UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRIK

FINAL YEAR PROJECT REPORT 1

DESIGN AND DEVELOPMENT OF OUTDOOR TIME DISPLAYING SYSTEM

AHMAD BUKHARI BIN ABDUL MUJID

B011210206

BACHELOR OF MECHATRONIC ENGINEERING

I declare that this report entitle "Design and Development of Outdoor Time Displaying System" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any degree.

Signature : .....

Name :.....

Date :.....

DESIGN AND DEVELOPMENT OF OUTDOOR TIME DISPLAYING SYSTEM

AHMAD BUKHARI BIN ABDUL MUJID

A report submitted in partial fulfillment of the requirements for the degree of Mechatronic Engineering

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2016

" I hereby declare that I have read through this report entitle "Design and Development of Outdoor Time Displaying System" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering(Mechatronic Engineering)"

Signature : .....

Supervisor's Name : DR. MUHAMMAD HERMAN JAMALUDDIN

Date : 21/6/2016.

Acknowledgement

Allhamdullilah praises to the Allah, the compassionate one yet merciful for giving me the opportunity and strength to complete this report within allocated time given.

We could not mere grateful to Universiti Teknikal Melaka (UTeM) as it allow us to pursue the Bachelor of Mechatronic Engineering in this very own university and to be UTeM graduate.

Many efforts have poured down to this report. However, it would have not been completed without the support and help from individual and organization. First, I would like to thank my parent for giving me strength and support to complete this report. Without their support I would have been stuck for a long time during completing the report.

Second, I would like to thank my advisor and guidance which is Dr. Muhammad Herman bin Jamaluddin. Without his guidance I would really lost to complete this project.

Last but not least I would like to thank all my friend that have been giving me support and guidance in order to complete this report. They help really make a difference for me as it is very helpful.

Abstract

This project highlight a solution and design and development outdoor time displaying system by using microcontroller concept. Time is important to make proper schedule so that there is no regret after what activities were done. In university, punctuality is important for students and staff, so that they can don't waste each other time. University Teknikal Malaysia Melaka does not has reference time for their students and staffs. This is one of the reasons why they come late to the lecture. The main objective of this project is to create outdoor time displaying system with reference time. When the objective is achieved, the students and staffs can be more punctual and can save their time. The method that will use to create the project is designing outdoor time displaying system that is waterproof and can stand UTeM environmental temperature and big enough for people around Fakulti Kejuruteraan Elektrik (FKE) to see. This design also displaying the current time by using Global Positioning System (GPS) module. The energy can be save by using microcontroller to adjust light emitting diode (LED) brightness using light dependent resistor (LDR) and heat sensor. Finally, the project should make the audience more discipline on their activities and cherish their time. Hence, the problem of punctuality can be minimized.

Abstrak

Projek ini menekankan reka bentuk dan menghasilkan sistem paparan masa di kawasan luar dengan menggunakan konsep pengawal mikro. Masa adalah penting untuk membuat jadual yang betul supaya tidak ada penyesalan selepas apa aktiviti telah dilakukan. Di universiti, ketepatan masa adalah penting untuk pelajar dan kakitangan, supaya mereka tidak membuang masa masing-masing. Universiti Teknikal Malaysia Melaka tidak mempunyai masa rujukan untuk pelajar dan kakitangan mereka. Masalah ini antara sebab-sebab mengapa mereka datang lewat ke kuliah. Objektif utama projek ini adalah untuk mewujudkan masa luar sistem memaparkan dengan masa rujukan. Apabila matlamat dicapai, pelajar dan staf akan lebih menepati masa dan boleh menjimatkan masa mereka. Kaedah yang akan gunakan untuk membuat projek ini adalah mereka bentuk masa yang memaparkan sistem luar yang kalis air dan tahan kepanasan di persekitaran UTeM dan cukup besar untuk seluruh warga melihat jam di Fakulti Kejuruteraan Elektrik (FKE). Reka bentuk ini juga memaparkan masa semasa dengan menggunakan Sistem Kedudukan Global (GPS) modul. Tenaga yang boleh berjimat dengan menggunakan pengawal mikro untuk mengubah kecerahan diod pemancar cahaya (LED) menggunakan cahaya kecerahan perintang (LDR) bergantung dan sensor haba. Akhirnya, projek ini perlu membuat disiplin penonton lanjut mengenai aktiviti-aktiviti mereka dan menghargai masa mereka. Oleh itu, masalah ketepatan masa dapat dikurangkan.

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	ABSTRACT	**ii-iii**
	TABLE OF CONTENT	**iv**
	LIST OF TABLES	**vi**
	LIST OF FIGURES	**v**
1	**INTRODUCTION**	**1**
	1.1 Motivation	2
	1.2 Problem Statement	2
	1.3 Objectives	3
	1.4 Scopes	3
2	**LITERATUE REVIEW**	**4**
	2.1 System Architecture	4
	2.2 LED characteristic and parameters	8
	2.3 Programmable Integrated Circuit	9
3	**METHODOLOGY**	
	3.1 Project Overview	12
	3.2 System Model	13

	3.3 Physical Model	14
	3.4System Operation	15
	3.5 Experimental Set Up	16
	3.6 Project Development	23
4	**RESULT AND DISCUSSION**	
	4.1 Solidwork	25
	4.2 Microcontroller Programming	28
	4.3 GPS and PC time differentiation	30
	4.4 Design and Integrate the software	35
	4.5 Analysis of the LED brightness	37
5	**CONCLUSION AND RECOMMENDATION**	
	5.1 Conclusion	40
	5.2 Recommendation	41
	REFERENCES	**42**
	APPENDICES	**44**

LIST OF TABLES

TABLES	TITLE	PAGE
Table 4.1	Time difference between PC and GPS	32
Table 4.2	Current based resistor	37
Table 4.3	Brighness of LED based on PWM	38

LIST OF FIGURES

FIGURES	TITLE	PAGE
Figure 2.1	Schematic diagram of wireless control system	4
Figure 2.2	Block diagram of Smart LED Display Boards system	5
Figure 2.3	Block diagram of LED display Board for advertisement using microcontroller	6
Figure 2.4	LED electronic symbol	7
Figure 2.5	Block diagram of the smart data logger with an external watchdog circuit built using ATtiny13	8
Figure 2.6	Relationship between relative light intensity and temperature	9
Figure 2.7	Block diagram of asynchronous 8051 microcontroller core, A8051	10
Figure 3.1	System architecture based microcontroller block diagram	13
Figure 3.2	Outdoor Displaying System Case	14
Figure 3.3	System overview block diagram	15
Figure 3.4	Driver Board	20
Figure 3.5	LED Board	21
Figure 3.6	GPS Board	22
Figure 3.7	Flowchart of the project development	23-24
Figure 4.1	Digital outdoor clock casing	25
Figure 4.2	Top view of the circuit casing	26

Figure 4.3	Dimension of the width of the casing	27
Figure 4.4	Side view of the casing	27
Figure 4.5	GPS Information	28
Figure 4.6	Programming process flowchart	29
Figure 4.7	Time difference between GPS and PC	30
Figure 4.8	Time PC based	31
Figure 4.9	Driver board circuit schematic	35
Figure 4.10	Driver Board and GPS Board Hardware	36
Figure 4.11	Brighness of LED based on PWM	39

Chapter 1

INTRODUCTION

As the technology rapidly growth and keep in advance due to time, so does in manufacturing of electronic. Most of the mankind want a easier life or minimizing their problem. As the life is rapidly busy nowadays, this time need to use smartly as possible. However, they does not use their time properly as many activities need to be done. Hence, they always need some device to remind them about time. In any university in Malaysia or event around the world, there are very few of outdoor time displaying system. One of it is in Universiti Teknikal Malaysia Melaka. In campus, the lecture mostly start at 8.00 am. However, there is a lot of students in this campus does not take this as a serious matter. This is because the students does not notice the actual time they are in. Thus, by showing them current time will warn and notify them that they late to attend the class or program. Therefore, this thesis proposes to design and develop the outdoor time displaying system. The proposed method will deliberates the vision of the time displaying which campus student and staff can see at any type of weather. The organization of this paper is as follows. The control methodologies of adjusting real time on UTEM in section II. Then, the integration method of the lightning effect with the light dependence resistor and heat resistor considering the vision is proposed. Subsequently, in section III, the experimental procedures to evaluate the systems effectiveness are explained. Additionally, the performance of the proposed method is discussed based on the obtained experimental results. Finally, section IV concludes the outcome of this paper.

1.1 Motivation

Time very important for student to success for their lives. Time management very important so that student can spend their time in brilliant way. However student around the world has less punctuality to arrive at promised time. Time management is used for us to plan schedule and to be more punctual, especially for student at UTeM. UTeM's student always come late during class, exam and meeting. This is because they are lack in discipline doesn't have revision time to follow. The reference time used by the student and the staff were difference. So, they were some gap time and argument between them. This reason make the student lot of knowledge since they came late. This project also useful to increase the basic knowledge of the microcontroller. Since the project bring benefit to UTeM student and staff, this project suitable to be proposed.

1.2 Problem statement

The digital clock display time at Greenwich which show the different time in 8 hours using Global Positioning System (GPS). The design of the project to be proposed need to big enough and protect the circuit from external disturbance such as weather and eternal force acted on the circuit. The size of outdoor clock as need to be big enough for surrounding passer-by person able to view. The sensor of the temperature sensor and LDR need to sensitive enough, so that the brightness of the LED can be adjusted by the microcontroller to save the energy.

1.3 Objective

1. To design a microcontroller-based real-time digital displaying system.

2. To simulate the digital displaying system's circuit using software simulation.

3. To analyze the performance of the digital display system according to its functionality.

1.4 Scope and limitation

The scope of this project is to build an outdoor time displaying system that will properly function according to the objective. The project will use a light dependence resistor and heat sensor as sensors with integrated circuit (IC) to save energy. The project will be designed and created which is viewable and clearly to see by the passer-by. The project will also display the current time to make the passer-by alert to their precious time.

Chapter 2

LITERATURE REVIEW

2.1 System architecture

Referring to [1], the project use microcontroller-based wireless real-time LED display control system mainly consist of a wireless transmission module nRF24E1, AT89S52 MCU of ATMEL Corporation, driver board and LED display. The instruction received by receiver module and transmits it to the microcontroller, where the instructions were processed, then drive it to the wireless control LED display.

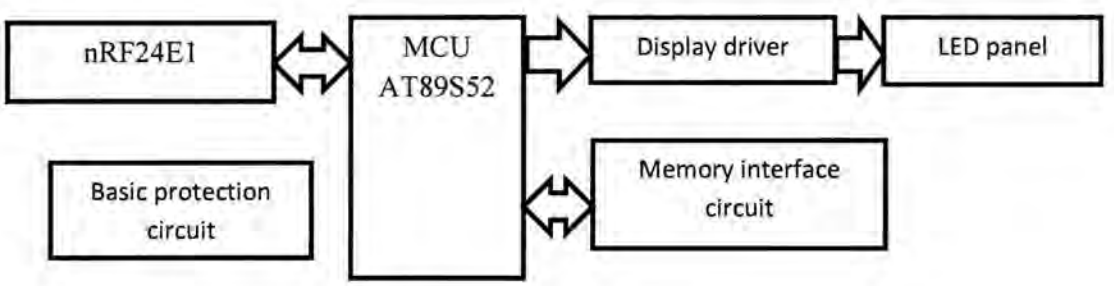

Figure 2.1 Schematic diagram of wireless control system

Based on [2,3], the AT89S52 microcontroller from Atmel used. The GSM receiver receive Short Message Service (SMS) validates the sending Mobile Identification Number (MIN) and display the desired information. The system is easy and less error and maintenance.

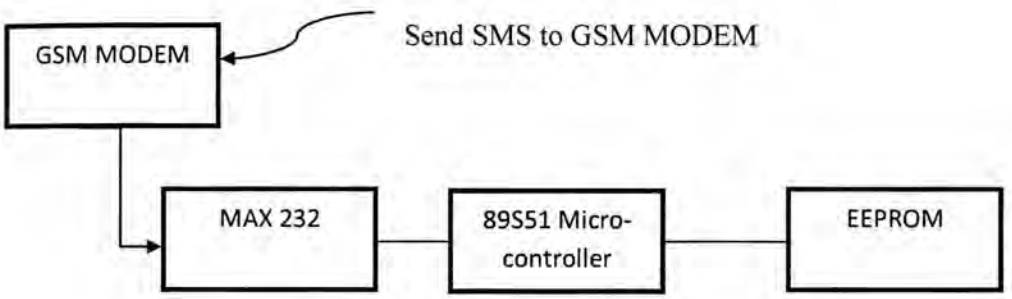

Figure 2.2 Block diagram of Smart LED Display Boards system

The LED display system consist of a Global Service for Message (GSM) receiver and a display toolkit which can be programmed from authorized mobile phone. The GSM receiver receive Short Message Service (SMS) validates the sending Mobile Identification Number (MIN) and display the desired information. The system is easy and less error and maintenance.

Project [4] is display message on 16 x32 LED matrix. The concept is when power is on, the LED display board is shown message and the performed in animation according to the rhythm music. The PIC 16F887 was used for this project and written with PIC Basic Pro Programming Language. The system block diagram as Figure 2.3

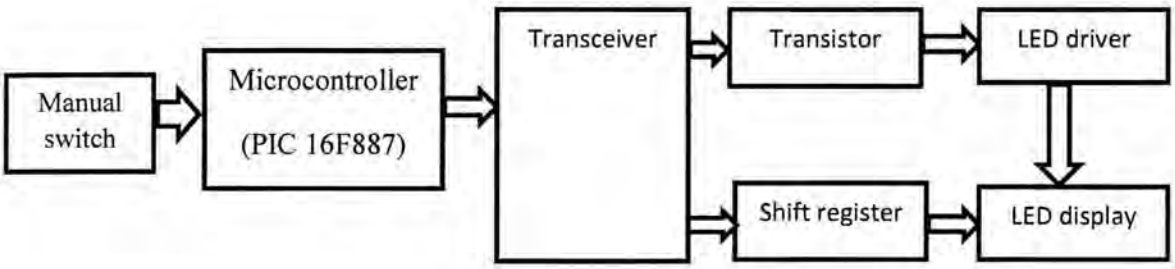

Figure 2.3 Block diagram of LED display Board for advertisement using microcontroller

The Figure 2.4 based on [9] has two microcontrollers, ATmega128 and ATtiny13 two serial ports (RS-232) to connect to the modem data communications jacks, 1 GB of available memory capacity, relays that can be activated remotely; eight channels of analog and digital inputs an integrated signal conditioning circuit , LCD display and external watchdog circuits.

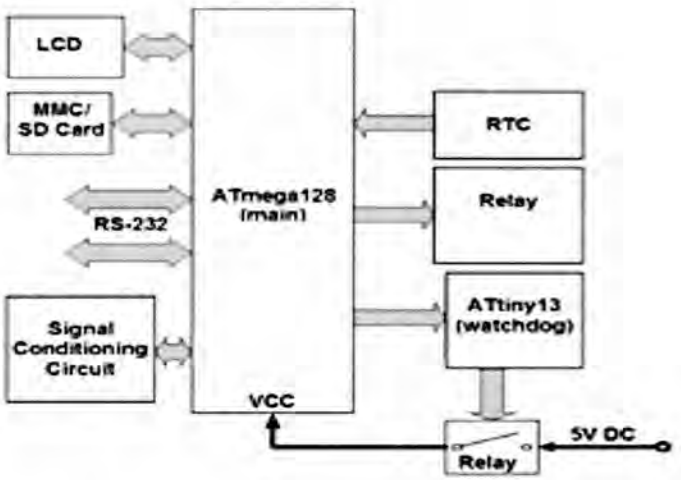

Figure 2.4 Block diagram of the smart data logger with an external watchdog circuit built using ATtiny13

The microcontroller become the brain of the system and it also becomes the watchdog and serve for monitoring the microcontroller whether the microcontroller active or not. The LCD will display the desired image program in the IC and the relay can be use as the switch. The RS-232 is the cable that will be used to connect the system to the main source such as PC.

From the referring block diagram the system use nRF24E1 and GSM MODEM as the data receiver, for the time purpose project, the project that will be proposed will use GPS since the GPS show time accurately receive from the satellite.

2.2 LED characteristic and parameters

LED has two terminal device that is anode and cathode. The electronic symbol is as Figure 2.5

-

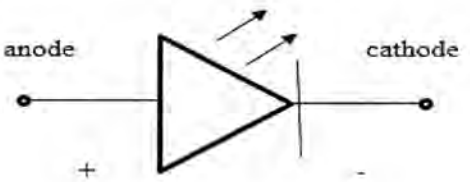

Figure 2.5 LED electronic symbol

In electronic circuit, the anode terminal need to connect to the high potential end and cathode is opposite, that is at low potential end. This forward bias make the voltage of two end of the LED remain constant [5]. The reverse bias make weak reserved current flow through the LED and if reverse current increase, then, the LED may loss one-way conductivity. The connection of LED will in forward bias position to make the LED undamaged and prolong the LED usage.

The relationship between relative light intensity and temperature related to the long lasting LED can be shown in [6] Figure 2.6

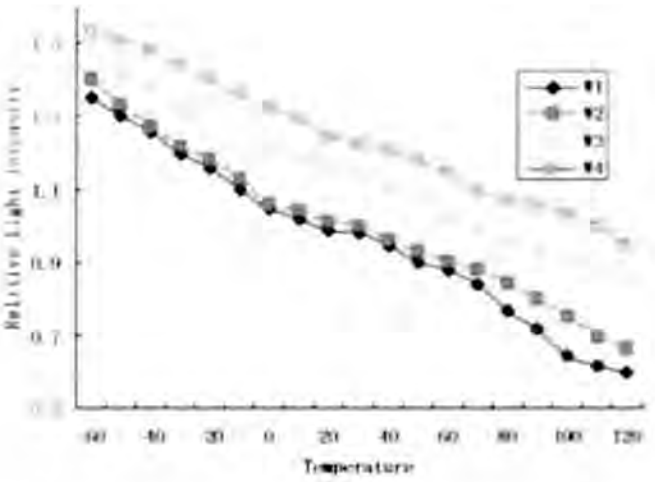

Figure 2.6 Relationship between relative light intensity and temperature

Refer to the Figure 2.6, the graph show that relative high intensity is inversely proportional the temperature. Hence, the LED performance increase when the surrounding temperature decrease. However, to avoid the outdoor lightning that may hurt people eyes, the brightness need to be adjusted. For the project to be proposed, the normal light intensity of the LED will be at 1.0 based on Figure 2.6 since the temperature outside is about 35 degree celsius. However, The project will use microcontroller to adjust the brightness based on the temperature and the light intensity of the surrounding.

2.3 Programmable Integrated Circuit

In this part, many type of integrated circuit like MCU AT89S52, 89S51, AT89S52, PIC 16F887 and SH-7144F will be discussed of what are their uses for this research.

The system use two parts: control part and receiving part. The receiving part receive wireless communication instruction via modulenRF24E1, then converted it into the control unit. The AT89S52 MCU will drive LED display based on received command.

The architecture of the S8501 and A8501 in [7] and [8] as follows:

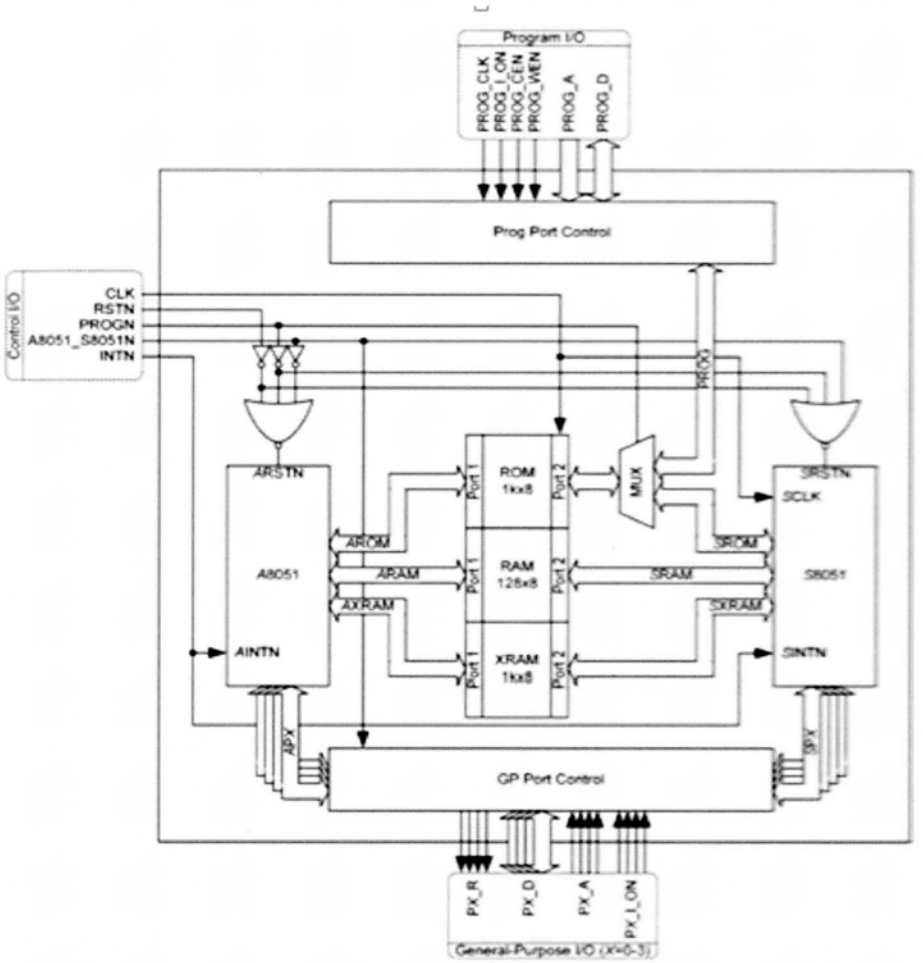

Figure 2.7: Block diagram of asynchronous 8051 microcontroller core, A8051

Figure 2.7 shows the architecture of ,the DC8051 S8051 and proposed A8051, and the shared embedded 1 kB ROM (read-only memory for program), 128 B RAM (random-access memory for data), and 1 kB XRAM (external random-access memory for data). The and also share three groups of inputs and outputs: the control I/O (main control signals), program I/O (programmable and debug signals), and general-purpose I/O (general-purpose input/output signals). They also share two controller blocks: the Programmable Port Control (programmable port) and the GP Port Control (general-purpose port controller). Programmable Port Control allows the initialization of the on-chip ROM by means of an off-chip mnemonic programmer (through the program I/O) during power-up

Based on [2,3], the AT89S52 microcontroller from Atmel used. This microcontroller provides all the functionality of the display and wireless control. The LED display system consist of a Global Service for Message (GSM) receiver and a display toolkit which can be programmed from authorized mobile phone. The GSM receiver receive Short Message Service (SMS) validates the sending Mobile Identification Number (MIN) and display the desired information. The system is easy and less error and maintenance.

The microcontroller PIC16F877 features 256 bytes of EEPROM data memory, self-programming, an In-Circuit Debugger (ICD), 8 channels of 10-bit Analog-to-Digital converter (ADC), 2 additional timers, 2 capture/compare/PWM functions, 2-wire Inter-Integrated Circuit (IIC) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

Based on [9] ATmega128 is chosen as a main microcontroller with consideration of how the capabilities and specifications of the chip are matched with the requirements of the data logger, as well as whether or not the chip is easily obtained. The main considerations are that the ATmega128 has 128 kilobytes ROM and 4 kilobytes of internal SRAM, which is enough to perform the complex features of the smart data logger. ATtiny13 is chosen as a slave or watchdog microcontroller because it is a low-cost and low-power microcontroller that has 1 kilobytes of ROM and 64 bytes of internal SRAM. These specifications are enough for the ATtiny13 to perform as an external watchdog microcontroller.

The microcontroller PIC16F877 is suitable for the design and development of outdoor time display since concept and the suitable pin are present. However all the microcontroller mention can be used since the project that will be design used the low memory and basic controller port. In the project the microcontroller used will be 89LPC952 since the IC is easy achieved and not outdated.

Chapter 3

METHODOLOGY

3.1 Project Overview

The aim of this project is to create outdoor time displaying system with reference time. The dimension of the project is about the size of outdoor clock at Menara Maxis, Kuala Lumpur. The scale of the project is suitable to view around the FKE. Secondly, the other aim for this project is to make the outdoor clock display current time at of Melaka so that the student can take it as reference time. The GPS module will use to take time running. The Global Positioning System (GPS) module take can refer time and location of the Greenwich. The programmable integrated circuit can adjust the time since it has 8 hour difference. The sensor that will be use is to save energy by controlling LED brightness. The sensor that will be use are LDR and heat sensor. The LDR detect the light and the programmable integrated circuit will adjust the LED brightness depend on the environment brightness. The heat sensor will be use to detect heat and make the programmable integrated circuit adjust the brightness depend on surrounding temperature.

The focus in this project is to design an outdoor time displaying system microcontroller based system. This microcontroller can change the time display and the brightness of the LED.