# Truck Tracking Business Online

by

Ms. Prapaporn Boonkajornkul

A Final Report of the Three-Credit Course
IC 6997 E-Commerce Practicum

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Internet and E-Commerce Technology
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The Graduate School of Assumption University has approved this final report of the Three-credit course, IC 6997, E-Commerce Practicum submitted in partial fulfillment of the requirements for the degree of Master of Science in Internet and E-Commerce Technology.

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# ABSTRACT

The purpose of this project is to study the Global Positioning System (GPS) application in Intelligent Transport Management Systems (ITMS) to propose maximizing the utilization of mobile resources. Moreover, ITMS report would describe technology that supports management of goods delivery service to be safer and more efficient from transportation. ITMS would acquire better information that also leads to the higher profits through better fleet management.

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in all weather conditions, anywhere in the world, 24 hours a day.

GPS is rapidly becoming commonplace in automobiles as well. Some basic systems are already in place, providing emergency roadside assistance at the push of a button (by transmitting your current position to a dispatch center). More sophisticated systems can show the vehicle's position on an electronic map display, allowing drivers to keep track of where they are and look up street addresses, restaurants, hotels and other destinations.

Moreover, this report would illustrate the financial analysis that includes cost comparison, comparison analysis and break-even analysis between traditional tracking system and real time tracking system. The report would also give examples of dangerous goods transportation reports in order to increase the safety level of goods transportation.

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# I. INTRODUCTION

## 1.1 Project Background

Ancient navigators once looked to the stars to find out where they were. Today, people are still looking to the skies for the same purpose, but they are getting the information from satellites, not the stars.

Since the government first launched a satellite navigation system known as the global positioning system (GPS) in 1978, the system's ability to pinpoint the location of an object has steadily improved. Already, GPS navigation is being built into cars and cell phones to enable people to figure out where they can find the nearest restaurants or locate someone in need of 911 assistance. Tens of millions of people track their locations today.

The Global Positioning System (GPS) consists of a constellation of satellites orbiting the earth. The satellites are approximately 20,000 kilometers above the earth and complete 2 orbits per day. The orbits are aligned at 55 degrees to the equator and there are six orbits used by the system. A total of 24 GPS satellites make up the constellation and they are positioned to provide 24 hour GPS coverage anywhere on earth. The GPS system is operated by the US military and signals are available, at no cost, to all users.

Using GPS to locate a position on the earth can help make tasks that were once difficult much easier and in some cases, previously impossible tasks are now possible with the help of GPS. GPS technology is applicable to applications that involve:

- Location – determining a basic position
- Navigation – getting from one location to another
- Tracking – monitoring the movement of people and things

- Mapping – creating maps of the world
- Timing – bringing precise timing to the world

## 1.2 Objectives of the project

To set up a web site for tracking the trucks with a strategy for the operation of Intelligent Transportation Management Systems (ITMS) by GPS (Global Positioning System), GPRS (General Packet Radio Service) and GIS (Geographic Information Systems) with the following goals:

1) Improve road safety and security for Goods delivery
2) Combat rising congestion, which is increasing travel time and industry cost
3) Enhance the attractiveness of Goods Transportation
4) Improve the competitiveness and performance of logistics systems

Sensible use of emerging technologies is essential to help meet these challenges. Intelligent Transport Management System (ITMS) are sophisticated multimodal "tools", which integrate advanced technologies and apply them to transport to develop solution that will improve the quality of people life. Thus, we could say that ITMS is all about saving lives, time and money, and improving the environment.

## 1.3 Scope of the project

1) To set up an Intelligent Transport Management Systems (ITMS) for fleet management
2) Reference of history of GPS
3) Concept of GPS ,GPRS and GIS
4) Application of GPS in Intelligent Transport Management Systems ( ITMS )
5) Analyze the cost of investment

Due to the affordable investment of ITMS, the transporters could set up this sort of system whenever they want to. However, in the beginning of implementation, they need to hire a system engineer to do the setting up and also provide training for their own staff. Thus, most transportation business in Thailand would be run by family style and they do not really have an idea about the benefit from ITMS so it might be difficult to convince them to apply ITMS to their business.

However, Trucktracking.com allows a customer to the research of its service listings and understands how ITMS could benefit to them. Thus, we believe that in the future ITMS would be one of the most important tools to improve Thailand Transportation and Logistic Business.

## 1.4 Deliverables

The final project is completed with full details of system implementation. The deliverables of the Project are as following:

1) Project Introduction
    a) Background of the Project
    b) Objective of the Project
    c) Scope of the Project
2) GPS applied for ITMS
3) Web Site Development
4) Company Financial Analysis

# II. LITERATURE REVIEW

Tracking of everything from people to packages can be expected to grow in significance as the price of tracking systems decline along with the decline of electronic chip/board prices. In contrast to vehicle navigation, tracking is a more passive function that is typically conducted from a central fixed site. Tracking allows for more efficient managements of a total transportation system inventory of cargo and vehicles, as well as reduced losses due to theft or accidents. Accuracy requirements vary depending on the specific application. In some cases, reliable sub-meter accuracy is required for tracking and controlling vehicles for collision avoidance (e.g., agriculture, construction, rail). GPS is being considered for new tracking applications such as enhanced 911 services for mobile phone users. When dialing 911 from a fixed location, the address of the caller can be easily identified. This is not the case for mobile phones, whether they are cellular can be easily identified. This is not the case for mobile phones, whether they are cellular or satellite-based. As a result, emergency services have a more difficult time locating mobile 911 callers. Enhanced 911 services would address this problem, but doing so raises privacy concerns such as the possibility of a mobile phone being tracked without the owner's knowledge. Experiments have already been conducted on using GPS to track persons on parole or otherwise subject to other legal restrictions through tamper-resistant ankle bracelets. A key problem for GPS, however, is the very limited ability of the signal to penetrate buildings.

Other communications links, such as FM radio waves, may provide a substitute carrier for GPS-like signals in limited areas. Public safety also is benefiting from GPS through better resource management and Vehicle dispatch of emergency service, and should continue to grow. GPS tracking and Navigation reduces response times and enables more efficient utilization of expensive vehicles used by emergency services such as police, fire, and search and rescue. GPS can also be combined with communications to coordinate the actions of multiple grounds, sea, and air emergency vehicles. Differential GPS systems can also be deployed to emergency locations to guide individuals, such as firemen working inside a burning building.

The Federal Emergency Management Agency uses GPS-based geographic information systems for inventory damage from natural disasters such as hurricanes, earthquakes, floods, and tornadoes. The same information is then used to target relief services and monitor reconstruction efforts.

## 2.1 Truck Tracking, the Factor of Fleet Management

**Truck Tracking** is a new generation Fleet Management System. It is termed Intelligent Transport Management System because it combines all pertinent LBS (Location Based Services) technologies to form an integrated control and command platform.

These include the most advanced components of:

- Global Positioning System (GPS)
- Geographical Information System (GIS)
- General Packet Radio Services (GPRS)
- Mobile Data Computer (MDC)
- Relational Data Base
- Web Services
- Microsoft .Net Framework

**Truck Tracking** will be used as the core of the customer's control centre; this may be in the form of a Control and Command Centre (C2) or a customer-centric call centre. It provides modules including G-CAD for daily track & trace operation, TripPlanner for fleet operation planning and FleetManager for data maintenance.

**Key Features:**

- AVL (Automatic Vehicle Location) & CAD (Computer Aided Design) with GPS (Global Positioning System)
- Map-based Route Planning
- GIS-based Mapping Control
- GEO-Fencing
- Vehicle Incident Monitoring and Alert
- Vehicle Movement Playback
- GPRS & GSM support
- Web-based Administration and Fleet Tracking
- Web-based Path Locator for Route Planning & Optimization
- Integrated with in-vehicle Mobile Data Computer

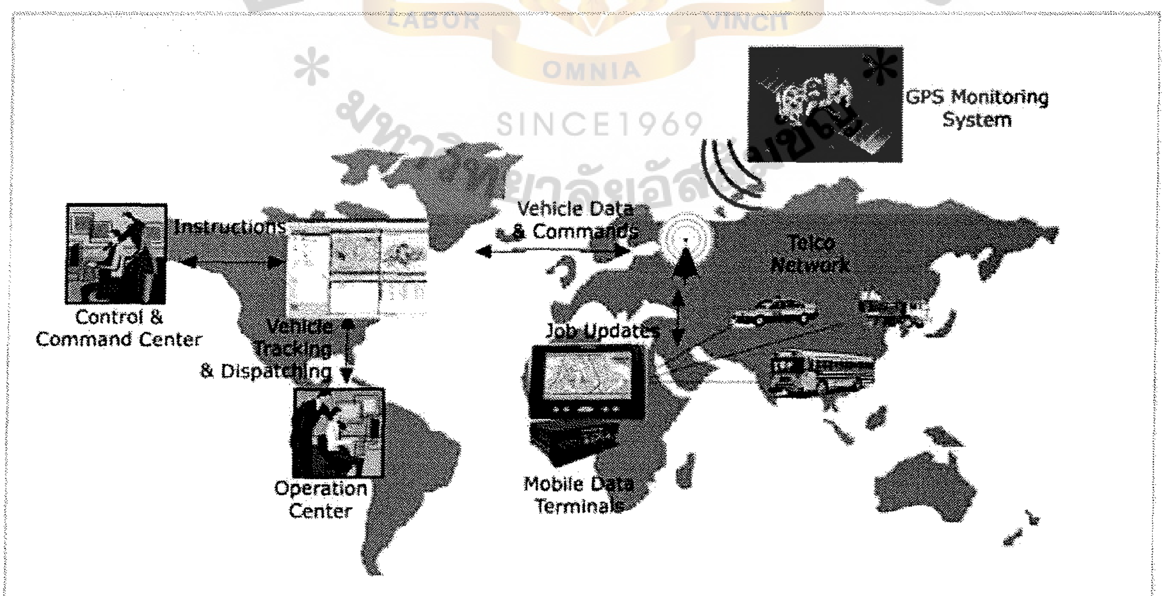



Figure 2.1. Illustration of Fleet Intelligent Transportation Management System

Using Global Positioning System (GPS) and in-built GPRS modem, every vehicle in the fleet is installed with a small black box which is hid in the vehicle. It allows the users to periodically retrieve real time GPS location of the vehicle. Anytime and anywhere is via the GPRS telecommunication network.

Using the Fleet software and GPS, navigation to unfamiliar destinations will never take longer than it has to, no more flipping through outdated maps. Operator will be able to direct the drivers to their respective destination efficiently.

The other important feature is speed monitoring. Its purpose is to restrict the traveling speed of vehicles. Traffic fines, accidents rates and maintenance cost of our customers were reduced drastically since the implementation of the system.

Management of a Goods Truck Fleet essentially involved ensuring timely arrival and dispatch of trucks. To go a step further it also involves ensuring that the truck touches the destination as per schedule. Thus, by application of Intelligent Transportation Management System (ITMS), would assist the transporter to have a closer monitoring and also actual record of the history of delivery that can be the benefit for acquiring the statistics for any further development of fleet management.

## 2.2 What is ITMS?

Intelligent Transportation Management Systems, or ITMS, encompasses a broad range of wireless and wire-line communications-based information, control and electronics technologies. When integrated into the transportation system infrastructure, and in trucks themselves, these technologies help monitor and manage traffic flow, reduce congestion, provide alternate routes to travelers, enhance productivity, and save lives, item and money.

Thus, Intelligent Transportation Management Systems the tools for skilled transportation professionals to collect, analyze, and archive data about the performance of the system during the hours of peak use. This data enhances traffic operators' ability to respond to incidents, adverse weather or other capacity constricting events.

Examples of Intelligent Transportations Management Systems include:

(1) Advanced Traveller Information Systems deliver data directly to travelers, empowering them to make better choices about alternate routes or modes of transportation. When archived, this historical data provides transportation planners with accurate travel pattern information, optimizing the transportation planning process.

(2) Advanced Traffic Management Systems employ a variety of relatively inexpensive detectors, cameras, and communication systems to monitor traffic, optimize signal timings on major arterials, and control the flow of traffic.

(3) Incident Management Systems, for their part, provides traffic operators with the tools to allow quick and efficient response to accidents, hazardous spills, and other emergencies. Redundant communication systems link data collection points, transportation operations centre, and travel information portals into an integrated network that can be operated efficiently and intelligently. We could say if an incident should occur, ITMS can help emergency personnel find the accident quickly and detour flow around it effectively. This quick response permits rapid removal of obstructions and helps minimize delays and disruption. Furthermore, even if a city does not have one overriding traffic control center, emergency vehicles may be equipped with tracking systems that enable precision resource deployment. Truck could also equip the GPS tracking equipment then the emergency service team would know exactly where the truck is really located.

Moreover, the systems could help emergency service team by providing the vehicle's exact location even if the driver is incapacitated. Such a system can also be useful in event of a breakdown, allowing repair crew to arrive quickly and prepare for whatever problem has been detected.

Intelligent Transportation Management System (ITMS) comprises a broad range of diverse technologies, from information and communications technologies and traffic management system to satellite navigation and positioning systems. Their successful development and application could hold the key to solving many of our transportation's problems, reducing environmental impact, increasing economic efficiency and saving lives.

Therefore, a function of ITMS, vehicle tracking system can be defined as a system, which enables the fleet operator to find out the location of a truck throughout the journey of the track against time.

Apart from utilizing, the data generated by the truck tracking system for enforcing the schedule of the trucks, this data also provides important inputs for decision making. The system facilitates computation of exact distance traveled in a given time span, computation of the speed of the trucks at a given location, analysis of the time taken by the truck to cover certain distance and so on. It becomes a very powerful tool in case the Transport Businesses and hiring truck, as computation of the distance traveled, based on which payments are made become totally objective.

Global Positioning System (GPS), which determines the location of cars, trucks, buses, trains and airplanes, are critical in the use of Intelligent Transport Management System (ITMS) to improve the efficiency and safety of Transport System while making them less congested and less polluting. This project would mention the role of positioning systems in ITMS such as the major types of positioning systems, the relationship between them, and methods for evaluating their performance.

Moreover, GPS based Intelligent Transport Management System (ITMS) provides the possibility of monitoring the movements of vehicles at an affordable cost. Therefore, ITMS would be applied for truck tracking. It could be said that an efficient vehicle system would require the integration of 2 modern technologies via the Global Positioning System (GPS) and the Geographical Information System (GIS).

Nevertheless, after we have looked into the web site of Energy Policies and Planning Offices (www.eppo.go.th), we would find the fuel price has increased dramatically during these few years and it is a major cost of Transportation Business. Therefore, Intelligent Transportation Management Systems (ITMS) could be one of solutions of cost reduction because since the transporters know the exact position of their trucks, they could have a better schedule for the next trip for every truck. Thus, it can be said that ITMS could be one of the solutions that could assist the economy collectively.

Furthermore, truck tracking by GPS could help to control the driver behaviour which related to transport operation and also generates the delivery report that includes the followings:

1) Speed of the Trucks (minute by minute)
2) Working hours in one day (Start and Stop engines)
3) Idle of engine
4) Truck routing (Trip by Trip)
5) Positioning of Truck (meter by meter and minute by minute)
6) Trip reports

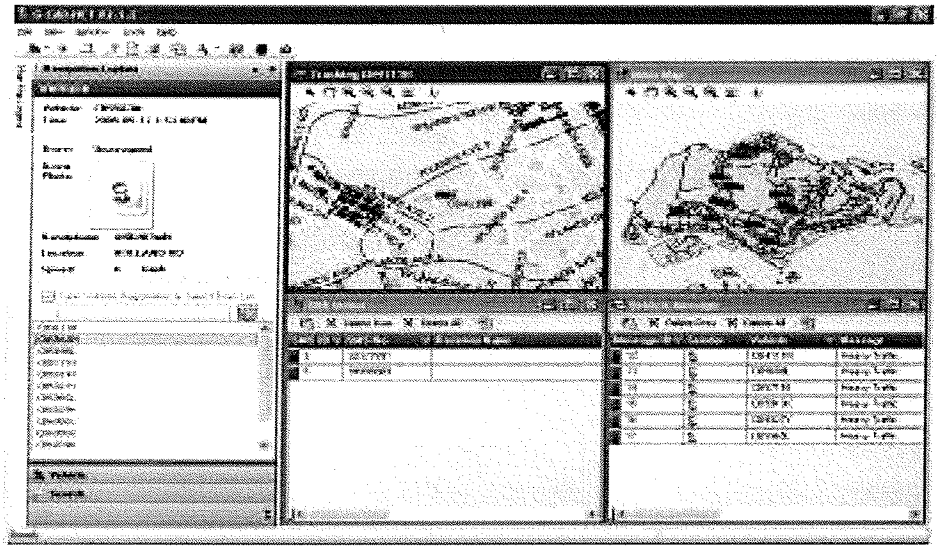


Figure 2.2. Fleet Screen Shot

From the items above, the system can be developed and add more functions as required by a transporter. We could say that the fleet management of Goods transportation need to be monitored carefully because, the driver behavior could cause many problems from stealing to disaster if without any monitoring as conventional method of fleet management. It could be said that once the driver takes the truck for delivery, the owner or manager would not really know what the exact route that driver is going for and how he drives the truck. For example, refer to the case of accident on April 2002, the 36,000 liters truck tanker of SC Carrier Co., Ltd. had smashed the high voltage pole inside the area of Maptaphut Industrial Estate Rayong. The driver had been burned dead in the accident and the plants in the industrial estate needed to shut down for 8 hours because of lack of electricity. The cost of shutting down from this accident is approximately THB 400,000.00 per hour for each plant. So, we cannot imagine how they could afford to compensate the damage cost. This is why we need to have a careful operation and monitoring of dangerous goods transportation.

Moreover, one of the most serious classic problems of fleet management in Thailand is "Petrol Stealing" by driver. The system could help the manager to monitor and control truck parking during the delivery. Thus, we could design the system to alert the manager when the truck has stopped longer than it should. So, the system could make the driver more disciplined, if they know that they are monitored or tracked by their manager.

Therefore, ITMS is the way to apply the advanced technology to make transport systems more efficient, less time consuming, more secure, safer, less congested, and less pollution on the road. Moreover, ITMS would mainly follow the role of positioning systems which would locate the position of vehicles on the road such as cars, vans, trucks, buses or trains. The technology that is applied for ITMS would adopt the Global Positioning System (GPS) and the Geographical Information System (GIS) which have been used for many purposes such as mapping for military activity, traffic navigation system, etc. Therefore, GPS and GIS would be important tools of ITMS to achieve the objectives.

Commercial fleet operators, such as B. Trans and other public transport providers, could adopt ITMS to improve efficiency and reduce their impact on the environment. The most common type of intelligent transport system deployed in a commercial fleet is a tracking/monitoring system. By equipping all fleet vehicles with a localization device that broadcasts positions to a control centre, managers can optimize fleet use, saving time and money and improving customer service.

Furthermore, many such tracking systems can also feed information back to the drivers via an in-vehicle telecommunication, enabling dynamic course adjustment and en route pick-up delivery changes. In addition, stolen vehicles equipped with a tracking devise can usually be located and recovered. The vehicle tracking system, for example, has helped the police to track and recover a 7.5 ton refrigerated heavy goods vehicle stolen in Bangkok, a truck taken from a car pack and found ready to be stripped, as well as several other vehicles.

On the business side, new innovations for commercial vehicles are easing the trip for lorry drivers, with fleet management systems helping to optimize deployment, decrease empty runs and increase driver security. Transport operators have also benefited from these systems, which contributes to optimal scheduling and better customer service. Moreover, devices such as the GPS tracking system is helping to speed up the verification of a lorry driver's compliance with regulations.

### 2.3 Technology solution for transportation

New applications and technologies are being developed every day. Better-known examples of ITMS technologies include:

1) On-board navigation systems
2) Crash notification systems
3) Electronic payment systems
4) Traffic control technologies
5) Weather information services
6) Variable message signs
7) Fleet tracking and weight in-motion technologies

The future of ITMS is promising. Yet, ITMS itself is anything but futuristic. Systems, products and services are already at work throughout the country. Still, the wide-scale development and deployment of these technologies represents a true revolution in the way we, as a nation, think about transportation.

Moreover, ITMS is fulfilling the need for a national system that it both economically sound and environmentally efficient requires a new way of looking at and solving our transportation problems. The decades-old panacea of simply pouring more and more concrete neither solves our transportation problems, nor meets Congress' board vision of an efficient transportation system.

Traffic accidents and congestion take a heavy toll in lives, lost productivity, and wasted energy. ITMS enables people and goods to move more safely and efficiently through a state-of-the-art, inter-modal transportation system.

## 2.4 Application of ITMS

One of the difficulties of Intelligent Transport within the road sector is the complexity and the large range of applications, more numerous than for other modes. In broad terms, we can say that the most significant applications fall in the following categories:

1) Road monitoring infrastructure
2) Traffic management and control
3) Network of traffic centres
4) Traveller information services
5) Freight and fleet management
6) Electronic fee collection
7) Emergency and incident management

The lines between ITMS applications are naturally quite blurry with much cross-over occurring and in fact enabling many of the applications themselves. The data collected through the monitoring infrastructure can be used for Traveler information, for example to display travel times as well as for feeding traffic management plans or speed management systems.

All of these systems and services are thus working together to enhance travel efficiency, improve safety and lessen the impact on the environment which are the reasons why ITMS came into existence. However, for this particular project would concern the fleet management by understand ITMS and its application.

## 2.5 Overview of GPS

GPS is comprised of these three segments:

1) Satellite constellation

2) Ground control/monitoring network

3) User receiving equipment

Formal GPS Joint Program Office (JPO) programmatic terms for these components are space, operational control and user equipment segments, respectively. The satellite constellation contains the satellite in orbit that provides the ranging signals and data messages to the user equipment. The Operational Control Segment (OCS) tracks and maintains the satellite in space. The OCS monitors satellite health and signal integrity and maintains the orbital configuration of the satellite. Moreover, the OCS updates the satellite clock corrections and ephemeredes as well as numerous other parameters essential to determining user position, velocity, and time. Lastly, the user receiver equipment performs the navigation, timing, or other related function such as surveying.

### 2.5.1 Categories of positioning systems

Normally, the major functions of positioning systems can be divided into 2 categories:

1) **Self-positioning**: The objects themselves deterring where they are.

2) **Remote positioning**: The central operation center would determine the location of the vehicles.

Radar is an example of a remote positioning system. Certainly, an inherently self-positioning system can function as a remote positioning system is each object transmits its position to a central operations center using mobile communication links. This is an indirect remote positioning system. Similarly, an inherently remote positioning system can function as a self-positioning system if the central operations center transmits the relevant location information to each object via a mobile communication link. This is an indirect self-positioning system. Some systems may carry out the remote and self-positioning function at the same time.

### 2.5.2 Basics of the GPS

Global Positioning System (GPS) has three components, namely

1) The space segment: consisting of 24 satellites orbiting the Earth at an altitude of 11,000 nautical miles.

2) The user segment: consisting of a receiver, this is mounted on the unit whose location has to be determined.

3) The control segment: consists of various ground stations controlling the satellites.

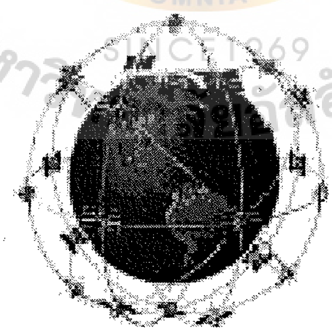


Figure 2.3. 24 Satellites orbiting the Earth

Each satellite generates radio signals that allow a receiver to estimate the distance between the satellite and the receiver. The receiver then uses these measurements to calculate its own location with reference to Earth in terms of coordinates expressed in latitude and longitude. Thus the receiver continuously recorded, can be stored in a memory module along with the receiver, or it can also be transmitted instantaneously to the central facility. The former would be an off-line system and the latter an on-line system.

## 2.6 GPS applied for ITMS

In general, concept of ITMS that implement by GPS, are normally integrated into a larger system. This larger system will be complicated and understanding of system engineering and an appreciation of the various components of the system. The ITMS subsystems would include the human and machine interface, sensors, communications, control work stations and actuators.

The components of the system could include the following:

1) A positioning system to determine the location of trucks ( depicted in the figure by the satellites )

2) Human-machine interfaces in the form of information displays for the customers at the office and operator console

3) When the truck is back to the depot control, the computer would gather the data from the trucks, process it, and send it to customers computer

4) A communication system to allow transfer of data from the control subsystems to the customer computer (depicted by the arrows)

On the other hand, a real time truck information system might have the following subsystems:

1) Wireless network Base station would have two-way communication link with the truck in order to detect the presence of truck.

2) Data would be sent to central control computer automatically

3) A control computer to gather the data, process it and send to customer

The above examples demonstrate that positioning systems will be just one subsystem in many Intelligent Transport Management System applications. In order to ensure that all these subsystems work together smoothly and that the overall system satisfies the customer's requirements, careful systems engineering analysis and design in required. Moreover, as part of this analysis, it will be necessary to consider the attributes of the positioning system as well as those of the other system and subsystem components.

### 2.6.1 GIS, the base for GPS

Geographical Information System (GIS) is a database system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data, which are spatially referenced to Earth. In simple words GIS is computer based software capable of handling maps and various details given on the map. Data generated by the GPS is spatial data referring to Earth. In other words this data is the coordinate of its own position expressed in latitude and longitude. This data needs to be positioned on a map of the area for any useful analysis. To be more precise a road map of the area, with important landmarks is required. On this map the GPS readings are superimposed for further processing.

### 2.6.2 Application of GPS for Land Navigation

It could be said that the promising market for GPS navigation in terms of sheer size is for land navigation products. Initial adaptation of the technology is taking place in the fleet tracking applications. The value of current fleet information is evident for delivery, scheduled service fleet dispatch and control. Hence, the controller could monitor the progress of trucks that are transmitting their position to a central location.

### 2.6.3 Potential for use

The potential for use of the reports generated was immense. 200 GPS units were mounted on all the buses of a depot. The readings were downloaded every three days and reports were generated. It now became possible to analyze the punctuality of the bus throughout the route. Cases of missed trips and short trips were brought to light immediately.

We could say by application of GPS, the distance delivered by the truck could be calculated accurately. Furthermore, the maximum speed of the truck could be informed by the system. Thus, GPS tracking system becomes a very useful tool for controlling the commercial trucks that have been taken on by transporters. Their billing can be made fully automatic without any chance of wrong billing on account of fake kilometers. The GPS readings could also be the base for scheduling of trucks, as now the actual time taken by a truck to cover a given distance was available. The system could also help in case of accidents by establishing the recklessness or otherwise of the driver.

## 2.7 Benefit of tracking

### 2.7.1 Enhance security system

Our tracking system can be incorporated to car anti-theft alarm system and if the alarm is triggered, warning will be send to the administrator via GPRS. For instance in the event of theft, vehicle started without using the ignition key or vehicles being moved without the engine being on could initiate a report to the administrator. It can also send an SMS message to the owner or insurance company.

### 2.7.2 Monitor fuel consumption

Using this system, the administrator is able to know the location of the vehicles, mileage traveled and this can help with the monitoring of petrol consumption. Proper routing will also assist in savings by using shorter route or avoiding certain location thereby enabling customers in lowering fuel consumption cost in the long run.

### 2.7.3 Idle report management

Idle report is created in alerting the administrator and take note of the driver leaving the engine running while in a stationery position. This profile will provide a report to the administrator the date, time, place and duration of the idling incident.

### 2.7.4 Petrol Saving Incentive

With the help of the system, best route plans can be plotted after a certain period of data collection and analysis. The data will provide the shortest/most effective route and then estimate the amount of petrol consumed for the particular route. From here, we can implement "a lump sum petrol budget" for the driver, example to give 9,000 Baht for the whole month of petrol usage. If the driver consumed less than what is given for the route, he can keep the balance saving as an incentive. However if the cost is over the projected amount then a report has to be submitted as to why the usage is high.

### 2.7.5 Maintenance Report

The system is able to program the recorded mileage of the vehicle and provide a report for maintenance purpose. It enabled the company to monitor the amount of vehicles due for maintenance on a regular basis thus it can prevent major damages and can save on major repair cost in the long run. The fleet can then be managed more effectively as status report will show vehicle availability and those under maintenance currently.

**2.7.6 Maximization of vehicle**

With the report generated from this system, the location of the vehicles is known and it can be deployed to achieve maximization in serving customers. It also assists in planning for ETD & ETA from or to customer around Thailand. In the event of an urgent call from customer, the nearest available vehicle can be dispatched to the customer thus help in saving cost and providing a faster service.

**2.7.7 Emergency / Distress button**

A button can be fixed in the vehicle for case of any emergencies or distress that could happen to the driver. The button can be activated in an emergency sending a emergency or distress signal to the administrator and immediate action can be taken to assist the driver.

**2.7.8 Prevent of abuse by drivers**

When the drivers of the vehicles are aware that the company is able to generate reports of their activities, psychologically the possibility of abuse will be reduced and directly or indirectly it helps the company to save cost in long the run.

The principal objective of this system is to create a long term preventive measure with the aim of promoting good driving habit and enhancing effective vehicle maintenance. In achieving this, saving will increased as expenses decreased thereby creating a "WIN WIN" situation for both the company and the drivers in due course.

Table 2.1. Retail Price of Petroleum products in Bangkok – DIESEL HSD

**Year to Year Price Analysis**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Min | 13.12 | 14.03 | 14.59 | 20.01 | 25.03 |
| WT. AVG | 12.12 | 14.03 | 14.59 | 20.03 | 25.06 |
| Max | 13.12 | 14.03 | 14.59 | 20.05 | 25.07 |

**Year to Year Price Increment Analysis (in %)**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Min | 0.00% | 6.94% | 3.99% | 37.15% | 25.09% |
| WT. AVG | 0.00% | 15.76% | 3.99% | 37.29% | 25.11% |
| Max | 0.00% | 6.94% | 3.99% | 37.42% | 25.04% |

**Year to 1st Year Price different Analysis**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Min | 0 | 0.91 | 1.47 | 6.89 | 11.91 |
| WT. AVG | 0 | 1.91 | 2.47 | 7.91 | 12.94 |
| Max | 0 | 0.91 | 1.47 | 6.93 | 11.95 |

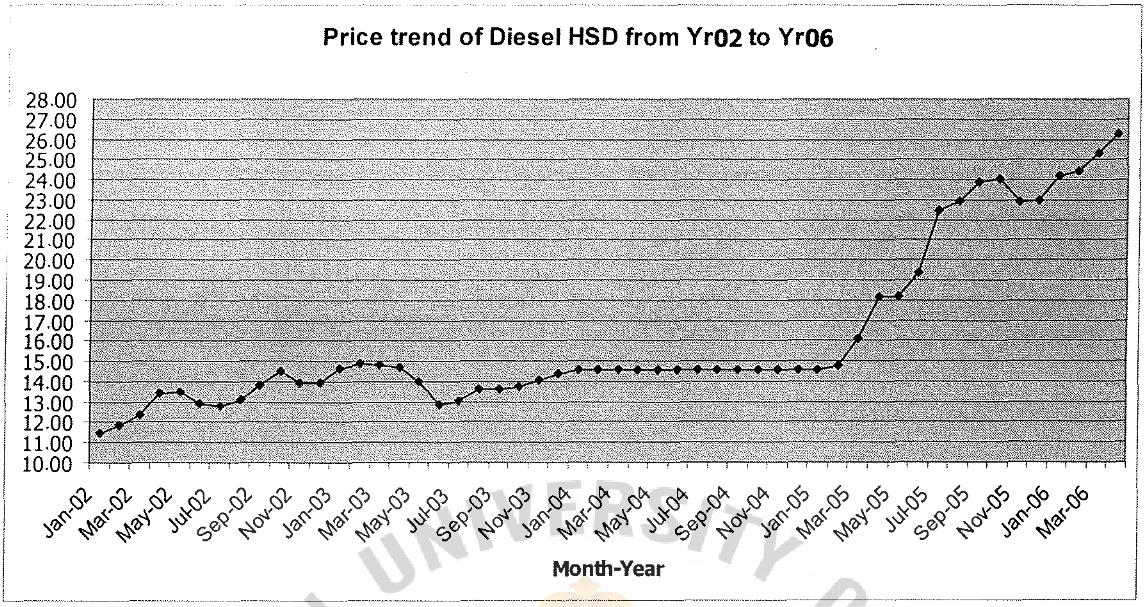
**Year to 1st Year Price different Analysis (in %)**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Min | 0.00% | 6.94% | 11.20% | 52.52% | 90.78% |
| WT. AVG | 0.00% | 15.76% | 20.38% | 65.26% | **106.77%** |
| Max | 0.00% | 6.94% | 11.20% | 52.82% | 91.08% |



From the above table provided by GT&T Engineering Co.,Ltd., shows that the petrol price has been increased gradually every year and tends to increase. The truck business entrepreneur will see how to save and control the petrol cost while their driver is on the road and they will never know the driver behaviour that may cause to lose the petrol in unnecessary way. To install the GPS in the truck, the truck business company can track their trucks and they will see how behaviour of the driver is as well as how to control the petrol. That is the main point of this project. The petrol price tends to increase as seen in the table 2.2 below.

Table 2.2. Price Trend of Diesel HSD from Year 2002 to Year 2006



## III. WEB SITE DEVELOPMENT AND DESIGN

Setting up the system is a design of coordination rhythm between the client and the project team. The client is the person/organization who owns the business. It is the client that has the need for the results of the project, who will pay, and who will put the results of the project into operation. The project team is the technical group that will actually develop the system. The client knows what they want, while the project team knows how to build it. Systems engineering is the process of matching the client's understanding of what is needed with the technical competency necessary.

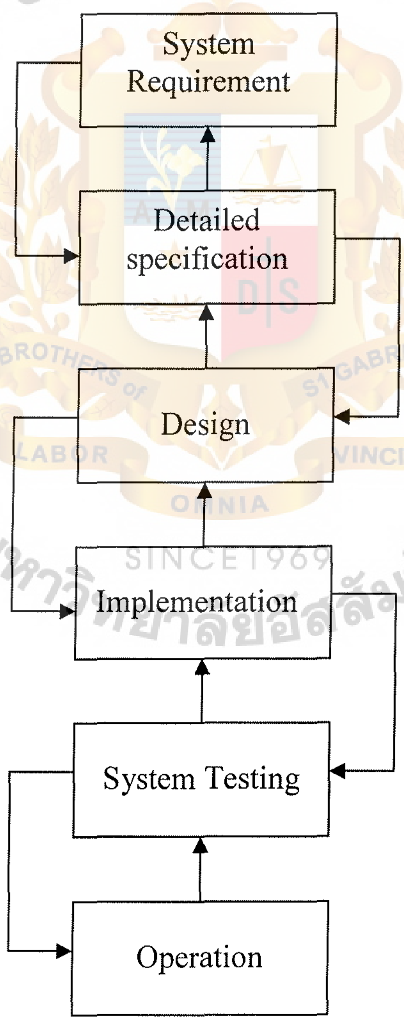



Figure 3.1. System life cycle

From the Figure 3.1, the implementation of large complex systems tends to go through a number of well-defined phases are called the system life cycle.

(1) System requirements phase

This is the earliest stage of the life cycle, when the overall system requirements are identified. This will normally be a number of needs being identified or evidence of a new market opportunity. The system requirements will normally be written in plain text. However, at this stage in the project, the budget will be the available funds rather than the actual funds needed to build the system.

(2) Detailed specification

During this phase, many of the important decisions are made. The detailed specification aims to be a clear statement of the system functionality and performance. Based on this document, it should be possible to prepare a fixed-price quotation, giving the cost of building the system and the timescale for implementation. It is during this stage that the system architecture is developed and a decision will normally be made on which type of positioning subsystem will be sued. The project plan, the quality plan, and the system test plan are developed at this period.

(3) Design

This phase is sometimes divided into two stages: high-level and low-level design.

a.) High-level design

During this stage, the detailed interfaces between the various subsystems will be defined. At this point in the project, the work can be divided into subprojects for the various teams who are responsible for the delivery of each of the subsystems.

b.) Low-level design

This stage would involve the design of the various subsystems. Note that if a subsystem is being bought off the shelf, then no low-level design will be necessary.

(4) Implementation

This phase involves the development of the various subsystems, based on the earlier design documents. Then the various subsystems are integrated to produce a working system. The details of implementation will vary depending on the nature of the subsystem. For example, there will be coding for software, and hardware need to be circuit board manufacturing. As each subsystem is completed, it will be tested individually. The implementation phase is completed when all the system components are integrated.

(5) System testing

During this phase, the system will be extensively tested to ensure compliance with the system test specification. Often, redesign or further implementation will be needed in order to comply with the specification.

(6) Operation

This phase will be necessary to carry out maintenance as well as regular upgrading of the system.

The arrows between each in Figure 3.1 indicates that there is often an iterative interaction between stages. The backward arrows are not a desirable pathway, but are almost inevitable. For example, during the design phase, it may be found that it is impossible to implement a function. Hence, the detailed specification may have to be modified to omit this particular function. Ideally, these sorts of changes should only occur between adjacent phases. However, it is sometimes necessary to traverse a number of different phases.

The composition of the project team will vary during different phases. At the detailed specifications phase, the team will be relatively small, consisting of experienced senior system engineers. It will be during this phase that the transport engineer is likely to deal with systems engineers to define the characteristics of the system. Thus, during the implementation phase, there will be a larger number of technical staff on the project team with a number of different designations, such as, software engineer, electronics engineer, mechanical engineer, and so on.

Obviously, it is seen that one of the most critical phases is the detailed specification phase. In this phase, many of the important decisions are often made by the client and the project team. It is during this phase that the client has to have a high-level understanding of the technicalities in order to make informed judgments about the proper trade-off between the different architectural options. Therefore, it is during this phase that the most important decisions about positioning systems are made.

With a clearer understanding of the systems engineering process, the company is now in a position to give a clear explanation of one of the principle aims of this project. It is to enable people who are likely to play the role of client in an ITMS project to understand sufficiently the nature of positioning systems to permit them to take proper responsibility in the project life cycle, particularly the detailed requirement specification phase.

During the detailed requirement specification phase, the project team may develop a number of architectural options. For example, a new form of traffic control system could have a highly centralized architecture or a decentralized hierarchical architecture. Each option will be analyzed in order to assess which option best satisfies the system requirements. The points below are some of the options that could be analyzed:

1) Integrity

2) Maintainability

3) Resilience

4) Reliability

5) Robustness

6) Functionality

7) Cost

8) Availability

9) Usability

10) Performance

As part of the architectural analysis, it will be necessary to identify the various types of positioning systems that could be utilized. For each positioning system being analyzed, it will be necessary to work out its contribution to the above issues. In the case of most of the above issues, the method of analysis will be the same for the positioning system as for other subsystems. For example, the communication system as for the positioning system can be analyzed with respect to reliability using the same technique. The major departure will come in the analysis is specified in manner different from the other subsystems. For example, the performance of a positioning system might be defined in terms of bits per second, and a computer system in transactions per second. Obviously, different forms of analysis are going to be needed in each case.

Thus, this project will concentrate on the analysis of the performance of positioning systems and the characterization of other unique aspects of these systems. It should be stressed that a positioning systems engineering will consider not only the aspects of performance outlined below, but also the other more general systems engineering issues such as reliability, maintainability, and so on.

## 3.1 Application of Positioning System

Previously, we have already mentioned about setting up the system which includes definition of system requirements, detailed specification, design, implementation, system testing and operation. As the objective of this project, we would focus on the system requirements, detailed specification and design phases, with only a cursory examination of the other phase.

**System requirements**

Normally, the system requirements are written in non-technical style which is a general requirement for the management team that wants benefits from the systems. The requirements could be divided into sections dealing with functionality, cost, quantity and timescale constraints. It is the functionality that normally contains most of the information that will aid positioning system selection. However, the other three constraints (cost, quantity and timescale) can have an impact depending on the nature of the system. From a positioning system point of view, it is important to keep the requirements as independent as possible positioning system technology. Nevertheless, it is important to make sure that the requirements can be fulfilled by available positioning technology. Thus, during this phase a model of the system should be constructed that will include available positioning system performance so as to ensure that the performance requirements are indeed achievable.

**Detailed specification**

In this detailed specification phase, it is necessary to remove the ambiguities inherent in the system requirement statement. Concerning to positioning systems, there are many times that system parameters such as accuracy are defined. Therefore, the best way to do this is to develop a model of the system that can be used to determine how positioning system parameters affect ultimate system performance. For example, in a courier fleet management system, the model might have as outputs the total cost of delivering all the parcels for a particular day. Generally, inputs might include some sort of distribution for the origin and destination of the parcels, the number of vehicles in the fleet, per kilometer and waiting time cost of each vehicle, and the average travel time of each vehicle. The positioning system inputs may include the accuracy and coverage of the system. The model would simulate the efficient dispatch of the vehicles, assuming the location information provided by the positioning system. Different levels of accuracy and coverage will have an effect on the likelihood of dispatching the closest vehicle and ultimately will impact on the daily operational cost.

An important factor to keep in mind is that different categories of position systems might need to have different specifications.

**Design**

The design phase is divided into two parts which include high-level design and low-level design. It is during the high-level design phase that the positioning system is selected though in some cases the selection might occur prior to this phase. This is done by identifying a wide range of positioning solutions and for each solution determining the level of compliance with the performance and cost specifications. This can be done in a two stage process. Firstly, considering many systems and quickly reducing the field to at most three or four possibilities. Secondly, each of these possibilities are examined in more detail.

The detailed design phase would involve locating the reference sites, choosing detailed equipment packages, design of the central site and so on. Low-level design is beyond the cope of this book and will often be carried out by the positioning system subcontractor. Moreover, beyond our purview is the design process for the case of projects involving the development of new positioning technology.

**Implementation, system testing and operation**

These areas involve a number of detailed considerations and will not be considered here. It is worth nothing that system testing is a very important aspect of the development of positioning systems. To do this effectively, it is necessary to have some independent reference positioning system in order to assess accuracy. A system that can serve this purpose well is an integrated GPS receiver with accurate dead reckoning. This can definitely provide coverage and deliver relatively high accuracy, allowing for a reliable evaluation on any positioning system.

## 3.2 Development of Truck Tracking Project

Developing this project involved a multidisciplinary approach, which ranged from mapping the routes depend on analyzing the results produced by the GPS. The stages involved in this process is as follows:

1) Digitizing the road map
2) Developing the GPS receiver module
3) Selection of GPS receiver
4) Development of the error correction software
5) Development of the analysis software

### 3.2.1 Digitizing the road map:

The first step of this project was the digitization of the road map of Thailand. Though numerous maps were available including the official map published by the Thai Military Mapping Service, the map was not suitable as the latest roads were not marked on them and moreover an exact map covering the entire area so it is not available yet. Therefore, recourses made to the satellite images need to be developed by private company such as DTC, LOXINFO, DTAC (WISETRAC), SAMART MAP, and etc.

### 3.2.2 Development of the GPS receiver module:

The GPS receiver module constituted the heart of the system. This along with the antenna was developed by many suppliers such as DTC, WISETRAC, SAMART and so on. It would be equipped over the roof of the truck in order to do the communication link with Wireless Network Base Station and GPS satellites.

Each receiver has a facility to store the unique ID and was capable of recording the coordinates of its location every minute. A memory module was also added to the receiver, which was capable of storing the recording up to 5 days. The module was designed so as to draw power from the truck battery. Here the first line indicates the Vehicle ID. Each line indicates a record. In every record, the first entry represents the Latitude-N and the second entry indicate Longitude-E (both in degrees, minutes and seconds), followed by Time (in Hour, Minute and Second) and Date. This data is converted into degree decimals for further processing.

### 3.2.3 Selection of GPS receiver

There is a lot of manufacturers produce over 200 different GPS set versions. Hence, GPS receiver selection is dependent on user application. The intended application strongly influences receiver design, construction, and capability. For each application, numerous environmental, operational and performance parameters must be examined. A sampling of these parameters is provided below:

1) Shock and vibration requirements
2) Temperature and humidity extremes, as well as atmospheric salt content.

3) Waypoint storage capability as well as the number of routes and legs needs to be assessed.

4) Physical size

5) Power supply and consumption

6) Cost of GPS receiver investment

As mentioned above, these are only a sampling of GPS set selection parameters. However, the user must carefully review the requirements of their application prior to selecting a receiver. In most cases, the selection will be a trade off that requires awareness of the impact of any GPS set deficiencies for the intended application.

**3.2.4 Development of the error correction software:**

When the GPS coordinates were plotted on the GIS map of the city it was found that sometimes the recordings were not exactly sitting on the roads. There were some errors responsible for this. Firstly, the routing has not been updated yet because, it would have to take time to do the research and survey for updating the route with a very high investment. Secondly, since digitization has to be done by manually tracing the satellite image some errors crept in at the stage. Thirdly, the system has given something which is called the selective availability of the GPS signals, the signals are not 100% accurate. In order to overcome this problem software was developed which was capable of pulling these coordinates onto the correct road thus facilitating further processing.

However, sometimes the GPS signal may not be available in some circumstances. For example, the truck runs under the bridge, overpass or toll way or diving in very bad weather conditions which might obstruct the communication between GPS satellite and GPS receiver. Thus, it is needed to have a back up plan as the subsystem of truck tracking activities. The speed sensor would be fitted in the truck together with GPS receiver in order to detect the driving behavior of the driver during the unavailability of GPS communication link and also keep record in the memory module. Finally, when the truck gets back to the depot, the operator could retrieve the data by the handheld loader from the memory module in order to complete the report for the particular trip of chemical delivery.

### 3.2.5 Development of the analysis software:

Generation of a log sheet for each schedule was a necessary output in order to find out weather the truck performed punctually as per the dispatching schedule. For this purpose the location of the truck was required periodically. The time interval could vary from a minute to half an hour. The GPS module was capable of throwing up this data in terms of latitude and longitude, but for a manager or controller who would analyze this data, expecting that he would be able to decipher the coordinates was asking for too much. Therefore, on the GIS road map of the city, landmarks were identified at every 200 meters length and a layer was created where the coordinates of all these landmarks were fed.

Software was developed which would animate the movement of the truck. Once the data was collected by putting the locations on the road it was overwritten on the background road map and the software ran a point on the map, which would exactly follow the actual truck movement.

## 3.3 Operation Reports

After having done the implementation of GPS tracking system, a number of operation reports will be generated as the reference for the particular trip of delivery. Thus, the report is the reflection of driving behavior or driver for which the manager could monitor and solve the problem before an accident occurs. Therefore, people might wonder how to prevent an accident by the report of driver behavior for the particular trip. For example, the driving report will record a number of details such as,

Speeding

1) Number of over speed limit
2) Unusual round / Minute
3) Max.speed
4) Max.round / Minute
5) Idle
6) Over Limited Round / Minute ( without moving )
7) Max.Round / Minute ( without moving )
8) Emergency Accelerate
9) Emergency Break
10) Percentage Number of Break
11) Number of Driver
12) Number of Registration
13) Number of on / off engine
14) Duration of trip
15) Duration on the road
16) Duration of low range of round / minute
17) Duration of low range of round / minute limit
18) Duration of idle
19) Average of low range of round / minute
20) Longest running time in the day
21) Average running time per half day
22) Average time over speed limit

23) Average time over limited round per minute

24) Total Stopping Time

25) Total Parking Time

26) Longest Stopping time

27) Average Stopping Time

28) Distance

29) Number of Parking

30) Distance in 1 day

31) Average Distance in half day

32) Fuel Consumption

Table 3.1. Driving Behaviour Report

Goods Truck Transportation Co.,Ltd.

| | |
|---|---|
| File No. ลค-5983 (26-5-2006) | From: 18-4-2006 time: 9:15:09 |
| Memory Module : ลค-5983.Truck | To: 19-4-2006 time: 18:15:21 |
| Registration No. : ลค-5983 | Driver name: Mr. Somchai Jongjai |

====================Driving Behaviour Report=====================

| | Items | Number | Measurement | Days | Hours | Minutes | Seconds |
|---|---|---|---|---|---|---|---|
| 1 | Over speed limited | 8 | Times | - | - | - | - |
| 2 | Over limited round / Minute | 0 | Times | - | - | - | - |
| 3 | Max. speed | 90 | Km./Hour | - | - | - | - |
| 4 | Max. round / Minute | - | Round / Min. | - | - | - | - |
| 5 | Idle | 8 | Times | - | - | - | - |
| 6 | over limited Round / Minute (not moving) | 0 | Times | - | - | - | - |
| 7 | Max. Round / Minute (not moving) | - | Round / Min. | - | - | - | - |
| 8 | Emergency Accelerate | 0 | Times | - | - | - | - |
| 9 | Emergency Break | 0 | Times | - | - | - | - |
| 10 | % Number of Break | - | % | - | - | - | - |
| 11 | Number of Driver | 0 | Person | - | - | - | - |
| 12 | Number of Registration | 0 | Times | - | - | - | - |
| 13 | Number of on/off engine | 28 | Times | - | - | - | - |
| 14 | Duration of trip | - | - | 3 | 0 | 12 | 0 |
| 15 | Duration on the road | - | - | 0 | 22 | 18 | 0 |
| 16 | Duration of low range of round / minute | - | - | 0 | 13 | 45 | 0 |
| 17 | Duration of low range of round / minute limit | - | - | 0 | 12 | 16 | 0 |
| 18 | Duration of idle | - | - | 0 | 2 | 58 | 0 |
| 19 | Average oflow range of round / minute | - | - | 0 | 0 | 25 | 22 |
| 20 | Longest running time in the day | - | - | 0 | 10 | 23 | 0 |
| 21 | Average running time per half day | - | - | 0 | 5 | 44 | 0 |
| 22 | Average time over speed limite | - | - | 0 | 0 | 1 | 26 |
| 23 | Average time over limited round per minute | - | - | 0 | 0 | 0 | 0 |
| 24 | Total stopping time | - | - | 1 | 13 | 26 | 0 |
| 25 | Total parking time | - | - | 3 | 23 | 41 | 0 |
| 26 | Longest stopping time | - | - | 0 | 4 | 40 | 0 |
| 27 | Average stopping time | - | - | 0 | 1 | 1 | 10 |
| 28 | Distance | 956.76 | Km./Hour | - | - | - | - |
| 29 | Number of parking | 32 | times | - | - | - | - |
| 30 | Distance in 1 day | 476.83 | Km./Hour | - | - | - | - |
| 31 | Average distance in half day | 239.19 | Km./Hour | - | - | - | - |
| 32 | Fuel consumption | 244.88 | Litres | - | - | - | - |

Nevertheless, in general, the operator manager would focus on three records of driving behavior seriously. Thus, most problems would really happen from speeding, idle time, working hours and fuel consumption.

Table 3.2. Speeding report

| Speeding Report | |
|---|---|
| ====Over the speed limit at 60 Km./Hrs. more than 3 Minutes==== | |
| File No. ลค-5983 (26-5-2006) | From: 18-4-2006 time: 9:31:00 |
| Memory Module : ลค-5983.Truck | To: 18-4-2006 time: 1:38:14 |
| Registration No. : ลค-5983 | Driver name: Mr. Somchai Jongjai |

| No. | Date of over speed limit | Time of over speed limit (Start) | Duration of over speed limit | Speed | Km.of over speed limit | Remarks |
|---|---|---|---|---|---|---|
| | Date | (Day:Hrs.:Min.:Sec.) | (Day:Hrs.:Min.:Sec.) | (Km./Hr) | (Km.) | |
| 1 | 18/4/2006 | 9:31:00 | 0:00:17:00 | 78 kph | 124.58 | |
| 2 | 18/4/2006 | 10:32:26 | 0:00:07:30 | 90 kph | 228.96 | Highest speed |
| 3 | 18/4/2006 | 11:07:26 | 0:00:09:58 | 65 kph | 541.23 | |
| 4 | 18/4/2006 | 11:20:32 | 0:00:21:36 | 75 kph | 552.36 | |
| 5 | 18/4/2006 | 20:38:00 | 0:00:15:16 | 76 kph | 557.74 | |
| 6 | 18/4/2006 | 20:56:00 | 0:00:08:00 | 74 kph | 572.26 | |
| 7 | 18/4/2006 | 21:36:08 | 0:00:29:00 | 76 kph | 580.11 | |
| 8 | 18/4/2006 | 23:41:26 | 0:00:59:12 | 77 kph | 583.22 | Longest time |

Obviously, the speed caused many tragic cases of accidents which the operation manager needs to take this matter seriously. Thus, the accident from speeding is avoidable case and it would cause not only damage for the company's reputation, goods, truck, and life of driver but also the surrounding or environment.

From the Table 3.2, there would be the record of speeding that drove faster than 60 kilometers per hour and longer than 3 minutes for 8 times in a trip of delivery. In the aspect of operation manager, is not acceptable to go across this matter at all. The particular diver has a risky driving behavior which could lead to a major accident.

Therefore, from this sort of information will push the management to solve the particular problem properly. For example, the problem of speeding could be solve by providing more defensive training or sack him from the company.

Table 3.3. Idle report

| ==============Idle Report============= | |
|---|---|
| File No. ลค-5983 (26-5-2006) | From: 18-4-2006 time: 9:31:00 |
| Memory Module : ลค-5983.Truck | To: 18-4-2006 time: 1:38:14 |
| Registration No. : ลค-5983 | Driver name: Mr. Somchai Jongjai |

| No. | Date of idle | Idle time (Start) | Idle time (stop) | Idle at Km. | Remarks |
|---|---|---|---|---|---|
| | Date | (Day:Hrs.:Min.:Sec.) | (Day:Hrs.:Min.:Sec.) | (Km.) | |
| 1 | 18/4/2006 | 9:31:00 | 0:00:17:00 | 0.00 | |
| 2 | 18/4/2006 | 10:58:00 | 0:00:07:00 | 17.10 | |
| 3 | 18/4/2006 | 11:07:00 | 0:00:08:00 | 17.13 | |
| 4 | 18/4/2006 | 11:16:00 | 0:00:21:00 | 17.20 | more than 20 mins. |
| 5 | 18/4/2006 | 20:29:00 | 0:00:23:00 | 189.68 | more than 20 mins. |
| 6 | 18/4/2006 | 20:54:00 | 0:00:07:00 | 189.74 | |
| 7 | 18/4/2006 | 21:35:00 | 0:00:29:00 | 205.17 | more than 20 mins. |
| 8 | 18/4/2006 | 23:41:00 | 0:00:59:00 | 294.41 | more than 20 mins. |

One of the driving behaviors that affected the cost of delivery is idle. The idle caused by traffic jam could be accepted. However, some drivers who take a long journey of a trip of delivery might want to take a rest by idle the engine and keep the air-condition on. Thus, definitely, idle the engine without running would consume more fuel. Then, the unexpected cost of delivery would lead to loss on transport business. Moreover, collectively, if every driver has the same behavior of idling, how to imagine what a loss for the economy of Thailand.

The table 3.3 Idle report, illustrates that the driver has been idle for 7 times but obviously, 3 times the idle times was longer than 20 minutes. Thus, the sort of idle report would help the manager to take action directly on the driver by warning or educating him the proper behavior of rest taking during delivery.

Table 3.4. Daily Report

| ==============Daily Report============= | |
|---|---|
| File No. ลค-5983 (26-5-2006) | From: 18-4-2006 time: 9:31:00 |
| Memory Module : ลค-5983.Truck | To: 21-4-2006 time: 1:38:14 |
| Registration No. : ลค-5983 | Driver name: Mr. Somchai Jongjai |

| Date | Distance (km.) | Over speed limit (time) | Idle (Min.) | Park (time) | Fuel consumption | On/Off Engine |
|---|---|---|---|---|---|---|
| 18/4/2006 | 294.41 | 8 | 8 | 9 | 68.27 litres | 8 |
| 19/4/2006 | 82.42 | 0 | 5 | 9 | 20.73 litres | 7 |
| 20/4/2006 | 476.83 | 21 | 10 | 10 | 111.88 litres | 9 |
| 21/4/2006 | 103.09 | 0 | 6 | 4 | 23.99 litres | 4 |
| **Total** | 956.76 | 23 | 29 | 32 | 224.88 litres | 28 |

From the Table 3.4, the daily report would summarize the driving behavior of the driver who does the delivery on particular shipment of dangerous goods. The daily report would include distance, speed limit, idle, parking, emergency break, estimated fuel consumption and times of engine turn on and off.

## 3.4 Web site development

By developing the web site, Macromedia Dreamweaver 8.0, Javascript, Microsoft Access and Adode Photoshop are used for web design. The site map of trucktracking.com is shown as the following figure 3.2.

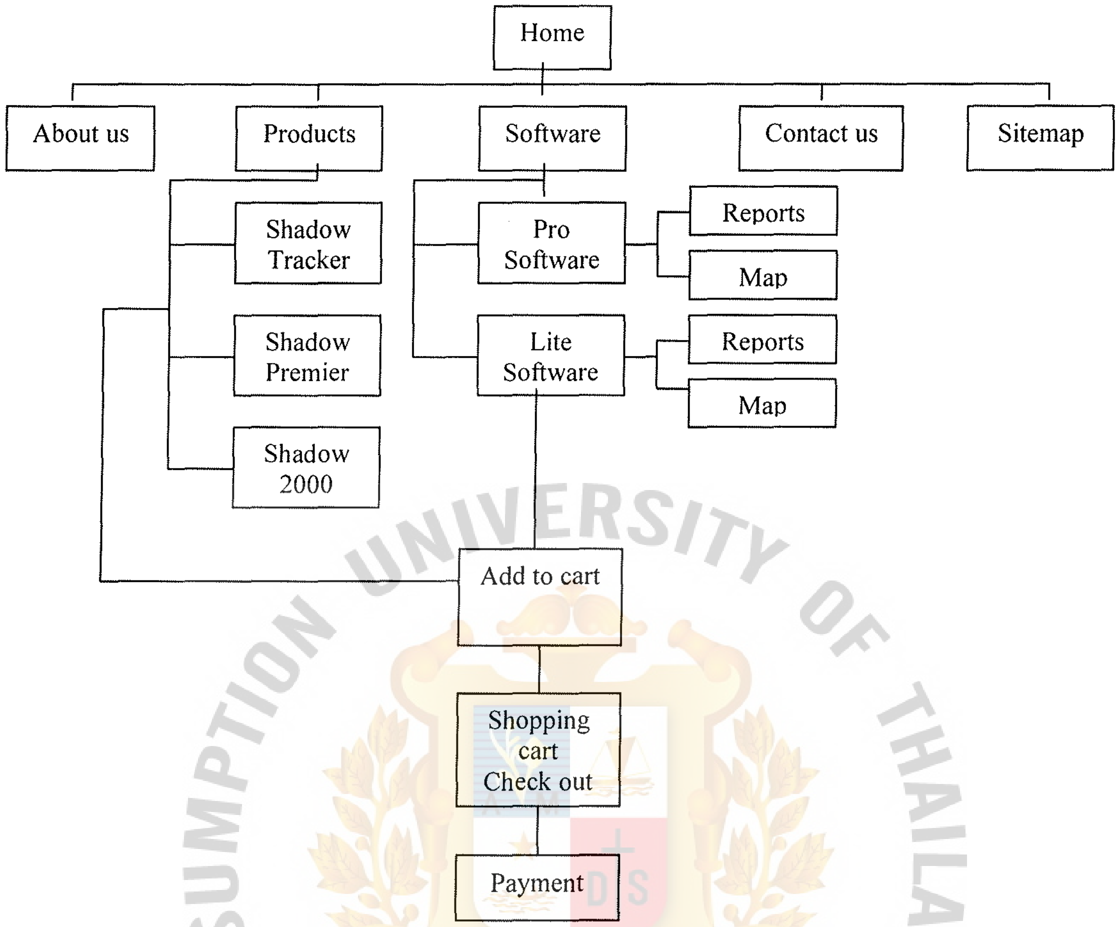



Figure 3.2. Sitemap

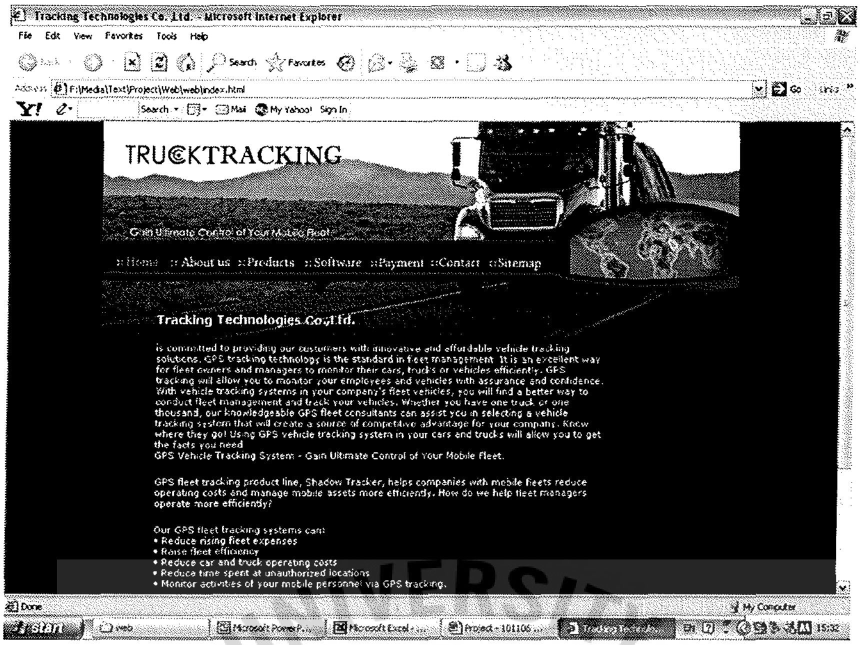



Figure 3.3. Home Page

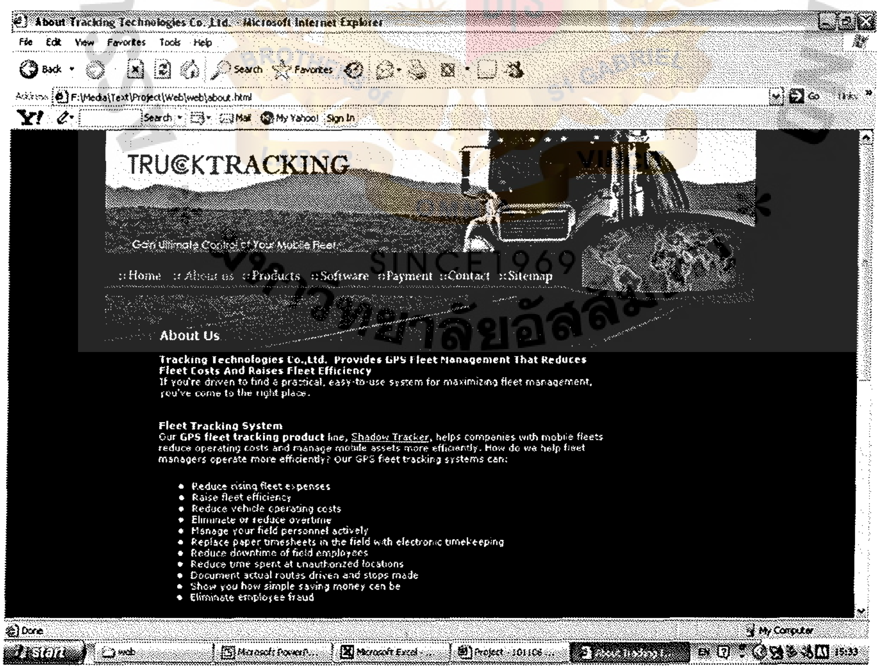



Figure 3.4. About us

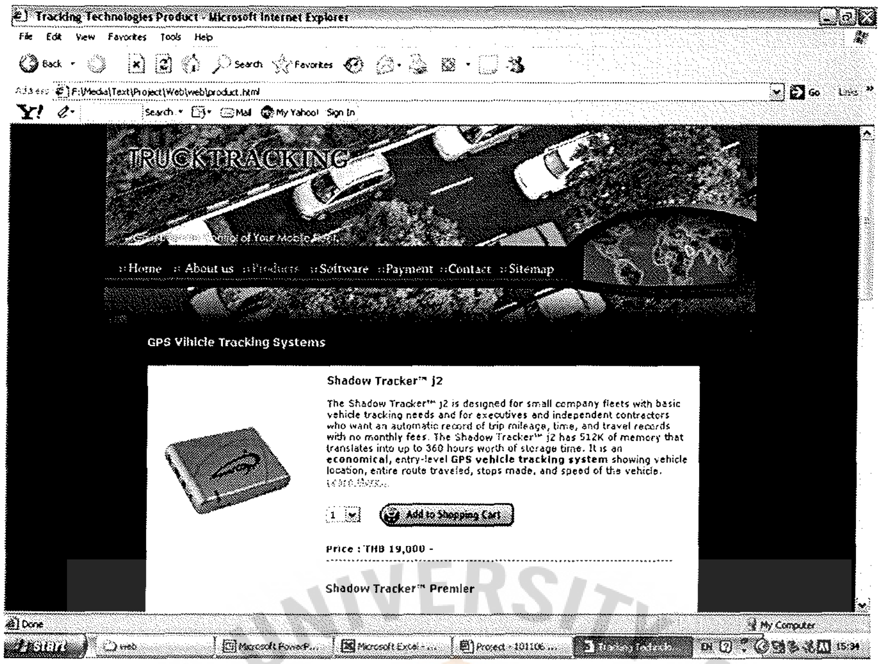



Figure 3.5. Product

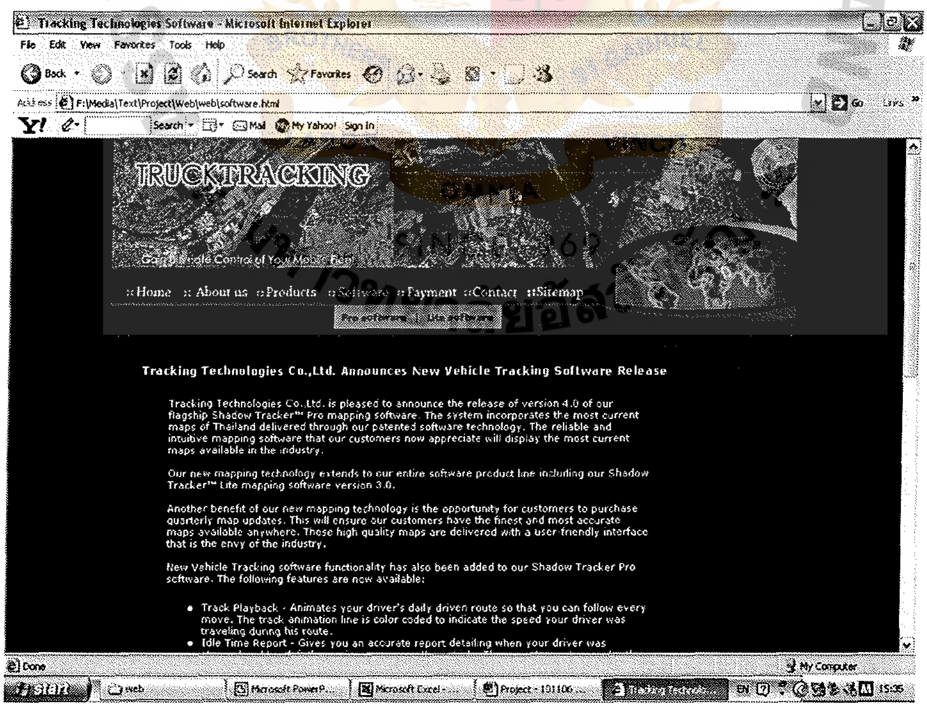



Figure 3.6. Software

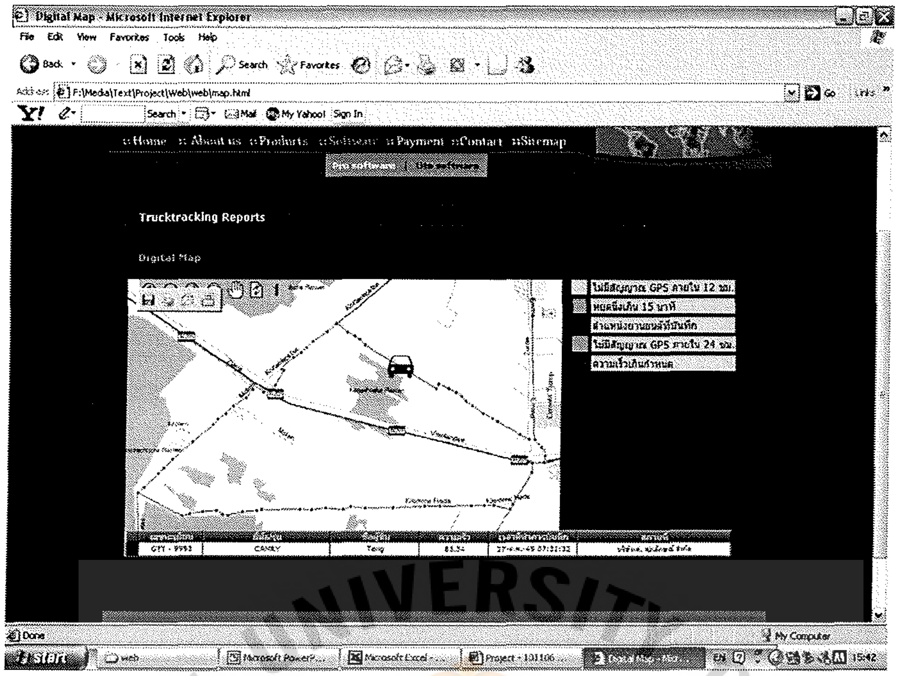



Figure 3.7. Digital map

In the figure 3.7, the digital map will be shown as the example of the software which can be tracked where the truck is, at any time, anywhere in Thailand.

Furthermore, the reports of each truck can be shown day by day as the following of example report in figure 3.8.

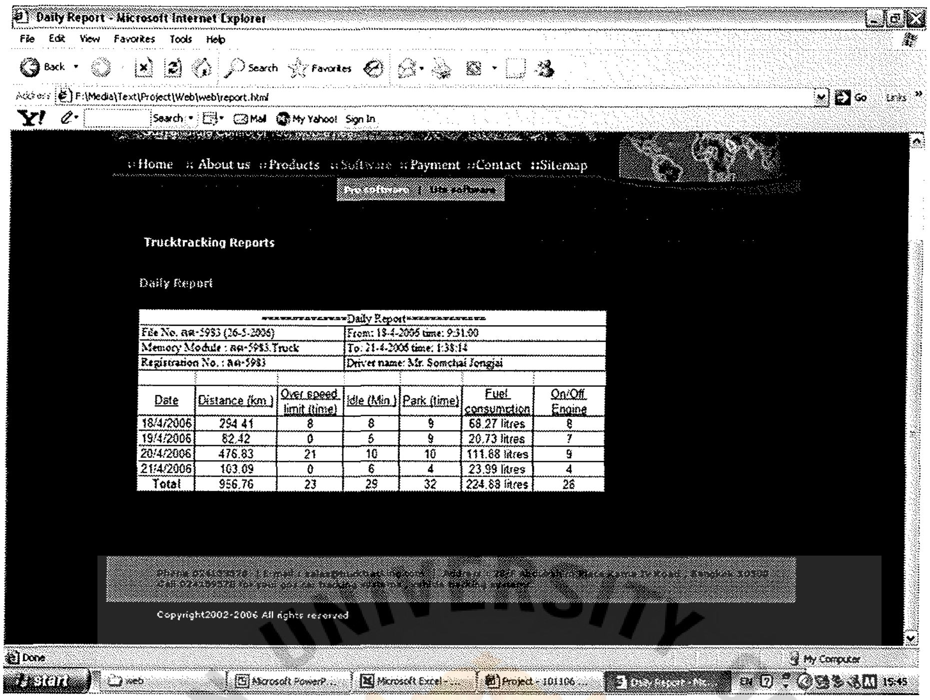



Figure 3.8. Daily Report

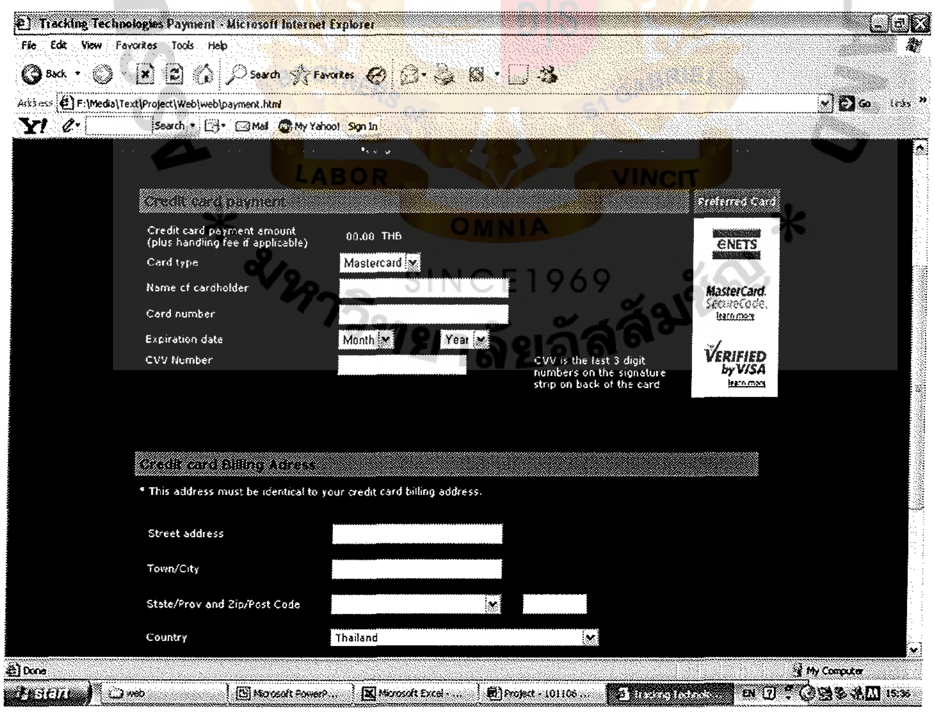



Figure 3.9. Payment

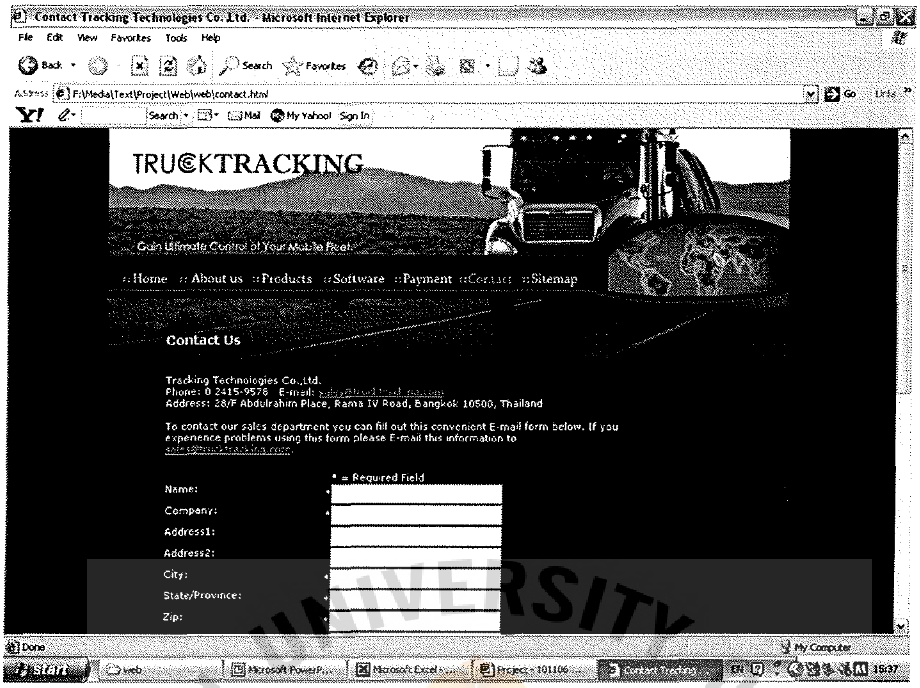



Figure 3.10. Contact us

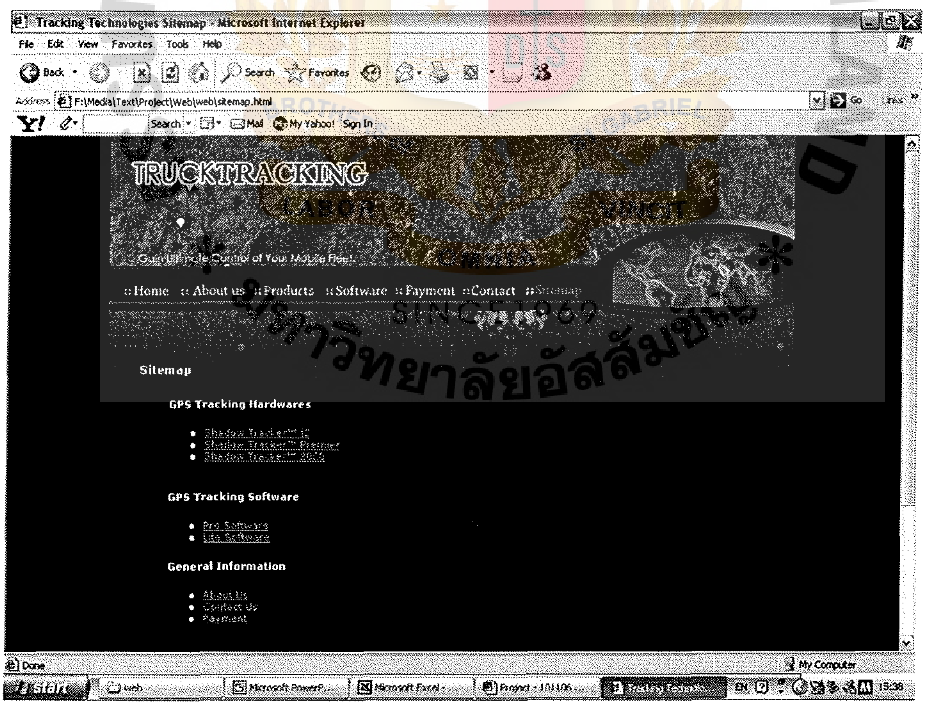



Figure 3.11. Sitemap

## 3.5 Database Design & Data Dictionary

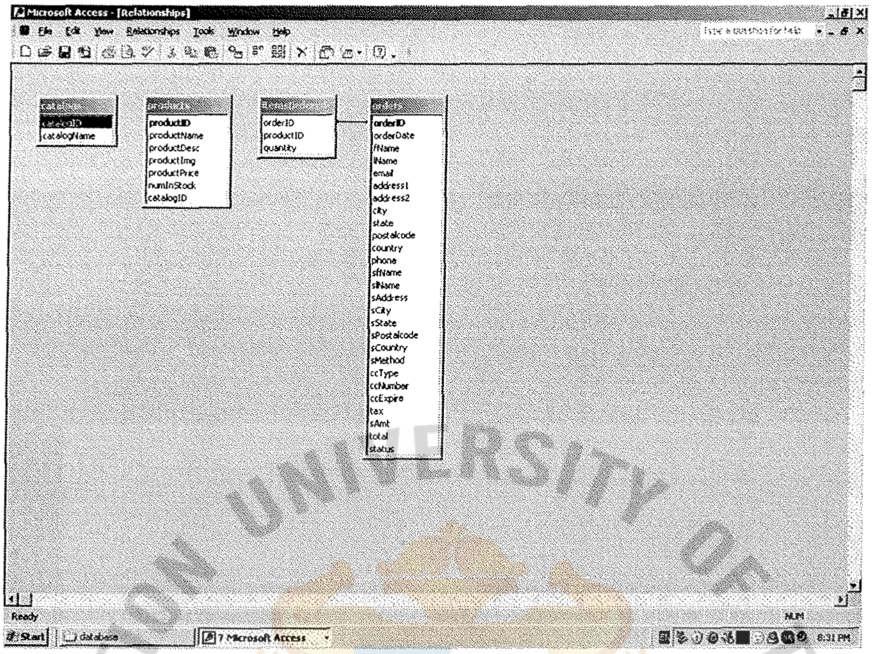



Figure 3.12. Table Relationship

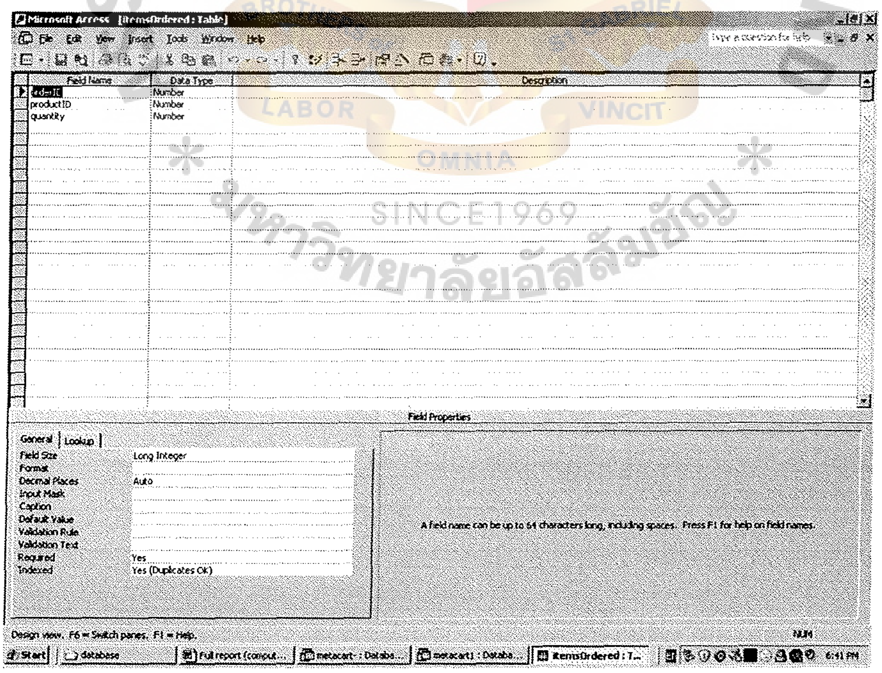



Figure 3.13. Items Order Table

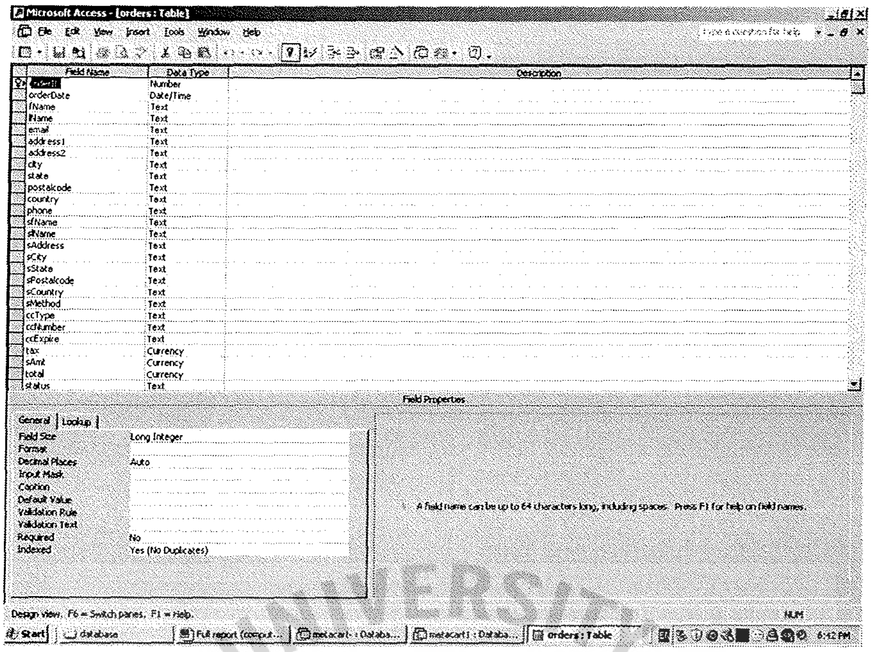



Figure 3.14. Order Table

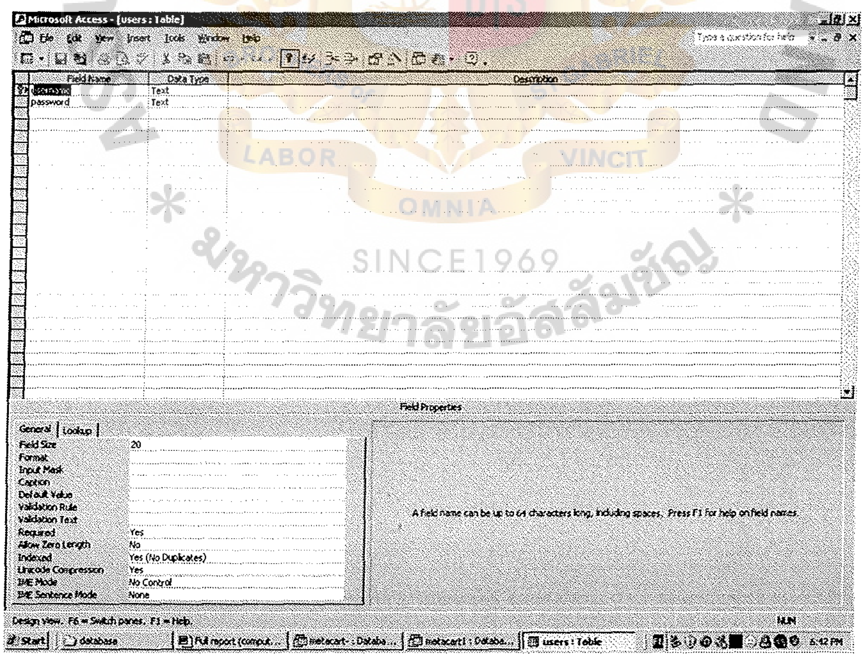



Figure 3.15. User Table

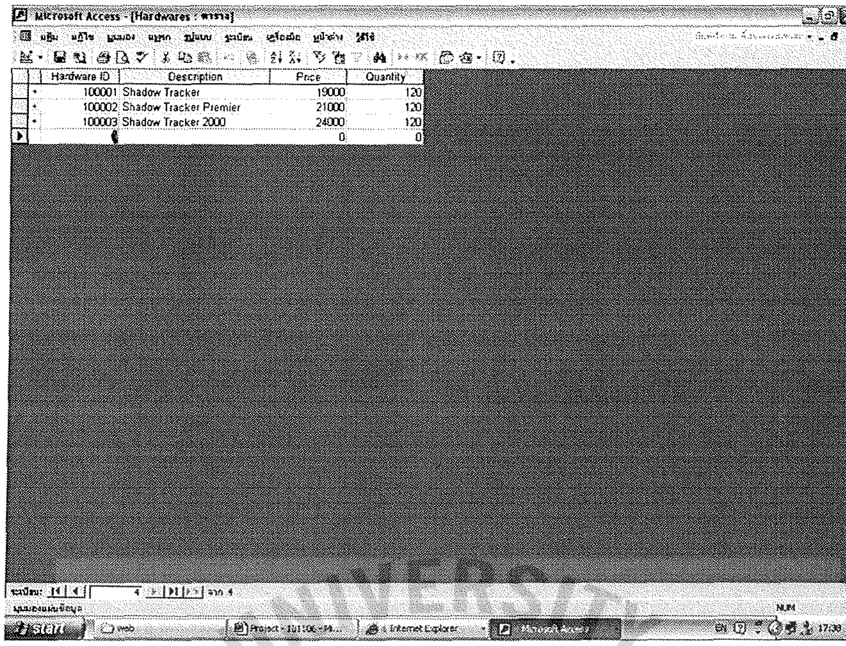



Figure 3.16. Products Table

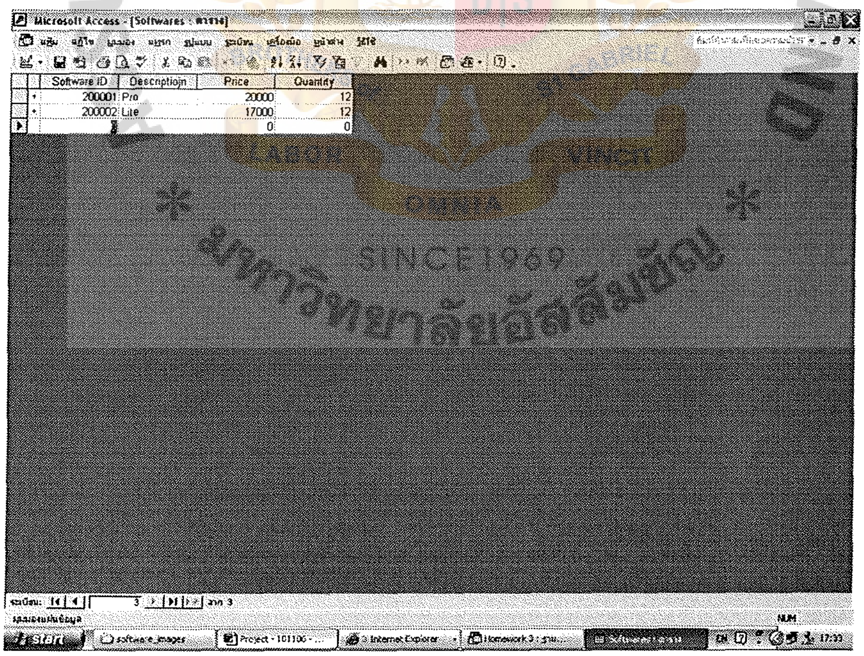



Figure 3.17. Software Table

### 3.6 Company Financial Analysis

Return on investment will be calculated by subtracting revenue with integrating capital investment cost as well as pre-operation cost. The annual fixed cost and variable cost every year is included. The expense and revenue summary in the first five years is shown below.

Table 3.5 Company Statement for 5 years

| **Expense** | **1st Year** | **2nd Year** | **3rd Year** | **4th Year** | **5th Year** |
|---|---|---|---|---|---|
| **Cost** | | | | | |
| Office Hardware | 100,000 | - | - | - | - |
| Office Software | 150,000 | - | - | - | - |
| Domain name | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Server cost | 30,000 | 25,000 | 20,000 | 15,000 | 10,000 |
| Advertisement | 15,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Administration cost | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| Officer salary | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Utilities expense | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 |
| GPS Devices cost | 2,448,000 (120 units) | 2,448,000 (120 units) | 2,978,400 (146 units) | 3,060,000 (150 units) | 3,672,000 (180 units) |
| Software cost | 192,000 (12 units) | 224,000 (14 units) | 256,000 (16 units) | 320,000 (20 units) | 384,000 (24 units) |
| **Total Cost** | **3,039,000** | **2,811,000** | **3,368,400** | **3,509,000** | **4,180,000** |
| **Accumulate Cost** | **3,039,000** | **5,850,000** | **9,218,400** | **12,727,400** | **16,907,400** |
| **Sales Revenue** | | | | | |
| GPS Devices Sales | 1,920,000 (80 units) | 2,800,000 (120 units) | 3,600,000 (150 units) | 3,840,000 (160 units) | 4,320,000 (180 units) |

| | | | | | |
|---|---|---|---|---|---|
| Software Sales | 240,000 (12 units) | 280,000 (14 units) | 320,000 (16 units) | 400,000 (20 units) | 480,000 (24 units) |
| Software Services | 12,000 | 26,000 | 42,000 | 62,000 | 86,000 |
| **Total Revenue** | **2,172,000** | **3,106,000** | **3,962,000** | **4,302,000** | **4,886,000** |
| **Accumulate Revenue** | **2,172,000** | **5,278,000** | **9,240,000** | **13,542,000** | **18,428,000** |
| **Profit** | **-867,000** | **-572,000** | **21,600** | **814,600** | **1,520,600** |

According to the financial data, return on investment is calculated and the total profit will return on 3rd year as seen in the following graph.

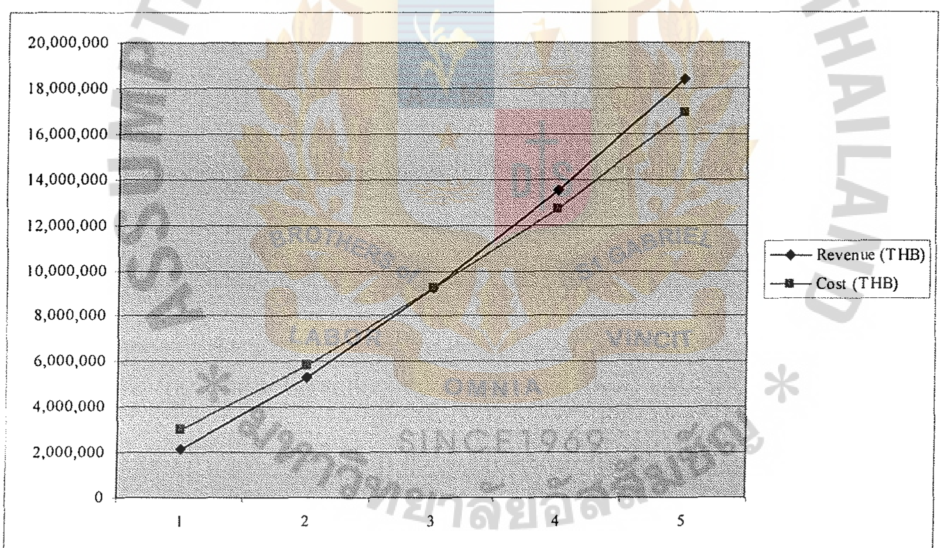



Figure 3.18 . Company Financial Analysis

# V. CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Conclusions

It can be concluded that goods transportation needs serious management in order to provide the ultimate safe delivery. Thus, many kinds of chemical need a special method of handling differently. However, it is necessary to have the drivers perform the goods delivery so it is difficult to avoid human errors. For example, they might park the truck in a prohibited area or drive at an unsafe speed. Moreover, external factors could cause serious incidents. For example, what the cost of damage will be if the chemical tanker truck has got a fatal accident. This would have an immediate effect of the death of people in the area of 20 square kilometers. Now, the transporter would not only be concerned about the fleet utilization but also the safety and security of goods transportation. Therefore, the necessity is an effective method to support fleet management for monitoring and keeping records in order to update the status of delivery or alert the controller and give driver the feedback or warning for their driving behavior.

In the past, the monitoring of driver behavior was used by Tachograph but it could be done after delivery has been done. However, currently, by the application of Global Positioning System (GPS) applied in Intelligent Transport Management System (ITMS) would be a solution for development of goods transportation management. Therefore, ITMS application will be a major source of innovation in the positioning field. The demands of ITMS for accurate, precise, robust, wide area positioning will prompt many developments, and GPS will be an important part of this project of ITMS application as well.

The report has defined the number of equipments concerned with the ITMS operation which includes the software of digital mapping system, GPS receiver and memory module. Then, number of output that includes various kinds of reports will be generated to measure the performance of driver. For example, the system would generate speeding report, idle report and daily report. These reports would assist the manager to monitor their driver accurately.

From the cost comparison table, ITMS have proved that it is not necessary to pay more for today's technology. Thus, the cost of real tracking equipment is not expensive than Tachograph. Moreover, ITMS would be cost effective in long run. In the company financial analysis chart has illustrated that the investment will be returned within 3 years.

Although, ITMS may not be a new method of transport management ITMS are implement in many developed country such as, USA, UK, Australia, etc. Thus, they have realized that ITMS could really improve the standard of transporters or even the whole supply chain management. This would also lead to higher standards of living in those countries as well. Therefore, the question is "why do we have to wait to implement of ITMS while they have already proved the better solution for transport management?"

Therefore, it can be said that ITMS is essentially a transport management system that applies information technology and telecommunications. ITMS would be the resolution of transport problems, such as safety, congestion, pollution and even infrastructure deterioration, and in so doing may provide policy makers, government, operators, industry and the general public with tools that will help them to meet their transport objectives more efficiently, cost-effectively and safety.

## 5.2 Recommendations

It is recommended that only a small number of goods transport entrepreneurs are applying ITMS in Thailand as compared to other countries. Some transporters do not know how to make use of ITMS and some of them may be afraid of new technology. Moreover, it would be a high investment to implement ITMS.

In the future plan, transporter may offer the real time tracking on web to customers to track their delivery. After initial implementation of ITMS, the development of ITMS will include:

1) Real time delivery tracking system on the website: The system would show and allow the customer to track the delivery online that is in action on the website.

2) Online accident alert: The truck may fit the sensors in the front and rear bumper. When the truck has crashed something, the sensor would alert the system at control center. Then, the safety team could prepare to handle the situation in time and take immediately steps as on emergency response.

There might be a limited number of transporters who apply ITMS to their fleet management. Thus, it would better if the starting in the area of web application recently. Website will be one of way to demonstrate how ITMS could benefit to transporters to customers.

Finally, ITMS could develop and adjust the level of safety standards for transporters. Furthermore, ITMS could improve the economy in Thailand as well.

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