UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CONCEPT, DESIGN AND IMPLEMENTATION OF SOLAR POWERED SMART WASTE BIN MANAGEMENT SYSTEM WITH LEVEL SENSE

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

by

NUR AZZIANA AFIFIE BINTI AZMAN
B071310776
941114-01-6620

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TAJUK: **CONCEPT, DESIGN AND IMPLEMENTATION OF SOLAR POWERED SMART WASTE BIN MANAGEMENT SYSTEM WITH LEVEL SENSE**

SESI PENGAJIAN: **2016/2017 Semester 1**

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I hereby, declared this report entitled "Concept, design and implementation of solar powered smart waste bin management system with level sense" is the results of my own research except as cited in references.

Signature : *NUR AZZIANA AFIFIE BINTI AZMAN*

Name : Nur Azziana Afifie Binti Azman

Date : 5th January 2017

APPROVAL

This report is submitted to the Faculty of Engineering of UTeM as a partial fulfillment of the requirement for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Permasalahan yang dihadapi dalam pengurusan sistem pepejal ialah tiada mekanisma untuk menguruskan aktiviti pelupusan sampah walaupun tong sampah sudah penuh dan tiada mekanisma untuk memberitahu pihak berkuasa mengenai status tong sampah apabila ia sudah penuh dan perlu dikutip cepat. Oleh kerana itu, projek ini bertujuan untuk membangunkan prototaip mengenai konsep, reka bentuk dan pelaksanaan sistem pengurusan berkuasa solar di tong sampah pintar dengan pengesan tahap ketinggian yang terdiri daripada beberapa modul seperti sistem sensor, modul pengawal, modul Wi-Fi dan modul GSM bagi menyelesaikan permasalahan tersebut. Tong sampah biasa yang dinaik taraf dengan menggunakan kuasa solar dalam menjana tenaga untuk mengesan tahap ketinggian sampah melalui sistem sensor apabila sampah mencapai kapasiti yang ditetapkan seperti 85% daripada kapasiti tong sampah. Terdapat sensor tinggi yang digunakan untuk mengesan tahap ketinggian sampah iaitu pengesan ultrasonik dan terdapat paparan LCD digunakan untuk memaparkan status sampah dari aspek ketinggian iaitu cara yang lebih mesra pengguna. Seterusnya, status didalam tong sampah di simpan di dalam unit kawalan seperti pangkalan data mysql dan program java sebelum data tersebut di hantar ke konsesi yang bertugas dalam kutipan sampah pada masa tersebut melalui sistem pesanan ringkas. Hasil dapatan dari unit kawalan yang akan mencetuskan modul pengawal untuk menghantar pemberitahuan kepada penerima melalui sistem pesanan ringkas (SMS) iaitu melalui modul GSM yang memaklumkan mereka bahawa tong sampah sudah bersedia untuk dikosongkan.

ABSTRACT

Difficulties encountered in the solid waste management system is no mechanism to manage the waste disposal activities even though the waste bin already full and there is no mechanism to notify the authority regarding the waste bin status when it is already full and need fast collection. Due to that, this project aims to develop a prototype of the concept, design and implementation of solar powered smart waste bin management system with level sense that consists of several modules such as sensor system, controller module, Wi-Fi module and GSM module for solving these problems. Regular trash upgraded by using solar power to generate energy to detect the height of the waste through the sensor system when the trash reaches the capacity established as 85% of the capacity of a dustbin. There are level sensors that has been used to detect the level of trash height is ultrasonic sensors and a LCD display is used to display the status of waste from the height which for more user-friendly way. Next, the status in the trash has been stored in the control unit such as a MySQL database and Java program before the data is sent to the concessionaire in charge of garbage collection at that time by text message. The Java in the control unit was trigger the controller module to send notification to the recipient via the short messaging system (SMS) through a GSM module that informs them that the waste bin is ready to be emptied.

DEDICATIONS

To my beloved parents

Who always give me courage to finish this project.

Also, to all people who had guided and inspired me throughout my journey

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AC-DC	-	Alternative Current/ Direct Current
AVR	-	Automatic Voltage Regulator
CSS	-	Cascading Style Sheets
DTIM	-	Delivery Traffic Indication Message
FTDI	-	Future Technology Devices International
GIS	-	Geographical Information System
GPRS	-	General Packet Radio Services
GPS	-	Global Positioning System
GSM	-	Global System for Mobile Subscriber Identity
GUI	-	Graphical User Interface
HTML	-	Hyper Text Markup Language
HTTP	-	Hypertext Transfer Protocol
IDE	-	Integrated Development Environment
IO	-	Input Output
IP	-	Internet Protocol
IR	-	Infrared
LBS	-	Local Base Station
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MSW	-	Municipal Solid Waste
SMS	-	Short Message Service
SQL	-	Structured Query Language
PHP	-	Hypertext Preprocessor
PIC	-	Programmable Interface Controller
PIR	-	Passive Infrared
RF	-	Radio Frequency

CHAPTER 1

INTRODUCTION

1.0 Introduction

In the era of increasingly advanced technology and the rapid growth in the human population in terms of economic development, the solid waste has been one of the worst environmental problems in Malaysia. This problem occurs due to the process control waste collection and management in the country where no solid waste management is managed effectively and efficiently. The wastes generated from various sources, which could lead to environmental pollution and can also pose a threat to the health of favorable breeding insect vectors of disease, animals, scavengers and rats which can cause various diseases. Moreover, the amount of waste in Malaysia is increasing sharply because of construction activity and it has a problem that came with the disposal of this waste based on Business Waste Management's article. At present, the total generation of municipal solid waste (MSW) to grow strongly with the increase in population, economic recovery, the construction industry, changes in consumption habits and urban lifestyle.

The problem of waste management is an issue that no end of time till now in developing countries in Africa, especially Nigeria. Municipal waste management in Nigeria is worrying, especially for human health that affected by air pollution, water pollution and soil contamination. Analysis of key issues that affect the efficiency of the municipal waste management is important to develop a solution that can be used in the new economy in Nigeria. Therefore, an increase in solid waste management system is indispensable nowadays which require proper management and appropriate

monitoring the status of solid waste in real time which can confirm a green environment and develop a viable first (Thompson et al. 2013). In India, improper waste management has caused an outbreak of dengue fever and other epidemic threatened. In recent years, waste management has become a unifying factor that will lead to public demonstrations across India, after corruption and fuel prices. Inefficient waste management is a global concern that requires a lot of research work and development towards exploring new applications for the management of a more efficient and environmentally friendly (Reshmi 2014).

One of the big challenges for managing the landfill for the liable party is caused by lack of proper management solutions. In order to know the details of the collection and management of this waste, interviews and site visits were conducted by the company responsible for waste management (Behzad et al. 2011). The study of the waste disposal system is also carried out to determine the type of waste in the country.

Figure 1.1: The solid waste is not managed effectively and efficiently

(Courtesy: http://www.selangorpost.com.my/2016/08/07/kerajaan-pkr-selangor-akui-gagal-urus-sampah/)

Figure 1. 1 above shows the real state of the problem faced by the authorities in this country, especially municipalities responsible for managing this residual waste. There are various factors that cause the condition occurs, one of which is that the authorities do not know the current situation is whether the trash is full or not and

the attitude of Malaysians who do not take the results seriously which is only to be complacent as lukewarm. Hence, the authorities in these countries have their regular schedules for each waste collection bins which when full or not, the garbage collector will wait for the appointed day to pick up trash. Table system they use is irrelevant because it would generate a problem when there are some big events such as the celebration of the feast and the results is the trash is loaded rapidly. Thus, the trash gathered by many smells which can lead to the destruction of the rest of the general cause harm to public health.

Solid waste management system is an important matter to be considered in the development of a premise to ensure proper management of solid waste in the premises can be managed and focuses on the design requirements of solid waste's collection, selection, storage methods and also the location where to place the collection of solid waste. Due to that, this project aims to develop a prototype of solid waste bin management system by designing an electronic system to provide a solution to irregular waste disposal system. This system was used level sensors to detect the overflow of the waste in the waste bin and the sensor was further fed to the microcontroller which would help the control unit to receive and store data regarding the status of the bin. Furthermore the collected data was stored in the database and can be used in the future for monitoring purpose. This system was notified the respective authority through SMS that the wastes in bin is nearly full and need fast collection. In addition, a solar energy system was used to provide power for operating the system.

1.1 Problem Background

Solid waste management is an important area related to a country's economic status and lifestyle of its inhabitants that can be defined as a discipline related to the control of the generation, storage, collection, transfer, transport, processing and disposal of solid waste. As a matter of fact, an aggressive economic development in Malaysia not influenced the solid waste management that still relatively poor in

terms of management itself. Malaysia is faced challenges with respect to the solid waste management sector because of the increase of population, tourism and economic growth for sustainable development and inadequate waste legislation enforcement, infrastructure and public attitude among residents (Behzad et al. 2011). Additionally, the term given to the waste materials are the waste generated by human activity and should be managed to avoid adverse effects on human health and the environment. To prove all this statement, the interview sessions have been done at SWCorp Malaysia in branch of Malacca was carried out to obtain more detailed information regarding the management of solid waste. Among the information that was collected is the way how solid waste is managed according to schedule, without the latest technology was found some problems encountered that need a solution in waste management. Among the problems encountered in solid waste management are:

1. There is no mechanism to manage waste disposal activities even though the waste bin is already full and overloaded.
2. There is no mechanism to inform and notify the authority regarding the waste bin status when it is overloaded and need fast collection.
3. No mechanism to producing electricity in term of environmentally friendly way for waste collection activities.

1.2 Problem Statement

The problem statements of this project are based on problem background that has been discussed above. There are the ways to find solution for the problems arises in waste management as follow:

1. How sensor and wireless communication technologies able to help in making the waste management activities more efficient and effective?
2. How to produce a portable and cost-effective waste bin?