

TOWER BASE STATION SAFETY SYSTEM USING GSM TECHNOLOGY

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DEDICATION

Dedicated to my beloved father, mother, lecturers, and friends.

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Firstly, Alhamdulillah, praise to Allah S.W.T for giving me a continuous strength to complete the FYP successfully.

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ABSTRACT

Wireless technology has already become an important application which usually integrated to wide range of device and other technologies. The enhancement provided by the wireless technology gives the ease of control to the users. Nowadays, majority of the electronic devices are equipped with wireless technology. This facts shows the necessity and benefits provided by wireless technology. This project mainly concern about the safety system at tower base station (BTS) using wireless capabilities. GSM technology will be used as the wireless modules. This project use microcontroller to handle various sensors and wireless communication protocol. All of the sensors will function as the watch guard. The information will be send to the mobile operator via GSM Modem. This kind of system will give ease of monitor of BTS to the user.

ABSTRAK

Teknologi wayarles telah menjadi suatu aplikasi penting yang biasanya bersepadu untuk pelbagai peranti dan teknologi lain. Penambahbaikan dari teknologi tanpa wayar memberikan kemudahan kawalan kepada pengguna. Pada masa kini, majoriti peranti elektronik dilengkapi dengan teknologi tanpa wayar. Fakta ini menunjukkan keperluan dan faedah yang disediakan oleh teknologi tanpa wayar. Projek ini menekankan kepentingan mengenai sistem keselamatan di stesen pangkalan menara (BTS) menggunakan keupayaan tanpa wayar. Teknologi GSM akan digunakan sebagai modul tanpa wayar. Ini menggunakan mikropengawal untuk mengendalikan pelbagai sensor dan protokol komunikasi tanpa wayar. Semua sensor akan berfungsi sebagai alatan keselamatan dan juga pemantauan. Maklumat tentang aktiviti di BTS akan dihantar kepada pengendali mudah alih melalui GSM Modem . Kecanggihan teknologi ini akan memberikan kemudahan dari segi kawalan dan keselamatan di BTS kepada pengguna.

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LIST OF ABBREVIATION

GPS	-	Global Positioning System
GSM	-	Global System for Mobile Communication
LCD	-	Liquid Crystal Display
PIR	-	Pyroelectric Infrared
TBS	-	Tower Base Station
SPICE	-	Simulation Program with Integrated Circuit Emphasis
CCTV	-	Closed Circuit Television
RFID	-	Radio Frequency Identification
V	-	Voltage
TIM	-	Telemangement Integrated System
IP	-	Internet Protocol
GPRS	-	General Packet Radio Service
RCU	-	Remote Control Unit
CMS	-	Control Management Unit
AC	-	Alternating Current
DC	-	Direct Current
UPS	-	Un-Interruptible Power Supply
I/O	-	Input Output
ADC	-	Analog to Digital Converter
USB	-	Universal Serial Bus
AVR	-	Aboriginal Voices Radio
PMW	-	Pulse Width Modulation
UART	-	Universal Asynchronous Receiver or Transmitter
SRAM	-	Static Random Access Memory
EEPROM	-	Electrical Erasable Programmable Read-Only Memory
ICSP	-	In-Circuit Serial Programming

TTL	-	Transistor-transistor Logic
FTDI	-	Future Technology Devices International
SMSMO	-	Short Message Service Mobile Organized
SMSMT	-	Short Message Service Mobile Terminate
SMA	-	Sub Miniature version A
IDE	-	Integrated Development Environment

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Chapter 1

INTRODUCTION

1.0 Overview

This chapter will cover the introduction of the project involving project background, overview of the project, problem statements, objective of project, scope of project, thesis outline and summary of work.

1.1 Project background

A cell site or cell tower is a cellular telephone site where antennae and electronic communications equipment are placed, usually on a tower, radio mast or other high place, to create adjacent cells in a cellular network. The elevated structure typically supports antennae, and sets of transmitters and receivers transceivers, digital signal processors, control electronics, a GPS receiver for timing, primary and backup electrical power sources. To keep the efficiency of cell tower operation, regular maintenance and security system is needed. Wireless security system is preferred in order to notify fault via text messages, built in GSM frequency communicator.

1.2 Overview of Project

Security system is considered as a crucial factor in order to keep tower base station operates efficiently without any disturbance. The aim of Tower Base Station Safety System is to design such a system which can monitor and control various alarms at the tower station. Intention of this project is to ensure the safety of power management unit which is keep at the base of the tower station [1]. In this work, we present the design and implementation of a GSM based wireless security system which consume a very less power. The design will be proposed by using Arduino as the backbone of the system and several sensors. The sensors that will be used in this

project are motion sensor (PIR), LM35 as the temperature sensor, magnetic sensor and MQ5 as the gas sensor. All of these sensors will detect any fault that related to its function, for example, PIR sensor will be able to detect a movement. This project enabled the wireless operator to monitor cell sites for performance degradation before it affects the network integrity. The GSM module is being used as the platform for mobile operator to communicate with the sensors. The security system will works when there are illegal activities occur at site. For example, PIR sensor will detect any movement, and trigger the GSM module to send the information to the mobile operator.

1.3 Problem Statement

Typically, the cell sites will consists of expensive machineries and copper cables. Mostly, the problems that occur at tower base station (TBS) is such as burglary, temperature fluctuation, unauthenticated entry, high energy consumption and high maintenance cost. Burglary occurs because the burglar has set their eyes on the equipment present in base station, including fuel [2]. The chances of copper wire, as well as machineries associated with base station getting stolen are very high due to their market values are very expensive. The site machineries operate at a specific temperature. When there are no proper ventilation, the temperature goes above the threshold value then they may get permanent damage [4]. Poor security may cause the outsiders enter the cell site easily. The unauthenticated entry may be harmful especially to the outsiders because they are exposed to Radio Frequency (RF) which is absorbed into human bodies and lack of cell site Personal Protective Equipment (PPE) [9]. High energy consumption and high maintenance cost occurs when a failure in monitoring temperature, improper and delay notice maintenance of site machineries which is may damage them permanently. Therefore, it is the objective of this project to enhance the safety measure of TBS. The basic idea is to design a safety system with various sensors that is adjusted to detect fault and monitor the cell site of irrelevant activities at cell sites.

1.4 Objective of Project

The aim of the project is to design and construct a control system which consist of various alarms of security system. The specific objectives of the project are:

1. To design the safety system solution of BTS using GSM technology.
2. To develop a prototype of safety system solution of BTS using GSM technology.
3. To apply the wireless transfer of feedback using GSM technology.

1.5 Scope of Project

The scope of this project is shown in the Figure 1.5. The scope of this project focused into three different part which is hardware, software and technology development. For this project, it involves two parts in order to accomplish one complete system in wireless networking. It has so-called-microcontroller board, Arduino Mega 2560 connected to the various sensors. This project also use the GSM module (Global System for Mobile Communication) to enable the user or mobile operator to host information when sensors are triggered.

Hardware part consists of several sensors, microcontroller, and GSM module. The sensors that being used in the project are PIR (Pyroelectric Infrared) sensor, LM35 for temperature sensor, Magnetic Switch as the magnetic sensor, and MQ5 as the gas sensor. The PIR sensor is to detect movement or motion of human and will be installed at the store room. Temperature sensor, LM35 is to monitor the fluctuating temperature inside the machineries room, magnetic switch is to detect open/close door, and MQ5 gas sensor to detect the presence of smoke. When any one of the sensors have detected any fault, it will trigger Arduino to communicate and instruct the GSM Module to send text message to the user.

Software part consist of Multisim, Proteus and Arduino IDE (Integrated Development Environment). Multisim is a circuit simulation based on SPICE (standard for circuit simulation). It contains a database of components that useful during designing circuits. Proteus is a software for microcontroller simulation, schematic capture and printed circuit board (PCB) design. Arduino IDE software was originated from the IDE for Processing and Wiring language. Program written with Arduino IDE is call sketch. The sketch can be programmed in C or C++ language.

Limitation of this project is combining all the sensors into one centralized solution. Therefore, the fundamental understanding of C and C++ must be strong. Due to complexity of the interface of all sensors, GSM Module and Arduino, the development time of the project will increase.

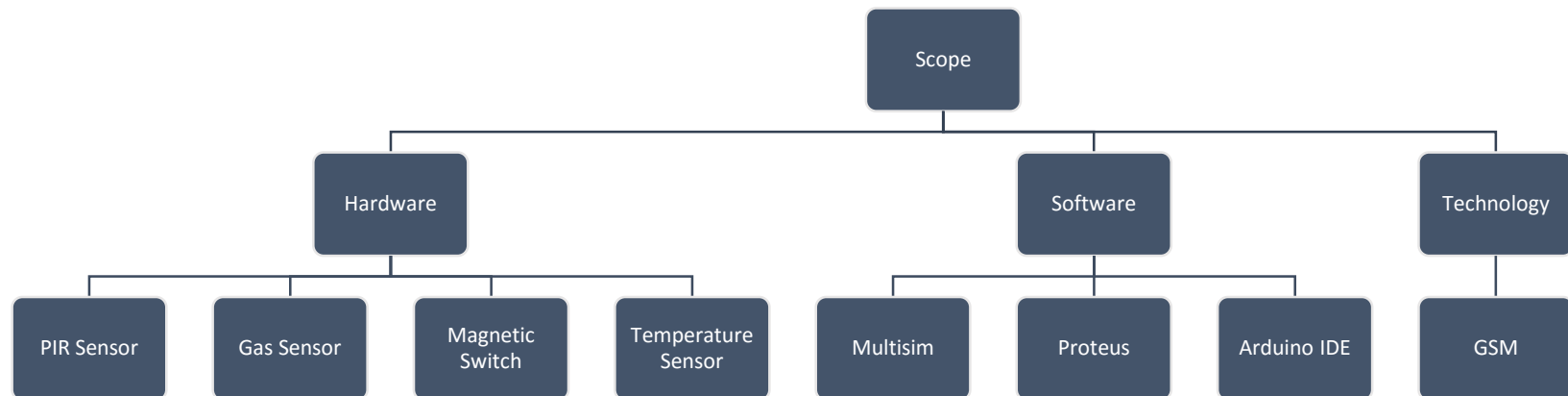


Figure 1.5: Scope of Project

1.6 Project Methodology

The block diagram of the project is shown in Figure 1.6. This project focuses on wirelessly alarm control and monitoring. The project development based on GSM technology. The security system will function properly when the sensors activated and detected any of fault, then the Arduino will trigger the GSM Module to submit the information at cell site using to the mobile operator. The project methodology shows that the steps that will be taken through this project.

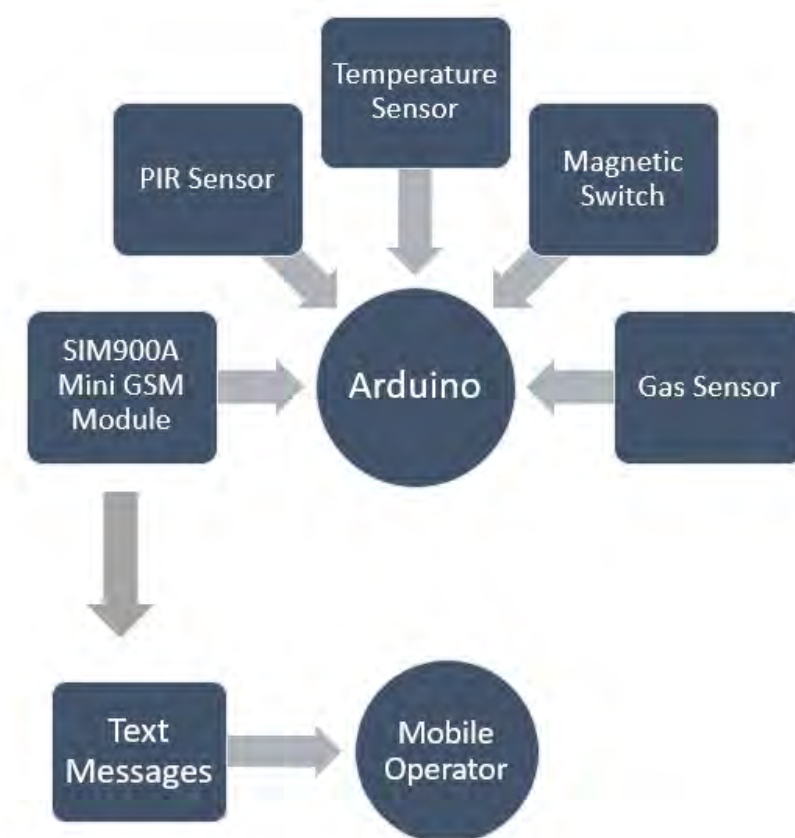


Figure 1.6: Block diagram of Project

The methodology of the project is divided into two parts. The first part is Hardware and second part is Software. In hardware part, this project will design the security system for the tower base station and understand how each of the sensors operates.

In the software part, the software for the security system of tower based station will be designed. Several software will be used such as multisim. Multisim is a software used to do the simulation before proceed to the hardware part.

1.7 Project Structure

The report of the project will cover by five chapters. The first chapter starts with an overview of project, objective, problem statement and scope of project. The literature review is discussed in Chapter 2 and project methodology in Chapter 3. Hardware and software implementation and the conclusion and suggestions will be cover in Chapter 4 and Chapter 5 respectively. When the project has been completed successfully, here are the main chapters:

Chapter 1: Study of Objectives and Scope of Project

- The purpose of this project is to design a safety system using GSM technology and develop a prototype the safety system solution of Base Tower Station using GSM technology.

Chapter 2: Literature review about GSM Technology and Base Tower Station

- Research on relevant topics of the project. The research has been done mostly from references books, internet and journal as sources. The purpose of doing literature review is to ensure the student gets a deeper knowledge and information for the project. The components needed for the hardware part also determined by doing research on project using GSM technology.

Chapter 3: Project methodology covering the planning, design and management of development of project.

- This chapter focuses and explains about the project methodology used in this project. This section will explain the method of how this project is made, the beginning of the project until the end. Every single thing that has been implemented in this project will be described thoroughly.

Chapter 4: Hardware and Software Implementation

- The fourth chapter will focus on the hardware and software progress. The testing, simulation and result will be shown in this chapter. Simulation and testing will be performed on each module in both hardware and software.

Chapter 5: Conclusion and suggestion for the next project

- The final chapter of this project will examine and review the solution of this project in order to achieve the objective of project. All of the problems will be discuss and conclusion will be made. Recommendation will be propose for the future improvement for this project.

Chapter 2

LITERATURE REVIEW

2.0 Chapter Overview

This chapter will focus and discuss the projects and paper work associated with this project. Related and previous project was studied in order to produce the quality and reliability of the project. By analysing the projects done by the previous researchers, there are several features that can be improved. Recommendation has also being made for the future enhancement that can be undertaken to improve the project.

Furthermore, there are few ideas that being used to implement this project from other similar project. Literature review process will be continuous from the beginning until the end of the project. By reviewing the previous works, the right actions can be undertaken and the features must be enhanced and improve in order to make this project reliable and marketable. In addition, there are also few findings from the internet and books were used in this project.

2.1 Previous Works

2.1.1 Title: GSM Based Tower Shelter Fault Monitoring System by Sharma. V.K., Tandon. R., Das. V.K., Gaur. S., and Goel. V [1]

This paper mainly discuss on how to develop low cost solution for monitoring health condition of tower base station. The proposed solution is using GSM technology to prevent the premature failure of telecommunication system. The project will be an embedded based hardware design and consists of a sensing system, signal conditioning electronic circuits, advanced embedded hardware for middle level computing, and a powerful computer network for further transmission of data to various places. A powerful GSM networking is designed to send data from a network to other network. Any changes in the parameters of transmission is sensed to protect the entire transmission and distribution and the parameters like BTS over load, voltage fluctuations, over temperature, oil quality and level.

The main objective of this to design a system which able to control and monitor various alarms at cell site. Safety is considered as a priority when it comes to cell tower system. This is because to ensure the safety of power management units which is at the base of the cell site. The ability of monitoring various threats like fire detection, smoke detection, status of the fuel level and to check if the is left open or closed is very important. Typical cell site usually consists of power management unit, machineries associated to the tower base station, battery unit and air-conditioners. Furthermore, the safety system from this paper also able to reduce the maintenance cost which is high, at the same time increase the intelligence of the system. The border between both approaches shifts continuously, as more and more intelligence is cast into algorithmic, system-theoretic form.