Application of Arduino Software Design for the Electric Rice Grain Blower with PIR Motion Sensor

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Imaginative Abstract. With the advancement of technology, various kinds of equipment have further been enhanced by incorporating fuel-powered motors or using electric motors as their prime mover. In addition, various types of function have been available ever since the existence of microcontrollers and sensors. Microcontrollers such as Arduino Uno can take in inputs through the digital I/O pins using sensors and perform the various commands embedded in the system. Application of microcontrollers on equipment and devices offers the user better controllability and flexibility on the function to be performed. With the help of these electronic devices, various functions can be done just by writing the code and commands and embedding them in the microcontroller. In this study, the researchers will be developing the software program for the Arduino component of the electric rice grain blower taking the PIR motion sensor as the input device.

CCS CONCEPTS • Hardware • Emerging Technologies • Electromechanical Systems • Microelectromechanical Systems

Additional Keywords and Phrases: Rice Grain Blower, PIR motion sensor, Arduino, Microcontroller

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1 INTRODUCTION

Work has been present since time immemorial and a large amount of equipment and machines have already been invented to make work more convenient. As technology emerged, a lot of new equipment and machinery were introduced that are way more convenient to use than the previous ones. This helped increase the amount of work that can be done with the same amount of time. With the continuous advancement of technology, further enhancements can be done as new technologies are introduced as well.

Sensors and microcontrollers were introduced as technology continued to advance. Various kinds of sensors with multiple functions were invented and have been used in industry to enhance operational aspects of machines, to ensure safety, to provide convenience, and many more. The microcontrollers, Arduino uno for example, are programmable electronic devices that can take in data from other devices, such as sensors, and execute the programmed functions. The best thing about these newly introduced technologies is that they consume very little amount of power. Thus, using these devices to further enhance equipments and machineries have been the trend recently.

Some farming machinery like rice grain blower, thresher, and mills which are stationary have been industrialized and are now powered by electricity to further reduce the amount of manpower required to operate these machineries. Another way of enhancing a machinery is by installing sensors that functions as an alarm, which can be further enhanced by incorporating the application of a microcontroller in the mechanism. Since these machineries were built to take in things like grains, a passive infrared (PIR) motion sensor would work better for these machines. With the use of a microcontroller and a PIR motion sensor, enhancing a machinery by installing an alarming system that will notify the operator when there is nothing being processed by the machinery will be quite challenging. Thus, the study aims to develop the application of software design of the Arduino using a PIR motion sensor in an electric rice grain blower.

2 REVIEW OF RELATED LITERATURE

The purpose of this study is to develop the application of software design for the electric rice grain blower with PIR motion sensor. This chapter contains some related literature about the chosen study and presents important concepts and ideas that the researcher considered in strengthening the claims relevant to the present study.

2.1 An Overview of Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are very useful as they can take in inputs from sensors, messages and turn them into outputs such as lighting an LED. Arduino boards, like Arduino Uno R3 (Figure 1), are programmable devices that follow the instruction written in the microcontroller on the board. To program such devices, Arduino programming languages and Arduino Software (IDE) are used. [1]

Figure 1: Arduino Uno R3. [Public Domain], via Pololu Robotics and Electronics. (https://www.pololu.com/product/2191)

Arduino has been the backbone of a lot of projects for quite some time. Novices and experts alike benefitted from the creation of an open-source platform which was a contribution from a worldwide community of makers. It was invented at the Ivrea Interaction Design Institute as an easy tool for fast prototyping to be used by students with no electronics and programming background. It started changing to adapt to new needs and challenges after it reached the large number of users.

2.2 An Overview of a PIR Motion Sensor

PIR motion sensors (shown in Figure 2) allow the user to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. Because of that, they are commonly used in appliances and gadgets almost everywhere. [2]

They are basically made of a pyroelectric sensor, which are used to detect levels of infrared radiation. Every object exudes a little amount of radiation and the hotter the object is, the greater the amount of radiation an object exudes. In a motion detector, the sensor is split into two parts which are wired up so that they cancel each other out. They are split for the purpose of detecting motion changes, not for the average infrared levels. If one side sees more or less infrared radiation than the other, the output will swing either high or low.

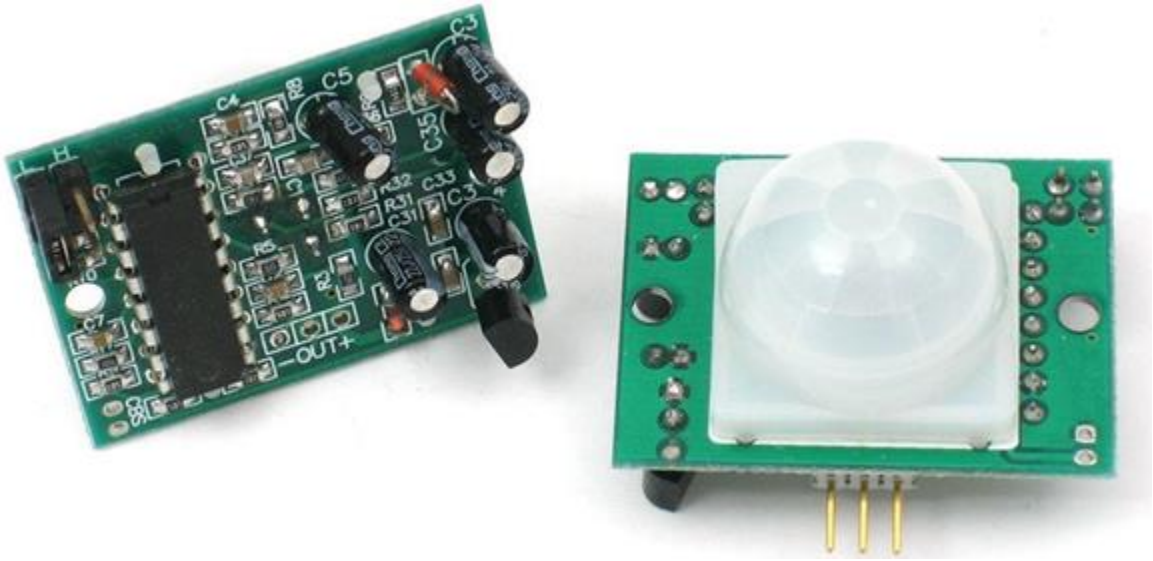


Figure 2: PIR Motion Sensor. [Public Domain}, via Adafruit Industries, Unique & fun DIY electronics and kits, (https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor)

2.3 Arduino Based Security System Using Passive Infrared (PIR) Motion Sensor

Figure 3 shows the block diagram for PIR motion sensor alarm. During the software programming phase of this project, the programming aspect were divided into 3 stages: the declaration stage, set-up stage and Loop stage. The declaration stage declares the pins to be used and designates their specific function. The set-up stage involved instructing commands in the pins on how they are going to work. These pins have been ordered by the program to send signal and receive signal. The input defines that Arduino should receive signal, while the output orders it to send signal out. The GSM works with signal connection, transmitting and receive signal both simultaneously. Once set-up is completed, the sensor can now work effectively. The loop stage is then assigned for the codes to work repeatedly when there is detection. After the program was successfully uploaded to the circuit, a test was carried out to determine if the PIR worked perfectly and it came out with positive results as it detected motion. As the sensor detects motion, it sends information to the Arduino which then gives an output signal making the buzzer sound an alarming noise and the GSM to send a security alert information. [3]

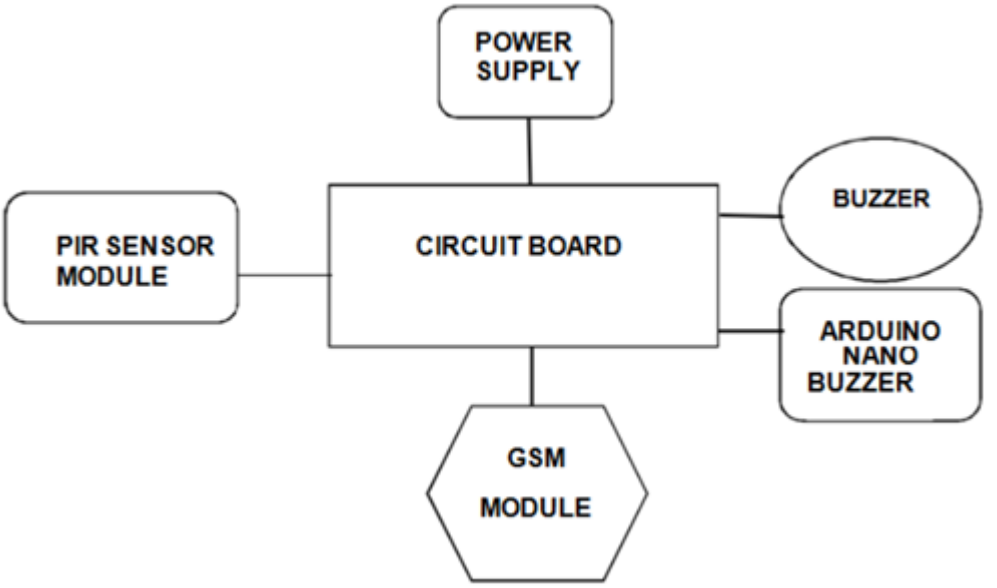


Figure 3: Block Diagram for PIR motion sensor alarm

3 PROPOSED METHODOLOGY

In this section, the system design, and the important for the application of Arduino software design for the electric rice grain blower with PIR motion sensor will be thoroughly discussed.

3.1 System Design

The system will be comprised of a power supply, a PIR motion sensor, and Arduino Uno R3 circuit board, and a buzzer. Power will be supplied to the Arduino Uno R3 circuit board which will be distributing power to the other components in the circuit.

The working mechanism of this system (shown in Figure 4) is that at the initial phase, when the sensor detects no motion, the buzzer is in the energized state. It works as an alarm system that tells the operator that the system is functioning well. When there is motion detected by the sensor, it sends information to the microcontroller which executes the written command that is to stop the buzzer's alarm. When there is no motion detected by the sensor within the set time delay, the microcontroller will start the buzzer's alarm again, notifying the operator that there is nothing being processed.

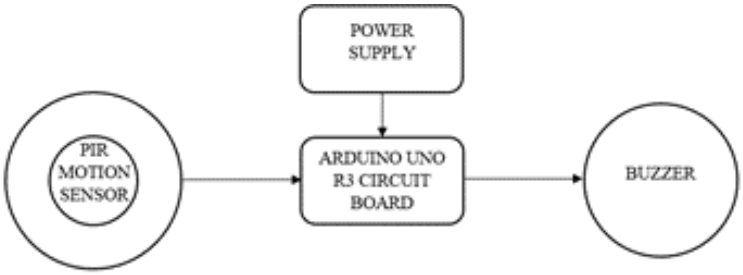


Figure 4: Block Diagram for the Arduino Software Design with PIR Motion Sensor and Buzzer

3.2 Important Code

```
// Arduino with PIR motion sensor

int buzzer = 13;          // the pin that the Buzzer is attached to
int sensor = 2;           // the pin that the sensor is attached to
int state = HIGH;         // by default, no motion detected
int val = 0;              // variable to store the sensor status (value)

void setup() {
 pinMode(buzzer, OUTPUT);   // initialize buzzer as an output
 pinMode(sensor, INPUT);    // initialize sensor as an input
 Serial.begin(9600);        // initialize serial
}

void loop(){
 val = digitalRead(sensor);     // read sensor value
 if (val == HIGH) {             // check if the sensor is HIGH
  digitalWrite(buzzer, LOW);   // turn buzzer OFF
  delay(1);                    // delay 1 millisecond

  if (state == LOW) {
   Serial.println("Motion detected!");
   state = HIGH;               // update variable state to HIGH
  }
 }
 else {
   digitalWrite(buzzer, HIGH);  // turn buzzer ON
   delay(200);                  // delay 200 milliseconds
   if (state == HIGH){
    Serial.println("Motion stopped!");
    state = LOW;                // update variable state to LOW
  }
 }
}
```

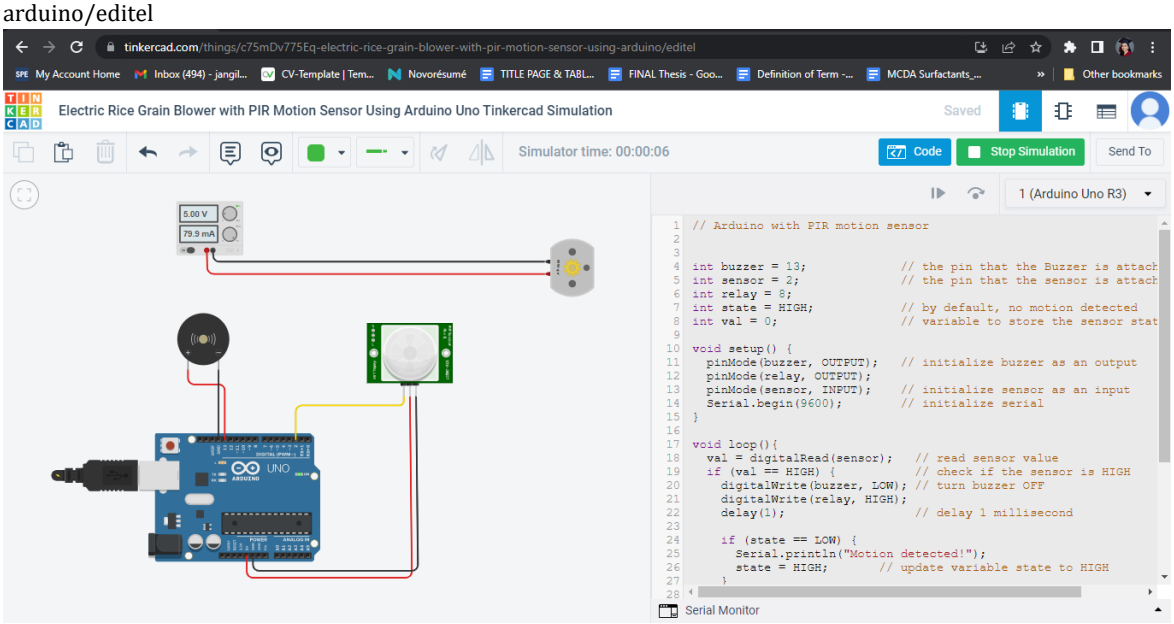
REFERENCES

<bib id="bib1"><number>[1]</number>Arduino.cc, (2018). What is Arduino? Retrieved June 15, 2022, from https://www.arduino.cc/en/Guide/Introduction</bib>
<bib id="bib2"><number>[2]</number>Fried, L. (2018). PIR Motion Sensor. Adafruit, 1. Retrieved June 15, 2022, from https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor</bib>
<bib id="bib3"><number>[3]</number>Akinwumi, S. A., Ezenwosu, A. C., Omotosho, T. V., Adewoyin, O. O., Adagunodo, T. A., & Oyeyemi, K. D. (2021). Arduino Based Security System using Passive Infrared (PIR) Motion Sensor. IOP Conference Series: Earth and Environmental Science, 655(1). https://doi.org/10.1088/1755-1315/655/1/012039</bib>

APPENDICES

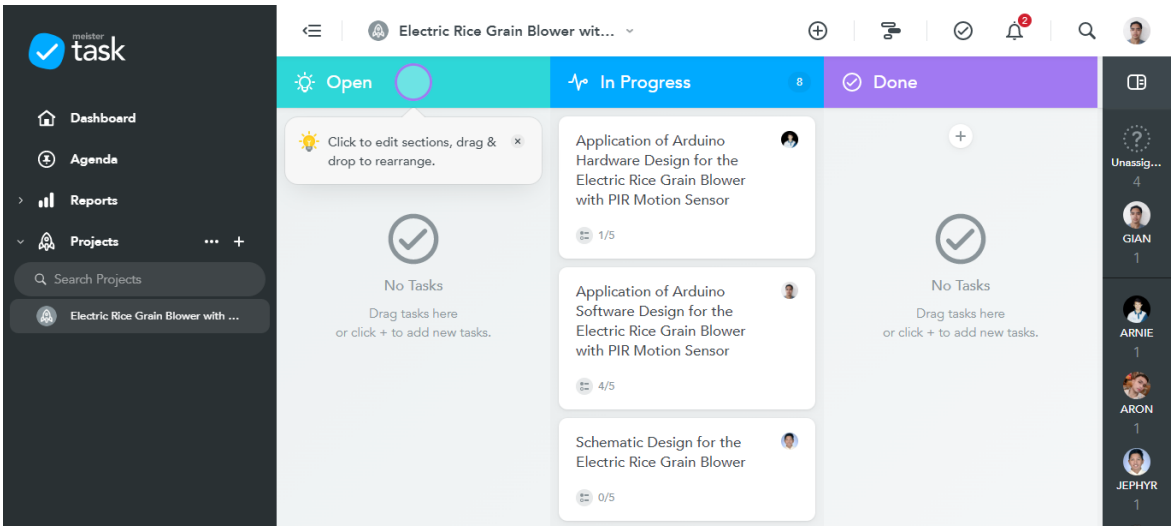
Tinkercad Simulation

https://www.tinkercad.com/things/c75mDv775Eq-electric-rice-grain-blower-with-pir-motion-sensor-using-arduino/editel



Meister Task

https://www.meistertask.com/app/project/y5nflQyw/electric-rice-grain-blower-with-pir-motion-sensor-using-arduino-uno



GitHub Contributions

https://github.com/MAKASA-LABORATORY/107-ERGBPMSUAU/commits?author=maquilang&since=2022-05-31&until=2022-06-17