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3
SMART BUS TERMINAL USING INFRARED IDENTIFICATION

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3.1.1 INTRODUCTION

Significant increase in vehicles inside city areas results in adding more troubles to that section of citizens using public transportation network as their primary source of travelling. This specific section of society is a victim of this rapid growing traffic volume and causing a huge waste of time due to not having proper information of required bus current position. The problem results in not only wasting of time but also mentally unhappy and tensed citizens. Nowadays, passengers want to get the clear information of their desired buses at station, like the position and estimated time of arrival of bus etc.

The implementation of Intelligent Transportation Systems (ITS) nowadays has developed to the incredible extent. This system is proved that is to be very useful not only in the safety purpose but also it eases to any users. The combination with infrared can use to monitor and identify the location of certain bus and present it the information to the bus passenger on LCD at terminal by using the simulation. The tag and the reader of the infrared devices are wirelessly connected and control station can authorize not only to monitor the bus but can also identify the particular of the bus such as bus registration number and bus company names.

3.1.2 LITERATURE REVIEW

A bus station is a structure where city or intercity buses stop to pick up and drop off bus passengers. It is usually larger than a bus stop, which is usually simply a place on the roadside, where buses can stop. It may be intended as a terminal station for a number of routes, or as a transfer station where the routes continue. The largest bus station in the world for now is Millennium Park Bus Depot located in Delhi India. While the largest underground bus station in Europe is Kamppi Centre of Helsinki, Finland which was completed in 2006. Usually, the terminal cost 100 million Euro to complete and took 3 years to design and covers 25,000 square meters, is the busiest bus terminal in Finland.

Every day, the terminal has around 700 bus departures, transporting some 170,000 passengers. Bus station platforms will be assigned to fixed bus lines, or variable in combination with a passenger information system. In the future, requires fewer platforms but does not supply the passenger the comfort of knowing the platform well in advance and waiting there [1]. In Malaysia, the public transport system is the important ways in communication systems whether for urban or community rural areas. As the country grew more towards advanced, the system relations in a country should have the competence and progress in terms of services and technologies [2]. In addition to the complaints of passengers on the bus they were traveling arrive or depart later than the scheduled time is often heard. In most cases, such as at the Puduraya, bus delays are often caused by traffic congestion leading to harassment stops or in transit. Nowadays, the bus passengers want to get more clear information of their desired buses at the station, like the position and estimated time of arrival bus at the terminal.

In foreign countries, Intelligent Transportation System (ITS) has been developed for several years, an applied in very broadly. For example, in New York, and Amsterdam public transport systems are used in today's most cutting-edge public transportation system and in the world's leading and this topic is a very popular in research universities, which involved embedded systems, communication systems, computer control and management of all areas, etc. The purpose of the research is to enable people to travel by public transport more comfort, convenient and rational use of urban transport system [3]. The Intelligent Transportation System provides real-time urban transit system stations and monitoring reports, increasing the efficiency of public transport system to ease the traffic congestion, facilitate more information to the travel of passengers, and also can help to reduce bus operating costs, has some innovative and practicability.

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3.2 METHODOLOGY

3.2.1 Introduction

The first thing that important is to decide the title and project that will be produced. The title and project that have been selected is Smart Bus Terminal with Infrared Identification. After that, I have to determine the objective and scope for the project. Need some research to know about information for Smart Bus Terminal and control method that already have in the world. To complete this project, it will divide three parts to concept design, design circuit and design programming. The ID Identification of the bus is discussed in concept design. For design circuit, the components need to be determined which one that will be use. For programming, also need to determine software that been use to execute program.

3.2.2 Concept Design

Figure 3.1 shows the flowchart for overall architecture of Smart Bus Terminal using Infrared Identification.

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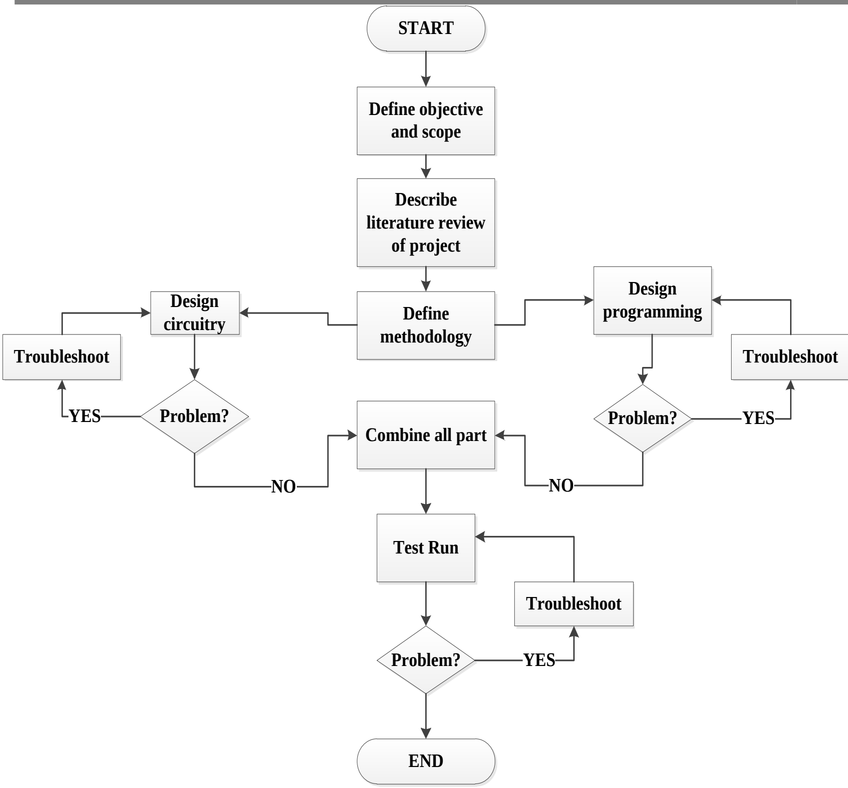

Figure 3.1: Flow chart overall architecture of Smart Bus Terminal using Infrared Identification

3.2.3 Circuit Design

On the circuit and electronics parts, the first stage of the design methodology is to understand the requirements of the project and the limitation of various constraints such as the level of technology, microcontroller reliability and the complexity of programming and interfacing. First, an intensive study is conducted to learn and observe the others circuit and devices used by similar projects and research projects conducted worldwide. From those technical studies of the circuit, schematic layout and components used, the suitable and most reliable circuits, components and peripheral interfacing method are modified and applied to this project electronics stage.

3.2.4 Main Circuit - 40-Pin 8-Bit CMOS FLASH Microcontrollers

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The PIC16F877A is useful as a reference device because it has a minimal instruction set but a full range of peripheral features. The general approach to microcontroller application design followed here is to develop a design using a chip that has spare capacity, and then later select a related device that has the set of features most closely matching the application requirements. If necessary, we can drop down to a lower range (PIC10/12 series), or if it becomes clear that more power is needed, we can move up to a higher specification chip (PIC18/24 series). This is possible as all devices have the same core architecture and compatible instructions sets. The most significant variation among PIC chips is the instruction size, which can be 12, 14, or 16 bits. The A suffix indicates that the chip has a maximum clock speed of 20 MHz, the main upgrade from the original 16F877 device. These chips can otherwise be regarded as identical, the suffix being optional for most purposes. The 16F877A pin-out is seen in Figure 3.2 and the internal architecture in Figure 3.3. The latter is a somewhat simplified version of the definitive block diagram in the data sheet.

PIC16 Microcontrollers features:

- MCU features
- Program execution
- RAM file registers
- Other PIC chips

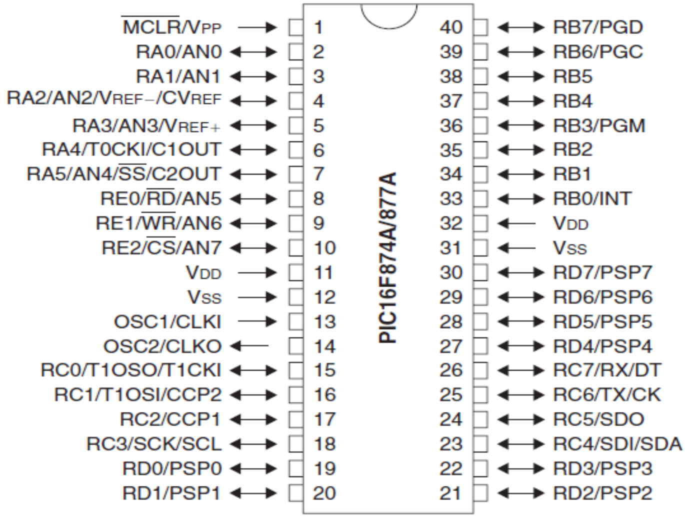

Figure 3.2: 16F877 pin-out

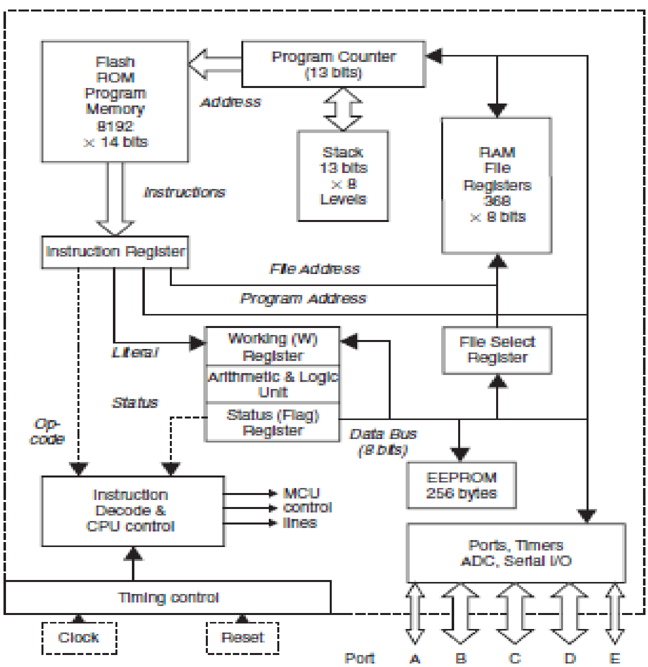

Figure 3.3: PIC16F877 MCU Block Diagram

- Program Execution

The chip has 8 k (8096 x 14 bits) of flash ROM program memory, which has to be programmed via the serial programming pins PGM, PGC, and PGD. The fixed-length instructions contain both the operation code and operand (immediate data, register address, or jump address). The mid-range PIC has a limited number of instructions (35) and is therefore classified as a RISC (reduced instruction set computer) processor.

Looking at the internal architecture, we can identify the blocks involved in program execution. The program memory ROM contains the machine code, in locations numbered from 0000 h to 1FFFh (8 k). The program counter holds the address of the current instruction and is incremented or modified after each step. On reset or power up, it is reset to zero and the first instruction at address 0000 is loaded into the instruction register, decoded, and executed. The program then proceeds in sequence, operating on the contents of the file registers (000 – 1FFh), executing data movement instructions to transfer data between ports and file registers or arithmetic and logic instructions to process it. The CPU has one main working register (W), through which all the data must pass.

If a branch instruction (conditional jump) is decoded, a bit test is carried out; and if the result is true, the destination address included in the instruction is loaded into the program counter to force the jump. If the result is false, the execution sequence continues unchanged. In assembly language, when CALL and RETURN are used to implement subroutines, a similar process occurs. The stack is used to store return addresses, so that the program can return automatically to the original program position. However, this mechanism is not used by the CCS C compiler, as it limits the number of levels of subroutine (or C functions) to eight, which is the depth of the stack. Instead, a simple GOTO instruction is used for function calls and returns, with the return address computed by the compiler.

3.2.5 RF Controller Configuration and Function

RF controller as shown in Figure 3.4 is a master of the collection, memory, display and transmission of vehicle's information and it is also the core component of traffic information collection subsystem. RF controller has included some basic components, including microprocessor, flash memory, EEPROM, SRAM, LED display, 5 LED display and 4 COM ports (COM 1 is a TCP/IP COM which communicate with PC; COM 2 is a serial port for RS485 devices; COM 3 is a serial port for RS232 devices; COM 4 is for downloading program or for RS232 devices).

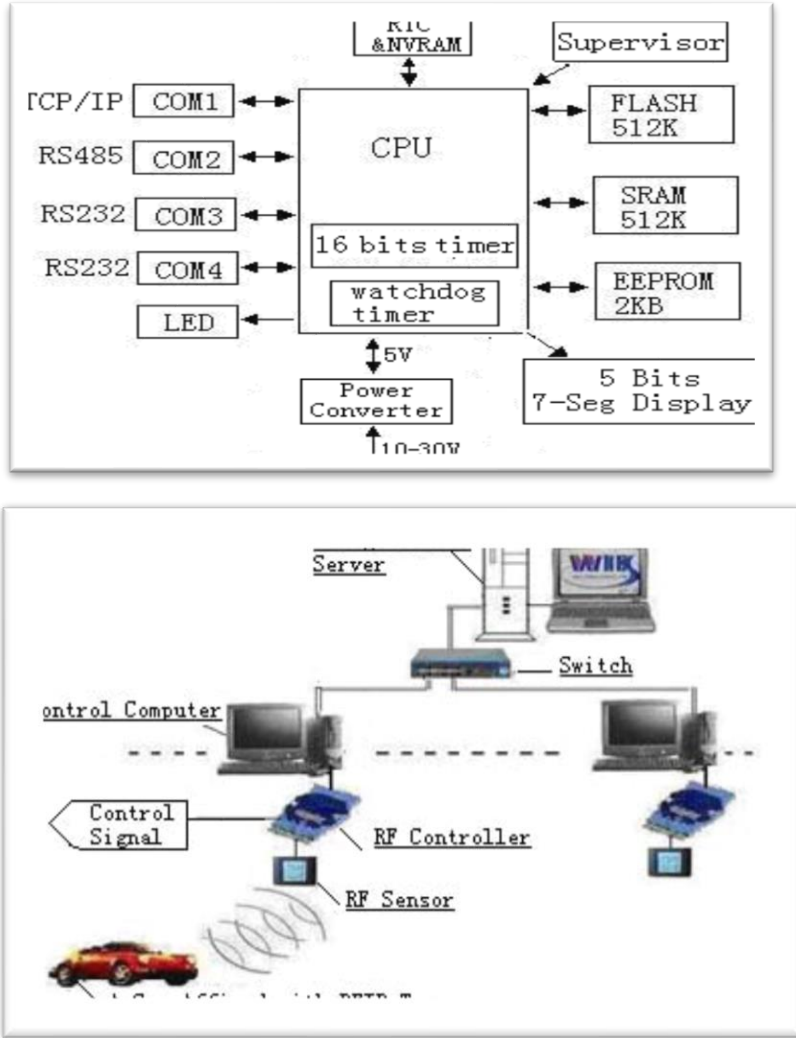

Figure 3.4: Framework of RF Controller

3.2.6 Liquid Crystal Display 16x2

The LCD is now a very common choice for graphical and alphanumeric

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displays. The range is from small, 7-segment monochrome numerical types such as those used in digital multimeters (typically 3x89 digits, maximum reading 1.999) to large, full colour, high-resolution screens which can display full video. Here we shall concentrate on the small monochrome, alphanumeric type which displays alphabetical, numerical and symbolic characters from the standard ASCII character set. The LCD as shown in Figure 3.5 has been chosen to perform the display to the bus passengers.

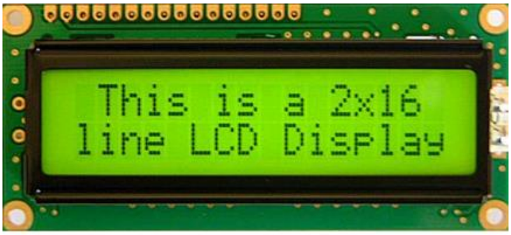

Figure 3.5: LCD 16x2

3.3.7 Programming Design

MPLAB® X IDE is a software program that runs on a PC (Windows, Mac OS, and Linux) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers.

MPLAB® X Integrated Development Environment brings many changes to the PIC® microcontroller development tool chain. Unlike previous versions of MPLAB® which were developed completely in-house, MPLAB® X is based on the open-source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily while also providing us with a much more extensible architecture to bring you even more new features in the future. Figure 3.6 shows the Flow chart of programing MPLab.

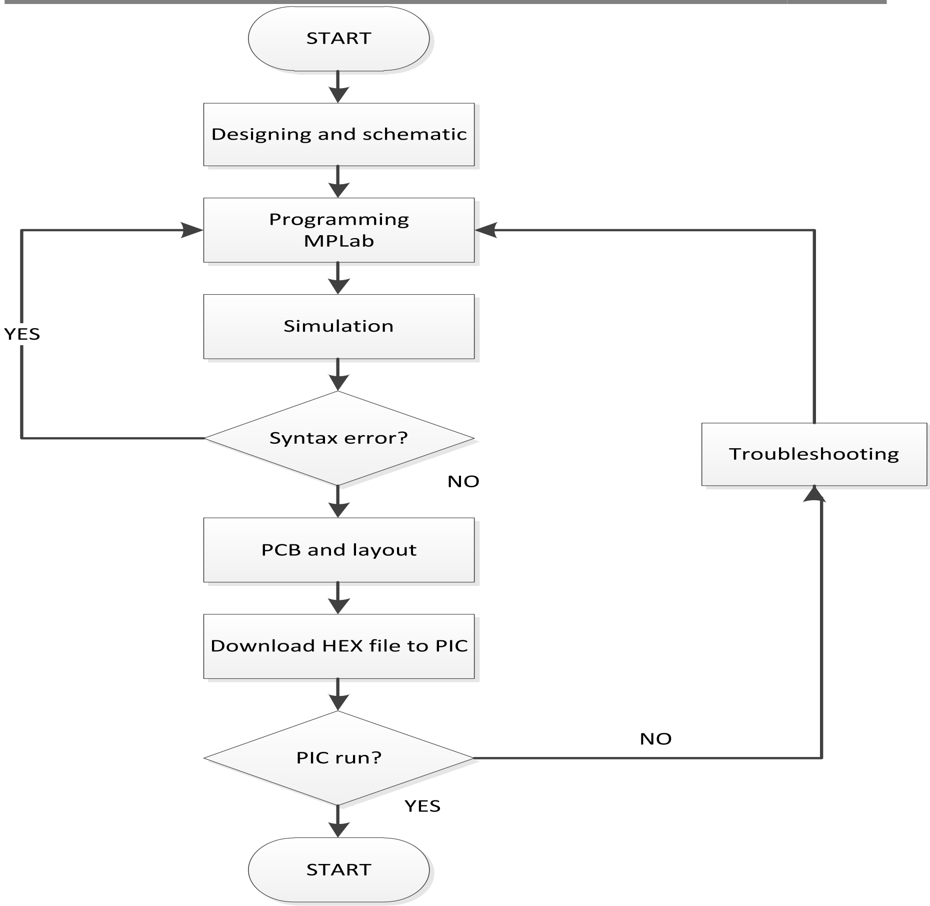

Figure 3.6: Flow chart of programing MPLab

3.3 RESULTS AND DISCUSSION

3.4.1 Introduction

Once the bus arriving at the bus terminal, the circuit ID of the bus will send data from sensor ID TX to the main circuit at Terminal Bus by receive from the sensor ID RX. The main circuit will trace the data and displayed the information from the bus through the LCD and passenger will get the information of arriving bus through LCD. LCD will display the correct bus registration number and bus company names. The information on the LCD will be captured for three different buses information and it will be

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refreshing at certain time. The passenger able to get the correct information of the bus from the LCD display and helps them to manage the time well. Figure 3.7 shows the block diagram of Smart Bus Terminal.

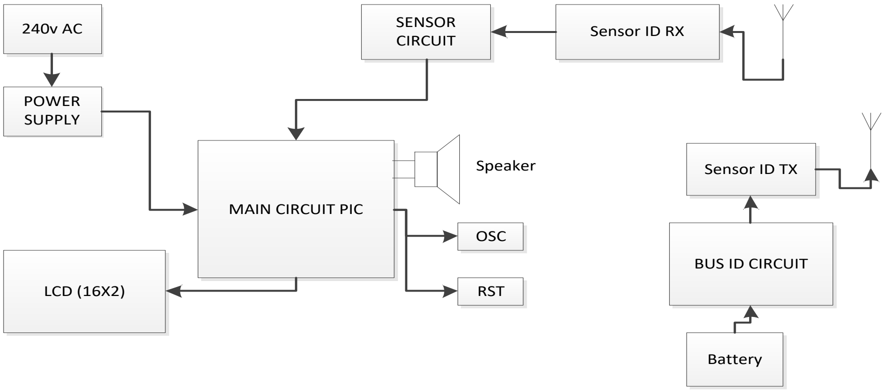
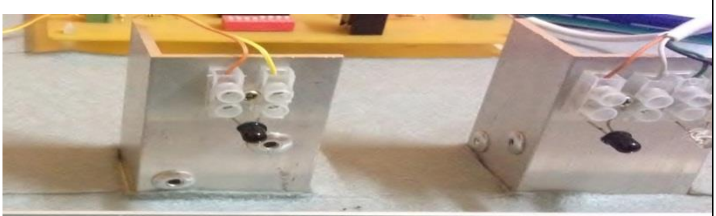


Figure 3.7: Block diagram of Smart Bus Terminal

3.4.2 Overall Circuit

Figure 3.8 shows the overall circuit design that have been used in this project.

CIRCUIT	PICTURES
Bus Terminal Circuit	
ID Sensor	

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Bus ID circuit	

Figure 3.8: Overall circuit design

3.4.3 Flowchart of the system

Figure 3.9 shows the flowchart of overall system

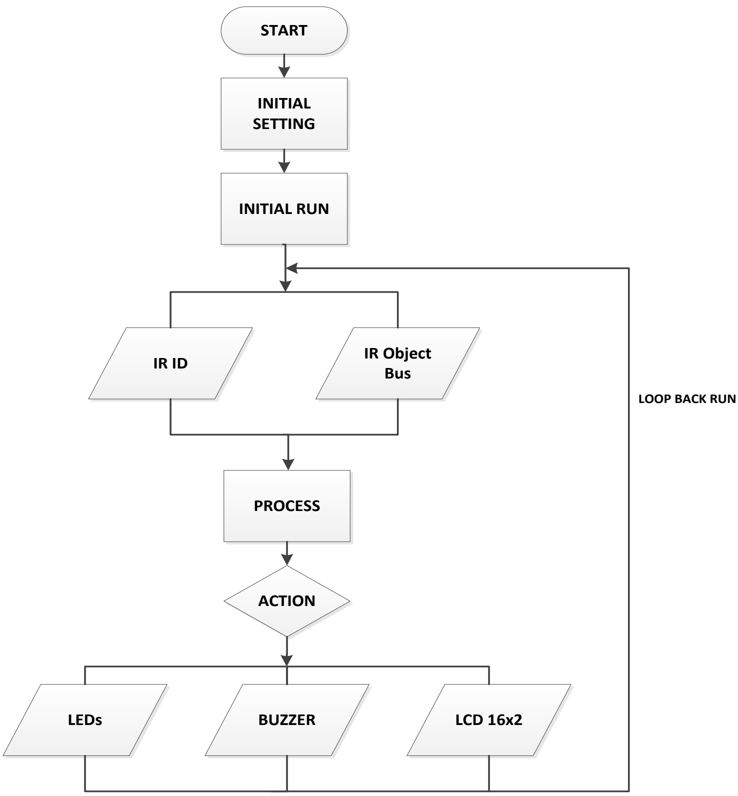

Figure 3.9: Flowchart of overall system

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3.3.4 Process of the system

Figure 3.10 shows the process of the system run.

STEP	PROCESS	PICTURES
1	Start of process	
2	Initial Setting	
3	Initial Run	
4	IR ID IR Object Bus	 

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5	Process	 
6	Action : - LEDs - Buzzer - LCD	 

Figure 3.10: Process of the system run

3.3.5 How the systems run?

The unit will be power on by the 240VDC as the start of the process as shown in Figure 3.11. The 2 LEDs light on determine the system is recognized the setting (initial setting process).

Figure 3.11: Initial Setting

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The initial run shows the LCD display 'STATION 1 – NO BUS', means that the system shows no detection of the bus at the terminal or main circuit (Figure 3.12).

Figure 3.12: Initial Run

The IR Receiver at 1 received the information data from IR transmitter (red circle) show the bus ID configurationis detected. Different ID configuration will be set at different buses. The LEDs light on shows the information data is sending (yellow circle) to the circuit using the configuration and calculation made by the microcontroller (Figure 3.13).

Figure 3.13: BUS ID configuration

The IR sensor set at 2 received information data from IR transmitter (red circle). Figure 3.14 shows the bus ID registration number and bus ID company name on the LCD.

Figure 3.14: BUS ID confirmation data

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The final action needs synchronization between ID transmitter and ID receiver at (1 and 2) to shows the actual result on LCD display. The LEDs light on shows output is successful and complete the process run of the system (Figure 3.15-Figure 3.17). The action will be repeated for the next two buses with the different output on LCD display.

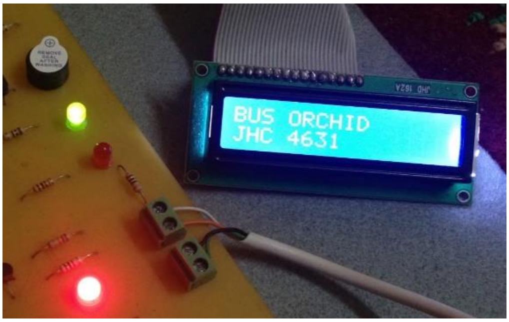

Figure 3.15: Result for one bus – Bus Orchid

Figure 3.16: Result Bus KKKL

Figure 3.17: Result Bus Budaya

3.4.6 Circuit Design

Figure 3.18 – Figure 3.23 shows the main circuit design, LCD block application circuit, bus circuit ID, IR sensor circuit, IR sensor pin identification and IR sensor reflection, respectively.

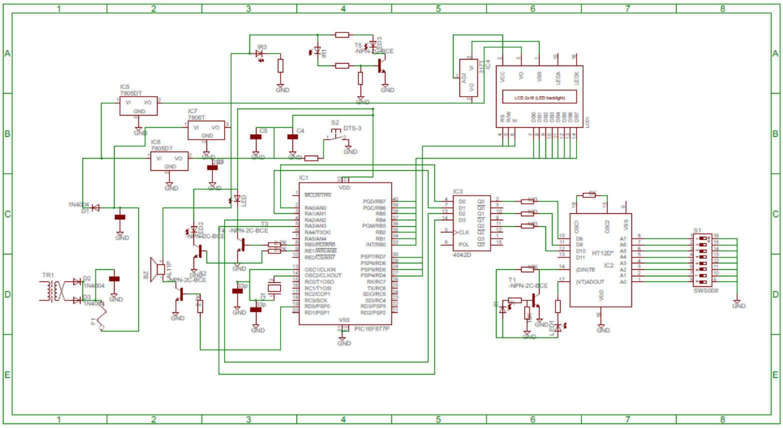

Figure 3.18: Main circuit design

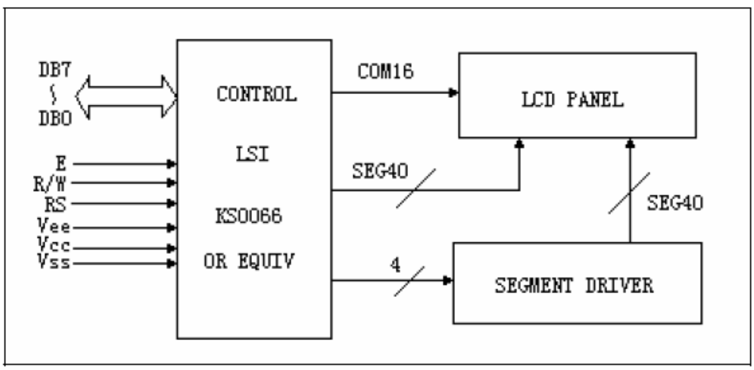

Figure 3.19: LCD block application circuit

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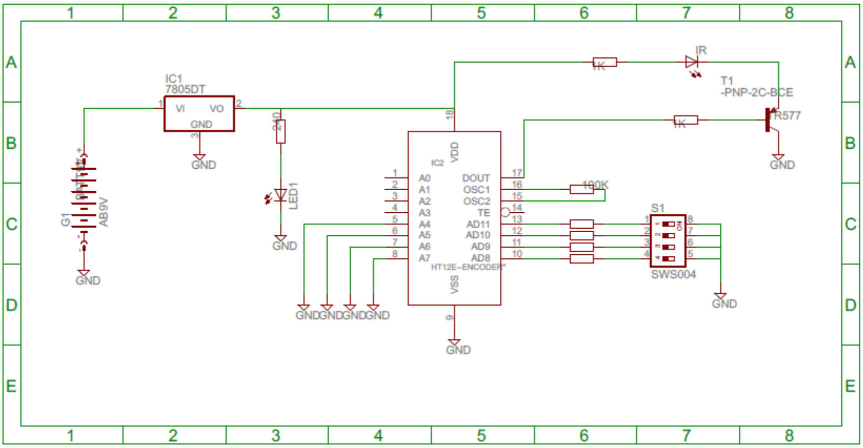

Figure 3.20: Bus circuit ID

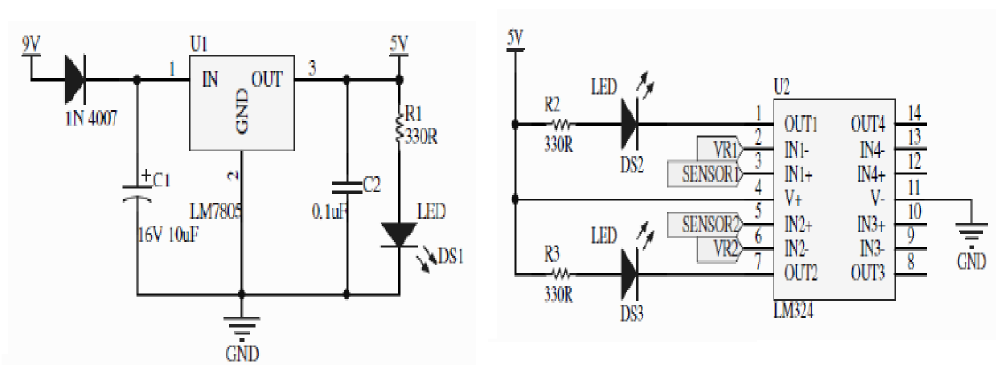

Figure 3.21: IR sensor circuit

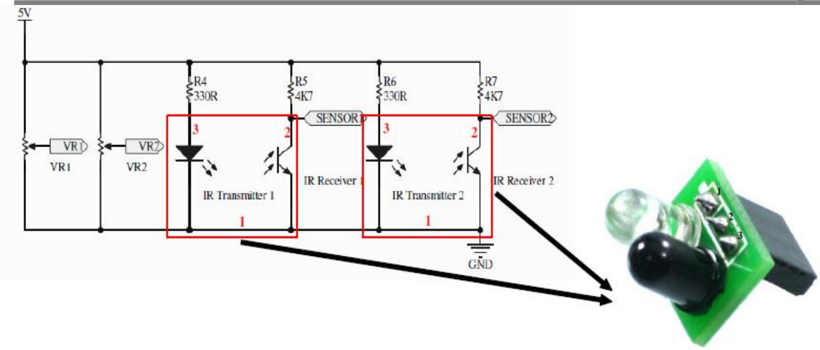

Figure 3.22: IR sensor pin identification

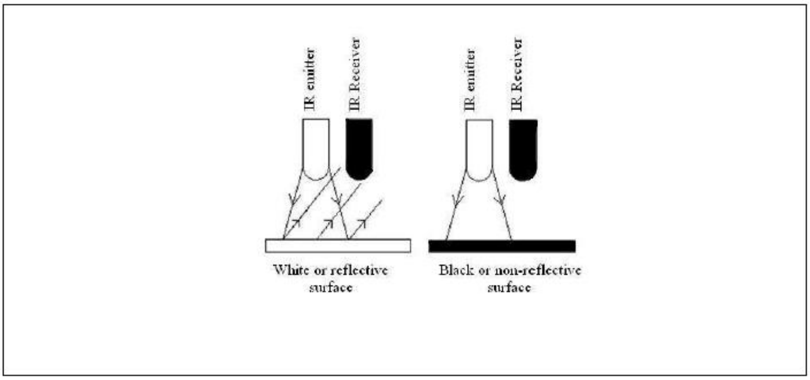

Figure 3.23: IR sensor reflection

3.5 CONCLUSION

Infrared is the system that can identify the targets and exchanges information based on the mode of non-contact, wireless and two-way communication. Because of its obvious advantages, it is widely adopted in ITS. RF controller is the core of intelligent traffic information collection subsystem. Under the control of the RF controller, the ITS realizes the information communication between vehicles and system. RF controller, establishing a platform of basic data for intelligent traffic information, is the pivotal technology for infrared being utilized in ITS successfully.

Concisely, this design adopted a new kind of method, with MCU combined with infrared and transceivers it to based automatic station-report function with multi-ID buses movement monitoring system. Both modules need to be configured correctly to obtain the most efficient monitoring frame work. It can carry on the effective management to the public transportation vehicles in the most convenient way to the suffered passengers. It has many extra possibilities, with considerable prospects for putting it on the market.

As for the future works, focus will be on designing of centrally monitoring server-based system by which the positioning data base of all the tracked vehicles could be examined. This would be help full to realize the station terminal as well as the factors effecting on well-organized monitoring system. For the purpose being, the magic of GSM technology will be suggested to utilize.

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