UMP VEHICLE ENTRY & EXIT MONITORING SYSTEM

(UMP VEEMS)

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ABSTRACT

Lately, the problem of stolen vehicles is frequently happened. This happens not because there is no direct supervision towards the vehicle, but the methods used are less efficient. Not only vehicles parked in public places are likely to be lost, but the vehicles in an area with security guards are also likely to be lost. For example, in government departments such as the office parking area, housing areas with guard posts and even in Universiti Malaysia Pahang itself. Student and staff of UMP need a safer place to park their vehicles. In UMP, the supervision at guard post is done manually where a few security guards will be stationed at each guard post to monitor the entry and exit of vehicles. The possibility of stolen vehicle is high because there is no identity inspection done to every vehicle's owner that enter and exit UMP area. Anyone can drive a vehicle inside UMP area with a condition that the vehicle has UMP sticker on it. The criminal may have stolen the vehicle by disguising as student or staff of UMP. To overcome this problem, UMP Vehicle Entry and Exit Monitoring System will be develop. This system can increase the safety of vehicle in Universiti Malaysia Pahang, especially for cars. With the existence of this system, the security guards of UMP Security Department will easily obtain the traffic report on vehicle entry and exit from UMP. This system will be able to record the vehicle registration number and matric ID of the driver.

ABSTRAK

Kebelakangan ini, masalah kecurian kenderaan semakin kerap berlaku. Hal ini berlaku bukan kerana tiada langsung pengawasan terhadap kenderaan tersebut, tetapi cara yang digunakan adalah kurang cekap. Bukan sahaja kenderaan yang diletakkan di tempat awam sahaja yang berkemungkinan akan hilang, tetapi kenderaan yang berada di kawasan yang mempunyai pengawal keselamatan juga berkemungkinan akan hilang. Sebagai contoh di jabatan kerajaan, seperti kawasan meletak kenderaan pejabat, kawasan-kawasan perumah yang mempunyai pondok kawalan dan malahan di Universiti Malaysia Pahang sendiri. Para pelajar dan petugas UMP memerlukan tempat yang selamat untuk meletak kenderaan. Di UMP, pengawasan di pondok kawalan adalah menggunakan cara manual, di mana beberapa orang pengawal keselamatan akan ditempatkan di setiap pondok kawalan untuk mengawasi kenderaan keluar masuk. Kemungkinan untuk kehilangan kenderaan adalah tinggi kerana tiada pemeriksaan identiti dikenakan terhadap setiap pemilik kenderaan yang keluar masuk. Sesiapa sahaja boleh membawa kenderaan di dalam kawasan UMP dengan syarat mempunyai pelekat kenderaan UMP. Penjenayah berkemungkinan dapat melarikan kenderaan curi dengan menyamar sebagai pelajar atau petugas UMP. Untuk menyelesaikan masalah ini, sistem pengawasan kenderaan keluar masuk akan di bangunkan. Sistem ini dapat meningkatkan tahap keselamatan kenderaan di Universiti Malaysia Pahang, khususnya bagi kereta. Dengan adanya sistem ini, pengawal keselamatan di Jabatan Keselamatan UMP mudah untuk mendapatkan laporan trafik kenderaan yang keluar masuk. Sistem ini akan mencatat nombor pendaftaran dan id matrik pemandu kenderaan tersebut.

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LIST OF ABBREVIATIONS

UMP	Universiti Malaysia Pahang
UMP VEEMS	UMP Vehicle Entry and Exit Monitoring System
UI	User Interface
RFID	Radio-frequency identification
GHz	Gigahertz
ID	Identification
LED	Light-emitting diode
IDE	Integrated Development Environment
IBM	International Business Machines Corporation
HTML	HyperText Markup Language
XML	Extensible Markup Language
DB	Database
SDLC	System Development Life Cycle
SQL	Structured Query Language
CPU	Central Processing Unit
RAM	Random Access Memory
HDD	Hard Disk Drive
DFD	Data Flow Diagram
LPR	License Plate Recognition

CHAPTER 1

INTRODUCTION

1.1 Background

In an age of modernization, the world is no longer a safer place for people to live freely without cautions and safety measures being implemented as a routine. Property and life have been valued as something that can be easily lost and replace. There are too many kinds of crime happened involving property and life such as robbery, scamming, privacy intrusion and homicide. One of the most common crimes nowadays is car theft or sometimes referred to as grand theft auto.

According to Charles (2013), the statistics of car theft in Malaysia showed about 24,299 cases in 2012 and declined to 16,258 cases until September 2013. Although there is a visible decline on the number of cases, the statistics still on an alarming number. The high level of car theft cases in Malaysia might be caused by several factors such as lack of security implementation on the vehicle, strategic location for car theft, and the increasing number of criminal syndicate for stealing car. Apart from the various factors for car theft cases, preventive measures must be implemented and action must be taken before the crime happen. Safety measures can be implemented on residential area such as building guard post or forming a voluntary security team.

1.2 Problem Statement

In University Malaysia Pahang, security issues have been a prolonged problem since a few years earlier especially at the student's residential colleges. It is because there is no restriction towards people or visitors that enter and exit UMP area. There is no proper system to monitor vehicles movements as it is done manually for certain period of time. The security officer at residential colleges guard post only record vehicle entry and exit on night duty manually into a record book. At the main gate, vehicle entering UMP only being check for identification but not being record into the record book. This manual system does not provide continuous vehicle monitoring and ignore the safety measure to identify the identity of every vehicle's owner.

Currently, UMP Security Department is still using manual procedure to control traffic by monitoring every single vehicle that enter and exit the UMP area. Authorized and unauthorized vehicle are monitored manually by checking every vehicle entering UMP whether they are UMP community or not. However, during monitoring process there might exist a few vehicles that are being overlooked by the security officer. Unauthorized vehicle may have entered UMP without alerting security officer and can exit the area undetected.

Another problem posed by the manual monitoring is no fix history log on vehicle entry and exit of UMP. The data is only recorded on an indefinite time and does not cover 24 hours a week. Therefore, the currently use manual monitoring system can be improve by developing an electronic monitoring system. With this new system, a more accurate and secure monitoring of vehicle entry and exit of UMP can be implemented. Less workforce of security guard will be used and UMP will be more secure from unauthorized vehicle. These new system is called UMP Vehicle Entry and Exit Monitoring System (UMP VEEMS).

1.3 Objective

The goal of this project is to develop UMP Vehicle Entry and Exit Monitoring System (UMP VEEMS). The following objectives are set:

i. To replace the existing manual system into an electronic monitoring system.
ii. To keep track and alert security department on unauthorized vehicle entering or exiting UMP.
iii. To generate report on vehicle entry and exit into UMP via the monitoring system.

1.4 Scope

i. Target Organization

UMP Security Department is the target organization for developing the system. The system is developed to create an electronic vehicle monitoring system to be used by security officer to enforce traffic law and control people who enter and exit from UMP.

ii. System User

The target user of the system will be the UMP Security Department staffs which are the system administrator and security officer. System administrator will register security officer to use the system, while security officer will use the monitoring system for 24 hours a week and check for unauthorized vehicle.

iii. **Function**

The main function of the system is solely intended on monitoring the vehicle that is authorized and unauthorized to enter and exit UMP. With the system, only students and staffs of UMP can pass by the gate at guard posts. The system will automatically capture vehicle plate number and check in the system database. For people from outside UMP, the system will alert security officer of the access failure and required them to leave their details to the security guard before entering UMP. The system will not handle any traffic offense made by students and staff. As long as the vehicle owner is a registered UMP community then they can pass through the system.

iv. **System Platform**

The system will be develop on Visual Studio 2013 platform with database MySQL. The programming languages that will be used will include C# and MySQL.

1.5 Methodology

To develop UMP VEEMS in a systematic way, a system development approach is chosen to be use. For this system, Waterfall Model is use as the development life cycle model. In the Waterfall Model, each phase must be completed fully before the next phase can begin. At the end of each phase, a review takes place to determine if the project is on the right path and whether or not to continue or discard the project. In this model the testing starts only after the development is complete. Each phase also does not overlap. There are six major phases in Waterfall Model as in Figure1.1 below.

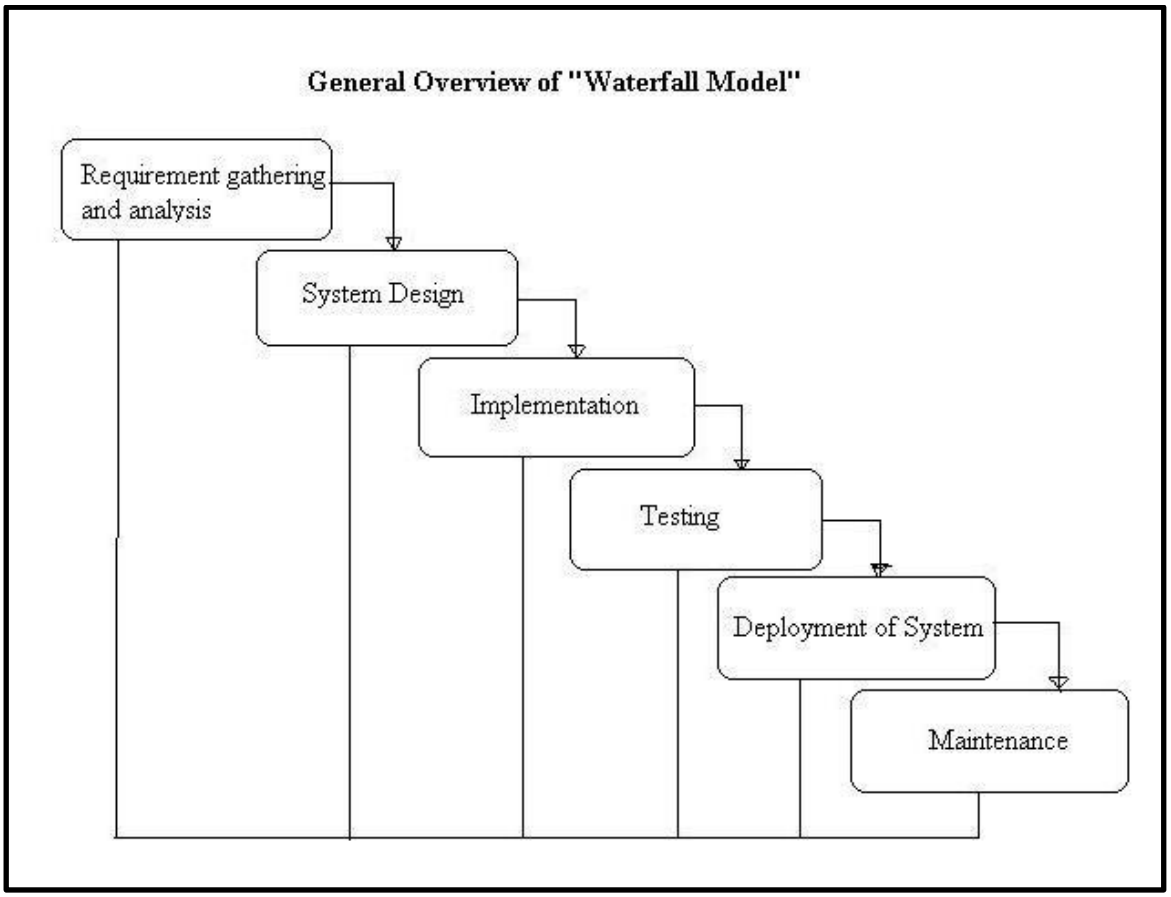

Figure 1.1: Phases in Waterfall Model

a) **Requirement gathering and analysis**

This is the first phase in Waterfall Model where information gathering occur by evaluating existing problem face by UMP community especially the Security Department. An idea to develop the system is then appeared and the problem of using manual system for vehicle monitoring is analyzed along with a discussed plan of development. Completing this phase will allow the first project objective to be fulfilled.

b) **System Design**

This is the stage where the basic layout design and functionalities as per the system plan is proposed. The design will cover on Visual Basic application system interface. Utilizing the Interface Guidelines for different stage of device, a fitting User Interface (UI) outline is delivered. This rule can guarantee application compatibility for different platforms and produce UI that match proficient standard. After completing this phase and the Implementation phase, the second project objective can be attained.

c) **Implementation**

This is the phase for real development of the system after the design phase has accomplished some progress. To check for functionality, suspicions, and serves to give understanding of the work scope, a working model is produced. The composed prototyped is made to work. After completing this phase and the System Design phase, the second project objective can be attained.

d) **Testing**

This is the phase for testing to find any bugs to be fix after the working system prototype is produced. Any improvement will also be analyzed in this phase base on the result of testing the system. After completing this phase and Deployment of System phase, the third project objective can be attained.

e) **Deployment of System**

After testing the system prototype and made improvement, the system is finally release on live. The UMP security department staff will be train to use the system and it will be deployed for use. The third project objective can be achieved when completing Testing phase and this phase.

f) **Maintenance**

This is the last phase in developing the system where the user of the system which is UMP security department staff, will use the system effectively and manage it well to prevent error and problems. Proper maintenance of the system will provide smooth process of achieving the third project objective.

Every phase in the Waterfall Model is done within a certain period of time that has been planned on the early development process. The Gantt chart of time stamps in system development can be referred on Appendix A. After all of the phases in the system development model have been completed, then the objectives of this project will be achieved.

1.6 Conclusion

The overall overview of the system is explained in a detail and compact explanation in this chapter. The background and problem statement behind the idea of developing the UMP VEEMS project are also identified. The goal and objective of developing the system are clearly stated. The scope of the application is set according to target user, functions, and development platform. The objective of this chapter is to provide guides for the UMP VEEMS project development to proceed smoothly.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

There will be five subtopics in this chapter that will cover on the detail explanation of Vehicle Entry/Exit Monitoring System, the Existing Vehicle Entry/Exit Monitoring Systems, and Software and Hardware Requirements.

Subtopic 2.2 will describe the definition and structure of vehicle entry and exit monitoring system. Sutopic 2.3 will highlight on selected technology which is the License Plate Recognition. Subtopic 2.4 will differentiate between existing vehicle entry and exit monitoring systems. Subtopic 2.5 will explain in detail about the software and hardware requirements to develop the UMP VEEMS system.

All contents in this chapter will be discussing the detail method of implementation that will be carried out during the development of this project.

2.2 Vehicle Entry/Exit Monitoring System

Vehicle entry and exit monitoring system or known as access control for vehicles is generally as old as RFID based access control. The presentation of magnetic stripe swipe cards, and later contactless RFID badges in the early eighties have pioneered the current access control industry. Since the early days manufacturers, integrators and clients have try to find the most ideal approach to control vehicle access to estates, sites and parking areas. The innovation utilized for vehicle access in the last decade is the microwave engineering consists of 2, 45 GHz readers to identify cars and other vehicles that are fitted with semi-active or active badges. Supporting reading distance of over 10 meters, this technology accommodates a convenient and flexible method for vehicular access control.

After 10 years without pivotal innovation it appears that there is new idea of inventions being experimented and developed. Currently, when a security manager or facility manager intend to control access to his estate, he or she will basically have to choose between conventional proximity technology or the microwave alternative. Manufacturers of proximity cards and readers, especially those operating in the 120-125 kHz frequency, have found ways to extend the reading distance of the card technology they deploy. Through enhancement of the reader or the tags used, a reading distance of around 1 meter has been reached, thus providing a fairly convenient way for drivers to present badges at the outer perimeter. The good thing about this solution is that the same proximity cards are used to provide people with access to the building, thus limiting the extra investment needed for vehicular access control when an access control system already is in place. Only one card type needs to be distributed and administered.

The recent technology has changed with the introduction of UHF in the automatic vehicle identification arena. Ultra High Frequency (800-900 MHz) has been used in the world of logistics for many years to track and trace parcels and products that are finding their way through the production and distribution processes.

The very nice thing about this technology is that it supports reading distances of several meters using relatively inexpensive passive badges (without batteries). Although being a slightly less robust technology when compared to microwave systems, the related investment

is greatly reduced, making it a very attractive alternative. Figure 2.1 shows the level of functionality versus investment of technology in vehicle access control.

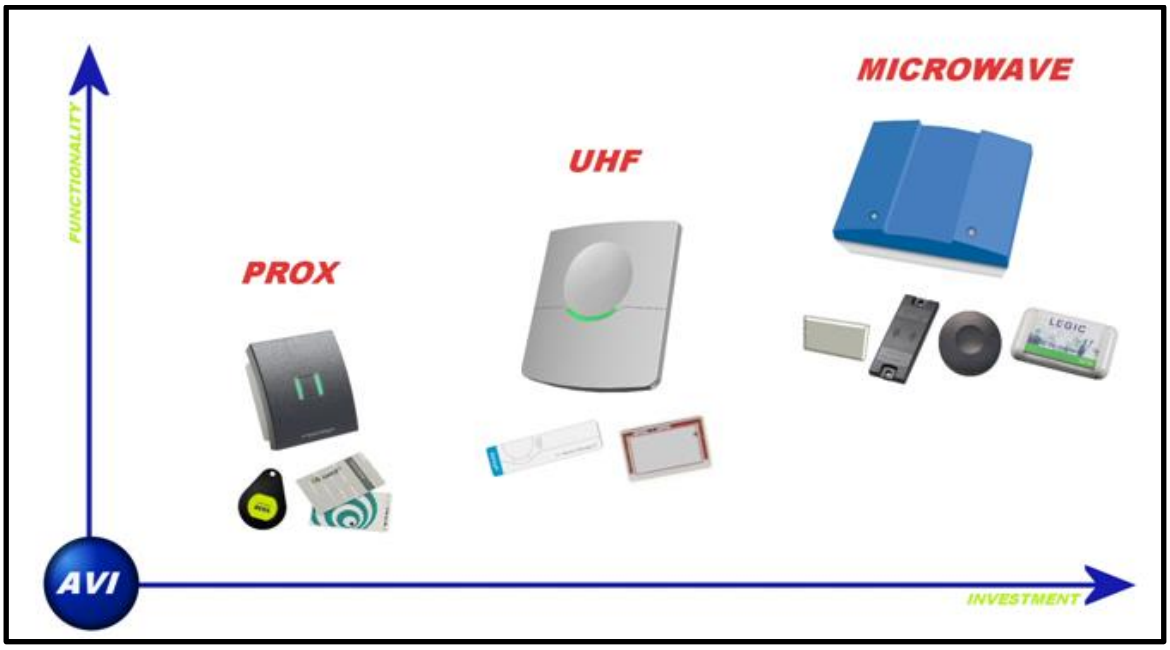

Figure 2.1: Vehicle Access Control Technology

Figure 2.2 below shows the structure of vehicle access control system using RFID and license plate recognition. The mechanism consist of the vehicle‘s owner to touch their entry card to the RFID scanner and the camera will capture the license plate of the vehicle. Both license plate and ID from the vehicle owner will be compare to the database to trigger the automatic barrier to open. The barrier will not open if the data collected is not the same or store in the database. This type of automated vehicle access control system usually applied at private site such as company building area or industry area.

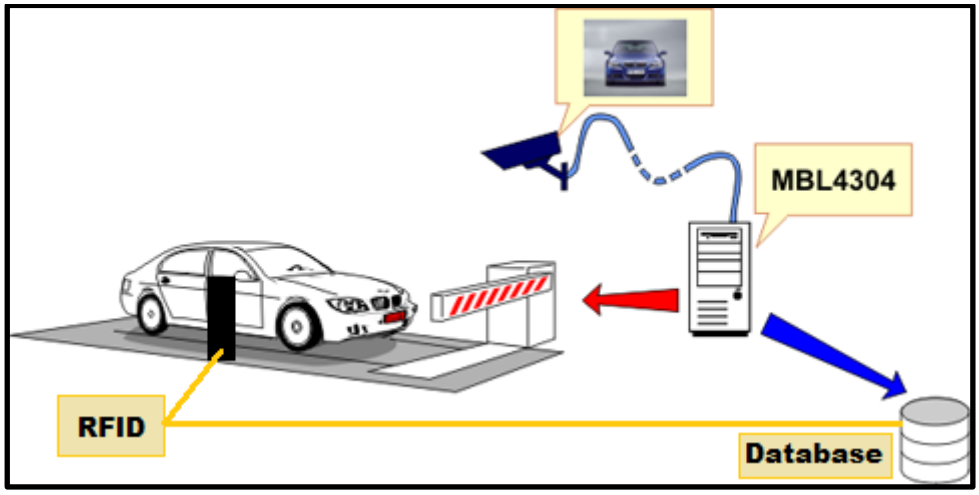

Figure 2.2: Vehicle Access Control Using License Plate Recognition

2.3 Access Control Technology

In developing the UMP VEEMS, there are several access control technology have been considered for the project purpose. However, the most recent technology implemented by majority of organizations is the License Plate Recognition (LPR). This technology has been considered as the main option for the UMP VEEMS project since it has many advantages for user.

2.3.1 License Plate Recognition

LPR (License Plate Recognition) is an image-processing technology used to identify vehicles by their license plates. This technology is used in various security and traffic applications, such as the access-control system featured in Figure 2.3.

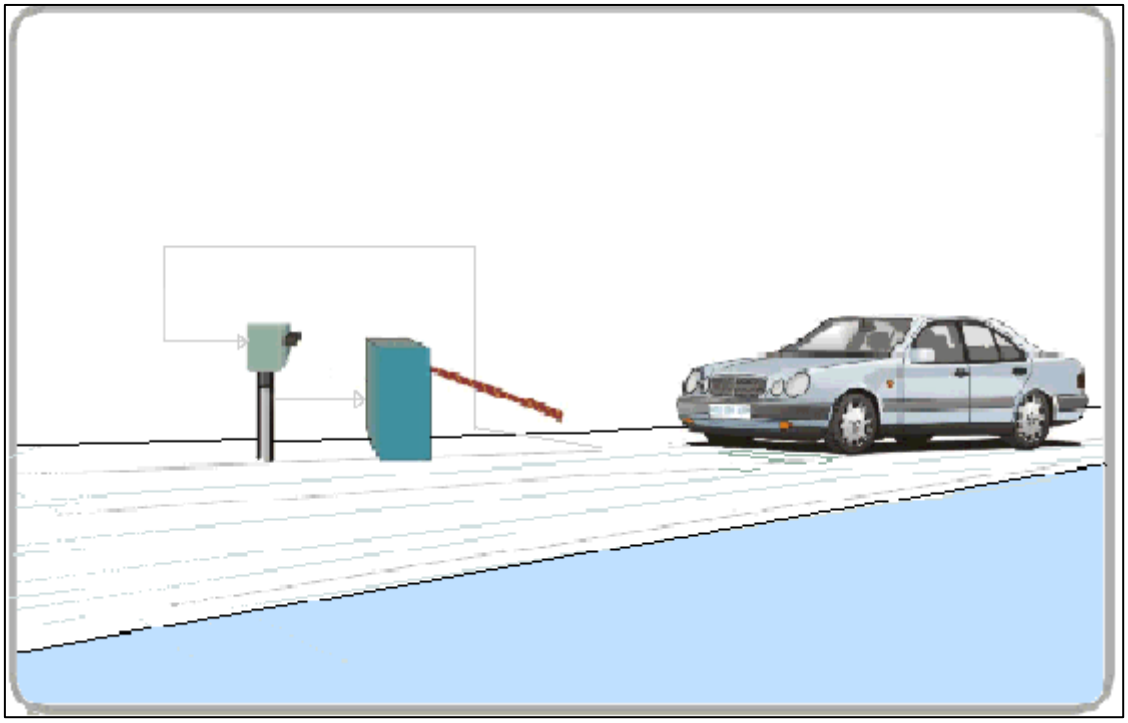

Figure 2.3: Access Control Using License Plate Recognition System

In the above example, while the vehicle approaches the gate, the LPR unit automatically "reads" the license plate registration number, compares to a predefined list and opens the gate if there is a match. This technology concept assumes that all vehicles already have the license plate displayed so no additional transmitter or responder is required to be installed on the car.

The system uses illumination such as Infra-red and a camera to take the image of the front or rear of the vehicle, then an image-processing software analyzes the images and extracts the plate information. This data is used for enforcement, data collection, and can be used to open a gate if the car is authorized or keep a time record on the entry or exit for automatic payment calculations.

The LPR system significant advantage is that the system can keep an image record of the vehicle which is useful in order to fight crime and fraud. An additional camera can focus on the driver face and save the image for security reasons. Additionally, this technology does not need any installation per car.

LPR systems normally consist of the following units:

1. **Camera** - Take the images of the car form either front or rear side.
2. **Illumination** - A controlled light that can bright up the plate, and allows day and night operation. In most cases the illumination is Infra-Red (IR) which is invisible to the driver.
3. **Frame grabber** - An interface board between the camera and the PC, allows the software to read the image information.
4. **Computer** - Normally a PC running Windows or Linux. It runs the LPR application which controls the system, reads the images, analyzes and identifies the plate, and interfaces with other applications and systems.
5. **Software** - The application and the recognition package. Usually the recognition package is supplied as a DLL (Dynamic Link Library).
6. **Database** - The events are recorded on a local database or transmitted over the network. The data includes the recognition results, the vehicle or driver-face image file.

Figure 2.4 shows a typical configuration of a LPR system, namely SeeLane System. The SeeLane application runs as a background Windows application in the PC, and interfaces to a set of SeeCarHead camera or illumination units which are interfaced by the frame grabber. The application controls the sensors and controls via an I/O card that is connected through a terminal block to the inputs and outputs. The application displays the results and can also send them via serial communication and via DDE messages to other application. It writes the information to local database or to optional remote databases via the network.

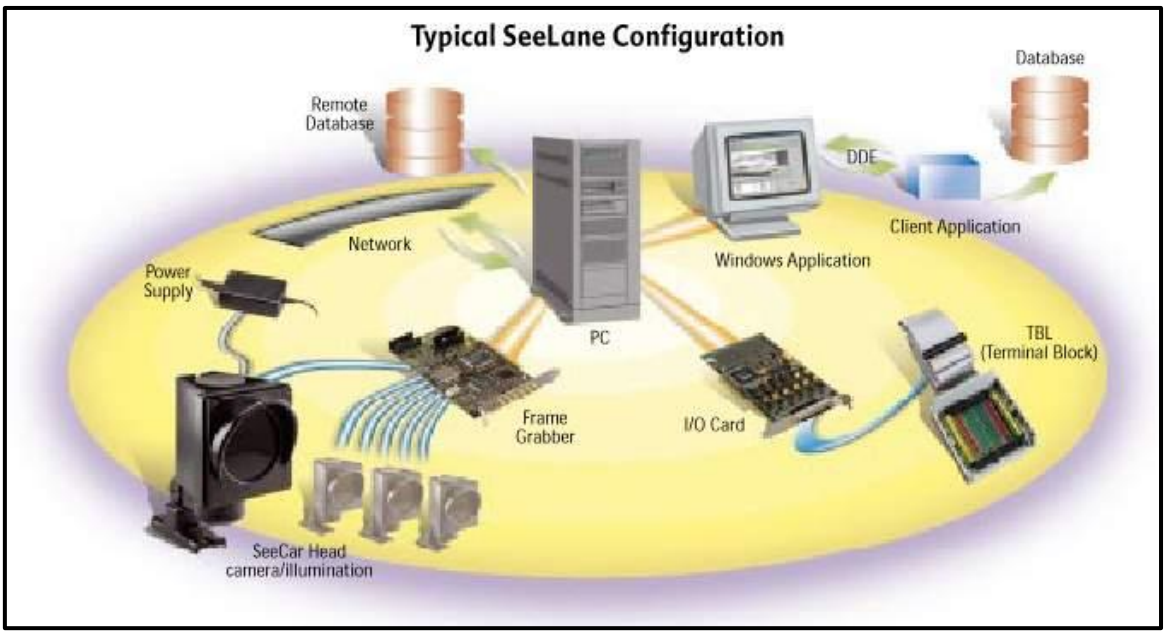

Figure 2.4: SeeLane LPR System