

## Design tools trash automatic using microcontroller arduino

Alharis Ramadhani<sup>a</sup>, Karnadi<sup>b\*</sup>

<sup>a,b</sup> Muhammadiyah University of Palembang, Palembang, Indonesia

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### CORRESPONDENCE

E-mail: [karnadi@um-palembang.ac.id](mailto:karnadi@um-palembang.ac.id)\*

### ABSTRACT

Waste is a waste which can not be used again, which could in solid, liquid or gas form. If we hear that a litter box can make the surrounding environment uncomfortable because it causes a foul odor and can also be a source of diseases such as itching, diarrhea, flu, dengue, bacteria and others. This can provide problems where the author can take the initiative to conduct research to be able to design and build a garbage box tool that works automatically by using an ultrasonic sensor HC-SR04 as a detector of an object that is in front of him using a distance of 10 cm which can be adjusted according to the command so that that distance will be able to open the trash box if it exceeds the distance of 10 cm then the sensor will not work, to open the trash box using a micro servo given 10 seconds to open the trash box if it is more than the specified time then the trash box will work to close the trash box where the dfplayer and speakers work to issue sounds that will be determined according to commands such as saying thank you for throwing trash in its place for the control system using an Arduino microcontroller to run a program. the set to work properly. The purpose of building the garbage box tool is so that the community is protected from bacteria that exist on the surface of the garbage box that can cause disease and increase the community to always take care of the surrounding environment.

## I. Introduction

In today's technological developments which are increasingly advanced which are sophisticated which have very fast information needs with various aspects of life so as to support performance through aspects, one of which is the health aspect which is to avoid the spread of bacteria and viruses. Hands exposed to viruses can cause bacteria and viruses to touch frequently touched objects or surfaces such as handrails, doorknobs, escalators and so on [1].

In the development of technological innovation, it can provide many benefits where the presence of a microcontroller is a small computer device which has an IC chip (Integrated Circuit) which has an operating program and carries out certain tasks in it which will process input through a programming language so that it can produce output [2].

With the existence of a microcontroller, namely Arduino, which can be useful and useful, such as building an electronic device, namely an automatic garbage box which can work by using an Ultrasonic sensor HC-SR04 which functions to detect the movement in front of the sensor and to open the box. The garbage uses a micro servo as well as for the operating system used, namely Arduino which aims

to avoid bacteria and viruses that can cause disease in the trash box [3].

For this reason, the author will design and build a garbage box that works automatically where the tool works when someone wants to throw garbage into the trash box, it will open automatically and when you have disposed of the trash in its place, the tool will close the trash box. automatically and when it has done the garbage disposal it will make a sound using dfplayer in accordance with the command [4].

Based on the explanation above, the author has a desire to design a simple tool with the title "Design of an Automatic Trash Box Tool Using an Arduino Microcontroller". In the process of making these tools using the methods used in writing such as the selection of devices hardware and software, system design, programming, testing or testing. It is hoped that with the automatic garbage box tool, it can work as expected and run well as desired so that it can provide good benefits.

### 1.1. Problem Formulation

In the explanation of the background above which has been described above in detail, with that the author will

formulate the problems to be discussed, namely how to work in building an automatic garbage box using an Arduino microcontroller.

### 1.2. Objectives

Based on the formulation of the problem described above, the goal is to build and design an automatic garbage box using an Arduino microcontroller with various modules integrated into one such as an ultrasonic sensor module as a detector of distance or movement, a micro servo serves to move the open and close the garbage box, dfplayer mini works when after there is garbage in it will give a sound like saying thank you for throwing trash in its place, which will build a device. This is to avoid bacteria or viruses that exist on the surface of the garbage box to avoid disease and to increase people's ability to protect the surrounding environment.

### 1.3. Problem Limitations

Based on the explanation of the background above in this paper, this is only limited to the design of the automatic garbage box using the Arduino microcontroller.

## II. Literature Review

### 2.1. Arduino Uno

Arduino board is a board that consists of a microcontroller that is open source, which is a control system to facilitate design to be useful for electronics use various fields known as microcontroller [5].



Figure 1. Arduino Uno [5]

### 2.2. Ultrasonic Sensor

Sensor ultrasonik HC-SR04 merupakan sebuah perangkat atau modul yang dapat mendeteksi dan mengukur sebuah jarak atau objek yang menghalangi sebuah sensor [6].



Figure 2. HC-SR04 Ultrasonic Sensor [6]

### 2.3. Mini DFPlayer

It is an electronic module that works as a player for an audio file or a music player sound module with a support which formats audio like file.mp3 generally known [7]. It aims to play a voice that can be adjusted by a command which will be used to build a trash box when someone wants to throw out the trash when the trash is dumped in its place.

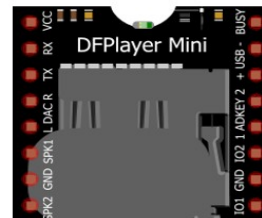


Figure 3. DFPlayer Mini [7]

### 2.4. Speaker Mini 5Volt

It is an electronic device that converts electrical signals into audio frequencies (sound signals) that can be heard by the human ear by emitting sounds or sounds which will be used to build an automatic trash box tool which will be linked to the mini dfplayer [8].



Figure 4. Speaker 5Volt [8]

### 2.5. Servo Motor

Is a component or rotary actuator designed to rotate or push an object with a control system as a mover that will move to open and close the trash can [9].



Figure 5. Servo Motor [9]

### III. System Development Method

In building a tool used in research which has several stages, namely descriptive techniques and tool development [10]. The development of the tool includes several stages such as system design and development of hardware (hardware) and software (software) controllers so that they can work properly in accordance with what is desired.

#### 3.1. Descriptive Techniques

In this stage as for the things that are done to collect data and information which then do the formulation of the problem. Based on the formulation of the problem, the elaboration of alternative solutions that may be based on previous research will be followed by designing the system and its supporting tools.

#### 3.2. System Design

Based on the stage of system design which will begin by making a block diagram of the system. System block diagrams are used to expedite the process of designing and manufacturing each component forming the system, so that the final result can be in accordance with what has been formulated [11].

Figure 6 shows the stages of the work process of the tool to be built. In the process input using an ultrasonic sensor HC-SR04 which functions as a detector of objects in front of the sensor and for the control system using Arduino Uno which is programmed as a controller or regulator of the designed system.

The output is in the form of information for the system to move the garbage box using a servo motor and dfplayer to open and close the garbage box and make a sound, namely thank you for throwing trash in its place when you have disposed of garbage in the garbage box.

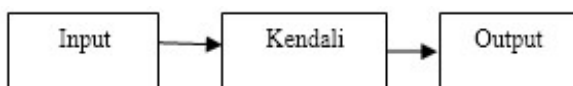


Figure 6. Block Diagram Design of automatic trash box tool without touching

At the stage of system design, which consists of design software and hardware.

In the stages of carrying out the design process, software namely how the work process of the series of hardware that will be made and doing the program as a hardware controller. The device will process the program available by the Arduino Uno which will process the input and become the output.

In designing the hardware to be built, it has several parts such as electronic parts and mechanical parts. In electronic components are collected as needed and then assembled into a module. These components can be controlled by software. The form of the final result of the equipment that has been determined in carrying out the mechanical design.

#### 3.3. Hardware Design

The components in the formation of hardware are as follows:

- 1) Arduino Uno
- 2) USB Cable Arduino
- 3) Ultrasonic Sensor HC-SR-04
- 4) Servo Motor
- 5) DFPlayer Mini
- 6) Speaker Mini
- 7) Power Supply
- 8) Jumper Cable

Simply put, these components will form three component modules such as a module ultrasonic sensors, servo motors and dfplayer as well as speakers where the module will be controlled by arduino to activate the module will be connected using a power supply. Based on this explanation, the module can be explained in Figures 7 to 9 as follows:

- 1) Figure 7 Arduino Module with Ultrasonic Sensor

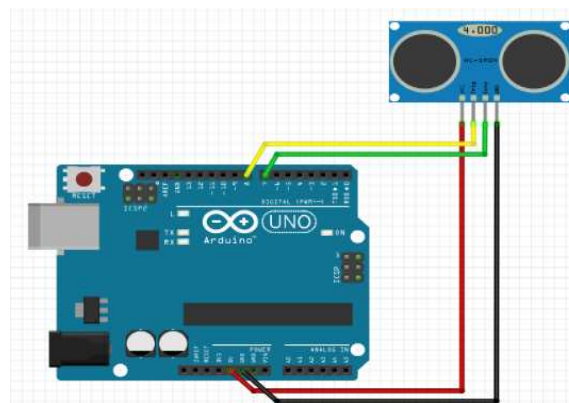


Figure 7. Ultrasonic Sensor Module

In Figure 7 it can be explained from table 1 as follows:

**Tabel 1.** Arduino Module Connection with Ultrasonic Sensor Module Ultrasonic

Arduino	Sensor Ultrasonik
5Volt	VCC
Pin Digital 8	Trigger
Pin Digital 7	Echo
GND Power Arduino	GND

2) Connecting the module with the servo motor can be seen from Figure 8 as follows:

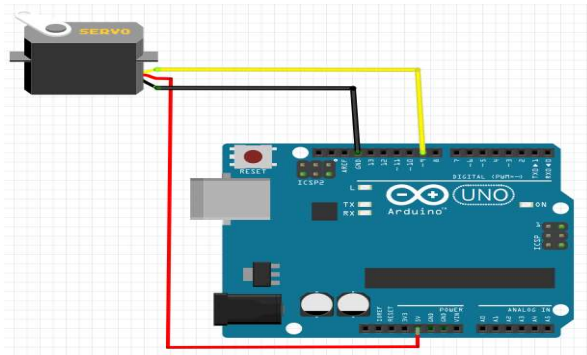


Figure 8. Arduino Module and Sevo Motor

**Tabel 2.** Connection of Arduino Module with Servo Motor Module Servo

Arduino	Motor Servo
Pin Digital GND	GND
5 Volt	VCC
Pin Digital 9	Input

3) Connecting Arduino module with dfplayer and speaker can be seen from Figure 9 as follows:

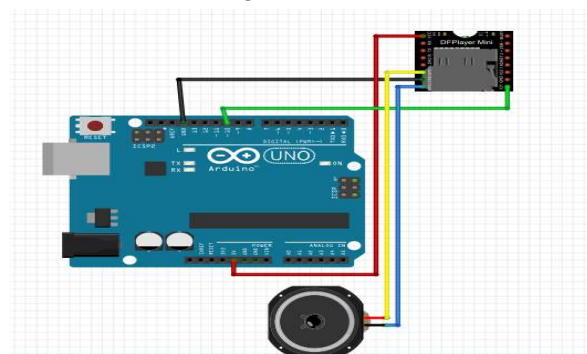


Figure 9. Arduino Module and DFPlayer and Speaker

**Tabel 3.** Arduino Module Connection with DFPlayer Module and Speaker

Arduino	DFPlayer	Speaker
5volt	VCC	-
PowerGND Pin	GND	-
Pin Digital 10	IO_1	-
-	SPK_1	KutufNegative
-	SPK_2	Kutuf Positive

The flowchart will work from a litter box that is opened and closed automatically. Based on Figure 10, the flowchart of the system is as follows:

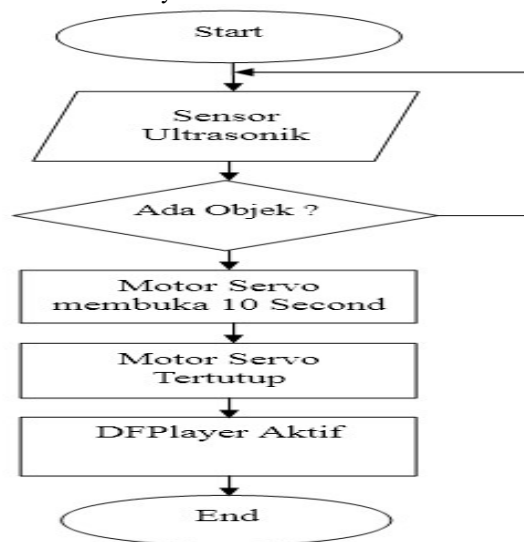


Figure 10. Flowchart of the Working System.

### 3.4. Software

The software used is using the Arduino IDE which is written using the desired C programming language to build a device to be built. In making the Arduino program, there are several stages, namely as follows: The

- 1) Arduino module is connected using a USB Arduino connected to a computer or laptop.
- 2) Writing a program text (often called a sketch) using a programming language is a coding process.
- 3) If you have done the coding, you will continue to upload the program to the Arduino using a USB cable and carry out the process that will execute the program sketch design that has been created and will be uploaded to the Arduino.

## IV. Results and Discussion

In carrying out the testing process, it can be done to see whether the system built is in accordance with what has been designed from the sketch used. In this study, the



testing process can be carried out by component parts in the formation of the system [11].

Figure 11 shows the Arduino circuit test with an ultrasonic sensor where the test shows that the circuit can work properly.

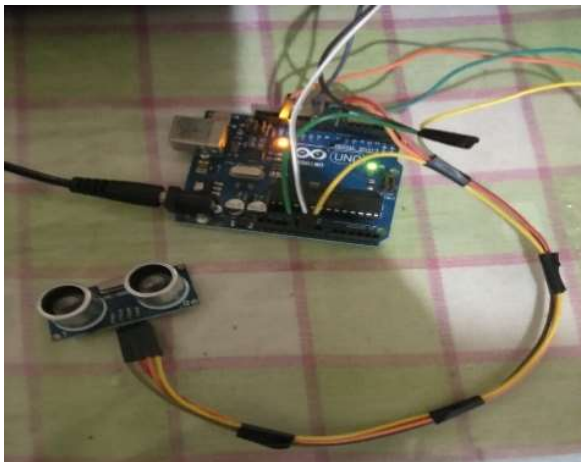


Figure 11. Testing Arduino Circuit with Ultrasonic Sensor

Testing Arduino circuit with a servo motor can be seen in Figure 12 as follows:

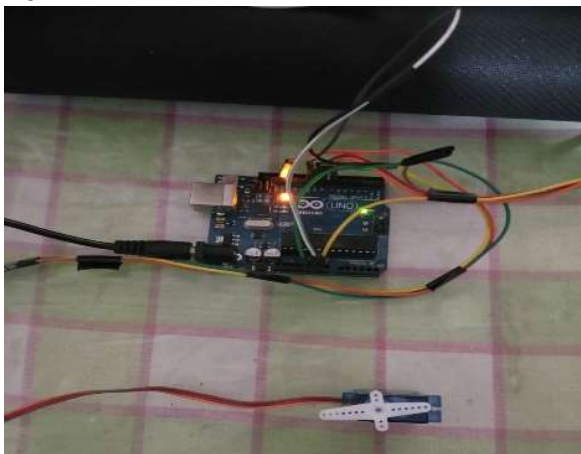


Figure 12. Testing Arduino Circuit with Servo Motor

Testing Arduino circuit with DFPlayer and Speaker can be seen in Figure 13 are as follows:

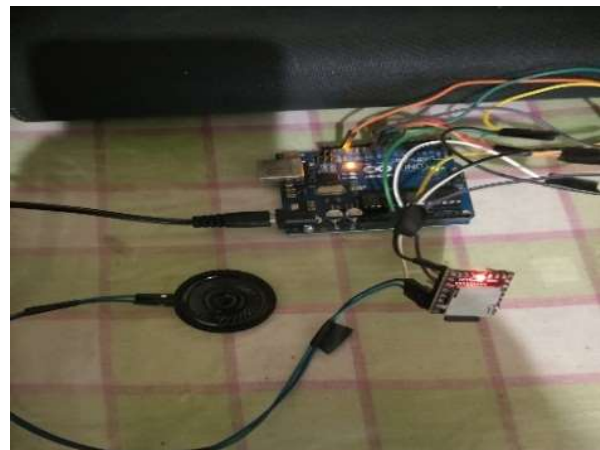


Figure 13. Testing Arduino Circuit with DFPlayer and Speaker

In each circuit, they will be combined according to the electronic circuit of the system as a whole which can be seen in Figure 14 below:

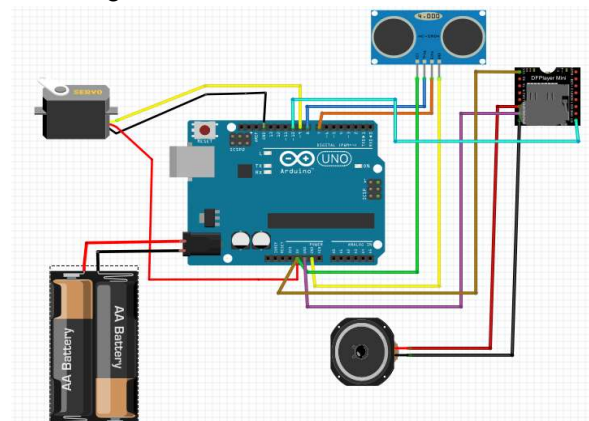


Figure 14. Schematic Overall Circuit

In Figure 15 can be shown the form of an automatic garbage box that works without touching an object after the schematic part of the circuit is installed properly.



Figure 15. Results of the Automatic Trash Box Circuit Schematic

## V. Conclusion

In the explanation that has been explained for the test results, it can be concluded as follows:

- 1) In this study an automatic box has been built without touching an object using the ultrasonic sensor HC-SR04 and Arduino Uno microcontroller.
- 2) The sensor used in this garbage box detects objects with a distance of 10 cm.
- 3) The system opens with a delay of 10 seconds and after that it will automatically close the trash box using a micro servo and an Arduino Uno microcontroller.
- 4) On the sound system that is used using DFPlayer and the speakers after removing the trash will work according to the predetermined command.

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