypad will be the main primary input for this system. The two LEDs and LCD will be the output for this system. The IR will be placed in the box, meanwhile 4x4 Matrix keypad will be placed outside to make the user easy to use this system. Lcd will be placed with LEDs outside the box to give information to the user.

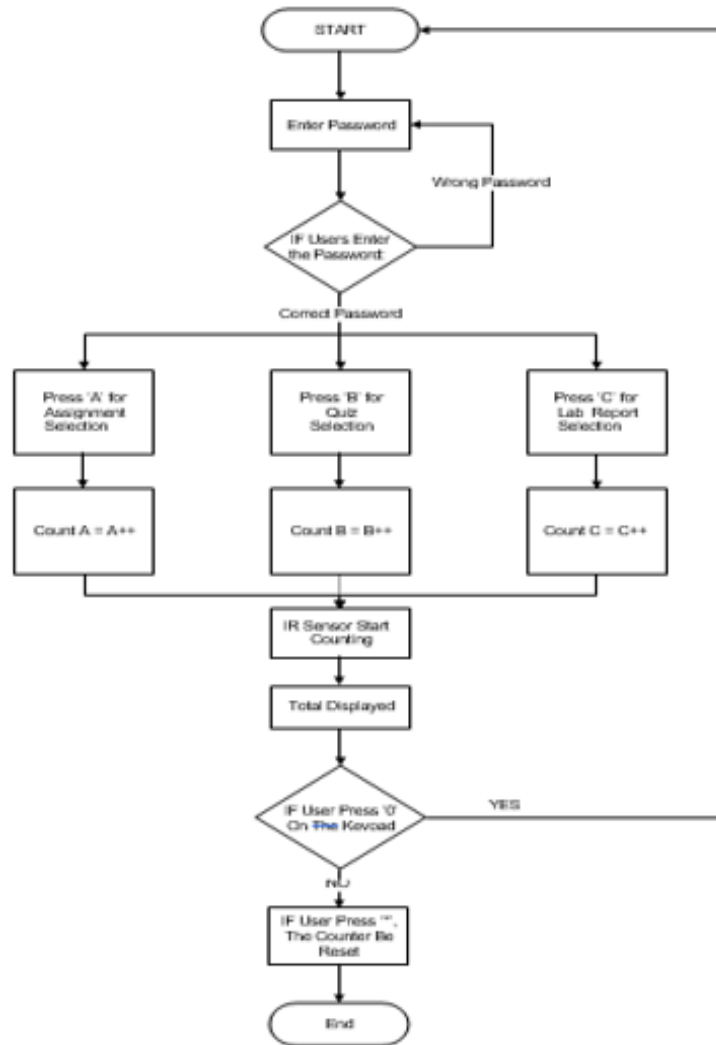


Fig. 2 Operational flowchart of submission box system.

2.2 Operational Flowchart

Every user has a different password to allow them to use this system. The password is required before the user can use the system and acts as safety. After the user keys in the password, they must choose the type they want to send either assignment, quiz, or lab. After selection has been made the IR sensor will be triggered and will start counting the counting process. If the user wants to know the total inside the box, the user may press the keypad and select D. To start again, the system user can press 0, and to reset the counter user can press *. Fig. 2 shows the flowchart of this system. Based on the figure, the first user needs to key in the password that has been set.

3. Results and Discussions

3.1 Hardware Development

Fig. 3 shows the circuit connection that been made using Fritzing software. The circuit has been designed to make the project achieve the goal of the project. During this phase the troubleshoot has been done to determine whether the connection of the circuit is in good condition or not.

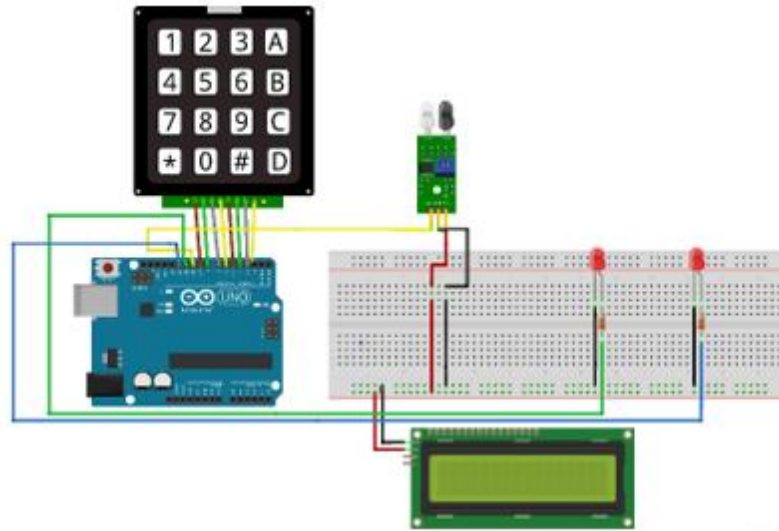


Fig. 3 Circuit and hardware connection of the project development.

Fig. 4 shows the prototype of the project. This prototype has been designed with several specification to solve the problem of this project. All the components have been installed to the model suitable with the design that been made. The figure shows the view from front view, top view and the circuit that been placed in the prototype.

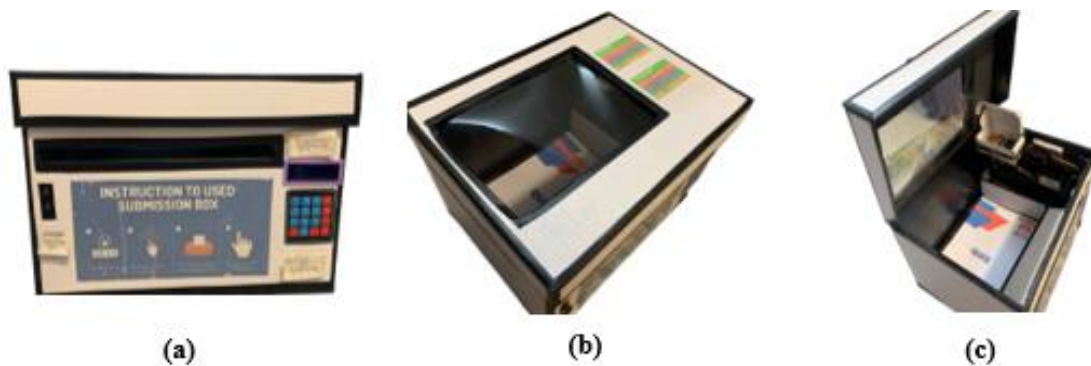


Fig. 4 The prototype of submission box development with (a) Front view; (b) Top view; (c) Circuit installation.

3.2 Software Development

The operational of the project is developed using Arduino IDE consists of three main blocks: password management, user selection and counter. Fig. 5 shows that the coding that been implemented in this project.

The Fig. 5(a) shows that the coding for the user to enter the password before the user can use the system. The user required to enter the right password before they can use this system. For this coding shown that if the password is true the LED will turn on to show that they have access to the system. Based on Fig. 5(b) is the coding for the user to make selection based on the type of work that user want to send. If the user selects for A, it will show the assignment that been selected, and it will make an operation to count for object A. After the user had submit the assignment, the user needs to press A button to stop the counting. All data will be displayed through the LCD. The Fig. 5(c) shows that the coding for the user to reset the counters and display the total count in the box. If the user reset the counter the counter will be 0 and the LED will OFF. If the box has reached the maximum capacity the LED will turn ON to give and alert for the user to collect their assignment.

```

void processKey(char key) {
  if (key == 'A') {
    if (enteredPassword == password1) {
      accessGranted = true;
      digitalWrite(10, HIGH); // Turn off LED 1
      digitalWrite(11, LOW); // Turn on LED 2
      delay(2000);
      digitalWrite(11, HIGH);
      //digitalWrite(10, HIGH);
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Access granted");
      lcd.setCursor(0, 1);
      lcd.print("Faculty: PPO");
      delay(2000);
      lcd.clear();
      performWork(); // Call the function to select the type of work
    } else if (enteredPassword == password2) {
      accessGranted = true;
      digitalWrite(10, HIGH); // Turn off LED 1
      digitalWrite(11, LOW); // Turn on LED 2
      delay(2000);
      digitalWrite(11, HIGH);
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Access Granted");
      lcd.setCursor(0, 1);
    }
  }
}

if (key) {
  switch (key) {
    case 'A':
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Assignment");
      lcd.setCursor(0, 1);
      lcd.print("Selected");
      delay(2000);
      lcd.clear();
      lcd.print("Count A: ");
      optionSelected = true;
      countObjectsForOptionA();
      break;
    case 'B':
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Quiz");
      lcd.setCursor(0, 1);
      lcd.print("Selected");
      delay(2000);
      lcd.clear();
      lcd.print("Count B: ");
  }
}

void resetCounts() {
  objectCountA = 0;
  objectCountB = 0;
  objectCountC = 0;
  lcd.clear();
  lcd.print("Counts reset");
  digitalWrite(11, HIGH); // Turn off LED 2
  delay(2000);
  performWork(); // Return to the work selection menu
}

void totalCount() {
  lcd.clear();
  lcd.print("Total count");
  lcd.setCursor(0, 1);
  lcd.print("A: ");
  lcd.print(objectCountA);
  lcd.print("B: ");
  lcd.print(objectCountB);
  lcd.print("C: ");
  lcd.print(objectCountC);
  if (objectCountA >= boxCapacity || objectCountB >= boxCapacity || objectCountC >= boxCapacity) {
    digitalWrite(10, LOW); // Turn on LED 1
  } else {
    digitalWrite(10, HIGH); // Turn off LED 1
  }
}
    
```

Fig. 5 The programme development with (a) Password entering; (b) Submission modes; (c) Count and reset.

3.3 Simulation

Fig. 6 shows the simulation has been made in TinkerCad simulations to check the coding that had been created. In this simulation, the keypad is utilised to select an option while the PIR Sensor counts the quantity that goes into the designated box. After the prototype is constructed, testing is carried out to examine each connection and the functionality of the connected circuit. There are issues at this phase as well that need troubleshooting. Based on Fig. 6 this project had been made a preliminary testing before the actual circuit has been connected. During this phase, the code has been testing either it suitable for this project or not.

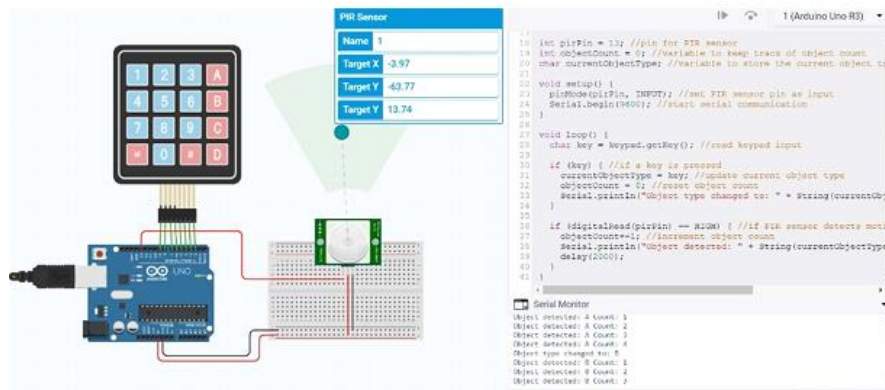


Fig. 6 The view of counter and selection simulation.

3.4 Result and Verification

The submission box with internal data storage's primary function is to keep track of the number of assignments sent there. Only the correct password will make this system functional. The user must choose the type of assignment to be sent after entering the correct password. The user will input the task in the box after choosing. The counter counts the contents of the box when the IR is activated and sends the data to the Arduino so that it can be kept in internal storage and displayed on the LCD. Additionally, there are buttons to reset the counter and the system for new users. When the box is full, the LED will light up, indicating that the box is full and ready to be collected. It is essential to think about all possible hardware installations when building the system, which makes it challenging to create hardware. The research indicates that the IR sensor can precisely identify an object as it passes through the box and that the LED can appropriately alert the user and function.

Table 1 shows the operation result of the submission box with internal data storage after a few test run sessions were carried out. The infrared sensor is representing counter to count the number of items that goes into the box. The LED is to show the condition of the box either it full or not.

Table 1 Operation results of submission box with internal data storage.

Entered Password	Range	Keypad Selection	State of Infrared Sensor	The number of items detected by the IR Sensor	Led condition for the box if box full
True	2cm	Selected	ON	10	OFF
True	3cm	Selected	ON	20	ON
True	10 cm	Selected	OFF	-	OFF
False	5cm	Not Selected	OFF	-	OFF
False	2cm	Not Selected	OFF	-	OFF
False	3cm	Not Selected	OFF	-	OFF

4. Conclusion

The submission box with internal data storage is a necessary prototype for all educators, especially lecturers. To simplify the process of delivering tasks, such as assignments, quiz attachments, and lab reports, lecturers can use this system to simplify the process of delivering those tasks to students. It is possible to store the number of students who are sending tasks in hardcopy through this device as a prototype. It was found that this prototype could be improved by integrating the internet of things (IoT) to make it easier for lecturers to access the number of senders via their mobile phones based on the results of the test. There is no doubt that this prototype will prove useful to lecturers in identifying the number of senders without having to count everyone. Their role as educators has been facilitated by these factors.

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