CHAPTER 1 INTRODUCTION

1.1 OVERVIEW OF THE DOCUMENT

This project thesis examines the task of learning to develop a cost-effective vehicle movement tracking system for companies to track their vehicles. This section discusses the background for choosing this particular project, the inspiration for such an undertaking, the objectives of the project, an overview of what the expected system is, and conclude with structure of the entire dissertation.

1.2 BACKGROUND TO THE PROJECT

The traditional technique for tracking the movement of vehicles in a commercial fleet involves the use of a central dispatch center and a two-way radio communication in each vehicle. This approach is commonly used worldwide by police departments, delivery companies, and taxi fleets. The use of a two-way radio communication forces driver to remove one hand from the wheel distracting them from the road and creates a serious potential hazard on today's busy roads. Vehicle Tracking Systems are commonly used by fleet operators for fleet management functions such as routing, dispatch, onboard information and security. Other applications include monitoring driving behavior, such as an employer of an employee, or a parent with a teen driver.

Vehicle tracking systems are also popular in consumer vehicles as a theft prevention and retrieval device. Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. When used as a security system, a Vehicle Tracking System may serve as either an addition to or replacement for a traditional car alarm. The existence of vehicle tracking device then can used to reduce the insurance cost, because the lost risk of the vehicle drop significantly.

These days, most of tracking applications use *Global Positioning System (GPS)* in their tracking systems to report position information automatically back to a central location. In such implementations of tracking applications, use Global Positioning System (GPS) as the *Location Estimation technology* and Network Transmission (SMS/GPRS) as the *Location Transmission technology* in those tracking systems. GPS based tracking applications are widely used in Europe and developed counties.

1.3 PROBLEM IN BRIEF

Deploying a GPS based vehicle tracking system for a small company is still a nightmare when it compares with the setup and the running cost involved in such deployment. Most of the currently available GPS base vehicles tracking systems are satellite based and are very costly, and thus it is not affordable to many. GPS based vehicle tracking systems are commonly used in Europe and mainly the developed counties like United States (US) and United Kingdom (UK), but it is not well suited for a county like Sri Lanka. Satellite bases tracking systems are not very much affordable and cannot be commonly deployed by most clusters in the developing region. Therefore, it is really important to address this subject matter through a novel concept which would open up same tracking exposure to organizations and individuals who have a lean budget.

1.4 OBJECTIVES OF THE PROJECT

The main objective of this undertaking is to deliver an alternative solution to real-time *Global Positioning System (GPS)* based vehicle movement tracking system. There is an increasing demand today, for real-time vehicle tracking applications, but high cost involved in deploying such commercial systems, decreases the interest. Therefore, the above concern was thoroughly considered when introducing a cost-effective vehicle tracking solution which would be appropriate for many. Alternative solution is based on the existing *Global System for Mobile communications (GSM)* infrastructure and *Location Based Services (LBS)*. This unconventional solution would be comparatively inexpensive, affordable and effective for small and medium-sized enterprises (SMEs), than to a GPS based vehicle tracking system. The customer organization chosen for this project is *Dialog Telekom Limited (DTL)*, a leading mobile telecommunication provider in Sri Lanka. This new solution would enable *Dialog Telekom Limited* to track and monitor their vehicles real-time and to stay up-to-date with all of them and whereabouts of their vehicles. Through this study, it is also expected to gain an adequate knowledge about *Network Cell Based Tracking System* using *GSM* infrastructure and to study and get sufficient understanding on how the *Location Based Systems* work and their possible services. It is anticipated to evaluate the final system to prove it within the acceptable limit of accuracy, especially for vehicle tracking. Moreover; it is aspired to prepare a deserving write up on the project.

1.5 INSPIRATION TO THE UNDERTAKING

The *Global Positioning System (GPS)* is the current technology which is used in almost all vehicle movement tracking applications, from Industrial shipping to taxi fleets. This was originally developed using a GPS receiver, which was mounted on tracking object and it receives GPS readings from orbit satellites around the globe, which uses triangular calculation to get their precise location on earth. The original GPS is a collection of 24 well spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment [Ahmed 2002]. Accuracy can be pinpointed to within one (1) meter with special military approved equipment [Ahmed 2002]. It has excellent accuracy but it is not affordable and effective for small and medium-sized enterprises (SMEs).

GPS is a powerful navigation tool which provides users with the capability to accurately determine their precise positions on or above the Earth's surface. The GPS infrastructure was originally developed by the United States Department of Defense (DoD) for military purposes, but is now also being used in countless civilian and government applications [Hofmann 1997]. The scope of these applications ranges from use by hikers and boaters, to the tracking of trucking fleets and endangered species.

The concept of a space-borne positioning system was first conceived by the *DoD* in 1973. From this initial concept came the *NAVigational Satellite Timing and Ranging Global Positioning System (NAVSTAR GPS)*, whose original function was to provide the United States military forces with the means to continually and accurately determine their position and velocity. "These capabilities were put to the test during Operations Desert Shield and Desert Storm. Coalition forces relied heavily on GPS to navigate the featureless Saudi Arabian desert. Forward air controllers, pilots, tank drivers and even cooks used the system so successfully that several U.S. Defense officials cited GPS as a key to the Desert Storm victory." [The Boeing Company 1999] NAVSTAR GPS became fully functional on July 17, 1995 at a total cost of more than 10 billion U. S. dollars [The Boeing Company 1999].

Real-time vehicle movement tracking using Global Positioning System (GPS) is one of the fast growing applications, which uses the satellite GPS facility. Even this method has an excellent accuracy, when considering the high setup cost and the running cost; this method is merely feasible for an exclusive segment in the community.

Positioning techniques vary widely in terms of cost and accuracy. Using an alternative method called "*Network based vehicle tracking system*" which uses GSM infrastructure; the same objective can be achieved with a reasonable level of accuracy especially in vehicle tracking. This technology can be identified as a proven and economical substitute for satellite GPS based vehicle movement tracking system.

1.6 THE POTENTIAL SOLUTION FOR VEHICLE TRACKING

The expected solution is a novel system for vehicle tracking which uses an existing GSM digital cellular network infrastructure and the location based service (LBS). This new system is brought out as a cost-effective vehicle movement tracking system for companies as well as for individuals. It intends to provide a reasonable accuracy in positioning vehicles even as using the minimal resources. This potential vehicle tracking system consists of following inputs, outputs and list of features with its final version of the application.

The main inputs into the expected system can be identified as follows;

1. GPS coordinates from the LBS.
2. The tracking number which is a 10-digit mobile number assigned to each tracking SIM.
3. Series of layers of vector maps.

   These vector maps consist of four different layers namely;

   a) Transport layer for roads.
   b) Land use layer for land marks.
   c) Grid layer for the main grid.
   d) Administration layer for administrational division.

The main outputs from the expected vehicle tracking system to end-user (tracking user) are summarized as follows;

1. Plot tracking vehicle's current location on the base map.
2. Display previous tracking information to the user.

Features of the expected vehicle tracking system are;

1. Multiple vehicles tracking at the same time.
2. Zoom-in and zoom-out feature on the map.
3. Magnifying a selected area on the map.
4. Feature of adding and removing tracking vehicles to and from the system.
5. Adding and removing map layers.
6. Adding new users to the system.
7. Draw polygons on the map to have "geo-fencing" feature with the system. Geo-fencing is an innovative concept introduced with the new system; it can draw polygons on the map as restricted areas where the vehicles do not suppose to go into. When a particular vehicle enters into one of those restricted areas the system will give a warning alert to the tracking user.

1.7 STRUCTURE OF THE THESIS

The following illustrates the structure of the entire thesis.

Chapter-2 describes problem domain illustrating the existing setup in the chosen organization. It will also discuss on various techniques used in location tracking.

Chapter-3 describes the overview of cell based tracking and location based service. And it also describes the relevance of location based service for developing the cost effective GPS based vehicle tracking system.

Chapter-4 discusses the approach applied to solve the problem. Location based service is the groundwork based for the new approach. Therefore more emphasis put on LBS to elaborate the operation. It will also discuss how LBS be utilized to implement a new tracking system.

Chapter-5 determines the analysis and design part of the proposed vehicle tracking system.

Chapter-6 describes the implementation of the proposed system. Software and Hardware integration is discussed in this chapter. How the vehicle tracking system is implemented, is discussed here.

Chapter-7 comprised of testing and evaluation of the vehicle tracking system. It covers all aspects of system testing range from unit testing to full system testing.

Chapter-8 is the conclusion chapter. This chapter discusses whether the anticipated objectives of the system have been fulfilled or not, or up to what extent and provides untested hypotheses for future research.

1.8 SUMMARY

Introduction to the proposed vehicle movement tracking system was discussed in this chapter. Further discussion on background environment and motivation to such undertaking was also done. And it also identified the main objectives of developing such system, the basic framework of the proposed system and its resource requirement.

The next chapter will discuss various approaches applied to deliver the products of vehicle movement tracking systems. And it will try to identify the problems that are still not being solved.