Design Of Automatic Hand Sanitizer Spray System Based On Arduino Uno Using Fuzzy Logic Method

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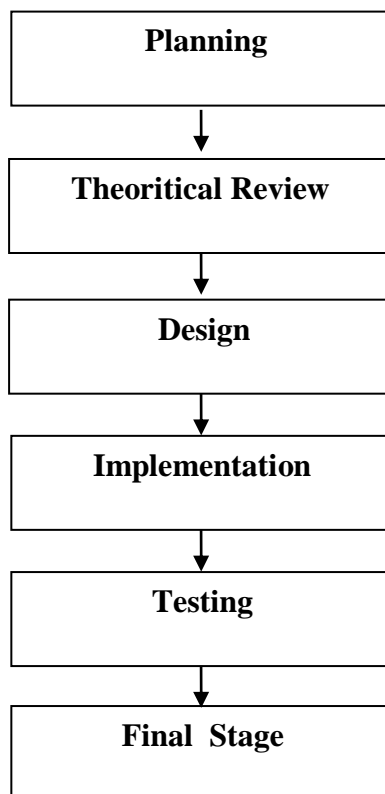
Abstract

Washing hands is the act of cleaning like fingers to wrists using water or other liquids. Hand sanitizer with a minimum alcohol content of 60% is believed to be effective for killing germs and other harmful microorganisms because hands are one part of the body that often interacts such as touching and can be a medium for the spread of viruses, germs and bacteria. The manufacture of tools is carried out as one of the efforts in advancing technology to provide convenience and comfort through the development of an automatic system for hand sanitizer containers. From the above problems an Arduino based automatic hand sanitizer system was created. This system works directly to be able to spray liquid automatically. This system is expected to make it easier for users to spray liquids without having to do it manually or touching the container directly to maximize time efficiency and keep it clean. By designing a prototype to make this automatic hand sanitizer using an ultrasonic sensor as input, Arduino Uno Atmega328p as a microcontroller, and a servo motor as a driver for the hand sanitizer container. The system on the tool to be made is capable of spraying liquid automatically at a maximum distance of 10 centimeters.

Keywords: Alkohol, Arduino Uno, Hand Sanitizer

INTRODUCTION

Hands as one of the organs of the body that often interact, touch and can be a medium for the spread of germs, viruses and harmful bacteria. For example activities when opening doors, pressing elevator buttons, using computer keyboards and shaking hands. Then without realizing it, after we eat, touch our face and at that time germs or viruses can enter our bodies. The impact caused by the habit of not maintaining hand hygiene can be mild to the point of being attacked by viruses and bacteria. And the spread itself can occur through hands and mouth, such as flu, diarrhea to COVID-19 disease due to the corona virus. The best thing we can do to prevent this is to use hand sanitizer. Alcohol-based hand sanitizer with a minimum of 60% is believed to be effective for killing harmful germs and microorganisms on hands, including preventing the corona virus. Now there are many public facilities that provide hand sanitizer, but the problem is that those who use hand sanitizers still have to touch the hand sanitizer container.

RESEARCH METHODS

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│    Theoritical Review   │
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│          Design         │
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│      Implementation     │
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1. **Planning**
   Planning is the initial stage where the author will identify and determine the scope that needs to be done in making an automatic hand sanitizer spray system based on arduino uno using fuzzy logic method.

2. **Theoritical Review**
   At this stage, the process carried out is to find information about the tool to be made. Information can be found in journals, scientific papers, books, and online media.

3. **Design**
   The author designed an automatic hand sanitizer spray system based on arduino uno using fuzzy logic method to simplify the next stage of the process, where the author designs the coding used, supporting devices and device assembly to get the best placement position.

4. **Implementation**
   At the implementation stage, it is classified into two stages, namely the first stage of making hardware (hardware) and the second stage of writing program coding (software).

   - Manufacture of hardware (hardware): The device is assembled according to the previous design stage
   - Write program code (software): Program code is typed to run device functions and adjust to needs.

5. **Testing**
   At this stage the device is tested to determine the ability of the tool that has been made, whether it has fulfilled the desire or not. The test was carried out several times to get the results.

6. **Final Stage**

At this stage, the author will discuss the conclusions and also suggestions from the results of the research that has been carried out.

Hardware Design
Diaram Block Running System
The block diagram above illustrates how the system will work. Ultrasonic sensors are used to detect the distance of objects, especially humans, then the ultrasonic sensor gives a signal to the Arduino Uno which then gives the command to the servo motor to drive the hand sanitizer spray.
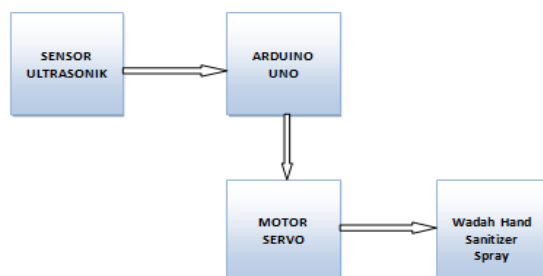

Figure 1. Diaram Block Running System

Overview Of The Ultrasonic Sensor Module Circuit
The Arduino circuit will read the input from the ultrasonic sensor where the sensor will have a range from 0-10 cm. the input that is read will be converted into a distance with a size of cm. The series of ultrasonic sensors with Arduino can be seen in the picture below:
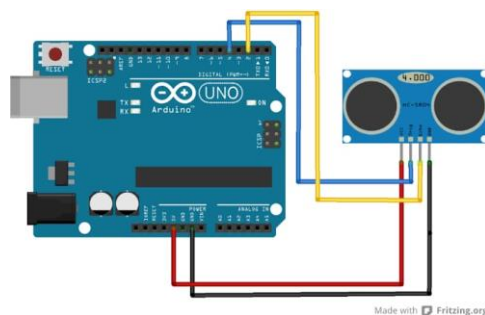

Figure 2. Overview Of The Ultrasonic Sensor Module Circuit

Overview Of The Servo Motor Module Circuit
This Arduino circuit with a servo motor module functions as an additional device on the Arduino which will be directly related to the hand sanitizer spray container. The circuit of the servo motor module with Arduino can be seen in the picture below:
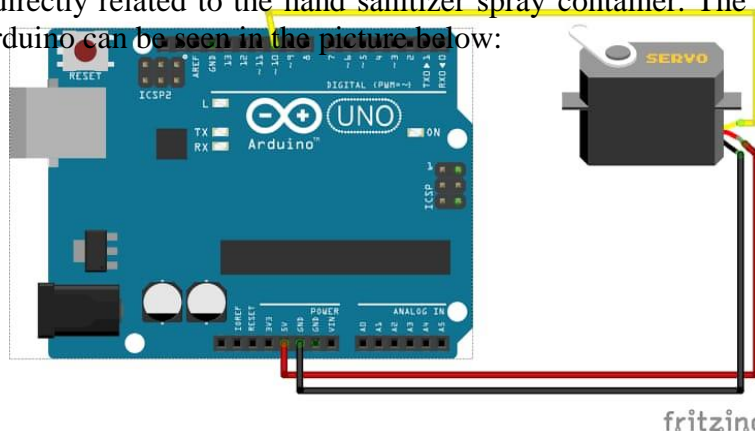

Figure 3. Overview Of The Servo Motor Module Circuit

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Overview Of The Overall System

In this series the ultrasonic sensor reads human movement at a predetermined distance, while the servo motor itself functions as a driver in the hand sanitizer spray container so that every time there is human movement that is read by the ultrasonic sensor, Arduino will give orders to the servo motor which will later be linked to the sensor. hand sanitizer spray container.
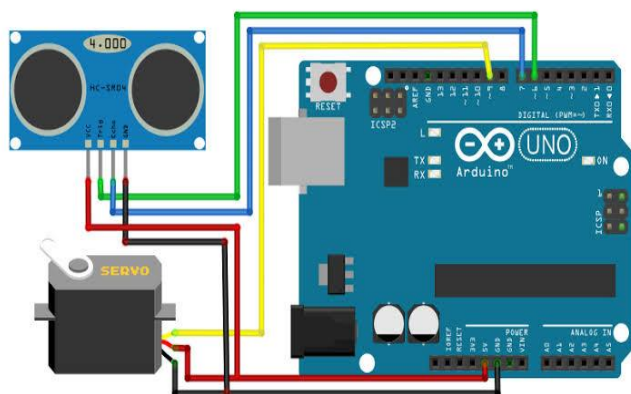

Figure 4. Overview Of The Overall System
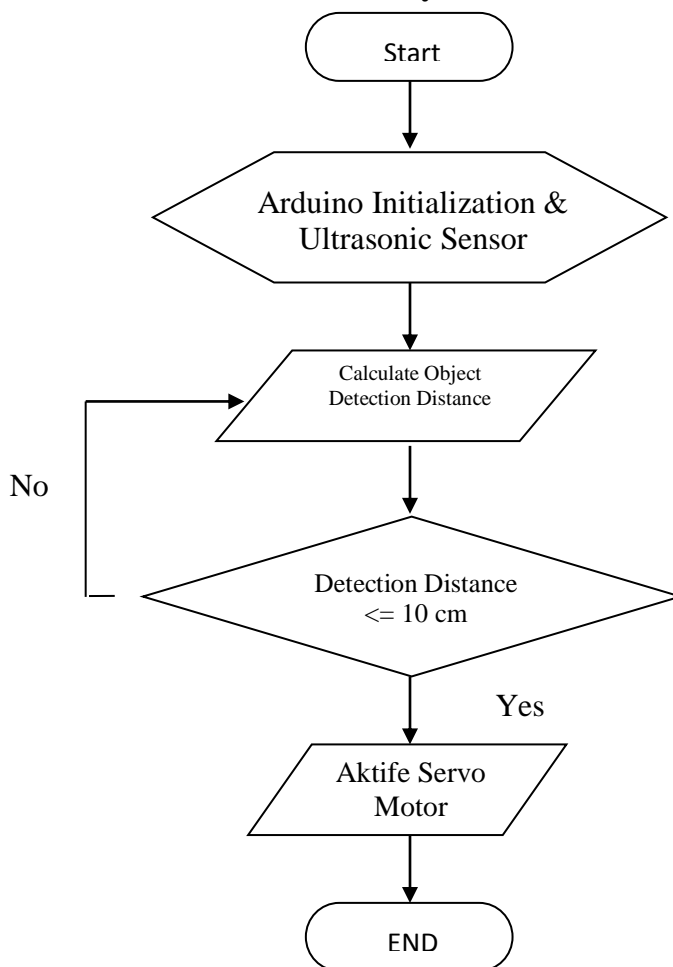
The Role of The System

Figure 5. System Flowchart

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System Flowchart Explanation :
1. *Start*.
2. Initialization of program preparation on arduino devices and sensors.
3. Next, read the input data from a distance detected by the ultrasonic sensor.
4. If the ultrasonic sensor detects a distance of <=10 cm, the servo motor is active.
5. END

RESULTS AND DISCUSSION

Servo Motor Trial
To activate the SG90 / MG90s Servo Motor using the Arduino IDE with the following steps:
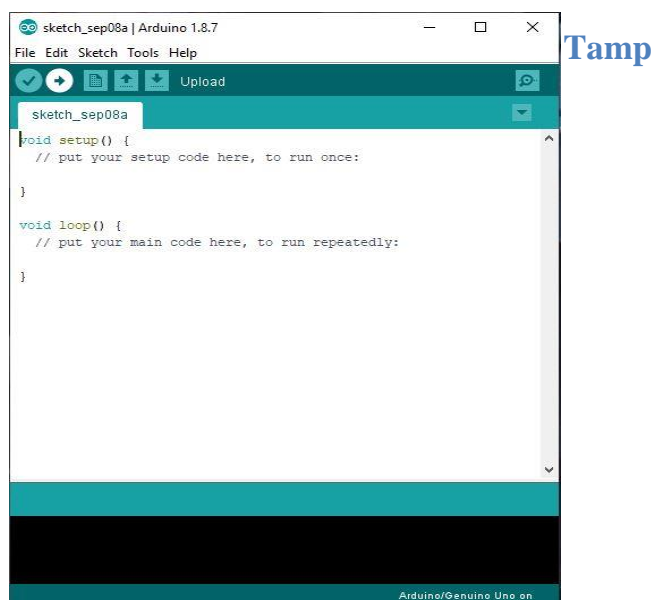
1. Open the Arduino IDE software as shown in the picture :

Figure 6. Arduino IDE Software Initial View

2. Type the program code below :

```
#include <Servo.h>
Servo testservo;
void setup(){
 testservo.attach(5);
}
void loop(){
 testservo.write(10);
 delay(1000);
 testservo.write(40);
 delay(1000);
 testservo.write(90);
 delay(1000);
 testservo.write(180);
 delay(1000);
}
```
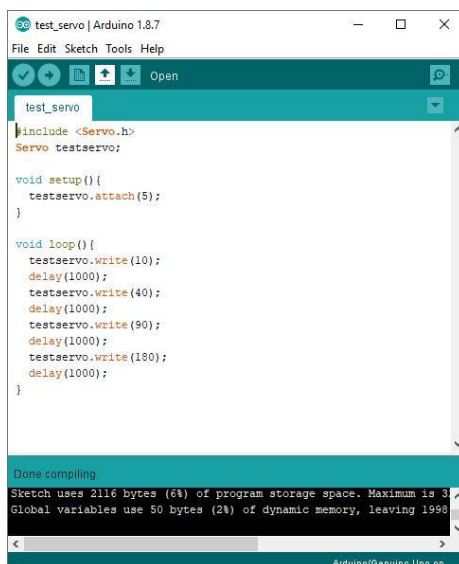
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Figure 7. Servo Motor Program Code Compiler Test Results

3. After the program code is successful, then assemble the hardware as shown below :
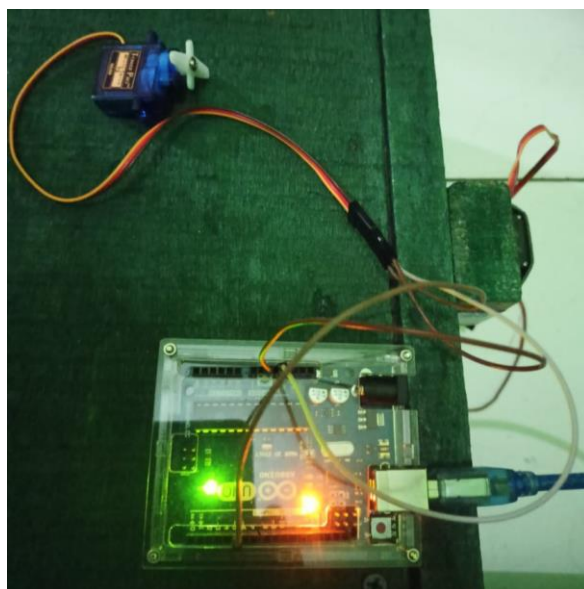

Figure 8. Servo Motor Test Circuit Results

After the program code and design have been completed, the next step is to input the program code into the circuit by clicking the menu bar on the Arduino IDE then clicking upload with a note that the Board and Port settings on the Arduino IDE menu bar are appropriate.

Ultrasonic Sensor Experiment With Servo Motor
To activate the Ultrasonic Sensor with the help of a Servo Motor using the Arduino IDE with the following steps:

1. Type the program code below :
    ```
    #define trigPin 7
    #define echoPin 6
    #include <Servo.h>
    Servo testservo;
    ```

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```
void setup(){
  Serial.begin (9600);
  testservo.attach(5);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}

void loop(){
  long duration, distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = (duration/2) / 29.1;
  if (distance <= 10) //jarak sensor
  {
    testservo.write(180); //sudut derajat motor servo
    delay(500);
  }
  else
  {
    testservo.write(10); //sudut
    delay(100);
  }
```

2. Then select Sketch on the Arduino IDE Menu Bar and click Verify/Compile to test the success of the program as shown below:
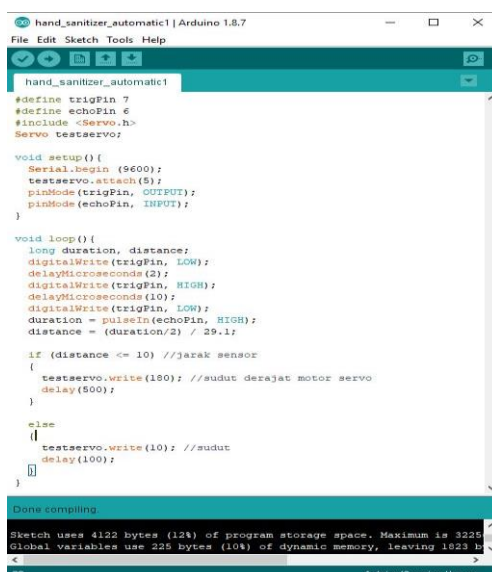

Figure 9. Compiler Result of Ultrasonic Sensor Program Code with Servo Motor
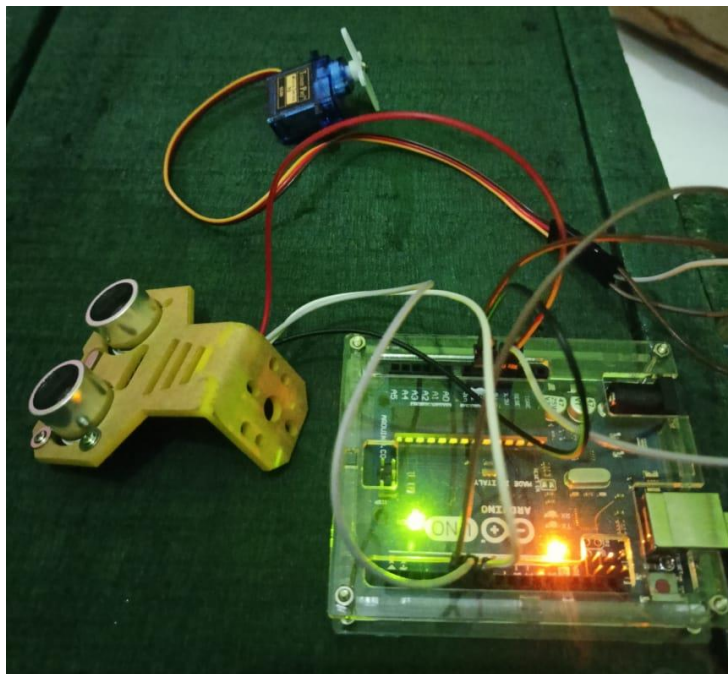
3. Then assemble the hardware

Figure 10. Result Of Ultrasonic Sensor Test Circuit With Servo Motor

4. After the program code and design have been completed, the next step is to input the program code into the circuit by clicking the menu bar on the Arduino IDE and then clicking upload:

```
  testservo.attach(5);
}
void loop(){
 testservo.write(10);
 delay(1000);
 testservo.write(40);
 delay(1000);
 testservo.write(90);
 delay(1000);
 testservo.write(180);
 delay(1000);
}
```

Implementation of Testing and Overall Design Using Two Servo Motors on the Sprayer

The implementation of this test is carried out to determine the performance of the components used in this study, the output is in the form of a sprayer that sprays water through the pull of a Servo Motor if the ultrasonic sensor detects objects or humans in front of the sprayer box. This test is done by placing an obstacle in the form of an object in the form of a person's hand which will be detected by the ultrasonic sensor and observing the output of water spray through the sprayer. Testing the ultrasonic sensor is by connecting the Ultrasonic Sensor to the Arduino Uno Atmega328P board with the VCC pin to 5V pin, GND pin to GND pin, Trig pin to pin 7, Echo pin to pin 6. Ultrasonic sensor testing is done by hand to measure the distance actually, here is the overall design program code:

```
  #define trigPin 7
  #define echoPin 6
```

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```
#include <Servo.h>
Servo testservo;
Servo testservo1;

void setup(){
  Serial.begin (9600);
  testservo.attach(5);
  testservo1.attach(3);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}
void loop(){
  long duration, distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = (duration/2) / 29.1;
  if (distance <= 10) //jarak sensor
  {
    testservo.write(100);
    testservo1.write(90);//sudut derajat motor servo
    delay(100);
  }
  else
  {
    testservo.write(180);
    testservo1.write(10);//sudut
    delay(100);
  }
}
```
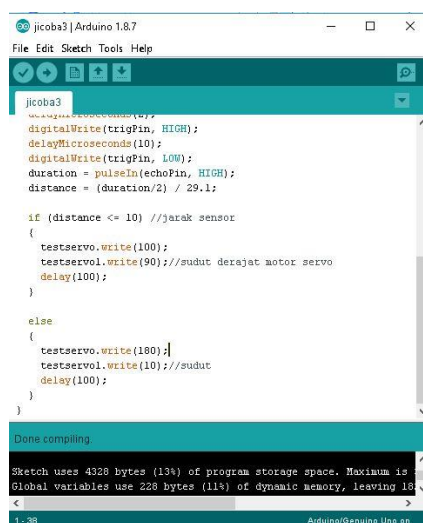

Figure 11. Overall Design Program Code

Hardware Testing

Figure 12. Final Result Test

After testing, the following test results are obtained:

Distance On Ultrasonic Season	Actual Distance	Servo Motoe	Sprayer
1 cm	0 cm	No Active	Does'nt Work
1 cm	1 cm	Active	Work
2 cm	2 cm	Active	Work
3 cm	3 cm	Active	Work
4 cm	4 cm	Active	Work
5 cm	5 cm	Active	Work
6 cm	6 cm	Active	Work
7 cm	7 cm	Active	Work
8 cm	8 cm	Active	Work
9 cm	9 cm	Active	Work
10 cm	10 cm	Active	Work
11 cm	11 cm	No Active	Does'nt Work

Table .1 Overall Test Data

Based on the test results above, it can be concluded that the distance of 0 cm at the actual distance read on the ultrasonic sensor is 1 cm, this happens because the minimum distance that is read by the ultrasonic sensor in the test is 1 cm.

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CONCLUSION

1. In designing and creating the system, devices are needed to connect to the Arduino Uno Atmega328p in the form of Ultrasonic Sensors and Servo Motors and are set using the Arduino IDE software.
2. Ultrasonic sensors are needed to detect the distance of the object, this is done by sending ultrasonic waves to the detection object and then it will be reflected back to the ultrasonic sensor so that the sensor can detect how far the object is to the sensor.
3. Servo Motor is used as an auxiliary tool in moving the Sprayer, Servo Motor will work if the Ultrasonic Sensor catches objects that are within range (catches signals from approaching objects).
4. In applying the Fuzzy Logic Method (Fuzzy Logic) in determining the conditions within and outside the range is to perform fuzzyfication in classifying distances, namely near, medium and far distances, then look for the membership function in each set, then carry out the implications by determining rules or regulations include:
    a. If (close range) then (status is active)
    b. If (medium distance) then (status is active)
    c. If (remote) then (status is inactive)

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