



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART SORTER DUSTBIN BY USING ARDUINO UNO

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

by

**ABDUL RAHMAN ASHRAF BIN MD ARIF B071510380
960403-04-5405**

FACULTY OF ENGINEERING TECHNOLOGY 2018

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: Smart Sorter Dustbin By Using Arduino Uno

Sesi Pengajian: 2018/2019

Saya **ABDUL RAHMAN ASHRAF BIN MD ARIF** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ****Sila tandakan (X)**

SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

TIDAK
TERHAD

Yang benar,



.....
ABDUL RAHMAN ASHRAF BIN MD ARIF

No 68, Jalaan KP4,
Taman Krubong Perdana,
75600. Krubong,
Melaka.

Disahkan oleh penyelia:



.....
ENCIK AHMAD SAYUTHI BIN MOHAMAD SHOKRI


AHMAD SAYUTHI BIN MOHAMAD SHOKRI
Pensyarah
Jabatan Teknologi Kejuruteraan Elektronik
Fakulti Teknologi Kejuruteraan Elektrik & Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 8/1/19

Tarikh: 8/1/2019

DECLARATION

I hereby, declared this report entitled Smart Sorter Dustbin By Using Arduino Uno is the results of my own research except as cited in references.

Signature: 

Author : ABDUL RAHMAN ASHRAF BIN MD
ARIF

Date: 8/1/19

APPROVAL

This report is submitted to the Faculty Of Electrical & Electronic Engineering Technology Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

Signature:



Supervisor :

ENCIK AHMAD SAYUTHI BIN
MOHAMAD SHOKRI

Signature:

Co-supervisor:

ENCIK WAN NORHISYAM BIN ABD
RASHID

ACKNOWLEDGEMENT

First of all, I am grateful because had established to complete this thesis entitled “Smart Sorter Dustbin By Using Arduino Uno”. I wish to express my sincere thanks to Encik Sayuthi Bin Mohd Shokri, my project supervisor for his valuable guidance and encouragement during my completion of this project.

I placed on record, my sincere gratitude to Encik Tengku Mohd Faisal Bin Tengku Wook, my teaching engineer for hi constant encouragement and guidance during my completion of my final year project report.

Deepest thanks and appreciation to my parents and friends for their cooperation, encouragement, constructive suggestion and support for the project completion .Last but not least, thanks to all committee of PSM 2018 for a great commitment and cooperation during my final year project

ABSTACT

Waste management system is a vital element that must be exist in the waste disposal process. Waste management system refers to the a system that will take care of the waste materials whether to recycle the waste materials or dispose the waste materials properly. However, lacks implementation of the waste management system in the waste disposal process can leads to various problems. This project proposes an innovation of the smart recycle bin. This project is powered by the Arduino Uno with several sensors such as infrared sensor, inductive sensor, humidity sensor and a servo motor. The main function of this system is to segregate the waste materials into dry metal, wet metal, dry non-metal and wet non- metal waste materials.

Contents

ACKNOWLEDGEMENT	
ABSTACT	
LIST OF FIGURES	
LIST OF TABLES	
LIST OF GRAPH	
CHAPTER 1 INTRODUCTION	
1.0 Introduction	
1.1 Background	
1.2 Problem Statement.....	
1.3 Objectives.....	
1.4 Scope.....	
1.5 Organization.....	
CHAPTER 2	
LITERATURE REVIEW	
2.0 Introduction	
2.1 Related Work.....	
2.1.0 Design And Implementation Of Smart Dustbin	
2.1.1 Waste Segregation Using RFID Technology	
2.1.2 Identification And Classification Of Plastic Resins Using Near Infrared Reflectance Spectroscopy.....	

2.1.3 A Review On PLC Based Automatic Waste Segregation	1
2.1.4 A Smart Waste Management With Self Describing	1
2.1.5 Comparative Study Of IoT Based Smart Garbage System.....	1
2.1.6 Solar Powered Electronic Trash Can.....	1
2.1.7 Smart Garbage Monitoring System Using Sensors With RFID Over IoT	1
2.1.8 Waste Segregation Using PLC.....	1
2.1.9 Smart Automatic Recycling Trash Basket	1
2.1.10 Autonomous Trash Sorting System.....	1
2.1.11 Smart Trash Bin	1
2.2 Matrix Table of Previous Related Work.....	1
2.3 Conclusion.....	2
CHAPTER 3	2
METHODOLOGY	2
3.0 Introduction.	2
3.1 Flowchart Of The Project.....	2
3.2 Flowchart Of Hardware Process.....	2
3.3 Hardware And Software Specification.	3
3.3.0 Arduino Uno	3
3.3.1 Technical Specification Of Arduino Uno.....	3
3.3.2 General Pin of Arduino Uno.....	3
3.3.3 The IDE Software	3
3.3.4 The Infrared (IR) Sensor	3
3.3.5 Humidity Sensor	3
3.3.6 Inductive Sensor.....	3
3.3.7 Motor.....	3
CHAPTER 4	3
RESULT AND DISCUSSION.....	3
4.0 Introduction	3
4.1 Final Prototype Data And Coding Analysis.....	3
4.1.0 Identification Of Non-Metal Waste Materials	3

4.1.1 Identification Of Metal Waste Materials	4
4.1.2 Identification Of Dry And Wet Waste Materials	4
4.1.3 Lid And Basket Positioning Of The Smart Sorter Dustbin	4
4.2 Prototype Of The Project	5
4.3 Discussion	5
4.4 Conclusion.....	5
 CHAPTER 5	5
 CONCLUSION AND FUTURE WORK	5
5.0 Introduction	5
5.1 Limitation.....	5
5.2 Future Work	5
5.3 Conclusion.....	5
 REFERENCES.....	5
 GANTT CHART	6

LIST OF FIGURES

- 1 Figure 2.1 Block Diagram Of The System (Aarti Chaudari,2017)
- 2 Figure 2.2 Block Diagram Of The System(Subhasini Dwivedi,2016)
- 3 Figure 2.3 Block Diagram Of The System(Sharaddha Kadam,2017)
- 4 Figure 2.4 Block Diagram Of The System(Joan P.Lazarp,2014)
- 5 Figure 2.5 Block Diagram Of The System(M.Narayanan,2017)
- 6 Figure 2.6 Block Diagram Of The System(by S.M.Dudhal,2014)
- 7 Figure 2.7 The Smart Trash Dustbin(Ryan Timothy,2016)
- 8 Figure 3.1 The Flowchart of The Project
- 9 Figure 3.2 The Flowchart of The Hardware Process
- 10 Figure 3.3 The Arduino Uno
- 11 Figure 3.4 Example Of The IDE Coding
- 12 Figure 3.5 The IR Sensor And The Basic Operation Of IR Sensor
- 13 Figure 3.6 The Humidity Sensor(DHT 11)
- 14 Figure 3.7 The Inductive Sensor
- 15 Figure 3.8 The DC Motor
- 16 Figure 4.1 Coding Of The ON State Of IR Sensor
17
- 18 Figure 4.2 Coding Of The OFF State Of IR Sensor
- 19 Figure 4.3 Coding Of The ON State Of Inductive And IR Sensor
- 20 Figure 4.4 Coding Of The OFF State Of Inductive And IR Sensor
- 21 Figure 4.5 Coding Of The OFF State Of On State Of All Of The Sensor
- 22 Figure 4.6 Coding Of The Servo Motors
- 23 Figure 4.7 Prototype Of The Project (Front)
- 24 Figure 4.8 Prototype Of The Project (With Waste)
- 25 Figure 4.9 Prototype Of The Project (Waste Platform)
- 26 Figure 4.10 Prototype Of The Project (Waste Storage)
- 27 Figure 5.1 The Limitations Of The Smart Sorter Dustbin

LIST OF TABLES

- 1 Table 2.1 Matrix Table of Previous Related Work
- 2 Table 3.1:The list of hardware and software major components
- 3 Table 3.2:The technical specifications of Arduino Uno
- 4 Table 4.1 Results Of The IR Sensor Condition
- 5 Table 4.2 Results Of The Inductive And IR Sensor Condition
- 6 Table 4.3 Results Of The Inductive, IR and Rain Sensors Condition
- 7 Table 4.4 Results Of The Inductive, IR ,Rain Sensors And Servo Motors Condition
- 8
- 9

LIST OF GRAPH

- 1 Graph 4.1 :IR Sensor Rays Detection
- 2 Graph 4.2 :Inductive Sensor Detection
- 3 Graph 4.3 :Current VS Resistance Of Rain Drop Sensor

CHAPTER 1

INTRODUCTION

1.0 Introduction

Waste management system is a vital element that must exist in the waste disposal process. Waste management system refers to the a system that will take care of the waste materials whether to recycle the waste materials or dispose the waste materials properly. However, lacks implementation of the waste management system in the waste disposal process can leads to various problems.

1.1 Background

This project proposes an innovation of the smart recycle bin. This project is powered by the Arduino Uno with several sensors such as infrared sensor, inductive sensor, humidity sensor and a servo motor. The main function of this system is to segregate the waste materials into dry metal, wet metal, dry non-metal and wet non-metal waste materials.

Based on a reference, Malaysians produce around 30 000 tons of waste materials every day. Due to the increase of the Malaysian population, the disposal rates rise up faster than the Malaysian utilities can handle. Most of the waste materials are not being recycled and only 5% of the daily waste materials are being recycled. In the worst cases, the waste materials are being disposed in the incorrect manners such as some of the waste materials being disposed in the river, at the landfill and etc. These scenarios caused almost 18 000 rivers in Malaysia to be affected and half of the numbers to be polluted and destroyed. In addition, the source of the clean water and the aquatic biodiversity dropped gradually. Most of the percentage of the waste materials come from the household sector. As an impact of the incorrect waste materials disposal activity, there is an increment of the spread disease occurred. The waste materials pollution caused several bacterial diseases such as gastrointestinal, stomach pain, vomit and diarrhea.

Recycling is a primary component of waste materials reduction and it is the third component of the “Reduce, Reuse, Recycle” waste hierarchy. There are different kinds of recyclable materials which include many kinds of paper, glass, metal and other materials. Recycling has been a common practice for most of human history, with recorded advocates as far back as Plato in 400BC. The different types of waste materials must be sorted, once recyclable materials are collected and delivered to a central collection facility.

Hence, waste segregation is crucial in order to reduce the burden on our earth. It is estimated that around 80% of waste materials can be reduced by providing a waste segregation system in public or household. This project is to innovate a smart sorter dustbin that will automatically segregate the waste materials into respective types of waste material dustbin.

1.2 Problem Statement

There are many problems occurred due to the waste pollution and not perform the recycling habit. These problems cause many negative impacts to the country and the humans. This subtopic will briefly explained about the problem.

The first problem is the waste pollution damage the river and the landfill. When the waste materials being disposed into the river, the living things inside the river will die due to the harmful substances that maybe contains in the waste materials. In addition, this action also will effect the depth of the river to become shallow and the flow of the river will be blocked by the waste materials. In the worst case, the residential area that located near the river will face flood whenever there is a heavy rain as the rain water cannot flow into the river. Moreover, the agriculture activity also can be decrease as the flora and fauna will affected because the toxidity of some waste materials may harm the flora and fauna.

The next problem is the health of the population can be decrease. It is because whenever the waste materials not being disposed properly, the bacterial will be increase and the virus can be spread through the air. Moreover, the disease that infected the infant can cause serious injury. As an example, dengue disease occurred due to the mosquito named Aedes. The normally habitat of this mosquito is the waste materials that can store the water such as wear out tire, plastic and drinks can.

1.3 Objectives

Based on the problem statements discussed above, the objectives of this study are:

- i. To innovate a smart recycle bin.
- ii. To create awareness about the recycling activity.

1.4 Scope

The scopes of this project are:

- i. The smart recycle bin can segregate between dry metal ,wet metal, dry non-metal and wet non-metal.
- ii. The type of metal use is the drink can.
- iii. The smart recycle bin only can segregate only one type of waste material at a time.

1.5 Organization

This project consists of 5 chapters, which are Introduction, Literature Review, Methodology, Result and Conclusion. The first chapter begins with the introduction of the study accompanied with the problem statement, objective and working scope for this project. The second chapter discusses about the related previous project. The third chapter discusses about the information of the components, concept and technique that will be use to complete the project. There is a flowchart of the project and its description to illustrate on how the project will be done. Chapter 4 is about the sampling data that obtained from the hardware results. The last chapter summarizes the outcomes of the project whether the objectives of the project is achieved or not.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The aim of this is to give a basic overview about the **innovation of the smart recycle bin**. Basically, this project is about to innovate a normal dustbin into an automated recycle bin that can segregate the waste materials into its type of classification. Most of the articles or journals about the smart waste management system have been analyzed. The method and the type of hardware used during the research are the core element that being analyzed. Moreover, the system being analyzed and comparison has been made in order to look for the strength and weakness of each research. Hence, the best method and solution can be choose in order to complete the smart recycle bin project.

2.1 Related Work

2.1.1 Design And Implementation Of Smart Dustbin

This paper wrote by Aarti Chaudari in 2017. This paper focus on the segregation of the waste materials such as metal, dry waste and wet waste and when the containers of the waste materials reached the maximum level, a signal will be transmit to the trash management department to carry out the clearing process. The design powered by Arduino Uno in order to receive inputs from the sensors and also to carry the data between the software and hardware. The metal and moisture sensor are used during the segregation process. When a person throw a thrash into the smart dustbin. Firstly, the metal sensor will define whether the trash is a metal or not. If the waste material is not a metal, the moisture sensor will define whether the waste material is wet or not. In order

to ensure whether the dustbin is full or not, an ultrasonic sensor was used as it will transmit a pulse and then receive it. The pulse then will be convert into electricity in order to acquire the time lag. If the time lag is long means the dustbin is not full and if the time lag is short means the dustbin is full. When the dustbin is full, RFID will send a signal to the waste management department in order to cleanup the dustbin.

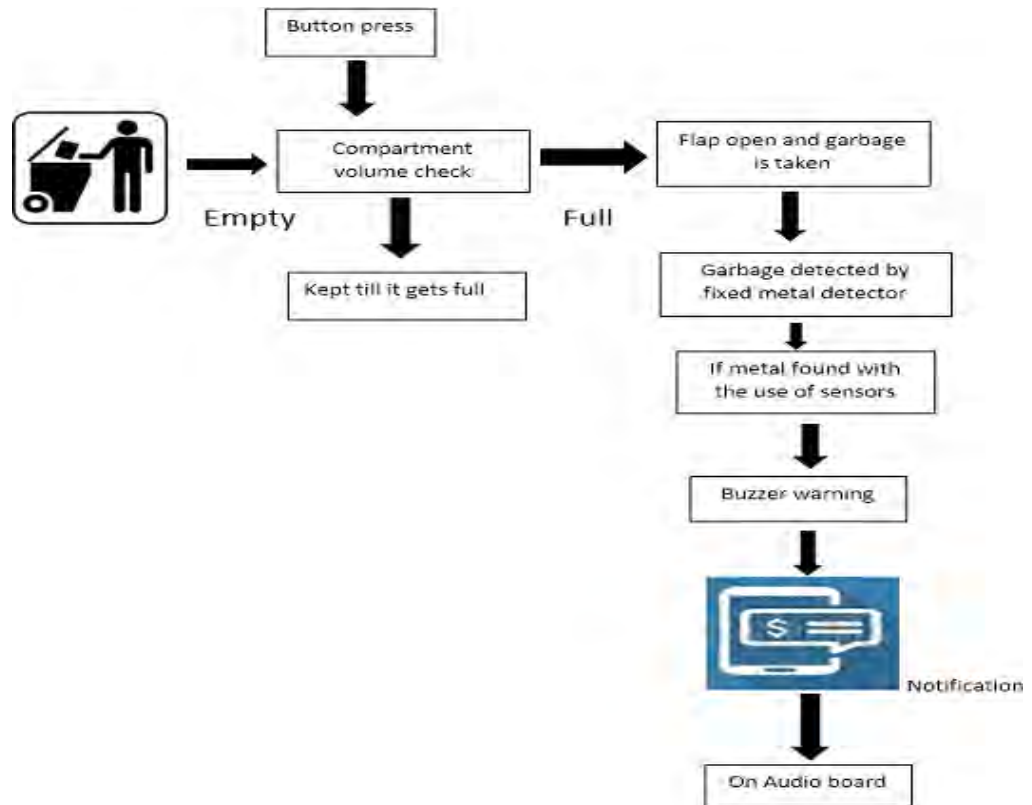


Figure 2.1 Block Diagram Of The System (Aarti Chaudari,2017)

2.1.2 Waste Segregation Using RFID Technology

This paper wrote by Sushma Margaret A and Sharanya Pamadi Sridhar from Bengaluru, India in 2017.They proposed a segregation system that can segregate waste materials into several classification such as plastic, non-plastic, wet waste and dry waste. This idea came out as a city named Bangalore has nearly become the ‘Garbage City’ as

the residents of the city refuse to properly dispose their waste materials at the provided waste landfill. The main technology that used was Radio-frequency Identification Device(RFID) and Internet Of Things(IoT).The basic flow of the system is firstly when the waste materials is dispose, the dustbin will identify whether the waste is plastic or non-materials. After the first segregation process is done, the dustbin will identify whether the waste is wet or dry. The process of the segregation is powered by RFID. Mainly the RFID has three major parts which are scanning antenna, transmitter with decoder and the transponder. The dustbin was equipped with the tags that has specified data to segregate the waste materials. Hence, the RFID will provide electromagnetic field to transfer data and automatically identifying the waste materials.

2.1.3 Identification And Classification Of Plastic Resins Using Near Infrared Reflectance Spectroscopy.

This paper wrote by Hamed Masoumi,Seyed Mohsen Safari and Zahra Khani in 2013.They proposed a system to differentiate type of plastics by using the near infrared reflectance spectroscopy. The plastic resins are identified and separate by using an automatic system. The method used in order to perform the system is the “Two-Fitter” identification method. By using this method, the system can differentiate between polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), polypropylene (PP) and polystyrene (PS).The method differentiate the plastic by analyzing the thickness ,label and cap exists on the plastic resins. Moreover, the identification and separation of the five major resins can be acquired by calculating the reflectance at two wavelengths in the NIR region.

2.1.4 A Review On PLC Based Automatic Waste Segregation

This paper wrote by Subhasini Dwivedi, Michael Fernandes and Rohit D' Souza in 2016.They proposed to segregate different waste materials such as plastic bottles, glass bottles and metal cans into different bins by using the PLC system. Mainly, their system made up of three main parts which are input block that has sensors such as photoelectric sensor, metal detection sensor and capacitive proximity sensor. Initially, the sensor use to detect the presence of the waste materials .Once there is the waste material on the conveyor, the sensor will trigger the PLC to start up the conveyor The photoelectric sensor use to detect the clear plastic bottles. The metal detection sensor use to detect the metal cans while capacitive proximity sensor use to detect paper and glass based on the behavior of the dielectric constant between the probe and target waste materials. The PLC located between the input and output block. The type of PLC use in the system is s7-300.It has 16 inputs and outputs isolated ports. Moreover, it has 24VDC of rated input and load voltage. The main function of the PLC is to receive the analog and input information from the input block and change the output of the system behavior based on the input condition variation. The input ports are connected to the sensors while the output ports are connected to the hydraulic cylinders. At the output block. there are four cylinder arms. The cylinder arms function are to pick up the waste materials at put in into the respective bin based on the type of the waste materials. Initially, when the sensor had triggered the conveyor to move, the sensor will identify the type of the waste material and then the respective hydraulic arm will pick up the waste material.

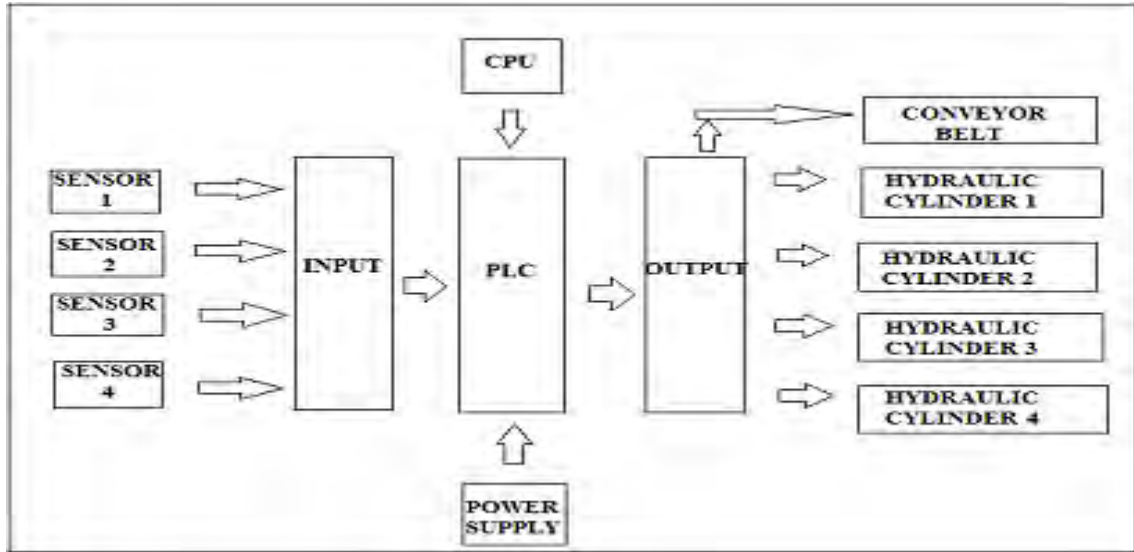


Figure 2.2 Block Diagram Of The System(Subhasini Dwivedi,2016)

2.1.5 A Smart Waste Management With Self Describing

This paper wrote by Yann Glouche and Paul Coudeuse in 2013. This paper proposed a smart waste management system in order to decrease the waste production. Moreover, they also proposed to make sure the waste materials are properly dumped and to reuse and recycling the disposed products. There are two types of waste system that have been developed. The first one is the self describing by using the RFID tag and the other one is self describing by using the QR code.

The Radio-Frequency Identification (RFID) is the technology used in the system. RFID obtained digital data from object or waste material by using the reader at the proximity of the object. Hence, it will automatically can perform the process of identification by tracking, checking of properties and etc. Moreover, the waste materials will be detected by the RFID by information properties stored in the RFID tag. The properties of the type of waste materials are stored in each RFID tag that will associate to a waste material that can help the user in the sorting and analyzing process.

The data in the of the RFID will associate to each waste material as it will aid the user to dispose the waste material in the correct dustbin. The objective is to decrease the sorting mistake. Moreover, it is also aid the user to learn the selective sorting rules applied locally. The RFID reader will read the tag of the RFID attached at the waste material. For an example, if the user want to throw away a plastic bottle, When the plastic bottle is near the dustbins, the RFID reader will detect and read the RFID tag. As a result, the plastic bottle dustbin lid will open as it recognized the plastic bottle by using the data stored at the tag attached to the plastic bottle.

Since the UHF RFID reader is expensive. An innovation has been carry out in order to decrease the costs. The RFID system was replaced with the QR codes technology. The QR codes technology is based on the NFC sensor contained in the mobile phone of the user. An application that has the information of the QR codes has been constructed. The QR codes will determine the type of the waste materials. The user has to scan the QR code by using the phone camera and a signal will be transmitted to the respective dustbin. Hence, the lid of the respective dustbin will be opened. In addition ,this method is better than the previous system as it can perform the IoT as it can record the number and type of waste materials disposed.

2.1.6 Comparative Study Of IoT Based Smart Garbage System

This paper wrote by Shraddha Kadam, Pratiksha Yewals and Prof Varsha Sharma in 2017. They proposed a waste management system in order to put awareness to the public about the garbage management. The main function of the Smart Garbage Management System is to detect the whether the dustbin is full or not. Hence, a cleaning process can be done if the dustbins are full. The core elements in the system are the sensors, microcontroller and GSM. The Block diagram shows the different component used in the Smart Dust bin System is Power Supply, IR Sensor, ARM Cortex M4, Using Internet and Dashboard/Mail Notification. Sensor is connected in dustbin it is used to detect the level of dustbin where dustbin is full or empty. The sensor senses the content of the dustbin and sends the signals or the data to the ARM microcontroller then the microcontroller reads the data from the sensor and process the data received from

sensor, and the same data will send to Dashboard section and this section send mail/message to respective Municipal / Government authority person or collection vehicle.

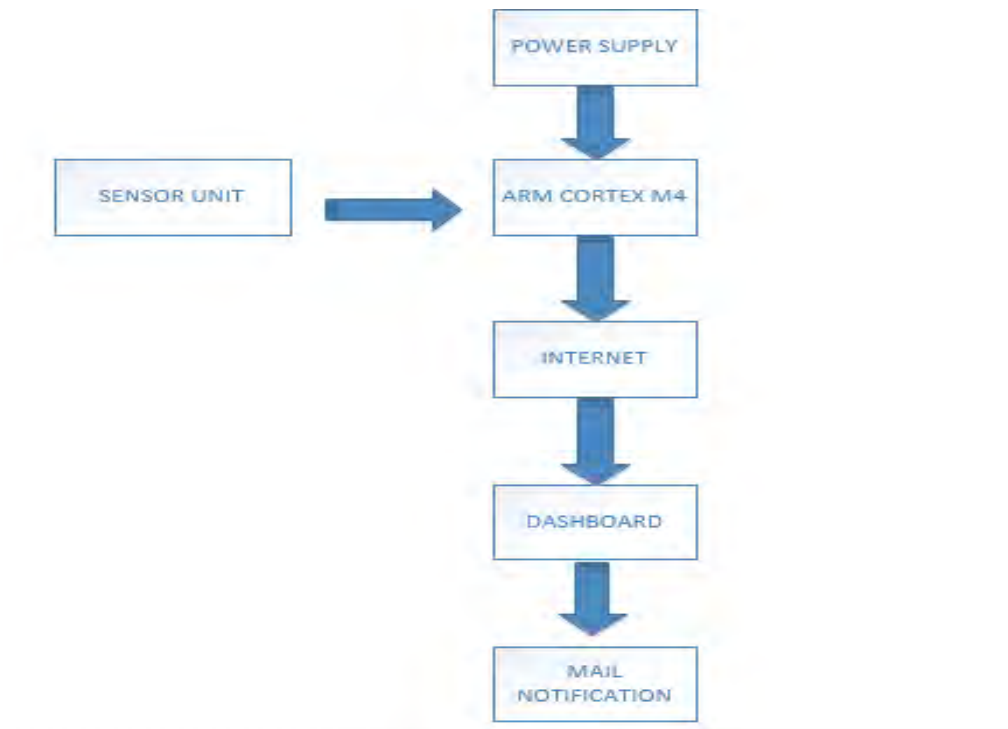


Figure 2.3 Block Diagram Of The System(Sharaddha Kadam,2017)

2.1.7 Solar Powered Electronic Trash Can

This paper wrote by Joan P.Lazaro and Alexis John M.Rubio in 2014.They proposed a solar powered electronic trash can. The aims of the project are to provide an innovation of a regular dustbin that using an embedded system with a solar powered technology and also to improve the disposal practises of students. Moreover, the creation also being build in order to create awareness about the solar powered technology. The basic flow of the system is the user need to scan the waste material at the dustbin. As a

result, the respective lid of the dustbin that suit with the type of the material with opened up for 10s.

Embedded system is the core element in the system. It is powered by two type of microcontrollers and two sensors. The microcontrollers used in the system are Basic Stamp 2 and Gizduino V3 while the sensors used in the system are magnetic and sonar sensor. The microcontroller is powered by the battery that being charged by the solar panel. The microcontroller is connected to the light dependent resistor and the magnetic sensor. The function of the magnetic sensor is to differentiate the type of the waste materials. Servo motor will opened up the lid of the dustbin for 10seconds. The Gizduino V3 will define whether the user has thrown the waste material or not and the result will be displayed at the LED matrix.

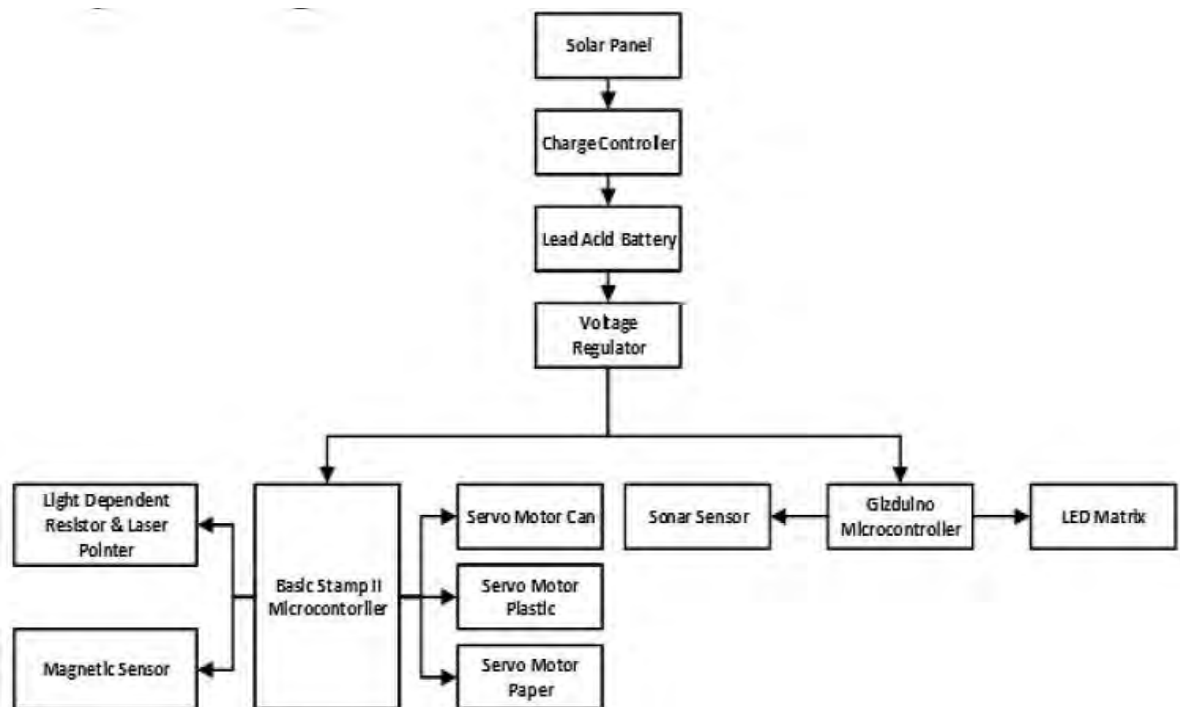


Figure 2.4 Block Diagram Of The System(Joan P.Lazarp,2014)

2.1.8 Smart Garbage Monitoring System Using Sensors With RFID Over IoT

This paper wrote by Somu Dhana Satyamanikanta and M.Narayanan in 2017.They proposed a new garbage collecting way to dispose the waste by using the latest technology. In this technology some sensors are connecting a some sensors to the bin. With the help of these sensors authorities can get information about the bin up to date by the particular ID of the bin so if the bin is over flowing, by the information given by the bin indicator they can easily find out the bin in which area it is located and squash it as early as possible. So, people can again use it. If the person coming to throw the waste into the bin they can receive a appreciation message and they can know what they thrown inside the bin through the RFID card reader

The system used the RFID technology. It contains some sensors like IR sensor ,weight sensor, photoelectric sensor and Radio frequency identification (RFID) CARD reader with help of these if someone is putting some garbage into the smart bins photo electric sensor will detect the clear representation objects and weight sensor will be placed below the smart bin it will calculate the percentage of the garbage is present inside the bin and with help of IR sensor it will send the information to the authorities who are responsible for that particular area .So, the particular authorities can receive the messages until the bin is squashed and the each bin is given an particular ID it will in display in the screen of the respected officer and they can take immediate action. If the person coming nearby two meters the bin which contain RFID CARD READER with the help of RFID reader it will read all the information about that particular person and send a message to him what they dropped inside the bin and appreciation message for using the bin.



Figure 2.5 Block Diagram Of The System(M.Narayanan,2017)

2.1.9 Waste Segregation Using PLC

This paper wrote by S.M.Dudhal,B.S.Jonwal and H.P.Chaudhari in 2014.They proposed an Automated Waste Segregation using the programmable logic controller(PLC).The research is quite same to other research that was mentioned in this literature review which entitled “A Review On PLC Based Automatic Waste”. The method used is same.PLC and sensors become the core in the system.PLC used in order to acquire the inputs and outputs and then react to the program constructed while the sensors used to detect the presence of the waste material on the conveyor belt and to detect the type of the waste materials.

The flow of the process is when the sensor detect the waste material on the conveyor, it will trigger a signal to the PLC.As a result, the conveyor belt will move. Then, a metal sensor will detect the presence of the metal type of the waste material while the waste material moving along on the conveyor belt. If there is any metal waste material, the sensor will trigger a signal to the PLC in order to move the robotic arm. The robotic arm will pick up the metal waste material and dispose it in the respective dustbin.