

**GSM/ZIGBEE COMMUNICATION DEVICE AND
DISPLAY SYSTEM**

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Special dedication to my loving family, all my siblings and my kind hearted supervisors Engr. Siti Aisyah binti Anas and Engr. Ranjit Singh A/L Sarban Singh and also my dearest friends.

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ABSTRACT

In this rapid evolution of telecommunication/information and communication Technology (ICT) environment, digital signage technology gains a lot of attention and the global market rises. In this society where information can come in any form, people acquire 90% of it visually; and this is done via various hardware and visual equipments. Electronic technology allows most of the applications to be controlled without moving an inch. By implementing electronic and communication technology together, control system applications become much more interesting. To deliver message effectively and at the same time being eco-friendly due to the social trend, this project is aiming at creating LED display information board using GSM technology and Zigbee technology. This system can replace the previous method of pasting information using papers which is not environmental friendly and system using wired entry which is time constraint and costly. The system is self-energized where the power supply for the whole system is from solar panels which absorb the sunlight. This system is controlled wirelessly by user no matter where the location of LED display board is. The message is typed in the mobile phone by user and send through GSM modem to the microcontroller. Microcontroller encrypts the message and sends to the LED display board to be shown to the public. ZigBee transmits and receives the message to be displayed in different display boards placed at different locations.

ABSTRAK

Dalam evolusi yang pesat bagi telekomunikasi/teknologi maklumat dan komunikasi (ICT) ini, banyak mengambil perhatian dan pasaran global naik. Dalam masyarakat ini di mana maklumat boleh dipapar dalam pelbagai bentuk, banyak orang memperoleh maklumat itu dengan 90% daripada visual dan ini boleh dilakukan melalui pelbagai perkakasan dan peralatan visual. Teknologi elektronik membolehkan kebanyakan aplikasi dikawal dengan tanpa bergerak seinci. Dengan melaksanakan teknologi elektronik bersama dengan teknologi komunikasi, aplikasi sistem kawalan menjadi lebih canggih. Untuk menyampaikan mesej secara berkesan dan mesra alam, projek ini bertujuan untuk mewujudkan paparan LED dengan menggunakan teknologi GSM and teknologi Zigbee. Sistem ini boleh menggantikan kaedah sebelumnya iaitu menggunakan kertas untuk menampalkan maklumat pada papan yang tidak mesra alam dan sistem yang menggunakan wayar menyebabkan kekangan masa dan mahal. Sistem ini menghasilkan tenaga diri sendiri di mana bekalan kuasa bagi keseluruhan sistem adalah daripada panel solar yang menyerap cahaya matahari. Sistem ini dikawal tanpa wayar oleh pengguna tidak kira di mana lokasi paparan LED. Mesej ditaip dalam telefon mudah alih oleh pengguna dan dihantar melalui modem GSM ke pengawal mikro. Pengawal mikro memudahkan mesej dan menghantar kepada paparan LED untuk ditunjukkan kepada orang ramai. Zigbee menghantar dan menerima mesej yang akan dipaparkan di paparan berbeza yang diletakkan di lokasi yang berlainan.

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LIST OF ABBREVIATIONS

GSM	-	Global System for Mobile Communication
SMS	-	Short Message Service
LED	-	Light Emitting Diode
IEEE	-	Institute of Electrical and Electronics Engineers
HVAC	-	Ventilation, and Air Conditioning
AMR	-	Automatic Meter Reading
AMI	-	Advanced Metering Infrastructure
WLAN	-	Wireless Local Area Network
LCD	-	Liquid Crystal Display
AC	-	Alternating Current
DC	-	Direct Current
DTE	-	Data Terminal Equipment
DCE	-	Data Communication Equipment
IC	-	Integrated Circuit
PIC	-	Peripheral Interface Controller
PCB	-	Printed Circuit Board

CHAPTER I

INTRODUCTION

1.1 OVERVIEW:

Global System for Mobile Communication (GSM) is one of the world's most popular platforms with its added value service, Short Message Service (SMS) and other applications. This is due to its user-friendly features and accessibility throughout the world. Since past decade, the usage of GSM has increased tremendously, and the concept of this communication platform is then being embedded into different systems and applications in order to streamline operations to get the ultimate result, which is cost and time saving.

To reap the benefits as mentioned, this project aims to apply SMS into another application, which is information display board. Light Emitting Diodes (LED) information display board is used due to its environment-friendly features. The overall idea of the system works in a way that messages that are intended to be shown will be sent through SMS typed on a mobile phone to GSM modem

and the message will be encrypted in the microcontroller and the information will be displayed on the LED board. ZigBee will be used as a device to transmit and to receive the messages from one main server to other information display boards.

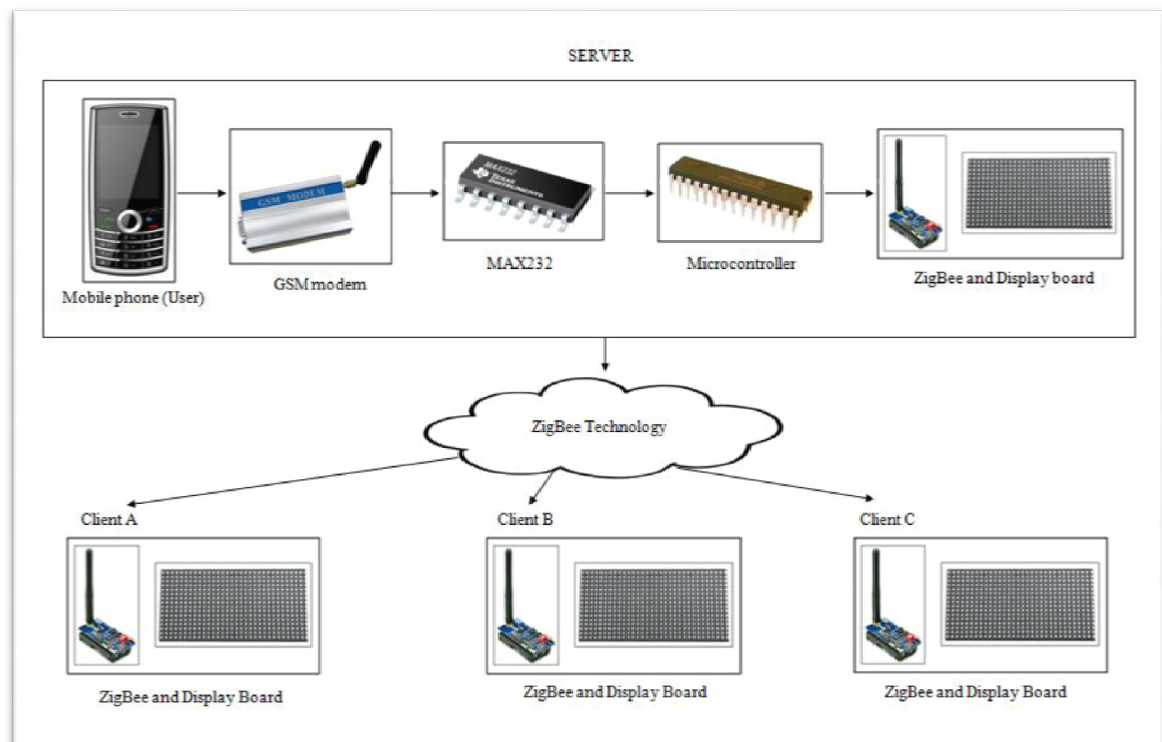


Figure 1.1: System Block Diagram.

The Figure 1.1 shows the architecture of the complete system for solar powered LED display board system. This system uses solar panel as its main energy source of power as another mean of saving the nature since the concern of protecting the environment has become more and more reflective among public. First of all, a message that is meant to be shown on display board is typed into mobile phone by the user. Next, the message is sent through GSM modem. MAX232 is the integrated circuit to be the intermediary between GSM modem and microcontroller. The message is encrypted by the microcontroller and the

information display board is updated accordingly. The message is sent using Zigbee technology to the other information display boards which are placed at different locations.

1.2 PROBLEM STATEMENT:

In the last time, information display boards are mostly paper-based before the invention of LED display board, and this has created inconvenience of showing the targeted people information during rainy days because the papers would be wet and wear out. Besides, it would be the possibility of the paper is not pasted on the board properly and dropped easily. After LED is introduced to the public, it is cleverly used to show information to public. However, again the problem arises when human resources, time and costs are wasted to change the information on display board placed at different locations one by one. Thus, this system is created to improvise the conventional method in such a way that the same messages can be sent to multiple LED display boards from one main system.



Figure 1.2: Manual Information Board.

1.3 OBJECTIVES:

The objective of this project is to create a device where competitiveness of message sending can be increased and will create immediate responsiveness. In this new era, the pace of technology advancement has reached a stage where real-time operation is very important. This means that the information can be transferred and received simultaneously and achieve real-time objective. Due to this reason, a real-time system for information display board is innovated to spread the message immediately to the public.

Second objective is to apply knowledge into advanced technology to create new device in communication field. New knowledge can be obtained in the process of designing and developing the proposed project where many researches about the particular areas have to be involved. The device such as LED display board, GSM modem, ZigBee and other component like microcontroller will be

discovered in details in order to complete the prototype development for this project.

The third objective is to create a device that is easy to use, convenient and save money. The idea of this project is initiated from previous some case study where engineers or technical staff is required to go to the location where the information board is placed, and if large amount of information board is used, it is troublesome to change the information one by one. Eventually, the delay occurrence is very high. To avoid this situation from occurring, a main system which is interconnected with all the subsystem is required. This provides convenience to the users as well as time saving and reduces costing, which are also focus elements of most of the companies.

1.4 SCOPE OF WORK:

- a) Solar panel collects radiant light or heat from the sun to allow self-energize for the whole system and energy source during night time.
- b) A SMS is sent by user using mobile phone.
- c) GSM modem is used as intermediate between the mobile phone and information display board for connection.
- d) ZigBee devices act as transmitter and receiver which are used for information sharing within certain distance.
- e) Information display board shows the message to be delivered by mobile phone.

1.5 THESES OUTLINE

This report is containing of six chapters. The description of each chapter is shown as follows:

Chapter one is the introduction of how the whole idea of this project is. This chapter contains five parts including overview, objectives, problem statements, scope of work and thesis outline. Each part describes the overall idea and explaining on every aspect of it, such as its viability, marketability, and how the system works.

Chapter two is the literature review where all the information is about all study conducted on similar projects as guidance to develop this project. This chapter is very important because it serves as a direction on whether everything works the way it should be and make sure that the system can work exactly or better than the previous researches if there is improvement on any part of the workflow. There will be a clearer understanding for the system used in this project from those information searched.

Chapter three is describing about the project methodology where the methodology to implement and investigate the proposed project described. The software and hardware methodology in the proposed project is included in this chapter as well as how they will be used effectively to achieve the optimum result.

Chapter four is explaining about the result and analysis with all the designs and coding is included in this chapter. The combination of software and hardware is done and tested to make sure that the system is functioning properly.

Chapter five is the last chapter which is explaining the conclusion and future work where it concludes the whole project that the objectives are achieved. Some recommendations for future work to develop this project are suggested for future references.

CHAPTER II

LITERATURE REVIEW

2.1 OVERVIEW

A literature review is a critical evaluation and discussion on published information in the research area. In this chapter, all the relevant literatures which are related to assumptions of study will be discussed. A thorough research for theories and methodology for this project has been done from different sources, such as internet, newspaper, and journals. This project emphasizes to use the Short Message Service (SMS) to send information through Global System for Mobile Communication (GSM). Besides, the information will be transmitted and received via Zigbee technology.

2.2 WIRELESS YECHNOLOGY

Wireless technology has replaced the situation where wires are no longer required for applications and mobility is deemed essential in operations [7]. The criteria for choosing a wireless technology include the following requirements [7].

- 1) Range
- 2) Reliability
- 3) Compliancy (standards)
- 4) Cost
- 5) Power consumption
- 6) Transmission rate

In the current market, the 3 most widely used wireless technologies include Zigbee, Wifi and Bluetooth. Below are the comparisons between the 3 technologies [8]:

Table 2.1: Comparison between ZigBee, WiFi and Bluetooth

Parameters	ZigBee	WiFi	Bluetooth
IEEE Standard	802.15.04	802.11.a/b/g	802.15.1
Nodes per Master	65535	32	7
Range (meter)	- 30m for indoor - 100m for outdoor	- 32m for indoor - 95m for outdoor	10m
Transfer Rate	250kbps	54Mbps	1Mbps
Battery Life	100-1000days	1-5days	1-7days
Cost	Low	High	Low
Power Consumption	125 to 400 μ W	Consumes more power	1mW-100mW
Reliability	High	Normal	High
Linking time	30ms	Up to 10s	Up to 3s