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Public transport state monitoring system using GSM and  
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**PUBLIC TRANSPORT STATE MONITORING SYSTEM  
USING GSM AND GPS**

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**Bachelor of Mechatronic Engineering  
July 2012**

**PUBLIC TRANSPORT STATE MONITORING SYSTEM USING GSM AND GPS**

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**A report submitted in partial fulfillment of the requirement for the degree of Bachelor of  
Mechatronics Engineering**

**Faculty of Electrical Engineering**

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**2012**

"I hereby declare that I have read through this report entitle "Public Transport State Monitoring System Using GSM And GPS" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronics Engineering"

Signature : 

Supervisor's Name : Musa Yusup Lada

Date : 2 July 2012

I declare that this report entitle "Public Transport State Monitoring System Using GSM And GPS" is the result of my own research except as cited in the reference. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 2 July 2012

Dedicated to my beloved family and friends.

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## ABSTRACT

Public Transport State Monitoring System (PTSMS) is a combination of several communication technologies such as Global System for Mobile Communication (GSM) and Global Positioning System (GPS). This system will act as an indicator if an accident occurs. The mechanism located at the public transport such as bus will activate the system if an accident occurs. The hardware will send signal in form of SMS to the central unit. The SMS (Short Message Services) including the alarm message of the accident and the longitude and latitude of the accident. The message received will be analyzed and the GUI (Graphical User Interface) will send notification email based on the accident with the coordinate to the public authorities. The GUI used is based on Visual Basic 2008 software. The interface contains form that can be integrated with the GSM modem and alarm circuit based on serial port command. The serial port for GSM Modem and alarm circuit is different but in the same time it is connected to each other. The GUI is triggered by a SMS that contain three main commands that are bus identification, longitude and latitude. Other SMS that has more than three commands will be considering spam and no feedback will be send. The longitude and latitude contain in the SMS will be integrated in Google Maps to find out the location of the accident.

## ABSTRAK

'Public Transport State Monitoring System' (PTSMS) ialah gabungan beberapa teknologi komunikasi seperti 'Global System for Mobile Communication' (GSM) dan 'Global Positioning System' (GPS). Sistem ini berfungsi sebagai penunjuk jika berlakunya kemalangan melibatkan bas yang mempunyai sistem ini. Mekanisme yang terletak di dalam bas akan mengaktifkan sistem jika berlakunya kemalangan. Mekanisme itu akan menghantar isyarat dalam bentuk 'Short Message Services' (SMS). SMS itu mengandungi maklumat seperti penggera keselamatan, latitud dan longitud. SMS itu akan dianalisis dan 'Graphical User Interface' (GUI) akan menghantar e-mel yang mengandungi maklumat kawasan kemalangan kepada pihak berkuasa. GUI yang dibina menggunakan Visual Basic 2008 dan mengandungi teknologi GSM dan litar kecemasan berdasarkan port siri yang berbeza. Port siri untuk Modem GSM dan litar penggera adalah berbeza tetapi dalam masa yang sama ia disambungkan antara satu sama lain. GUI ini boleh diaktifkan jika SMS yang diterima mengandungi tiga perkataan sahaja iaitu maklumat bus, longitud dan latitud. Sebarang SMS yang mengandungi lebih daripada tiga patah perkataan tidak akan dilayan dan diambil sebarang tindakan. Longitud dan latitud yang terkandung dalam SMS akan disepadukan dalam Google Maps untuk mencari lokasi kemalangan.



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## LIST OF ABBREVIATIONS

GSM	-	Global System for Mobile
GPS	-	Global Positioning System
SMS	-	Short Messaging System
GUI	-	Graphical User Interface
TTL	-	Transistor-Transistor Logic
CMOS	-	Complementary Symmetry Metal Oxide Semiconductor
GPRS	-	General Packet Radio Service
PC	-	Personal Computer



## CHAPTER 1

### INTRODUCTION

This chapter will give basic introduction about how the idea of this project been generated. This chapter contain introduction, objective of the project, problem statement, scopes of work, brief methodology, and report structure.

#### 1.1 Introduction

Monitoring system for the commercial vehicle especially bus using Global System for Mobile Communications (GSM) technology is an indicator system that is designed to alert the public authorities and the bus company about the accident occur and its location. The trigger mechanism for this system is short messaging system (SMS) that containing the bus identification, longitude and latitude. When an accident occur, the bus modem will send notification SMS to the bus company and in the same time graphical user interface (GUI) will analyzed the SMS and alert the public authorities regarding the accident. In the same time, the alarm will be triggered.

This project is solely based on receiving notification SMS using GUI based on GSM technologies as transfer medium. In general, the project is partly software and partly hardware. The hardware configuration can be categorized into two parts which are electronic and telecommunication. This project will use MOD 9001D GSM/GPRS Modem as receiver medium. DB9 port will react as transmitter for the PIC microcontroller and receiver for the GSM modem. The graphical user interface will be built using vb.net software that is visual basic 2008. AT command is used to control the function of the modem.

Public Transport State Monitoring System is designed for any party that uses bus as the transportation medium. Bus accident had increased rapidly now days. None notification system had been created for commercial vehicles with coordinates applications. This project will use solely on Short Message System (SMS) that act as triggered mechanism.

## 1.2 Project Objective

The main purpose for this project is to design monitoring system for public vehicle especially bus using Short Messaging System as triggered mechanism. Therefore, the objective as below should be achieved.

- I. To develop a Graphical User Interface (GUI) that react with MOD 9001D GSM/GPRS Modem.
- II. To sequence GSM technologies with the interface with time response less than 30 seconds.
- III. To sequence the interface with GPS technologies based on data carried by the signal (SMS).
- IV. To develop an alarm system using microcontroller (TTL) with personal computer (CMOS) as the signal source.

### 1.3 Problem Statement

Public transportation such as bus has grown in aspect of quantity in Malaysia. Approximately, 100 000 bus including commercial bus, industrial bus, IPTA bus and others had been register to Jabatan Pengangkutan Jalan (JPJ). In such a huge quantity, it is difficult for public authorities to monitor each bus. This difficulty of monitoring the buses, it leads to accident that increases lately either small scale accident or large scale accident. In late two years, some bus accident that involved casualties had been reported. For example, the accident occurs in 26 December 2009 that takes place in KM 272.7 Lebuhraya Utara Selatan that takes 10 casualties. Statistic given by the ministry state that the overall number of commercial vehicles involved in accidents has been increased by 25.35% in five years (2000-2005) as show in figure 1. Furthermore, the percentage of accidents involving buses has increased more than 100% of a total of 131.25% over the same period. There is no a monitoring system created to overcome this problem now days.

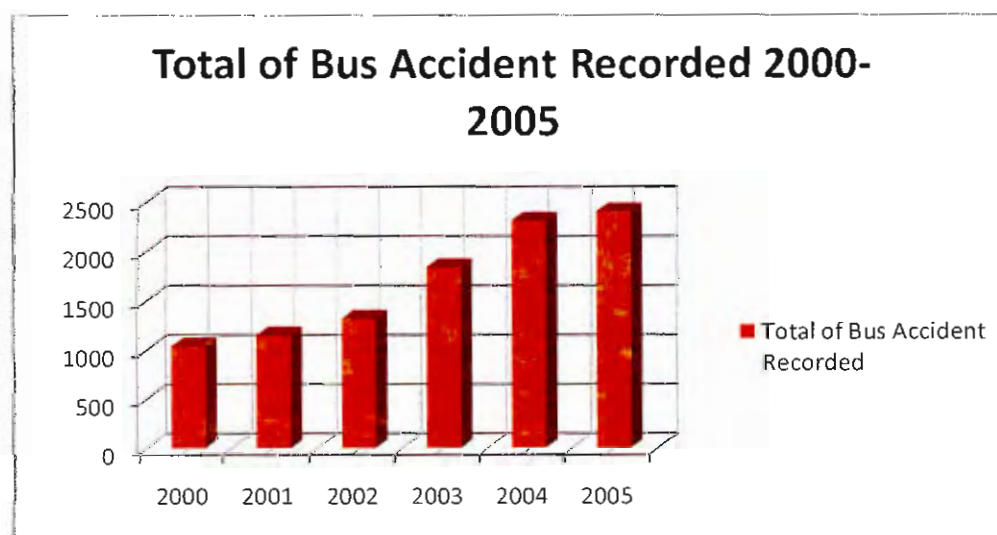


Figure 1: Bus Accident Recorded

## 1.4 Scope of Project

As we are concern with scopes of work while doing the project, so it must be created properly. The scope of work listed as below:

- I. The interface will be developing using visual basic 2008. The interface will be connecting with MOD 9001D GSM/GPRS Modem that works as GSM receiver. It also can be connect with Google Map to determine the location based on the data received from the SMS.
- II. For alarm system, PIC16F877A will be used as the microcontroller. PIC16F877A was used because it is the cheapest microcontroller that has Rx and Tx pins. 12 volt mini strobe siren will be used as the output of this system and USB to UART Converter V2011 will be used to connect the interface with the alarm system.
- III. For the software integration, MikroC will be used as the compiler for the developed C language. Proteus 7 will be used to design the schematic diagram of the circuit. To establish a communication path between the PIC and the PC, USART library will be used as the communication channel. Hyper Terminal will be used to determine the AT Command compatible with the modem and Visual Serial Port Emulator (VSPE) will be used to set up simulation connection for serial port.

## CHAPTER 2

### LITERATURE REVIEW

This chapter will explain the previous related research or project done regarding this concept. The chapter concludes the background study for Public Transport State Monitoring System Using GSM and GPS. The best PIC microcontroller, GSM Modem, Graphical User Interface (GUI), other components used and previous related project will be explained in this chapter. Information obtain from literature review is very important for the project.

#### 2.1 GSM

GSM is a short from Global System for Mobile Communications and it is actually a digital cellular communications system. The GSM mobile telephony service is based on a series of contiguous radio cells which provide complete coverage of the service area and allow the subscriber operation anywhere within it. Prior to this cellular concept, radiophones were limited to just the one transmitter covering the whole service area. The functional architecture of a GSM system can be broadly divided into the Mobile Station, the Base Station Subsystem, and the Network Subsystem. The subscriber carries the mobile station; the base station

subsystem controls the radio link with the Mobile Station. The network subsystem, which is the main part of which is the Mobile services Switching Center, performs the switching of calls between the mobile and other fixed or mobile network users, as well as management of mobile services, such as authentication.[10]

### 2.1.1 MOD 9001D GSM/GPRS Modem



Figure 2: GSM Modem

SMS control system which incorporates the global remote GSM technology with the purpose to develop an economy control solutions using a modem such as vehicle navigation, remote monitoring, wireless internet access and other application. The MOD 9001D GSM/GPRS modem fits the need of data transfer with SMS data communication, GPRS data navigation, circuit switch, and TCP/IP protocol. The AT command set and RS232 interface will bring easy data connection without any extra circuit control.[3]

The MOD 9001D GSM/GPRS modem also support an extended set of AT command. The features available in extended set of AT Commands are:

- I. Reading, writing and deleting SMS messages.
- II. Sending SMS messages.
- III. Monitoring signal strength.
- IV. Reading, writing and searching equivalent data.

This modem also can be connected directly to computer serial port for GSM communication purpose including sending and receiving text messages. It also can be connected to RS232 serial equipment that allow dial up system for remote management purpose. This includes data loggers such as DataTaker and Pace Scientific. General packet radio service (GPRS) connectivity also will allow the user to set up the remote management system in any kind of application. The set up will not use any kind of devices to write up the AT command. The AT commands will be writing automatically in the device. GPRS also available with a built-in TCP/IP stack.

### 2.1.2 Features

- I. Support Chinese/English SMS data communication.
- II. Support 900/1800/1900 MHz GSM Tri band.
- III. Status light indication.
- IV. Support AT Command set.
- V. Standard RS232 serial port.
- VI. Accepts standard SIM card.
- VII. GPRS Class 10
- VIII. 5 to 12V DC supply.
- IX. Dimensions : 115 x 65 x 27 mm

### 2.1.3 Installation of GSM Modem

- I. Insert a valid SIM Card provided by the GSM network operator into the SIM Card holder.
- II. Install the GSM modem to standard location and connect the antenna to the SMA connector.
- III. Fix the serial cable to the GSM Modem.

- IV. Connect the GSM Modem power supply interface with the power adapter output jack.
- V. Make sure all connection done properly.

## 2.2 AT Command

GSM modem such as mobile phone is the main device for communication system that used GSM network. So, there are a proper standard and compatible protocol should be follow to be able to communicate with GSM modem. The common protocol used in GSM network is called AT Commands because it is quite similar to the instruction set used in the microcontroller and it can transmit and receive information in any kind of format.

The “AT” means attention and it is a special command that used by the (Complementary metal oxide semiconductor) CMOS to communicate with GSM modem. To make any communication happen, user must set up the proper AT Command following certain protocol. For the example, when the GSM modem receiving an AT Command set, the CMOS will respond with the message.

Different modem has different AT Command set. So, to make sure proper AT Command set been use, integrated with the HyperTerminal must be done. Besides that, the HyperTerminal must be set as setting properly to make sure the GSM modem can be integrated perfectly. The baud rate must be set to 9600 bps, data bit must be set to 8 bits, parity must be set to none and stop bit must be set to 1 bits. Before making connection, the GSM modem must be set up its proper setting first.