

DESIGN AND BUILD OF AUTOMATIC HAND SANITIZER USING ARDUINO

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Abstract

An automatic handwashing device is a handwashing device that works automatically by utilizing an infrared sensor as a hand detector and using the Arduino Uno as the main controller. In this study, the authors discussed the design of an Automatic Handwashing Device that is placed on the hand-sanitizer faucet using the InfraRed sensor (detecting hand movements) based on Arduino Uno. This system includes the design of hardware (Hardware) and software (Software). Researchers use descriptive analysis techniques that are presented in table form. In this study, the authors conducted an analysis and design of the devices used to build the input and output processes including System Algorithms, Research Design, and Research Flowcharts. The results showed that the Hands Sanitizer device automatically runs well and can be assembled using Arduino Uno microcontroller components and IR (Infrared) sensors. In making this program, the Arduino Uno application software is needed.

Keywords: Infrared sensor, Arduino Uno, Handsanitizer



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INTRODUCTION

The culture of washing hands in Indonesia is still lacking. This is evident from the health problems that exist in Indonesia. Especially with the emergence of the Corona Virus Disease (Covid-19) pandemic which has become a topic of conversation in the world. Until now, no vaccine or drug has been proven to be effective in treating this disease. One of the prevention efforts undertaken by the government is washing hands with soap.

Washing hands is one of the sanitation measures by cleaning hands and fingers using water and soap by humans to be clean and break the chain of spreading the virus (Listina, Solikhati, & Fatmah, 2020). Washing hands is also an effort to prevent the spread of viruses and diseases. This is done because the hands are very active as carriers of germs and cause germs to spread from one person to another, either direct contact or indirect contact (using other surfaces such as towels, glasses).

One of the problems in washing hands using a hand sanitizer is still manual. To press the hand sanitizer gel liquid to come out, the user must come into direct contact with the faucet. Usually, the hands to be washed are dirty, contain lots of germs (bacteria, fungi, viruses) or substances that can endanger health that sticks to the hands and will move to the faucet, when the user touches them again.

In this problem, the writer has a solution, namely by making an automatic handwashing device using Arduino technology which is placed on the hand sanitizer faucet, in this automatic handwashing process it can help washing hands to make it easier and more practical. (Manullang, 2019) One no longer needs to press a hand sanitizer faucet for washing hands. Only by placing your hand under the sensor, the sanitizer gel liquid will automatically come out

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A hand washing tool is an electronic device designed to wash hands automatically, making it easier for users to wash their hands. This sanitizer has been set automatically on the Arduino Mega 2560 which acts as a microcontroller. Arduino Uno is a microcontroller board based on ATmega328 (datasheet) (Febriansyach, Santoso, & Latifa, 2020). It has 14 input pins from digital output where 6 of these input pins can be used as PWM output and 6 analog input pins, 16 MHz crystal oscillator, USB connection, a power jack, ICSP header, and reset button. To support the microcontroller so that it can be used, it is enough just to connect with a USB cable or mains with AC-to-DC-adapter or battery to run it. (Kadir, 2015)

The power source consists of a reset pin, a 3.3v power supply pin, a 5v power supply pin, 2 ground pins (GND), and 1 V input pin, the power source can be used as a power supply or digital on Arduino which is a serial communication pin. bidirectional so that it can function as input or output. (Dahlan, 2017)

Infrared (infrared) is electromagnetic rays with a wavelength of more than light, which is between 700 nm and 1 mm. Infrared rays are light that is not visible. When viewed using a light spectroscope, infrared light radiation will be seen on the electromagnetic spectrum with a wavelength above the wavelength of red light. (Suyadhi, 2010)

A Servo motor is a device that can control the position, can bend, and maintain a position based on the reception of an electronic signal. Because a DC servo motor is a tool that functions to convert electrical energy into mechanical energy, the permanent magnet DC servo motor converts electrical energy into mechanical energy through the interaction of two magnetic fields (Kadir, 2013)

Hand Sanitizer is a hand sanitizer that has an antibacterial ability to inhibit and kill bacteria (Nugraha, 2020). Many hand sanitizers come from alcohol or ethanol which are mixed with thickening agents, for example, carbomer, glycerin, and make them similar to jelly, gel, or foam to make it easier to use. This gel is gaining popularity because it is easy and practical to use without the need for water and soap. This sanitizing gel is a comfortable alternative for the community. (Fauzi, Hapsari, & Rosmiati, 2019)

This automatic handwashing device is not something new to be developed, there have been several similar studies regarding this automatic handwashing device which are expected to facilitate user access in washing or cleaning hands using antiseptic hand sanitizer which has undergone several component changes and the development of features provided by previous researchers.

Several related studies discuss Arduino, in terms of automatic handwashing device. Research conducted by (Prasetyo & Jarwo, 2015) who title Designing Automatic Handwashing Tool Prototype with HC-SR04 Ultrasonic Sensor Based on Arduino Uno R3 Micro Controller. This research made a tool that can adapt to the user's needs based on the user's hand position, if the user enters the left hand, the microcontroller will activate the handwashing mode with water, but if the user enters the right hand the microcontroller will activate the handwashing mode with soap.

The next related research is research conducted by (Hendri, 2018) entitled Automatic Hand Sanitizer Equipped with Water, Soap, Hand dryer, and LCD Using an Arduino-based Ultrasonic Sensor. The research made a tool that can remove water and then remove soap liquid. Furthermore, hot air helps the process of cleaning hands and also displays the active status of the tool displayed on an LCD.

Some differences in the research that will be carried out on some of the research that has been conducted by previous researchers are that this study uses the Arduino Mega 2560 which is different from previous studies using ATmega 8535. In this study, the

authors used an IR sensor as a hand detector to wash hands automatically, which is different from previous studies using an ultrasonic sensor as a means of driving out and stopping water in the water tap.

The researcher did not explain the differences between Mega 2560 and ATmega 8535 that become the central point of this research aim to prevent the spread of the Covid 19 virus outbreak, namely by cleaning your hands using the Hans Sanitizer automatically without having to touch them directly.

RESEARCH METHODS

This research method contains about how the systematic method used by researchers to get answers to questions on the object of research. In this study, the authors discussed the design of an Automatic Handwashing Device that is placed on the hand-sanitizer faucet using the InfraRed sensor (detecting hand movements) based on Arduino Uno. This system includes the design of hardware (Hardware) and software (Software).

In this case, the authors conducted research observations at home, the study used a soap bottle as a place to run an Automatic Hand Washing Tool. The time used for conducting research observations is from July 30, 2020, to August 8, 2020.

In designing an Automatic Handwashing Tool that is placed on the hand-sanitizer faucet using an Arduino Uno-based InfraRed sensor (detects hand movements). It requires data or data analysis techniques, researchers use descriptive analysis techniques whose presentation is in the form of a table consisting of hardware (hardware) and software (software). In this study, the authors conducted an analysis and design of the devices used to build the input and output processes.

RESULTS AND DISCUSSION

A. Result

In this stage, the tool has been designed and made in prototype form. Where this tool will work in accordance with what has been designed and programmed through Arduino, namely when the Infrared sensor detects the presence of the Hand, the Servo will automatically pull the faucet on the Sinitizer to clean the hands. Next, the author will describe several stages of the benefits of the tool that has been completed in Figure 1. below:



Figure 1. Tool Results

Before the work process of making an automatic handwashing device with Arduino Uno, the author will describe the design in making the tool. The component assembly

process is the first thing the writer does. Combination of Arduino Uno microcontroller, IR sensor, servo motor using jumper cables. The scheme of the series of making automatic hand washing devices can be seen in Figure 2. below:

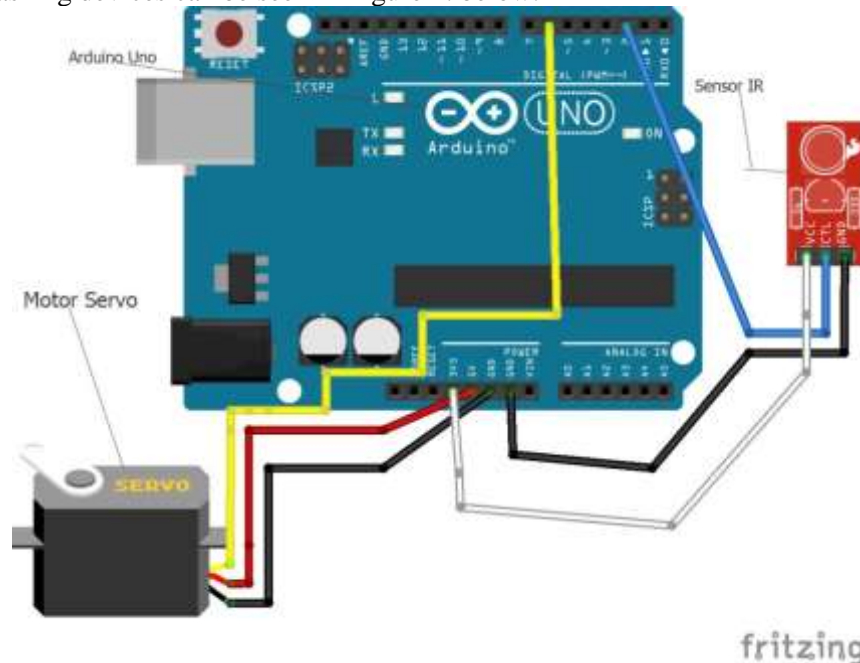


Figure 2. Circuit Schematic Drawing

In Figure 2. above, you can see the Arduino Uno microcontroller board as a liaison between several components according to certain pins. The following is a description of the pin connection which can be seen as follows:

1. The GND pin on the IR sensor is connected to the GND pin on the Arduino.
2. The VCC pin on the IR is connected to the 3.3 v pin of Arduino.
3. Pin OUT on IR connected to pin GND Arduino.
4. The VCC pin on the SERVO is connected to pin 5 arduino.
5. The GND pin on the SERVO is connected to the GND pin on the Arduino.
6. Pin OUT on the SERVO sensor is connected to pin 8 on the Arduino.

After the pins on each module are connected according to their place, then the process of inserting the program into the Arduino Uno module series as a whole uses the Arduino IDE software, so that the circuit can work according to what has been designed. After the pins on each module are connected according to their place, then it is the process of entering the program code into the Arduino circuit through the Arduino IDE software which has the same syntax with the C ++ programming language. The process of entering the program code into the Arduino Uno microcontroller also requires a connector, namely in the form of a USB cable. For the main data input on the component of the tool made by the author, the Infrared Sensor is used to notify the presence of the hand so Arduino can process the data sent as a detector. The following is an image of the infrared sensor which functions as a detector from this tool, it can be seen in Figure 3 below:



Figure 3. Image of Infrared Sensor

In Figure 3 is an image of the infrared sensor that is located on the prototype. In this tool, this sensor functions as input, namely when the sensor detects the presence of the hand, this process is the initial process of this tool working.

The data received from the infrared sensor is received by the Arduino microcontroller and according to the Arduino program, turn on the servo motor for the process of pulling the faucet that the hand is detected and immediately removing the sanitizer gel. The following is a display of the serial monitor on the Arduino IDE software when the sensor is in normal condition and also when the hand detects it can be seen in Figure 4 below:

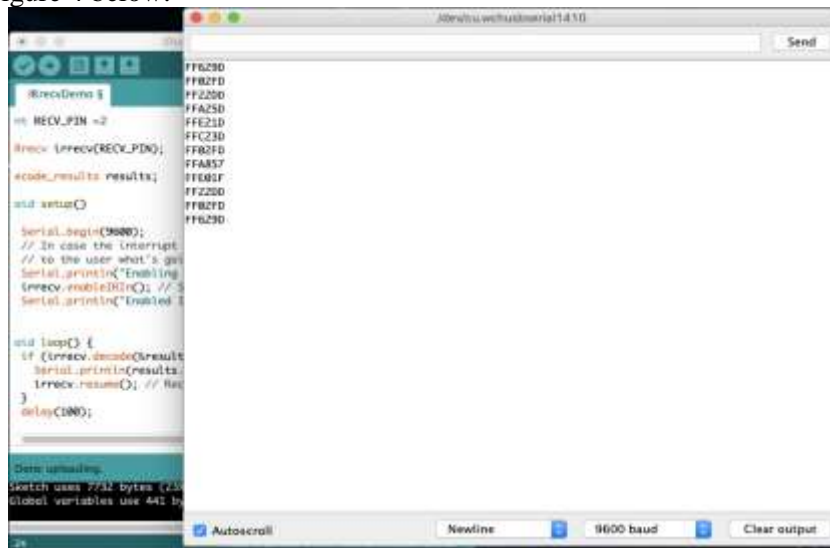


Figure 4. Serial Monitor Image on Arduino IDE Software

In Figure 4. above can be seen where the process is still not detected by the hand, and when the hand has been "DETECTED", the sensor will detect the hand. In making this automatic Hands Sanitizer tool, the writer has succeeded in making a tool according to the results that have been designed beforehand. It can be seen in Figure 5. below:



Figure 5. Tool Output Results

Figure 5 shows the result of the output that produces gel to clean hands without having to wash using soap. The process of the tool that has been completed is designed.



Figure 6. Image Servo

In Figure 6 is an image of the servo motor that has been located on the Prototype and functions as a pulling tap on the Hands Sanitizer tool.

B. Discussions

In this discussion, the author will describe the validation of system requirements specifications, work procedures, and the advantages of the system that has been designed. The system work procedure starts from the flow of an electric current of 12 volts to the Arduino board and other components that have been connected to one another, such as an infrared sensor to detect the presence of a hand, then the servo motor will pull the faucet on the sanitizer and work to clean the hands.

1. Data Validation

By using this tool for automatic hand washing based on infrared sensor testing with the Arduino Uno microcontroller, it will be validated by testing some of its components to test the performance of the tool that has been designed.

a) Testing infrared (IR) sensors

An Infrared sensor, the character of this tool functions as a detection of the state of the hand. Infrared is connected directly to the microcontroller port which functions to send processing results for processing in the form of detection on the servo motor. The program used to view the address of the infrared sensor is as follows:

```

const int pinIR = 2;
void setup() {
  Serial.begin(9600);
  pinMode(pinIR, INPUT);
  Serial.println("Deteksi Sensor IR");
}
void loop() {
  int sensorState = digitalRead(pinIR);
  if (sensorState == LOW) {
    Serial.println("Tedeteksi");
  } else {
    Serial.println("Tidak terdeteksi");
  }
}
    
```

a) System Requirements Specifications

In making this tool, which is a tool for automatic hand washing, several components and equipment are needed to support the tool assembly process from start to finish. Several components and supporting equipment can be seen in table 4.1. below this:

Table 1. System Requirements Specifications

Number	Components	Total	Equipment	Amount
1.	Arduino Uno	1	Glue	1
2.	<i>infrared sensor</i>	1	Wire	1
3.	<i>servo motor</i>	2		
4.	Jumper Cables	6		13

b) System Work Procedure

After the data validation process is carried out to perform system testing, the next process is that the author will explain the system work procedures that have been made. This system work procedure is made to ensure whether the entire system has been running stably in accordance with the design made by the author. The process system procedure that has been designed can be seen in Figure 7. below:

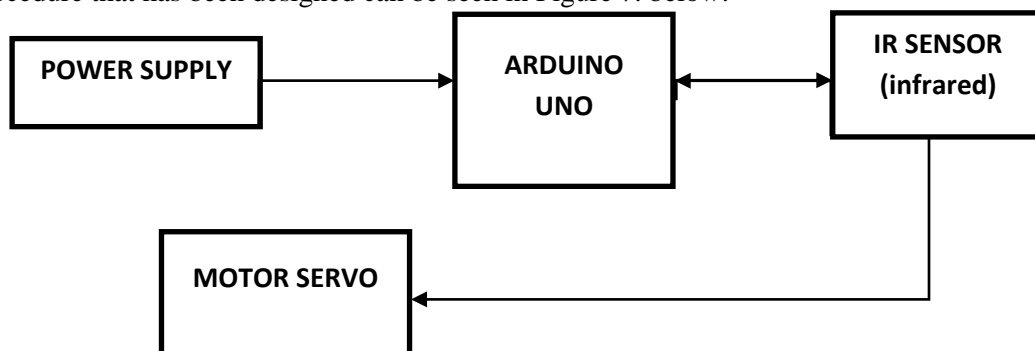


Figure 7. System Work Procedure

In Figure 7 which is an image of the system work procedure by providing 12 volts of power to the Arduino board then the infrared sensor module will respond for 2 seconds, this is useful for checking whether the sensor is off or on. then the sensor will validate and read the data, the data is then directly processed into the Arduino board and the servo motor

will work. If an error occurs in the sensor module, the light on the sensor will go out. Conversely, if the sensor module has detected the result, the servo motor will pull the gel tap on the sanitizer.

c) Weaknesses and Strengths of the System

The results of the device that the authors work on have advantages and disadvantages of the system. The advantages and disadvantages of this system are as follows:

1. Advantages of the System

a. With this tool, it ensures the safety of people who use the sanitizer in order to reduce the prevention of the spread of the virus and release the sanitizer gel automatically.

2. System Weaknesses

a. The servo motor is easily damaged because it is not strong enough to pull the faucet on the installed sanitizer.

b. This tool still uses direct power from the electric current to stay active.

d) Program Code

```
#include <Servo.h>
Servo myservo;
int angle =2;
int angleStep =50;
void setup() {
  myservo.attach(6);
  pinMode(5,INPUT_PULLUP);
}
void loop() {
  if (digitalRead(2) == HIGH){
    myservo.write(90);
  }
  else {
    myservo.write(90);
  }
}
```

CONCLUSION

Based on the results of the previous description, as well as the results carried out during the research, a conclusion was made that the Automatic Hands Sanitizer Tool runs well and can be assembled using Arduiono Uno microcontroller components and IR (Infrared) sensors. In making this program, the Arduino Uno application software is needed to create programs and work systems on device that are made in order to run component components that have been installed in such a way. For the IR (Infra Red) Sensor on the Hands Sanitizer it has also worked well, where the sensor will work to detect the presence of the hand.

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