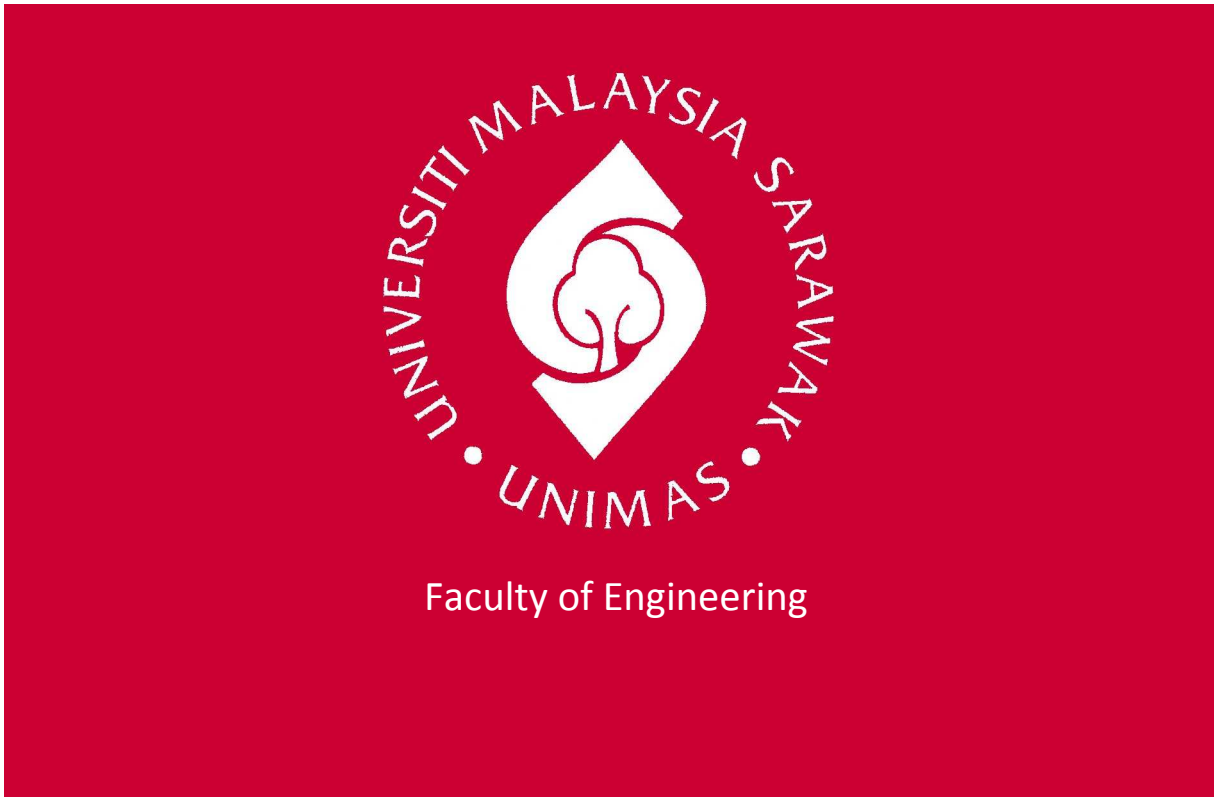

AUTOMATIC LOCATION IDENTIFICATION USING GPS TECHNOLOGY

Yeoh Kok Cheow

Bachelor of Engineering with Honours
(Electronic & Telecommunication Engineering)
2009

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AUTOMATIC LOCATION IDENTIFICATION USING GPS TECHNOLOGY

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This project is submitted in partial fulfillment of the requirements for the degree of
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Dedicated to my family and Kae Wen because all the wonderful things they have done for me and supporting me all the way.

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ABSTRAK

Isu keselamatan kampus merupakan salah satu isu yang paling penting dalam sesebuah institusi pengajian. Pihak berkuasa institusi sentiasa mencari alternatif yang terbaik untuk meningkatkan tahap keselamatan kampus. Kecurian peralatan merupakan antara masalah yang paling serius dalam isu keselamatan kampus ini. Ini adalah kerana tidak mungkin bagi pihak berkuasa institusi untuk menjaga semua peralatan di dalam institusi pada setiap masa dan masalah kehilangan peralatan ini selalu menyukarkan staf keselamatan untuk mencarinya. Oleh itu, objektif kajian ini adalah untuk membangunkan sebuah sistem identifikasi tempat secara automatik berdasarkan teknologi *Global Positioning System (GPS)* sebagai penyelesaian bagi masalah tersebut. Fokus kajian ini ialah implimentasi peralatan dengan menggunakan produk *off-the-shelf* dan pembangunan perisian sistem pengesanan tersebut. Peralatan tersebut digunakan untuk melaporkan koordinat-koordinat bagi alat pengesan kepada pusat kawalan. Pusat ini mengandungi perisian yang digunakan untuk operasi pemetaan dan menunjukkan lokasi-lokasi atas peta elektronik bagi peralatan yang dikesan. Kod pengisian ini dihasilkan dengan menggunakan *Microsoft Visual Basic 6.0.* Sistem pengesan ini meliputi kawasan UNIMAS dan ia boleh diaktifkan secara manual atau automatik. Segala konsep dan *screenshot* disertakan bersama dengan perbincangan yang berkaitan dalam kajian ini.

ABSTRACT

Campus security is one of the most important issues for any learning institution. Institution administrators always seek the best alternative to improve the security of their campus areas. In fact, the primary concern of the campus security issue is the thefts of equipment. It is because keeping an eye on all the equipment in the campus is impossible for institution administrators and therefore, missing equipment is always a troublesome event which leads the security staff into a desperate circumstance to recover the equipment. Thus, the objective of the study is to develop an Automatic Location Identification (ALI) system based on Global Positioning System (GPS) technology as a solution to the problem. The focus of this study is the implementation of hardware using off-the-shelf product and the development of software for the tracking system. The hardware is used to report the coordinates of the tracking equipment to the remote monitoring server. The server, which consists the software is responsible in mapping operation and shows the locations of the equipment on electronic map. The source code is written using Microsoft Visual Basic 6.0. The tracking system covers the UNIMAS area and it can be activated manually or automatically. All the concepts as well as screenshots are provided in the discussion on this study.

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LIST OF ABBREVIATIONS

AFM	-	Automatic Fleet Management
a-GPS	-	Assisted Global Positioning System
ALI	-	Automatic Location Identification
AOA	-	Angle of Arrival
CRM	-	Control Room Module
DoD	-	Department of Defence
EOTD	-	Enhanced Observed Time Difference
FCC	-	Federal Communications Commission
GIS	-	Geographic Information System
GPS	-	Global Positioning System
GSM	-	Global System for Mobile
GUI	-	Graphical User Interface
IVM	-	In Vehicle Module
KML	-	Keyhole Markup Language
NERTU	-	R & T Unit for Navigational Electronics
NMEA	-	National Marine Electronics Association
RFID	-	Radio-frequency identification
RSSI	-	Signal Strength Indication
SIM	-	Subscriber Identity Module
SMS	-	Short Message Service
TDOA	-	Time Difference of Arrival

USB	-	Universal Serial Bus
VB6	-	Visual Basic 6
XML	-	Extensible Markup Language

CHAPTER 1

INTRODUCTION

1.1 Overview

Tracking defines an action involved in an observation of a person or an object either mobile or non mobile. The object being tracked is usually integrated with certain hardware which is able to calculate the current location of the object and provide a timely ordered sequence of respective location data to the model. This model could be a human observer or system software which is capable to serve for depicting the motion on a display capability.

Nowadays, there are varieties of technologies which are employed with the tracking system. These technologies can be categorised in two groups which are ‘lag time’ tracking and ‘real time’ tracking. ‘Lag time’ tracking is for tracking done within a small area such as within a building and the tracker data is collected after an object passes a certain point. It usually refers to bar code, choke gate or Radio Frequency Identification (RFID) which is widely used in the shopping complex or warehouse. In contrary, ‘real time’ tracking involves in collecting location data by interpreting the tracker system in a predefined of time. Several location based real time tracking technologies have been proposed and implemented in last few years and the most popular one is Global Positioning System (GPS).

1.2 A Review of GPS Tracking System

Global Positioning System (GPS) is a system composes a network of 24 satellites in semi synchronous orbit surrounding the earth. Initially, GPS was developed by U.S Department of Defence (DoD) for military purpose in the early 1970s. However, it was later made available to civilians due to its benefits of autonomous positioning and nowadays it is a dual-use system that can be accessed by both military and civilian users [1]. The satellites periodically emit radio signal of short pulses to GPS receiver. Once the GPS receiver receives the signal, one's location can be determined and it becomes the key technology for giving position of an object in tracking system.

In order to utilise the GPS technology in tracking system, a GPS tracker is needed. GPS tracker is a device that uses Global Positioning System to determine the specific location of a vehicle, person, or other assets to where it is attached by recording the positions of the assets at regular intervals [2]. There are a few types of GPS trackers and their usage are depending on the types of tracking, for instance fleet management, vehicle tracking or for surveillance purpose. Generally, GPS tracker is divided into three categories: data loggers, data pushers and data pullers.

1.2.1 Data Logger

GPS data logger is a small, robustness unit that can log or record the positions of the device at regular intervals in its external or internal memory. Its major usage is to perform certain analysis in the computer based on the saved data of the locations and

it is more often used by sport enthusiasts. Most of the sport enthusiasts use it to save track locations and then transfer them into computer in order to perform analysis such as to calculate the length or duration of a trip. [2]

1.2.2 Data Pusher

Instead of saving GPS data, the GPS unit send the data which consists the coordinates to the server at regular intervals. The server usually uses these data and maps them on the electronic map to determine the location of the current object which integrated with this GPS unit. It is widely applied for security purpose and it is predicted to be used widely in the future. The vehicle tracking system is the best example utilising this GPS technology. It becomes more popular due to size reducing in the hardware and the data charges prices decreasing such as Short Message Service (SMS) services. [2]

1.2.3 Data Puller

Data puller GPS tracker is similar to the data pusher and the only difference between them is data puller will only send the GPS data when there is a request. This technology is not really common but an example of this kind of device is a computer connected to the Internet and running GPSD which is a utility that monitors one or more GPS receiver attached to a host computer through serial or USB ports [2]. However, nowadays it usually combines with the data pushers in order to have more compact functions. [2]

1.3 Statement of Problem

Thefts of equipment normally happen in organisations. Some of these equipment cost range up to thousands of ringgits such as laptop and they always get stolen due to their mobility and small in size. However, there will be no immediate notifications about the removal of the equipment and sometimes it even takes a few days to discover the missing equipment. This happens when the theft occurs during the non-working day of the organisation and the personnel can only discover the theft by the next working day. What makes the situation worst is the equipment may already be dissembled and the recovery of the equipment is nearly impossible. Sometimes even though there are immediate notifications of removal of the equipment, the movement of the equipment could not be traced and these are normally happening as well in organisations. Therefore, an automatic location identification of equipment system needs to be deployed in order to perform earlier detection once the equipment being removed and immediately track down the movement of the equipment.

1.4 Objectives

The purpose of this project is to design an automatic location identification (ALI) system or also known as tracking system for security purpose in UNIMAS based on GPS technology. The area covered for the tracking is within UNIMAS area in order to track missing equipment in university. The objectives of this project are as follows:

i. To propose a method to create an electronic map from paper map for finding the location of an equipment.

ii. To identify and propose hardware to be used in communication between the equipment and the server.

iii. To develop a mapping software that can perform ALI functions.

1.5 Expected Outcomes

The expected outcomes of this project are as follows:

i. A proposed method to produce an electronic map from paper map. It will allow faster and easier transformation of any given paper map to its corresponding electronic format.

ii. Hardware set up used for communication between the equipment and the server which has no significant delay and not subjected by the distance limitation in transmitting the information to the server.

iii. A mapping program which is able to perform the ALI functions by mapping the coordinates on the electronic map and show the location of the equipment in real time.

1.6 Project Report Outline

This project report is divided into five chapters. Chapter 1 covers an introduction of the tracking system, reviews of tracking system that based on GPS technology, statements of problem, objectives and the expected outcomes for this project.