

## Smart Dustbin with Garbage Level Monitoring

**Muhammad Ikmal Che Mat Salwi, Muhammad Syamir Supaiman, Mohammad Alif Asraff Ainul Jamilus, Mohd Sabani Mohd\***

Electrical Engineering Department, Centre for Diploma Studies,  
Universiti Tun Hussein Onn Malaysia, Pagoh Higher Education Hub, 84600 Panchor,  
Johor, MALAYSIA

DOI: <https://doi.org/10.30880/mari.2022.03.02.039>

Received 31 March 2022; Accepted 31 May 2022; Available online 28 July 2022

**Abstract :** In this research, the problem of spreading of bacteria and virus upon the contact on the dustbin can be solved by smart dustbin. Apparently, the main objective of this project is to design a prototype of smart dustbin with garbage level monitoring that can solve the problem. In order to create the smart dustbin, a one dustbin, box 64x43cm and related electronic device that can relate with the Arduino Uno microcontroller will be used. The methodology that is been apply in this project will be used the System Development Life Cycle (SDLC) which contains of planning, analysis, design, implementation and maintenance. However, there are 4 major steps only selected in order to suite with the project which planning for the data collection of hardware and software, analysis for the analysis of the circuit project, design for mechanical parts, and implementation for testing and troubleshoot of the circuit. The principle of this dustbin is works by the sensor that is sense the object, and let the lid to lift up by using the servo motor. Then, the sensor in dustbin will works as level monitoring to display the percentage left in the dustbin by LCD display. This project used Proteus software in order to do the analysis of Vin and Vout for the circuit. The result in this project is the measurement of the distance that sense from the sensor lid and the measurement sensor from level monitoring.

**Keywords:** Sensor lid, Sensor level monitoring, Arduino

### 1. Introduction

Dustbin is the useful thing that it is being used every day in order to dump the waste in it. However, to dump the waste in the dustbin the user needs to lift up the lid of the dustbin in order to dump the waste. This case will lead us to get an infected with the bacteria which it can spread out into human body and caused sickness to us. Bacteria is a germ that is finer than the bacteria that can cause a disease in human, animal and plant [1]. Moreover, in this day people are facing with the Corona virus that can infected the human or animal. This virus is very dangerous because the person who are infected will have a potential to facing a death. This virus can spread by touching or sneezing from the person who are infected. Thus, if the person is touching the lid of the dustbin, the potential to affect others is higher [2].

---

\*Corresponding author: [sabani@uthm.edu.my](mailto:sabani@uthm.edu.my)

2022 UTHM Publisher. All rights reserved.

[publisher.uthm.edu.my/periodicals/index.php/mari](http://publisher.uthm.edu.my/periodicals/index.php/mari)

Therefore, to avoid getting infected with bacteria, the project that can solve this problem is a smart dustbin with garbage level monitoring. Smart dustbin with garbage level monitoring is a garbage that has a sensor that can sense a presence of object in front of it in order to automatically lift up the lid of the dustbin. Thus, with the use of this smart dustbin, the chance for the bacteria to spread out into human body is low because the user does not need to touch the lid of the dustbin to dump the waste.

In addition, there was a case that the user is not knowing either the dustbin is full or not and when they open the dustbin, the dustbin is full. To avoid this case happening the use of the smart dustbin with garbage level monitoring is preferred because it can display the percentage of the trash that has in the dustbin by using the sensor. Besides, when the dustbin is full the red LED will light up in order to give a message to the user that the dustbin is full.

Therefore, the objective of this project is to create a smart dustbin with garbage level monitoring that will open the lid automatically without need of touch, and it will display the percentage of trash inside the dustbin.

## 2. Materials and Methods

The materials and methods section is where all the detail information about the project is developed. The detail about the various material such as type, specification, quantity and the functions has been included in this section. Then, the details that is related with the development or methods adopted in this project also include in these sections.

### 2.1 Materials

**Table 1** is showing all the related material with the functionality that will be utilized in this project. The material section is the process where the equipment is being selected with the suitable materials that is suitable to the project, while the unsuitable material will be eliminated [3]. An extensive research has been made before choosing the material needed. The research is made to make sure the material chosen is suitable with the project development. Besides, the cost needed in development in this project also is cheap as part that is listed below.

**Table 1: Material and function table**

No	Material	Function	Quantity
1	Servo motor	Use to lift up and lift down the lid of dustbin	1
2	LCD-16	Display the necessary information	1
3	Ultrasonic Sensor	Sense the distance	2
4	Arduino Uno R3	Works as microcontroller and store all the programming code to give information to the electrical component	1
5	Resistor (220 $\Omega$ )	Limiting the current flow	1
6	Resistor (1k $\Omega$ )	Limiting the current flow	
7	Potentiometer (10k $\Omega$ )	Adjust the bias level of the LCD to display	1
8	Red LED	Turn On when the dustbin is full and turn Off when the dustbin is empty	1
9	Dustbin	Used as the body of the project	1
10	Breadboard	Use to connect the electrical wire and electrical component	1

11	Box (64cmx43cm)	Use as a cover for electrical parts	1
12	Electrical casing	Use to cover the electrical wiring	1

## 2.2 Methods

The methodology that is used in this project are referring to the System Development Life Cycle (SDLC), which it contains of planning, analysis, design, implementation and maintenance. However, there are 4 major steps only selected in order to suite with the project which planning, analysis, design and implementation.

### 2.2.1 Planning

Planning is where all the data collection of the hardware and software that is require to complete this project. The data collection for the hardware is related with the material that will be used in this project included the electrical and mechanical parts. While the data collection for the software require is related with the software that will be used in this project. Data collection for the mechanical parts are where all the equipment is chosen in making this project. It related with the material list at **Table 1** which it requires a box 64x43 cm, in order to do the process of covering the electrical component, electrical wiring and used as the lid of the dustbin. In addition, the electrical casing also will be use in covering the electrical wire in the dustbin. On the other hand, the data collection for electrical is where all the electrical component that is require for making this project. For intense, the electrical component that is used in this project is Arduino Uno which works as microcontroller, servo motor which use to lift up and down the lid of the dustbin, ultrasonic sensor which works as a sensor for the dustbin to lift up and down the lid and to works as level monitoring for the dustbin and the LCD to show the percentage that left in the dustbin when the trash in. Lastly, the data collection for the software that is suitable with the working process of the project is important in order to facilitated the working process of the project. Therefore, the software that is chosen in this project is Arduino, thinker cad and proteus because it can apply the code of Arduino programming code [4].

### 2.2.2 Analysis

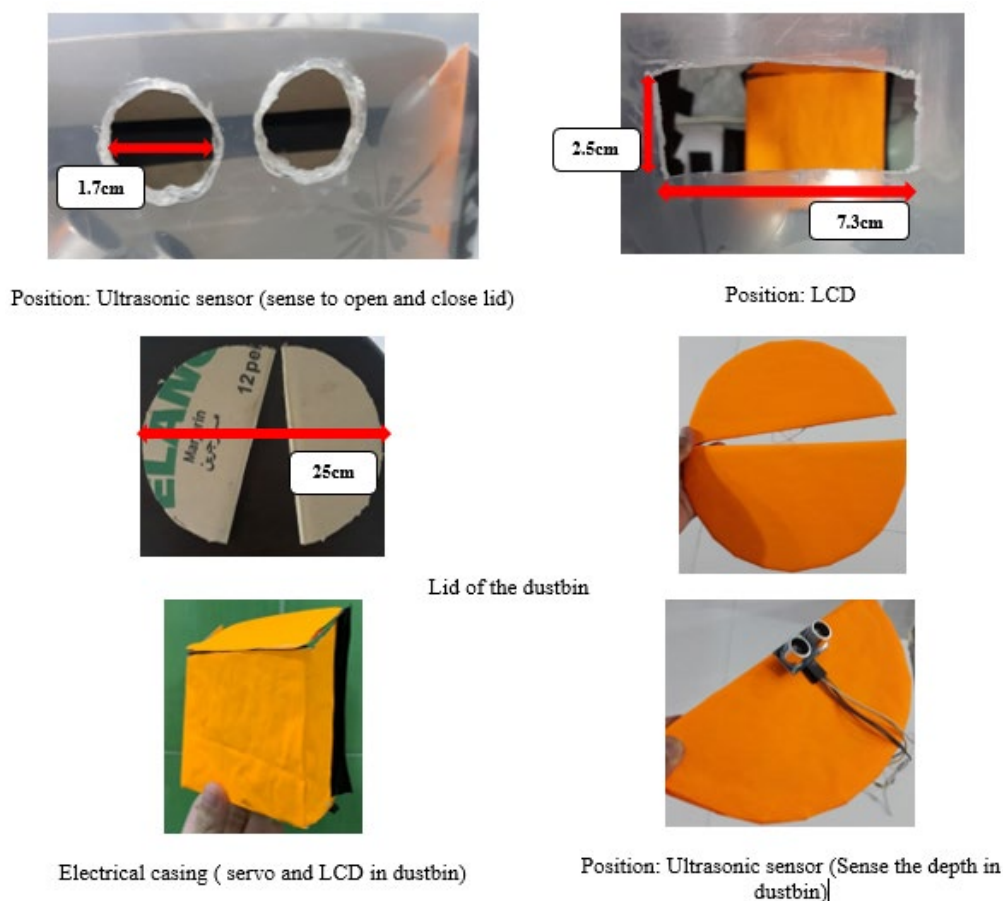
Analysis is the process of analyzing the problem in order to get a better result. However, in this project, the analysis that will be cover is the electrical component for the project. This process is crucial because every electrical installation needs a right tolerance measurement in order to avoided from bad accident happened. Therefore, to avoid from bad accident from happening or having a poor result, the analysis of the voltage is being made for each of the electrical component that is used in this project. **Table 2** illustrates the analysis of input and output voltage.

**Table 2: Input and Output voltage**

Component	Input Voltage (Vi)	Output Voltage (Vo)
Arduino Uno R3	12	5
Servo motor	5	5
Ultrasonic sensor	5	5

### 2.2.3 Design

Design parts in this project is related with the method that is been used for the placement of the electrical component and the method to covering the electrical component and electrical wiring. This part is where all of the mechanical parts will be joining together with the dustbin in order to make this project successful. Therefore, all the mechanical parts will be going through to process of drilling, cutting, measurement, assemble etc. In this project, the equipment that is related with the mechanical parts is a dustbin, a box 64x43cm, and a thread. This dustbin will be modified to facilitate the working process of installation the electrical connection and also to organized the position of the electrical component. Therefore, the dustbin will be drilled in order to make a hole for the electrical component to been placed at the dustbin and also the hole for the electrical wiring between microcontroller (Arduino nano R3) and the electrical components. Box is selected as the lid of the dustbin due to its weight that is lighter than plastic or metal which making the process of the dustbin is easier to open and close by the servo moto. The joining process in this project is used adhesive bonding such as glues, and double-sided tape. As for the cutting parts, the essential task that is related in this project is cutting and shape the box for the lid of the dustbin, and also for the covering the electrical components by using the box. The process of the cutting also related with the plastic wire cover, which it's been cut into a small part in order to cover the electrical wiring in the dustbin. **Figure 1** illustrates the design of mechanical parts.



**Figure 1: Design of mechanical parts**

### 2.2.4 Implementation

Implementation is the process of testing and troubleshooting of the project in order to make sure the result in good condition. The software that is chosen to use for testing and troubleshooting for the project is Proteus software. Proteus software is one of the software that can apply the code of

Arduino programming. In addition, it also has a microcontroller Arduino Uno and the relatable electrical component that is used in this project. **Figure 2** illustrates the electrical circuit that is been testing in Proteus software.

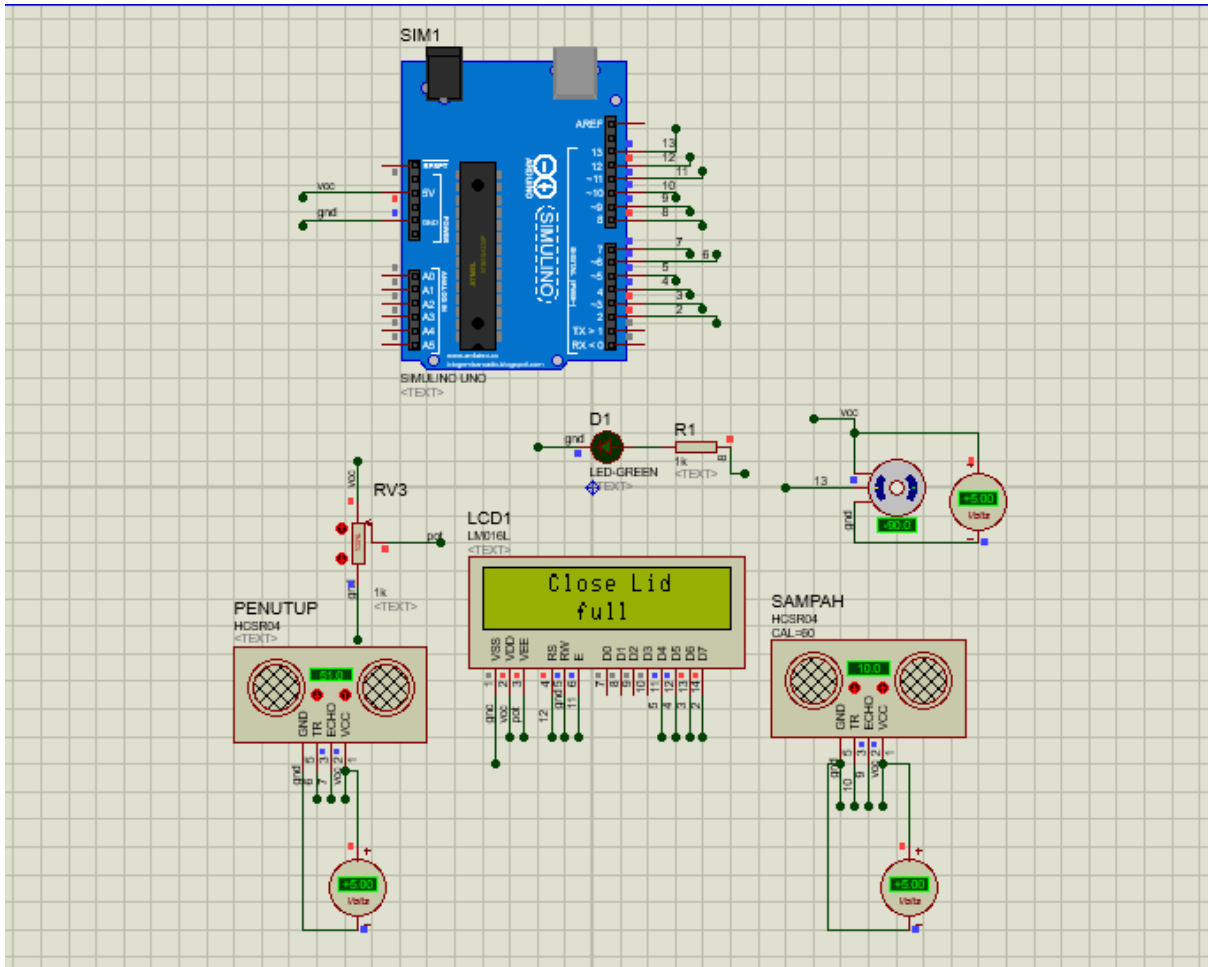


Figure 2: Electrical circuit

### 3. Results and Discussion

The results and discussion section presents the data and analysis of this project. The issue that will be highlighted in result and discussion section is how far the sensor will detect the object in order to open and close the lid and the level of the garbage in the dustbin.

Table 3: The length of the sensor’s sensitivity

Length (cm)	Detect	Not detect
0-10	/	
11-20	/	
21-30	/	
31-40	/	
41-50	/	
>50		/

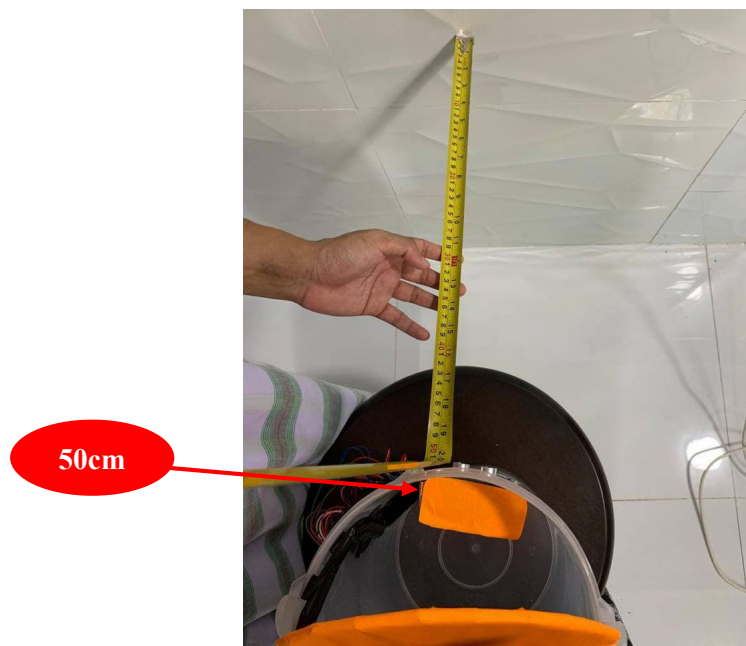
Based on the **Table 3**, the length of the sensor’s sensitivity was measured by hand using measuring tape and in centimeter (cm). The maximum length that the sensor can reach is 50 cm and the sensor will be not detected if the hand is 50.1 cm and above. The reason that the sensor cannot reach 50.1 cm and above is because the sensor (lid) coding has been set to open the lid when it detects below than 50 cm and it close the lid when above 50 cm. In addition, the lid will open whenever the sensor detects the object in front of it and it will stay open until the sensor stop detecting the object in front of it. Thus, the lid will immediately close.

**Table 4: The level of the garbage**

Level (cm)	Condition of the dustbin
0-10	Full
11-12	4% left space
13-15	20% left space
16-18	36% left space
19-21	52% left space
22-24	68% left space
25-27	84% left space
28-30	100% left space

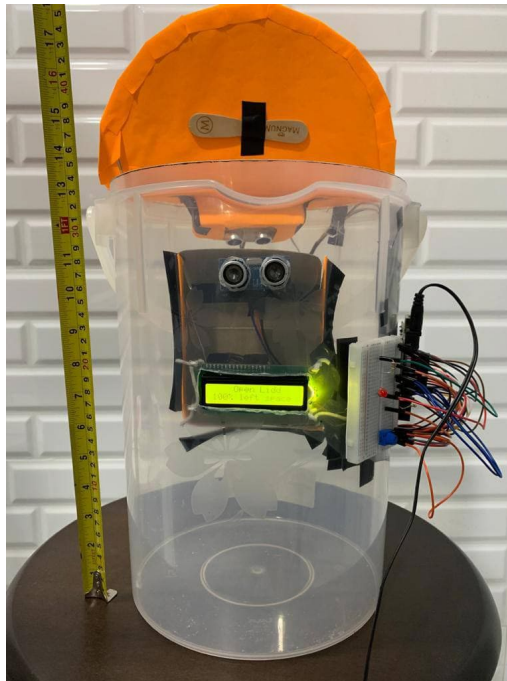
In **Table 4**, the level of the garbage will be detected by the sensor and the condition in the dustbin will be displayed on the LCD. When the level of garbage is 28 cm until 30 cm, the dustbin is actually empty and the LCD will display ‘100% left space’. This is because the minimum level of garbage has been set at 30 cm due to the height of the dustbin is only 33 cm (real height). Whenever the level of garbage decreases by 2 cm, the space left also will decrease by 16%. The lower the level of garbage, the lower the space left in the dustbin.

In the **Figure 3**, the sensor’s sensitivity was measures by hand using measuring tape. The sensor’s sensitivity has been set 50 cm and below it to allow the lid to open. Based on the **Figure 3**, the lid is open when it is 50 cm.



**Figure 3: Measuring the length of the sensor’s sensitivity**

Based on the **Figure 4**, the level of garbage is also measured using measuring tape in cm. The height of the dustbin is 30 cm so when the dustbin is empty, the sensor will detect and it will display on the LCD '100% left space'.



**Figure 4: Measuring the level of garbage**

#### 4. Conclusion

For the conclusion, the use of the smart dustbin with garbage level monitoring is very suitable for nowadays. The smart dustbin with garbage level monitoring is an easy-to-use product because the user just needs to stand in front of the sensor lid to make the lid of the dustbin to lift up and dump the waste in the dustbin. Then, the user just needs to stand away from the sensor lid in order to make the lid to go down, and the smart dustbin will display the percentage left in the dustbin by showing at the LCD display. In the part of that, the use of this product can help to reduce the pollution and make the environment became clean as before. It is recommended to replace the box that used in this project as an electrical casing component and electrical wire with plastic cover that modified by using 3D-printed machine in order to get a perfect result in terms of look and durability.

#### Acknowledgement

Thanks to the Centers for Diploma Studies of Electrical Engineering, Universiti Tun Hussein Onn Malaysia for its support.

#### References

- [1] A. Vidyasagar, "What Are Bacteria?," April 2019
- [2] W. H. Organization, "Coronavirus disease (COVID-19): How is it transmitted?," WHO, 13 12 2020. [Online]. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-how-is-it-transmitted>. [Accessed 8 June 2021]

- [3] A. P. Mouritz, "ScienceDirect," Introduction to Aerospace Material, 2012. [Online]. Available: <https://www.sciencedirect.com/topics/materials-science/material-selection>. [Accessed 8 June 2021]
- [4] S. Fitzgerald and M. Shiloh, ARDUINO PROJECTS BOOK, Torino, Italy, September 2012