



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**TO DESIGN A SMART DUSTBIN FOR MONITORING AND  
DETECTING WASTE LEVEL**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) With Honours

by

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**DECLARATION**

I hereby, declared this report entitled To Design A Smart Dustbin For Monitoring And Detecting Waste Level is the results of my own research except as cited in references.

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Date : 12 JANUARY 2017 .....

## APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor Of Electrical Engineering Technology (Industrial Automation & Robotics) With Honours. The member of the supervisory is as follow:



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## ABSTRAK

Dalam masyarakat yang semakin maju dan membangun, senario kebersihan menjadikan pengurusan sampah yang tidak terurus boleh menjatuhkan maruah dengan sesebuah masyarakat. Pembuangan sampah dan sampah yang berada dalam tong sampah yang tidak terkawal boleh membawa sampah penuh dan bertaburan, yang mana boleh menyebabkan persekitaran hidup tidak bersih, dan ia boleh mencetuskan beberapa penyakit serius dalam sesebuah kawasan bermasyarakat. Ia juga menyebabkan kawasan itu dipandang rendah. Untuk mengelakkan ini dan untuk meningkatkan pembersihan, 'Smart Bin for Monitoring and Detecting Waste Level' adalah dicadangkan dalam kertas kerja ini. Dalam sistem yang dicadangkan, tahap sampah dalam tong sampah dikesan dengan bantuan sensor ultrasonik, dan ia akan mengesan tahap sampah dalam tong. Dengan menggunakan kit Uno Arduino, sensor ultrasonik dipasang kepada pemproses. Tong juga akan memaparkan peratusan sisa yang ada di dalam tong sampah dengan menggunakan paparan LCD dan juga 3 biji lampu yang diluar tong akan memaklumkan kepada pengguna sama ada tong penuh atau tidak. Peratusan data yang telah dikesan akan dihantar kepada sistem dengan menggunakan RFBee yang dipasang juga pada Arduino kit. Pemancar dan penerima kedua-duanya bertugas di Arduino untuk proses menghantar data dari tong untuk dimasukkan ke dalam sistem. Ini akan membantu untuk menguruskan kutipan sampah yang cekap dan cepat.

## **ABSTRACT**

In a society that increasingly advanced, the scenario of cleanliness with respect to garbage management is degrading tremendously. Garbage disposal and garbage in the trash can lead full and scattered garbage that can cause life environment is not clean and it may provoke several serious diseases to the nearby people. It also degrades the valuation of the area. To avoid this and to enhance the cleaning, 'Smart Bin for Monitoring and Detecting Waste Level' is proposed in this report. In the proposed system, the level of garbage in the dustbins is detected with the help of ultrasonic sensor, and it will detect the level of garbage in the bin. By using Arduino Uno kit, the ultrasonic sensor is mounted to the processor. The bins will also displays the percentage of waste that is in the bin by using the LCD display and also flame lamp 3 seed in bins will inform the user whether the barrel is full or is not. The percentage of data that is sent to the system by using ZigBee installed also on Arduino kit. Transmitter and recipient are both attached to the Arduino to the process of sending data from bins for incorporation into the system. This will help to manage the garbage collection efficiently.

## **DEDICATION**

Specially dedicated to,

My beloved parents, family members, and friends for your supports, encouragements, understanding, and all the favour. May Allah bless all of you

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By the name of Allah, the Most Compassionate Most Merciful

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## Table Of Contents

<b>ABTRAK</b>	<b>i</b>
<b>ABSTRACT</b>	<b>ii</b>
<b>DEDICATION</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT</b>	<b>iv</b>
<b>TABLE OF CONTENT</b>	<b>v</b>
<b>LIST OF TABLES</b>	<b>viii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE</b>	<b>x</b>
<b>CHAPTER 1</b>	<b>1</b>
<b>INTRODUCTION</b>	<b>1</b>
1.0 Introduction	1
1.1 Project Background	1
1.2 Objective	2
1.3 Problem Statement	3
1.4 Project Scope and Limitations	3
1.5 Summary	4
<b>CHAPTER 2</b>	<b>5</b>
<b>LITERATURE REVIEW</b>	<b>5</b>
2.0 Introduction	5
2.1 Level Sensor.	6
2.1.1 Ultrasonic Sensor.	6
2.1.2 Infrared Sensor (IR)	7

2.1.3 Maxbotix Sensor	9
2.2 Data Sending	10
2.2.1 RFID	10
2.2.2 ZIGBEE	11
2.3 Controller	12
2.3.1 Arduino UNO	13
2.3.2 PIC Microcontroller	14
<b>CHAPTER 3</b>	<b>15</b>
<b>METHODOLOGY</b>	<b>15</b>
3.0 Introduction	15
3.1 Methodology	15
3.2 Arduino CT UNO	19
3.3 Ultrasonic Ranging Module	21
3.4 Radio-Frequency Identification (RFBee)	22
3.5 XBee Shield and SKXBee	23
3.6 Indicator Lamp	25
3.7 LCD Display	26
<b>CHAPTER 4</b>	<b>27</b>
<b>RESULT AND DISCUSSION</b>	<b>27</b>
4.0 Introduction	27
4.1 Hardware and Software Development	27
4.1.1 Ultrasonic Sensor	28
4.1.2 Transferring Data	29
4.1.3 LCD Display and Indicator Lamp	31

4.1.4 Receiving Data	32
4.2 Level Detecting And Transferring Data Collections.	34
<b>CHAPTER 5</b>	<b>37</b>
<b>CONCLUSION</b>	<b>37</b>
5.0 Introduction	37
5.1 Conclusion	37
5.2 Recommendation	38
<b>REFERENCE</b>	<b>39</b>
<b>APPENDIX</b>	<b>41</b>

## LIST OF TABLES

Table 3.1: Pin specification	21
Table 3.2: RFBee Specification	23
Table 4.1: The percentage in the bin every second	34
Table 4.2: The percentage in the bin in one month	35

## LIST OF FIGURES

Figure2.1: Ultrasonic Working Principle	7
Figure2.2: IR sensor working principle	8
Figure2.3: Working Principle of Maxbotix sensor	9
Figure2.4: RFID working principle	11
Figure2.5: ZigBee working principle	12
Figure2.6: Arduino Uno Mode	13
Figure2.7: SK40C with PIC	14
Figure3.1: Flow Chart	16
Figure3.2: Flow Chart of the full project progress	17
Figure3.3: Arduino CT UNO	19
Figure3.4: Similarity of both microcontroller.	20
Figure3.5: Ultrasonic Sensor	21
Figure3.6: RFBee	22
Figure3.7: XBee shield	24
Figure3.8: SKXBee	24
Figure3.9: Indicator lamps	25
Figure3.10: LCD Display	26
Figure4.1: Connection Using Fritzing Software	28
Figure4.2: The connection between microcontroller and sensor	29
Figure4.3: Microcontroller Arduino CT Uno with Xbee Shield and RFBee	30
Figure4.4: Arduino CT Uno connected With Xbee Shield	30
Figure4.5: RFBee connected to Xbee Shield	31
Figure4.6: LCD Display And Indicator Lamp	32
Figure4.7: Receiver RFBee	33
Figure4.8: The complete installation.	33
Figure4.9: The Microsoft excel database.	35
Figure4.10: Percentage VS Level	35

## LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

LCD	-	Liquid Crystal Display
m	-	Meter
v	-	Voltage

# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

In this chapter, it is explain about the project introduction. It will briefly explain about the project background, problem statement that we face in our daily life, the objective of this project, and the scope and limitation for this project. The project is Smart Bin for Monitoring and Detecting Waste level. The explanation is for more understanding to the people about how to keep cleanliness at any place and to keep save the using of waste plastic bag.

### 1.1 Project Background

In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out.(Reis et al. n.d.; Couderc 2013; Arebey et al. 2009; Singh & Singh 2015; Nadu 2014) This will cause to the number of diseases as large number of insects and mosquitoes breed on it(Reshmi 2014; Imteaj et al. 2015; Thakker 2015; Nadu 2014; Bhor & Morajkar 2015). Furthermore, the scenery in the surrounding area will also affect our eyesight. This will cause discomfort to someone else or our self. So, this project is to improve our living environment, or where we work.

This project is to produce a smart bin where it will show the level of waste that is in the bin by using a sensor that can detect the level of garbage inside the bin. Then, LCDs will be used to show to the user the percentage of garbage that is in the dustbin. The bin it also have three indicator lamp where it goes and tells the user whether the dustbin is full or not. The three indicator lamp is red, yellow and green. For the red lamp, it will alert to the user the bin is full and it cannot throw any rubbish inside the bin, and when the red lamp is light up, the LCD will the display the percentage 85% and above. The yellow lamp is to alert to the consumer the bin is almost full and the LCD will display 70% to 84%. The last lamp is the green lamp is to alert the consumer the bin is not full and it can use, and the LCD will display 0% to 69%. The percentage of waste that has been measured will be sent to the management system for the collection or not. For process data transmission, RFBee will be used for this process.

## **1.2 Objective**

1. To design smart bin using level sensor to detect level of waste in dustbin.
2. To alert the dustbin user about level condition of the bin (empty (green lamp), almost full (yellow lamp) or full (red lamp)).
3. To monitor the dustbin level by sent the data to the waste management system for collect the garbage when the percentage shows more than 70%.



### **1.3 Problem Statement**

Waste is a matter which is often underestimated in a society. It also takes time to clean the area and maybe spoil the mood of the worker to clean the area. Waste Management services need to check each bin either the bin is full or not. Effect the consumption of cost and time energy that produced by Waste Management Services. The garbage inside the bin is not full, but the worker also collects the plastic waste. This can be the use of plastic bag will increase. Thus, this project is design to prevent the bin spill out the waste by give warning to user from throw to almost full dustbin and monitor the bin before waste inside bin spills out.

### **1.4 Project Scope and Limitations**

This smart bin can be used everywhere, whether in a residential area or an organization. To achieve the objective, this was based on the scope below:

1. The level sensor used is ultrasonic sensor where the sensor will generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. This will allow garbage in the bin will be detected the height of the garbage bins.

2. To alert the user whether the trash is full or not, this product uses three indicators light that is the green light to let know to the user the bin is not full and the waste can be disposed of in the bin, the yellow light to let know the user the bin is almost full, and the red light to let know when the bin is full and cannot disposed any garbage inside the bin. Other than the three lights, the bin will display the percentage of garbage using the LCD. This is to tell the percentage of garbage that people will not throw trash into the bin.

3. This product use RFBee to transfer data. The data in question is the percentage of waste that is in the bin, where this data will be sent to management services to make garbage collection when trash has been reached on 70% and above.

4. From the management service, the pop up alert will appear when the dustbin is about 70%. To reset the pop up alert, the bin has a reset button to reset the pop up and back to normal condition.

### **1.5 Summary**

After elaborate the project, we can see how the beginning process of this project so that the project can be completed. It occurs when a problem is often the case in the present that becomes a bad impression to the people. The smart dustbin is one of the initiatives to maintain cleanliness in the surrounding area.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

This chapter discusses on theory and comprehensive project concept. The purpose of this section is to explain about the perspective and method used to complete this project and to discuss how far this project interrelated with study and theory that is existing. Apart from that, this chapter will also show a theory and concept that have been used in solving problems. Comprehension theoretically is very important as the guide in conducting any study. The result of certain study could not be valued otherwise compared to theory.

To build this project, it requires the knowledge that is not readily offhand. There are few main parts need to be investigated in this project. The first and important part that needs to investigate is sensor that need to use and also the data transmission.

## **2.1 Level Sensor.**

Level is the main part to detecting level of the garbage inside the bin. Level sensor that need in this project is active level sensor (Singh & Singh 2015; Thakker 2015). The active level sensor is to detect the changes of waste level inside the bin. The active level sensor must be the non-contact level sensor. It is because the waste will change and the size of the waste is not same. There are few types of level sensor that can detect level of an object. Before choosing the right level sensor, it needs to investigate and study about the sensor and how the working principle of the level sensor that needs to use. There are two types of level sensor that is used for detecting garbage inside the bin. the level sensor is Ultrasonic sensor (Singh & Singh 2015; Thakker 2015) and Infrared sensor (Reshmi 2014; Bhor & Morajkar 2015; Nadu 2014).

### **2.1.1 Ultrasonic Sensor.**

One of the sensor that can detect level is the ultrasonic sensor (Thakker 2015; Nadu 2014). Ultrasonic sensors are sensor that converts ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers, many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively. Active ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions, convert it to an electrical signal, and report it to a computer.



Figure 2.1: Ultrasonic Working Principle

According to (Thakker 2015), ultrasonic sensor is to detect the level of the garbage inside the dustbin by place the three ultrasonic sensor at angle 120 degree from each other to covered up the whole bin. Every area inside the bin will be detected by the ultrasonic sensor and there are no blind spot that the sensor not covers up. The range of the ultrasonic sensor may vary according to the size of the bin. So, by considering all parameters, the specification of ultrasonic sensor can be implemented in this project.

### 2.1.2 Infrared Sensor (IR)

Another sensor that can detect level inside the bin is IR sensor (Reshmi 2014; Bhor & Morajkar 2015; Singh & Singh 2015; Nadu 2014). An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the

photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received

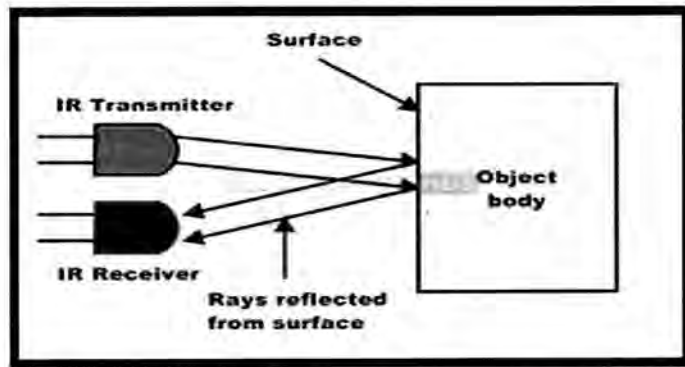


Figure 2.2: IR sensor working principle

According to (Bhor & Morajkar 2015), the IR sensor is for level detection of the garbage in the bin, but also need the weight sensor to measure the weight of the garbage. The IR sensor is consists of IR transmitter and IR receiver. The IR transmitter consists of LED which sends the IR beam to the object and the beam will turn back to the IR receiver. So, the IR sensor detects the level of the garbage inside the bin and the beam is turning back to the receiver to measure the length of the garbage.

### 2.1.3 Maxbotix Sensor

Maxbotix sensor is one of the level sensors that can detect the length of any object. It is same like ultrasonic sensor, but the receiver and transmitter is at the same area. The HRLV-MaxSonar-EZ is the name of the MAXbotix sensor, and the sensor line is the most cost-effective solution for applications where precision range-finding, low-voltage operation, and low-cost are needed. This sensor component module allows users of other more costly precision rangefinders to lower the cost of their systems without sacrificing performance. The HRLV-MaxSonar-EZ sensor line provides high accuracy and high resolution ultrasonic proximity detection and ranging in air, in a package less than one cubic inch. This sensor line features 1-mm resolution, target-size and operating-voltage compensation for improved accuracy, superior rejection of outside noise sources, internal speed-of-sound temperature compensation and optional external speed-of-sound temperature compensation. This ultrasonic sensor detects objects from 1-mm to 5-meters, senses range to objects from 30-cm to 5-meters, with large objects closer than 30-cm are typically reported as 30-cm. The interface output formats are pulse width, analog voltage, and serial digital in either RS232 or TTL. Factory calibration is standard.

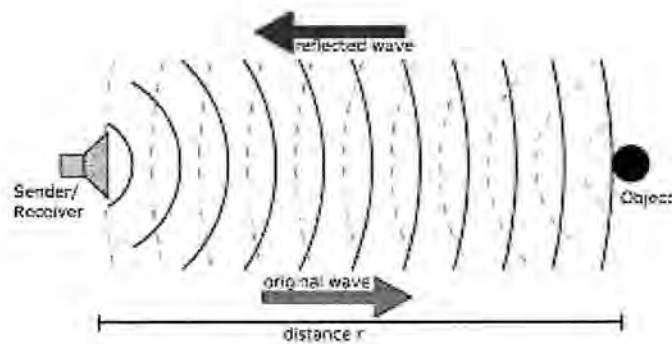


Figure 2.3: Working Principle of Maxbotix sensor

## 2.2 Data Sending

The percentage of garbage inside the bin will be send to the management system. By sending the data, it needs the data sender from the bin to the system. There are few types of data transmission between hardware to software. There are a few types of data sending that have been use from previous project. Such as RFID (Ali et al. 2012; Couderc 2013; Arebey et al. 2009; Reis et al. n.d.; Nadu 2014; Lee & Wu 2014; Singh & Singh 2015; Issac & Gsm 2013), ZigBee (Li 2012; Ferrari et al. 2008; Nadu 2014; Bidai 2014; Reis et al. n.d.; Bhor & Morajkar 2015), and using GSM (Issac & Gsm 2013; Reshmi 2014; Bhor & Morajkar 2015; Thakker 2015; Ali et al. 2012; Arebey et al. 2009; Nadu 2014).

### 2.2.1 RFID

Radio Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. The RFID system is made up of two main parts which is the tag and the reader. The tag is embedded with the receiver and transmitter. The component on the tags has two main parts which is the microchip and an antenna. The microchip is to store or to process the information and for the antenna is to receive and transmit the information. The tag is containing a specific serial number for the specific object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked. To read the information encoded on a tag, a two-way radio transmitter-receiver called an interrogator or reader emits a signal to the tag using an antenna. The tag responds with the information written in its memory bank. The interrogator will then transmit the read results to an RFID computer program