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Light Detection For White Asparagus Farm Using Arduino

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ABSTRACT

Nowadays, Technology has been a part of human life. in the world of agriculture, the existence of technology greatly helps plant productivity. Automation in the world of agriculture becomes the new norm, in many aspects of the field, such as in optimizing plant growth. One particular plant which requires delicate environment condition is white asparagus which could only grow optimally under low to no light environment. This project is a device to detect light in the plant room. When the light intensity passes certain threshold, an alarm is activated and a warning message is sent through Short Messaging Service to the owner's cellphone. In addition, this device is also equipped by fire sensor to detect fire in the planting area and provides warning through the same channel. The test of the device gave promising results to be developed further in real planting area.

Keywords: Arduino, Flame Sensor, GSM Module.

I. Introduction

The development of technology in the world of agriculture is very helpful towards economic growth for the community. As an example, the asparagus plant known as the king of vegetable has a high selling price. Upscale restaurants usually serve these vegetables as a main dish along with steak. Asparagus is a type of vegetable that is used as a cooking ingredient. This vegetable can also be said to be a relative away from onions. Asparagus is known to have low calories and sodium. In addition, asparagus also does not contain any cholesterol, no wonder many people manage it into various kinds of food. Besides it feels good it also has benefits for the body. The history of asparagus is very long. Around 2000 years ago this vegetable was consumed by the community. In ancient times, Hippocrates, Ancient Greek doctors used asparagus as a medicine for diarrhea. Actually, this asparagus grows in Central Europe, Southern Europe, the Middle East, Western Siberia, and North Africa. China, Peru and Mexico are the three biggest asparagus producing countries in the world. Structurally this herbaceous plant grows up to (100-150) cm with fat stems. There are flower plants have a shape like a bell. Actually, this plant is only eaten by its lever even though there is fruit but it is poisonous. In terms of the benefits of asparagus is a source for Vitamins K, B1, B2, C, E, Folate, and Selenium. Then, there are iron and protein compounds which are very good for the human body. It can maintain the digestive system, overcome urinary tract infections, and help treat diabetes, rheumatism, and other diseases. Behind it all asparagus can still be developed again into vegetables that are more aesthetic and high-value, white asparagus. There are still many Indonesian people who are not familiar with white asparagus but in Europe, China and America this plant is very popular because it tastes more delicious. However, it is very difficult to plant. White asparagus grows without light, so the color is white.

To make it easier for businesses in the field we make a light and fire detection device. In addition to detecting light, our device can also detect fire events. The way it works is that if there is light, our tool will send information to the business owner or manager that there is light in the room so that the business manager can check whether there is a malfunction in that place. By facilitating business people, it is hoped that Indonesia will be able to produce prosperity for the people by planting this vegetable king. This tool can also detect if there is a fire so that it can be overcome earlier. For that the application of this tool must be in a stable room condition and avoid direct light. This tool can actually be modified into such a way according to place, condition, and application. But of all those things, this tool will be very helpful for people to get better welfare.

II. Basic Theory

A. Microcontroller

Arduino Uno R3 is a type of microcontroller based on ATmega328P chip. Arduino Uno has 14 digital input / output pins. There are 6 analog input pins, using 16Mhz crystal including A0 to A5 pins, USB connection, ICSP header power jack and reset button. These are all used to support the microcontroller circuit. Simply connect it into a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. Arduino Uno R3 specifications can be seen in Table 1.

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Table 1. Specification

Microcontroller	ATmega328
Voltage operation	5 Volt
Input Voltage	7-12 Volt
Pin I/O Digital	14
Pin Analog	6
DC Pin I / O	50 mA
Flash memory	32 KB
Clock Speed	16 MHz

In Arduino there are ATMega328 which have the main PORT, namely PORT B, PORT C, and PORT D with a total of 23 pins input / output. PORT can function as a digital input / output and function as a peripheral. ATMega328 is a microcontroller output from Atmel that has a RISC (*Reduced Instruction Set Computer*) architecture, where each execution process can be faster than the completed instruction set computer architecture or commonly called CISC. Following Figure 1 for more details about Arduino Uno R3 and ATMega328.

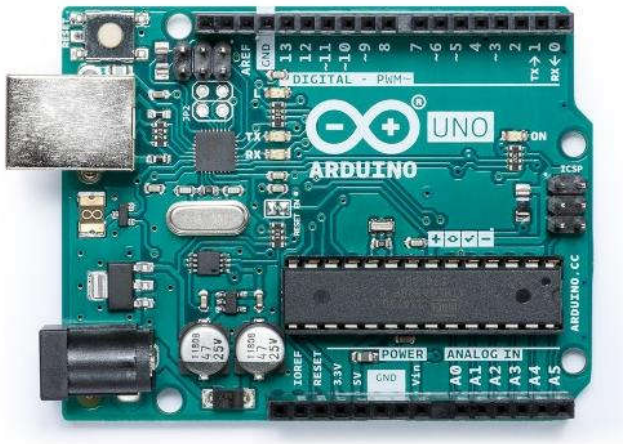

Figure 1. Arduino Uno ATMega328 R3.

B. Breadboard

Breadboard is a kind of board that is used to make electronic rankings with the aim of testing without having to solder. The advantage, electronic components will not be damaged and can be used again to make another range. Breadboard is generally made of plastic, with many holes on it. The hole in the middle is made to design vertically series following the Y-axis and for the plus and minus or VCC and Ground uses horizontal serial design. Figure 2. to depicts the connection flow of the breadboard itself.

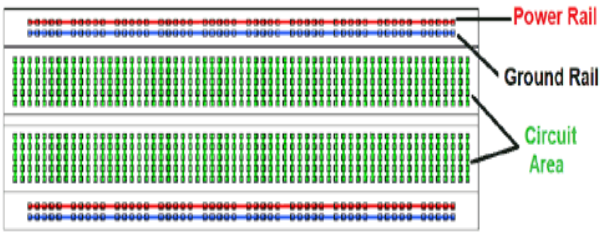

Figure 2. Breadboard Connections.

C. Jumper DuPont Wire

Cable Jumper DuPont is a jumper cable used for electronic circuit projects that are done using breadboard. This cable is used to connect the cable to the PCB and also other electronic components on the breadboard. Usually this tool weighs approximately 50 grams. Available various types of jumpers, male to male, male to female, female to female. This cable is very helpful in designing electronic circuits on a breadboard. An example of this wire is shown in Figure 3.

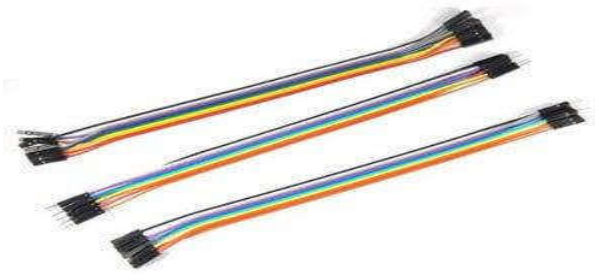

Figure 3. DuPont Jumper Wire.

D. Flame Sensor

It is a sensor that has a function as a flame detector and also light with a wavelength between 760nm-1100nm. This sensor uses infrared as a transducer in sensing fire or light conditions. This sensor is used in the area of office space, apartments and hotels. How this sensor works by identifying or detecting flame using the optical method. This sensor uses a transducer as an infrared. Figure 4 shows an example of a flame sensor.

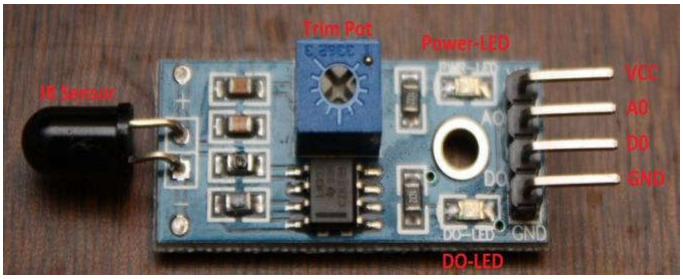

Figure 4. Flame Sensor.

E. SIM800L GSM Module

Module SIM800L is a GSM/GPRS serial module. This module could interact with cellphone service communication channel by inserting micro sim card into the module. The service that the module could use among others is short messaging service as the one used in this project. An example of this module is shown in Figure 5.

Figure 5. SIM800L GSM Module.

III. System Design

A. *System Design*

A general idea of the design is shown in Figure 6. Flame sensor is used as input. Then it is processed with Arduino using ATMega328 microcontroller. Buzzer and GSM 800L are as output.

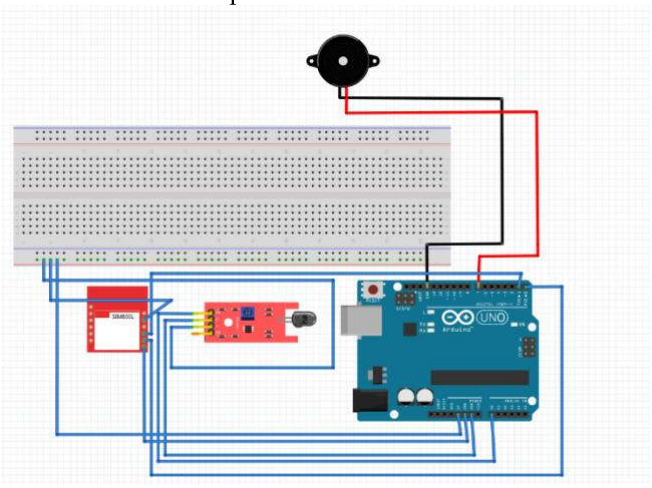

Figure 6. Complete Circuits.

For the simple explanation the works of the device is shown in the flow chart in Figure 7.

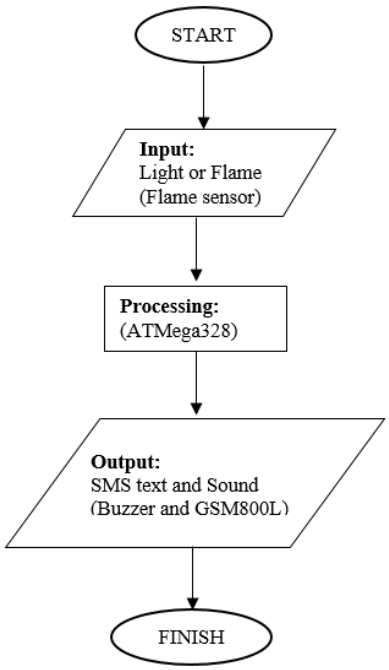

Figure 7. System Flow Chart.

B. *Software Implementation*

The Arduino code used in this project is shown in Table 2.

Table 2. Arduino Code

```
int a=0;
int b=0;
int bellPin = 7;
const int sensorMin = 0;
const int sensorMax = 1024;

void setup() {
pinMode(7,OUTPUT);
Serial.begin(9600);
}

void loop() {
int sensorReading = analogRead(A0);  // read
the sensor on analog A0:
int range = map(sensorReading, sensorMin,
sensorMax, 0, 3);

if(range==0)
{
   if(a==0)  // if fire is detected
   {
      digitalWrite(bellPin,HIGH); //buzzer high
      Serial.println("AT+CMGF=1");
      delay(500);
      Serial.println ("AT+CMGS=\"YOUR
NUMBER\" ");
      delay(500);
      Serial.print("Light Detected!!! \n ");
      delay(500);
      Serial.write(26);
      delay(500);

a++; b=0;
   }
}

if(range==2)
 {

  if(b==0)// No fire detected.
  {
     digitalWrite(bellPin,LOW); //BUZZER
OFF
     Serial.println("AT+CMGF=1");
     delay(500);
     Serial.println  ("AT+CMGS=\"YOUR
          NUMBER\"");
      delay(500);
      Serial.print("Condition is safe \n");
      delay(500);
      Serial.write(26);
      delay(500);

b++;a=0;
   }
}
  delay(1);
}
```

Those kinds of codes applied in this research. It can be seen in the first three lines of first table leads into the main elements which the int purposed to declare the variable of each data types that will be used in Arduino. The input of the codes itself should be match with what we have input on the Arduino.

On the second part of first table, const int, used to declare the data into the Arduino. The sensorMin and sensorMax of a flame sensor must be added into the code. Then, void setup, we input the pin 7 that will run works on the Arduino and connected with buzzer.

After the void setup has ran well, Void loop, the codes need to added in order to detect the range and "sensorReading". The range use the library as a mapping of three elements which are sensorReading, sensorMin, and sensorMax.

If range used as a light detector that capable to measure the scale of light itself. The sensor and buzzer will automatically be turning on and warning when there is light detected.

There are two process inside the loop, which are when the light is came then the sensor will send the messages of "Light Detected!!!," to the owner. Instead of no light detected, or lack of light, then the sensor system will send the messages of "Condition is safe".

The codes above include a++ and b++ that both uses the array forms of that code. The array is applied either when the condition is turning on or turning off, it will automatically not send the message twice.

IV. RESULT

Based on the measurement that we have already conducted; the Figure 8 shows us that the light sensor in inside room (No Light) condition. Then it will be sending a message "Condition is Safe". on mobile phones whose numbers have been registered in the Arduino IDE code.

Figure 8. Light Sensor Test 1 (Inside Room).

On this measurement, Figure 9 shows us that the light sensor in outside room (Light Condition) Then it will be sending a message "Light Detected!!!" on mobile phones whose numbers have been registered in the IDE Arduino code. This message could also be seen in the Arduino's serial monitor as seen in Figure 10.

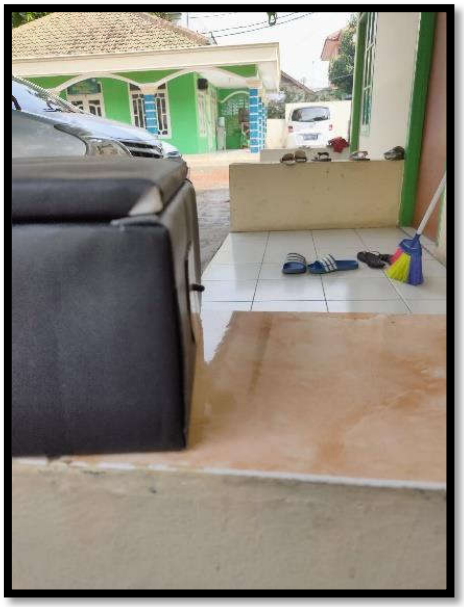

Figure 9. Light Sensor Test 2 (Outside Room).

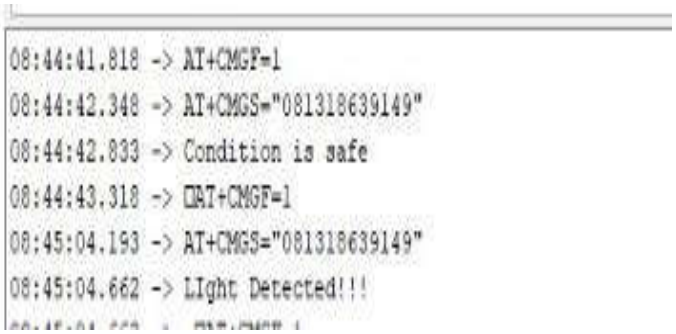

Figure 10. Serial Monitor at IDE.

After the light sensor gets the data from the light around it, then sending a message to the number that has been registered, the data will be printed first on the serial monitor, this is only to display backup information if the SMS module does not get a signal.

This message is sent by a light sensor where it states a light condition in a room. when the sensor is in a room with low light intensity as in Figure 8, the message that will be received is "Condition is Safe". Then from the experiment in Figure 9 where the light sensor is in a high-intensity light condition, the light sensor will send the message "Light Detected". followed by Buzzer's voice, and we define that this condition is dangerous, because the object that we observe here is white asparagus. The message received on the cellphone can be seen in Figure 11.

Figure 11. Message sent to the cellphone.

V. Conclusion

After testing the results of the measurement, it is possible to draw several conclusions:

1. The measurement of light sensor in no light condition, was a condition that is less than 15 lux, and light condition measurement is get by light in condition >15 lux, lux is SI derivative units of lighting and light emitting power, measure the light flux per unit area. This is equal to one lumen per meter square.
2. Delay between sensor detected the light until sending the massage is 0,5 seconds or 500 milliseconds. Referring our observe object, White Asparagus 0,5 seconds delay is no matter, before giving serious treatment.
3. The only problem with this project is the use of sim cards, conditions where bad signals or run-out pulses can occur, so make sure the sim cards, signals and pulses are in good condition.

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