



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF PUBLIC TRANSPORTATION (BUS)
NOTIFICATION USING PIC MICROCONTROLLER**

This report submitted in accordance with requirement of the
Universiti Teknikal Malaysia Melaka (UTeM)
for the Bachelor Degree of Engineering Technology
(Electrical Industry) (Hons.)

by

NURUL AZLIYANA BINTI AZMAN

B071310383

911009-01-5442

FACULTY OF ENGINEERING TECHNOLOGY

2016

i

DECLARATION

I hereby, declared this report entitled “DEVELOPMENT OF PUBLIC TRANSPORTATION (BUS) NOTIFICATION USING PIC MICROCONTROLLER” is the results of my own research except as cited in references.

Signature :
Author's Name : NURUL AZLIYANA BINTI AZMAN
Date : 12 DECEMBER 2016

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 Power) with Honours. The member of the supervisory is as follow:

.....
(PROFF MADYA MOHD ARIFF BIN MAT HANAFIAH)

ABSTRAK

Pengangkutan boleh dirujuk sebagai pergerakan orang dari satu tempat ke tempat lain dengan menggunakan apa-apa jenis pengangkutan seperti bas, kapal terbang, kereta, dan lain-lain sistem pengangkutan bas adalah pengangkutan yang paling digunakan pada masa kini, setiap negara di dunia pekerja yang besar dan pelbagai stesen bas untuk menyampaikan orang mudah dari satu destinasi ke destinasi yang lain. Dengan stesen bas besar dan banyak penumpang sistem pengangkutan bas mendapat lebih kompleks, dan juga kemungkinan penumpang hilang pedoman atau tersilap dalam destinasi mereka menjadi lebih serius. industri pengangkutan dengan peranannya berusaha tidak untuk melaksanakan pelbagai pendekatan yang boleh memberitahu penumpang dengan jadual bas dan destinasi yang dikehendaki termasuk peta dan sistem pemberitahuan bunyi. Dalam projek ini sistem pengangkutan bas dibangunkan untuk mereka bentuk sistem pemberitahuan untuk pengangkutan dengan bas menggunakan modul tanpa wayar ZigBee, untuk membangunkan satu program untuk sistem pemberitahuan dengan menggunakan PIC Microcontroller dan untuk meningkatkan kecekapan dan kebolehpercayaan sistem pengangkutan bas awam sistem. Ia bertujuan untuk mereka bentuk sistem yang mudah untuk dilaksanakan di stesen bas di mana sistem akan menyumbang untuk mengatur sistem penjadualan bas serta destinasi yang diinginkan. Pelaksanaan sistem pada dasarnya termasuk komunikasi ZigBee wayarles, PIC Microcontroller, LCD, dan buzzer. ZigBee berfungsi sebagai alat komunikasi di antara stesen bas dan bas. PIC Microcontroller berfungsi untuk mengawal alat untuk memandu seluruh sistem. Menunggu penumpang di stesen bas hanya akan menekan butang untuk memberitahu pemandu bas bahawa penumpang boleh didapati di perhentian bas. Di samping itu, datang ke dalam bas ditetapkan akan menghantar isyarat melalui ZigBee ke stesen yang menunjukkan bahawa bas yang akan datang ke stesen. Sistem bunyi (buzzer) adalah digunakan untuk memberitahu penumpang yang tidak dapat membaca pemberitahuan pada LCD.

ABSTRACT

Transportation can be referred as the movement of people from one place to another utilizing any type of transport such as bus, plane, car, etc. The bus transportation system is the most deployed transport nowadays, every country in the globe employ a large and various bus stations to conveniently convey people from one destination to another. With enormous bus stations and plenty of passengers the bus transportation system gets more complex, as well as the possibility of passengers lost their direction or mistaken in their destination becomes more serious. Transportation industry by its role strives hardly to implement various approaches that can notify the passengers with bus schedules and desired destination including maps and sound notification system. In this project a bus transportation system is developed to design a notification system for transportation by bus using the ZigBee wireless module, to develop a program for the notification system by using the PIC Microcontroller and to improve the efficiency and reliability of the public bus transportation system. The system aims to design a convenient system to be implemented in the bus station in which the system will significantly contribute to organize the bus scheduling system as well as the desired destination. The system implementation basically includes Zigbee wireless communication, PIC Microcontroller, LCD, and a buzzer. Zigbee works as a communication tool between bus station and the bus. PIC Microcontroller works at controlling tool to drive the whole system. Awaiting passengers on a bus station will simply press a button to notify the bus driver that a passengers is available at the bus stop. In addition, coming bus into specified will send signal through Zigbee to the station indicating that a bus is coming to the station. A sound system (buzzer) is utilized to notify the passengers who unable to read the notification on the LCD.

DEDICATION

To my beloved parents and family
I would like to thank you and appreciated for all my family and friends.
Without their prayers and support I can't be still here.

ACKNOWLEDGEMENT

First of all, I am grateful to ALLAH because can complete my final year project 1 successfully on time.

I also wish to thank my mother Siti Hawa Binti Hashim and my father Azman Bin MD Said and the whole of my family for prayer and support me in completing this final year project

Also not forget to thank my supervisor Prof Madya Mohd Ariff Bin Mat Hanafiah that had given me with much information, guidance, advices and motivation finish this final year project

Lastly, I also want to thank all my friends that helping me to complete this final year project

TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	vi
List of Figures	vii
List Abbreviations, Symbols and Nomenclatures	viii
CHAPTER 1: INTRODUCTION	1
1.1 Project Background	1
1.2 Problem Statement	2
1.3 Objective	3
1.4 Scope	3
1.5 Project Contribution	4
CHAPTER 2: LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Theory and Basic Principles	6
2.2.1 ZigBee Wireless	7
2.2.1.1 History	8
2.2.2 Microcontroller	11
2.2.3 PIC Microcontroller	12
2.2.4 LCD	13
2.2.5 Buzzer	14

2.2.6	LED	14
2.3	Previous Studies	15
CHAPTER 3 : METHODOLOGY		16
3.1	Introduction	16
3.2	Project Implementation	16
3.2.1	Bus Stop Design	19
3.2.2	Bus Design	21
3.2.3	Components Selection	23
CHAPTER 4 : RESULTS AND OVERVIEW		25
4.1	Results	25
4.2	Project Results	29
CHAPTER 5 : CONCLUSION & RECOMMENDATION		32
5.0	Conclusion	32
5.2	Recommendation	32
REFERENCES		33
APPENDIX 1		35
APPENDIX 2		36

LIST OF TABLES

Table		Page
Table 3.2.1	Bus Stop Design	20
Table 3.2.2	Bus Design	21

LIST OF FIGURES

Figure	Page
Figure 2.2.1 Zigbee Symbol.....	7
Figure 2.2.1.1 Zigbee Architecture.....	8
Figure 2.2.2 Microcontroller.....	11
Figure 2.2.3 PIC Microcontroller.....	12
Figure 2.2.4 LCD.....	13
Figure 2.2.5 Buzzer.....	14
Figure 2.2.6 LED.....	14
Figure 3.1 Flowchart.....	17
Figure 3.2 Flow Chart Project.....	18
Figure 3.2.1 Bus Stop Design.....	20
Figure 3.2.1 Bus Design.....	21
Figure 4.1.1 Circuit at Driver Bas.....	26
Figure 4.1.2 Circuit at Bus Stop.....	26
Figure 4.1.3 Simulation at Driver Bus.....	27
Figure 4.1.4 Simulation at The Bus Stop.....	28
Figure 4.2.1 Display the Beginning.....	29
Figure 4.2.2 Destination Bus A.....	30
Figure 4.2.3 Destination Bus B.....	31

CHAPTER 1

INTRODUCTION

1.1 Project Background

The bus transportation system is the process of transporting passengers from one location to the desired user's location. The rapid technologies and industrial advancements have effectively contributed to produce enormous and efficient transportation methods. The amount of population increases and their need for more transportation systems increase as well.(Koga, 1999)^[1] .Not all people are being able to process their own transport and travel individually.

The collectivity transport means are essential to enable people to move around cheaply and reduce the traffic jam on roads. (Koga, 1999)^[1]. Bus transportation is an efficient system that allows people to travel to variety of destinations at low cost. Developed countries have implemented various modernized bus transportation systems that enable passengers to freely travel to any desired locations. However, there are some obstacles that encountered by passengers who using bus transportation(Koga, 1999)^[1].

One of them is the possibility of passengers missing a bus due to the deficiency of the bus transportation system(Me, 2013)^[3]. Another thing is that, it would be a waste of time and cost in which, when the bus is coming into a bus station that no passengers waiting. A modernized bus transportation system can be implemented in order to mitigate these deficiencies.

1.2 Problem statements

Nowadays the need for travelling from place to place is becoming a routine that people almost do every day. There are various transportation systems, in which people can travel from one place to another. Bus transportation is the people's common choice to use due to its availability at low cost and simple travelling methods to the user's destination.

The disadvantages of using the bus transportation is when there are many passengers want to use it, they could be missing the bus and this makes them unable to reach a destination punctually(Me, 2013)^[3]. Moreover, the drivers and transportation vendors waste time and cost by driving a bus to an empty bus station(Koga, 1999)^[1]. All these obstacles exist due to the olden and inefficient systems and technologies of bus transportation.

However, these bus transportation system's deficiencies can be mitigated by developing a technology system that can significantly contribute to managing, improving, and modernizing the bus transportation systems. The system utilizes a microcontroller that controls the Zigbee wireless communication module that acts as a communication tool between the bus stations and the buses.

The systems working principle include PIC 16F877A microcontroller, Zigbee, LCD, and sound buzzer where the bus drivers will receive an indicating signal through Zigbee(Ke, Ruiqiang, & Cuixia, 2008)^[2]. The signal will show that the passengers are waiting in specified destinations. In addition, a signal will be send to the bus station that will sound a buzzer that notifies the passengers that a bus is coming to their station. Passengers can also see which bus is coming to their station through a LCD. This will be reducing the time and cost wasted, and improves the effectiveness of the bus scheduling systems.

1.3 Objectives

The objectives of Public Transportation (BUS) Commuter Notification system are:

- 1) To design a notification system for bus transportation by using the ZigBee wireless module.
- 2) To develop a program for the notification system by using the PIC Microcontroller.
- 3) To improve the efficiency and reliability of the public bus transportation system.

1.4 Scope

The scope of this project includes designing bus transportation systems utilizing a Zigbee, PIC 16F877A microcontroller, buzzer, and LCD. The Zigbee wireless module is the communication device between the buses and the bus stations. Furthermore, the PIC microcontroller acts as the controlling and processing device that drives the entire system. A programming code will be developed and uploaded into the PIC.

Then, it will be interfaced with the Zigbee module for communication purposes. Signals will be sent from bus stations to the buses and from buses to the bus stations. It provides a two-way communication. Upon receiving the signals, it will be notified by the sound of the buzzers and visualization of texts on LCDs. Moreover, after the passengers ride the bus, the driver can reset the notified messages on the bus by pressing a reset switch.

1.5 Project Contribution

This project will notify the bus drivers by sending signals from ZigBee that there are passengers waiting at the specified destinations. In addition, the passengers will know that the bus is available and the message will be shown at their bus stop via LCD screen. This project improves the bus transportation system and mitigates the time and cost wasted as it is in current bus transportation system. This system also aids the passengers who sometimes miss their bus due to their carelessness. Moreover, passengers can spend their waiting time by reading books or using gadgets without worrying about missing the bus. Indirectly, this project also saves cost for the bus transportation vendors.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Travelling is the process in which people would spend days and even months to reach the desired destination. People started using boats that made of wood to travel across the sea. Now, travelling becomes easy with the availability of several transportation means ranging from simple motorcycle to huge airplane. The present-day consumers should be able to ride any vehicle, and easy to get the transportation to the destination with desired time and speed. Among the various transportation system currently used is the bus transportation systems, which is a collectively transport mean. Bus transportation is widely developed in most countries. It is utilized to provide a collective transport for people who are not affordable to have own transport(Koga, 1999)^[1]. Then, bus transportation would reduce the traffic jam occurred due to the plenty of individual transport moving on the roads. The developed countries implement an organized system, including station and booking tickets are implemented just like any other transportation system such as airlines transport systems(Gardner, Souza, & London, 2009)^[4].

The most important is implementing the system for bus transportation, since it enables passengers to move around in convenience and arranged way. As a tourist may not possess an individual transport, bus transportation would make it easier for them to travel to a desired destination. Apart from that, energy consumption could be reduced by utilizing bus transportation where passengers will take collectively transport instead of using individual transport. Hence bus transportation not only convenience to passengers but also contributes in reducing energy consumption and travelling costs as well.

2.2 Theory and basic principle

Many theories have been proposed to explain what are ZigBee wireless and PIC microcontroller. Although the literature covers a wide variety of such theories, this review will focus on the basics of Zigbee and PIC microcontroller method of analysis and a gap in literature. However, other information from past, researchers will also be included in this chapter for readers to understand more about this project.

2.2.1 Zigbee Wireless

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks with a small, low-power for digital radios. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi. Applications include wireless light switches, electrical meters with in home displays, traffic management systems, and other consumer and industrial equipment that require a short-range low rate wireless data transfer(Ke, Ruiqiang, & Cuixia, 2008)^[2].

Low power consumption will limit the transmission distances to 10–100 meters depending on power output and environmental characteristics. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more than the distance. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys.) ZigBee has a defined rate of 250 Kbit/s, is best suited for intermittent data transmissions from a sensor or input device.



Figure 2.2.1: ZigBee symbol

2.2.1.1 History

ZigBee was created in 1998 and standardized in 2003, and revised in 2006. The ZigBee standard has evolved since its original release in 2004 and it is a new low cost, low power wireless networking standard for sensors and control devices.

ZigBee provides network speeds of up to 250kbps and is expected to be largely used in wireless sensor network applications where high data rates are not required. ZigBee uses the media access control layer and physical layer for communication between devices. ZigBee also offers a short-range wireless networking capability with low cost, low data rate and low power consumption. (Kobayashi, 2016)^[5]

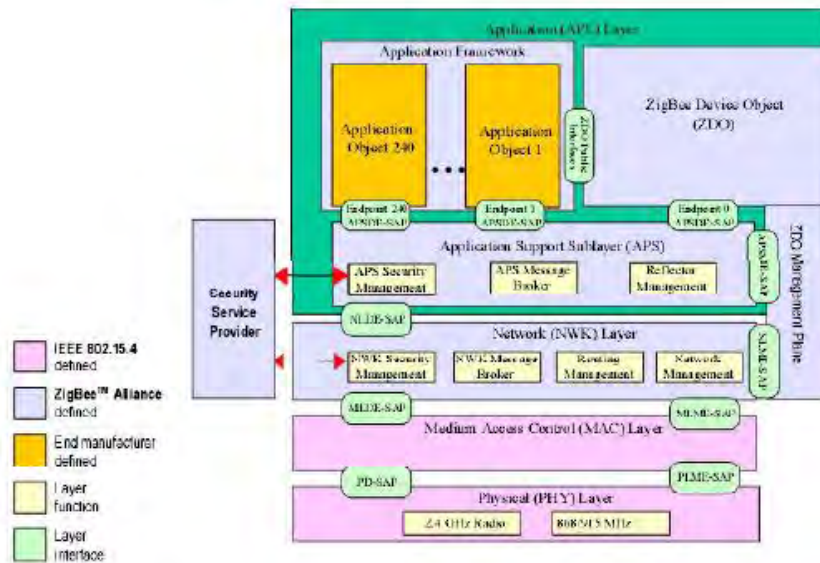


Figure 2.2.2.1: ZigBee stack architecture, which is made up of blocks called layers.

Each layer will perform a specific function in the ZigBee protocol architecture. The data link entity provides the data transmission service and a management entity provides the all other services. Each service entity exposes an interface to the upper layer through a service access point (SAP) and each SAP supports a number of service primitives to achieve the required functionality. The ZigBee protocol will be built upon on this foundation by providing the network layer (NWK) and the framework for the application layer. The application layer framework consists of the application support sub-layer (APS) and the ZigBee device objects (ZDO).

The lower frequency PHY layer covers both of the 868MHz European bands and the 915 MHz band that are used in the United States and Australia. The higher the frequency the more layers are used on virtually worldwide. The responsibilities may also include transmitting frames, synchronization and providing a reliable transmission mechanism. The ZigBee network layer supports star, tree, and mesh network topologies. The ZigBee coordinator is responsible for initiating and maintaining the devices on the star network topology.

Star network topology will control the coordinator and all the devices and directly communicate to the coordinator. The ZigBee coordinator coordinates for starting the network and choosing the key network parameters. The routers move data will control messages through the network by using the hierarchical routing strategy and ZigBee is employed by carrier sense multiple access (CSMA)

The advantages of ZigBee is that it will get through the CSMA is will be reduced the current drain and having longer battery life elimination of waiting time for polling. ZigBee also be developing the sensor and control the application for wireless personal area network (WPAN) applications that cover short distance communication and control requiring low data rates(Nugroho & Sahroni, 2014)^[6].The factors of prime propelling will be caused the significant of reduction in the power consumption and will provide the wireless stand, which the facilitators will improve the battery life from hours to months. Therefore ZigBee technology will innovate the proprietary solution by creating numerous interoperability issues. The implementation will combine with the very low power consumption and limited cost of implementation. The active development of ZigBee Chipsets and complete solution development by various companies globally stand witness to the expected boom of the ZigBee Standard in the very near future in several applications including ITS.

2.2.2 Microcontroller

A microcontroller is a small computer that uses integrated circuit and it consists of processor core, memory, programmable input and output. Then, microcontrollers were designed for the embedded application that contrast to the microprocessor that is used in the personal computer or the other general-purpose application for various discrete chips. Microcontroller are utilized in the automatic control products and devices, such as the automobile engine control system, implemented medical devices, remote controls, power tools, embedded systems and so on.

It will reduce the size of the system compared to the design that use the separate microprocessor, memory, input and output devices. They have combined the signal of the microcontroller that will come to integrate the analog components that need to control the non-digital electronic system. Some of the microcontroller may use the four-bit words and will operate at the clock rate of 4 kHz frequency(Belvedere, Bianchi, Borghetti, & Paolone, 2009)^[7].



Figure 2.2.2 : Microcontroller

2.2.3 PIC Microcontroller

Peripheral Interface Controller (PIC) is a family of Harvard architecture microcontrollers that was developed by Microchip Technology. They derived the PIC16F887 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller". The model of PIC had read-only-memory (ROM) or field-programmable EPROM that used for program storage with some erasing memory. The all current models that used Flash memory for program storage and newer models allow PIC to reprogram itself.

The program memory and data will be separated. The data memory is 8-bit, 16-bit and in later models, 32-bit wide. They are programmed using computer software such MPLAB, C/C++ compilers, and PICKit series. Some parts have in-circuit programming capability that low-cost development programmers are available and have a high-production programmer.

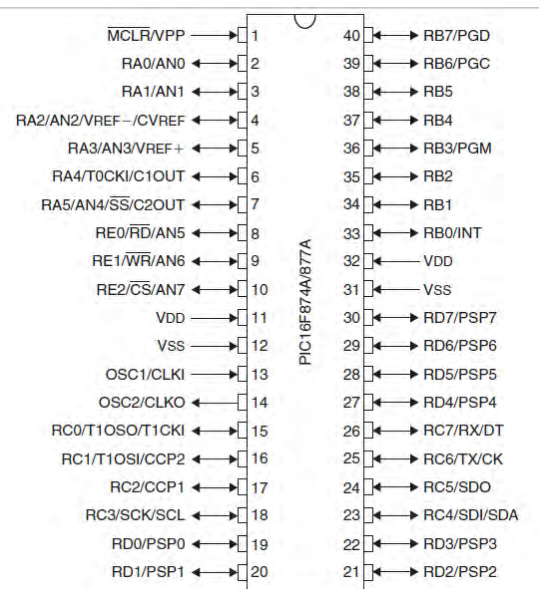


Figure 2.2.3: PIC16F877A

2.2.4 LCD

The LCD display will be connected to the output of the bus transportation systems unit. The coding is constructed using embedded C language and is uploaded to the PIC microcontroller using C compiler and LCD's pins are connected to the PIC. LCD display will be using 7-segment display. The advantages of using this LCD are their low cost power consumption, ideal in low power, and come in different shapes and size. The disadvantages of using these materials are battery operated and batteries needed to be replaced when its power is used up.

There are two types of LCD connections, parallel LCDs and serial LCDs. Parallel LCDs are connected to the microcontroller I/O ports using 4 or 8 data wires and data is transferred from the microcontroller to the LCD in parallel form. Series LCDs are connected to the microcontroller using only one data line and data are transferred to the LCD using the standard RS232 asynchronous data communication protocols. Series LCDs are easier to use, but they usually cost more than the parallel ones. Serial LCDs also have the advantage that only one wire is required to interface them to a microcontroller, thus saving the I/O pins. In this section, we shall be looking at the interface and programming of both types of LCDs.

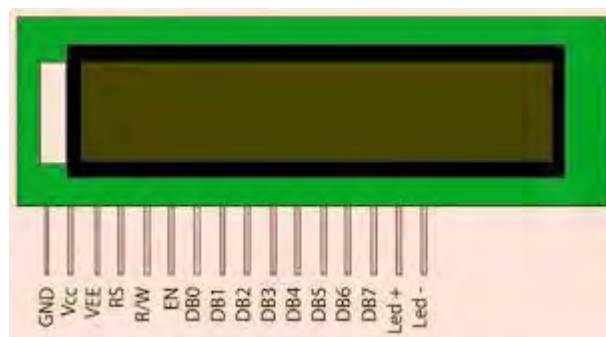


Figure 2.2.4: LCD