Expert Systems: Forecasting Petrol Orders for PETRONAS Petrol Station

By

Fong Kah Wei

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Information System)

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CERTIFICATION OF APPROVAL

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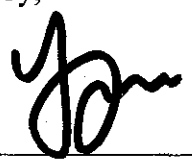
Approved by,

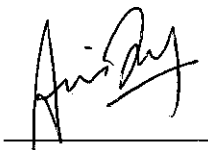


(Mrs. Vivian Yong Suet Peng)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
DECEMBER 2004

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the reference and acknowledgements, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.



FONG KAH WEI

ABSTRACT

This system aims to develop an expert system (ES) prototype to assist PETRONAS petrol station's manager to predict the weekly petrol sales. Accurate result is very important to the manager because this will determine the amount of petrol left in the petrol station storage tank. An empty tank will interrupt the petrol station daily operation and the manager needs to bear the cost as well. Currently the manager does not have any assisting material (training only provided before the petrol station start operating) to support them during planning and most of them based solely on their experienced. There is no guideline to guide inexperience manager particularly the new petrol station manager. The scope of study is to understand the process during making decision to order petrol from the depot, the underlying factors that involved in forecasting, external parties that influenced the forecast and the method used to develop the ES. The system will develop using rule-based ES that introduced the if-then rules. The system will allow more flexibility to the users to customize their own rules according to their needs. Two interfaces will be used to distinguish different user roles that involved in the system; administrator and operator. The system is depending on the system knowledge base and the inference engine to formalize and analyze the rules from the users inserts data. Later, the system will come out with the forecasted order and other details to guide the petrol station manager to make decision. The significant of this project will improve the performance, efficiency of the petrol station and also increase PETRONAS petrol selling throughout the nation.

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The writer is indebted and grateful to everyone who has provided both direct and indirect assistance to the completion of this project.

First and foremost, the writer is greatly indebted to the project supervisor, Mrs. Vivian Yong Suet Peng, who had continuously monitored his progress throughout the duration of the project. Her constructive comments, advices and guidance led to the final outcome of this project.

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Last but not the least; the writer would like to thank En. Khairul Shafee Bin Kalid, who is a lecturer in Information System faculty, for his invaluable advice, critics, comments and support.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLE

ABBREVIATIONS

AI – Artificial Intelligence

ES – Expert System

KB – Knowledge Base

KVDT – Klang Valley Distribution Terminal

PDB – PETRONAS Dagangan Berhad

PETRONAS – Petroliam Nasional Berhad

CHAPTER 1
INTRODUCTION

1.1 Background of Study

Artificial Intelligence (AI) has been a very promising field for several decades. The research in numerous branches of artificial intelligence has fulfilled the widespread expectations and has demonstrated good progress. The successful applications of several ES have been demonstrated and the number of effectively ES has been continuously increasing. These successes have led to the introduction of large number of ES with artificial intelligence in with various applications.

An ES will develop to help the PETRONAS petrol station manger to forecast the petrol order for every week. This project will enable us to carry on the research and understand the PETRONAS Dagangan Berhad (PDB) business operation process with their client (petrol station manager). The study will open up a wide area for AI application to penetrate the retailing business for petrol selling. This invasion will help the petrol station management to increase their performance and efficiency in running the business.

Currently the process of ordering petrol is very conventional which require the petrol station manager to fill in the form manually and later fax it to Mesra Link center at PDB for further process. The request form contains the detail of the amount of fuel that the particular petrol station wanted to order and the day of delivery for the coming week.

Then, PDB compiles the requests from all petrol stations according to their coverage area and later, send it to the nearest depot for further action. Upon receive the request; the person in charge at the depot will schedule the tankers that will deliver the requested

amount of petrol on the requested dates to the requesting PETRONAS petrol stations nationwide.

Therefore, it is necessary to place order early so that PDB and the depot will have sufficient time to fulfill the demand by every petrol station. Usually, orders are placed for deliveries 2 and 3 weeks ahead or maybe sometimes 1 week. Although the need to do forecast is not clear, every manager needs to know how to do it in order to place order for petrol which will be required only 2 and 3 weeks from the time the order is placed.

In case of serious under supply, manager can call for emergency load. Order can be placed in the morning for immediate reload in the afternoon. However, each station is restricted to maximum 2 requests per month; beyond which will lead to warning and action will be taken by PDB.

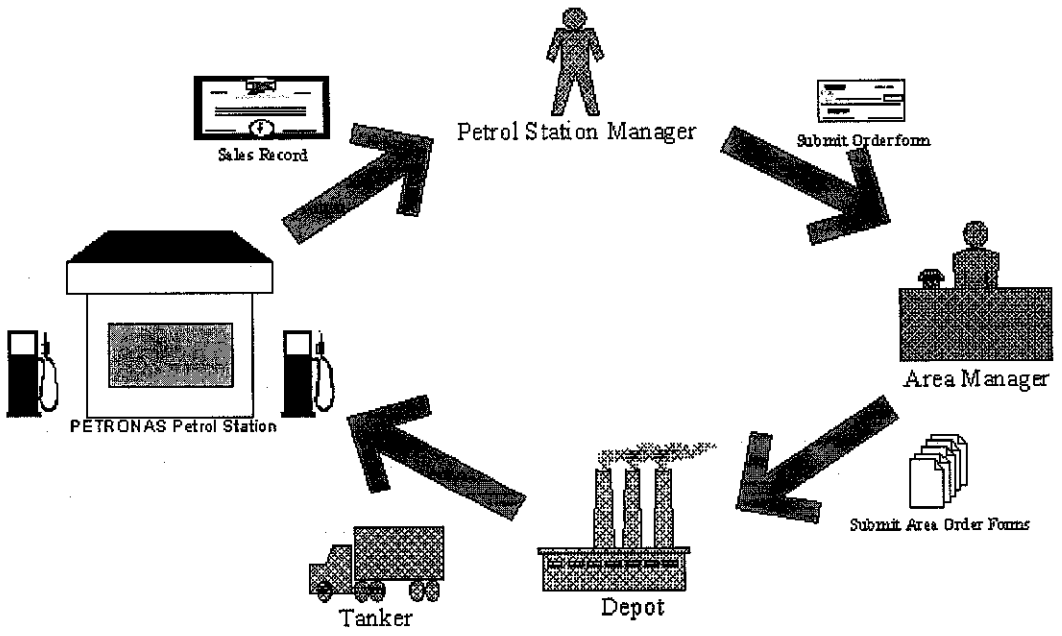

Figure 1.1 Petrol Ordering Process at PETRONAS Petrol Station

1.2 Problem Statement

1.2.1 Problem Identification

Profit making is the main goals that need to achieve by every manager in a business operation, so does the manager at PETRONAS petrol station. Petrol station's manager have important role to play when he or she makes a decision on how many liters of petrol need to order and when the order arrives to maintain the continuity of sales. The decision to place the order is solely based on the forecasted result that periodically computed by the manager.

However, using the manual way is not an effective and efficient way to predict the petrol order at the petrol station. This is due to the lack of skills and experienced by the manager to come out with a precise result although training had provided to them.

The owner of the petrol station will bear all the consequences if the prediction did not work out similar with the real result. If the manager underestimates the sales of the petrol on a particular day, this will lead to insufficient petrol in the underground tank at the petrol station before the next tanker arrives. In contrast, if the manager overestimates the petrol sales, then the petrol tanker have to return the extra petrol delivered to the petrol station back to the depot. This will increase the operational cost of the petrol station. In addition, if the petrol station manager frequently makes the same mistake, they will be penalized or black listed.

To overcome the problem, an ES that based on the manager's knowledge will be developed to assist the manager in forecasting the amount of petrol that need to order for every week.

1.2.2 Significant of the Project

An ES will provide the following benefits:

a. Reduce or control human factors in decision making for more accuracy and objective forecast;
b. Manager can concentrate on bringing more sales to the station and cut down the operational cost of the petrol station;
c. The non-expertise users are able to carry out the forecasting process if the manager is not around; and
d. Manager can keep track their previous ordering record for future reference.

Possibly, an ES paves way to a fully-automated petrol station in the future whereby a computer system will resume the roles of human manager.

1.3 Objectives and Scope of Study

1.3.1 Objectives

The main objectives of the system are to achieve the followings:

- To provide a value added ES that is general acceptable by the nationwide PETRONAS petrol station operator in predicting the petrol order.
- To identify the factors that influence the decision making process in forecasting the weekly petrol order
- To develop a prototype version of ES to forecast the weekly petrol order that can save time and cost, in the mean time increase the efficiency and performance of the current method.
- To develop a prototype version of ES that has the overall accuracy of more than 90%.
- To implement rule-based ES

1.3.2 Scope of Study

Study focuses on how a manager at a typical local PETRONAS petrol station forecast the future order of petrol enable them to place the order for the coming weeks. An ES prototype will be designed that allow the user to derive the weekly forecast.

The whole system will be developed based on the ES model where rule-based method is used to formulate the rules based on the manager general knowledge and experience in forecasting the petrol order. The rules act as conditions to the system where users' input will be tested and verified for its accuracy.

The prototype system allows the user to modify the rules by changing the variables according to their needs. This is because different petrol station will have different rules to adhere with. However, the parameters/factors that use to control the outcome will be fixed. This will remain the conformity of the rules that apply to general PETRONAS petrol station throughout Malaysia.

CHAPTER 2
LITERATURE REVIEW AND THEORY

2.1 What is Artificial Intelligence (AI)?

Many people define AI differently; Simmons and Chappell [1] define AI as the behavior of a machine which, if a human behaves in the same way, is considered intelligent. However some define AI as a study to make the machine to act humanly or perhaps in more advances the machine can perceive, reason and act [2].

Under the roof of AI, there are a few areas of AI, such as, ES, fuzzy logic, neural networks, natural language processing, robotics and etc. This can help us to understand more about AI in detail. Most of the AI related systems are built based on this foundation and customized it with other methodology which can bring more development to the AI world. For example, AI can use as a decision tool to assist manager for efficient strategic and operational management [3], reduce the managerial risk [4] and use to predict the climate [5].

2.2 Expert System (ES)

ES become so popular among the developers due to its easy understanding approach. ES direct application of expertise where the expert knowledge is transferred into computerized system to assist non-expertise user to conduct the similar task that conducted by the expert. However, ES do not replace the expert in the particular field but can make their knowledge and experience more widely available [6]. In addition, the computer based ES also view as a viable alternative from other model especially statistical model for decision making in the fields of finance, accounting and marketing [9].

The structure of ES is developed based on three major components which include the user interface, inference engine and knowledge base [6]. The user interface is the interface between the systems with the user. User uses the user interface to communicate with the system by inserting input or viewing the output. The inference engine is where all the reasoning is done during processing the request by the users. The inference engine will retrieve the knowledge or the rules that store in the knowledge base.

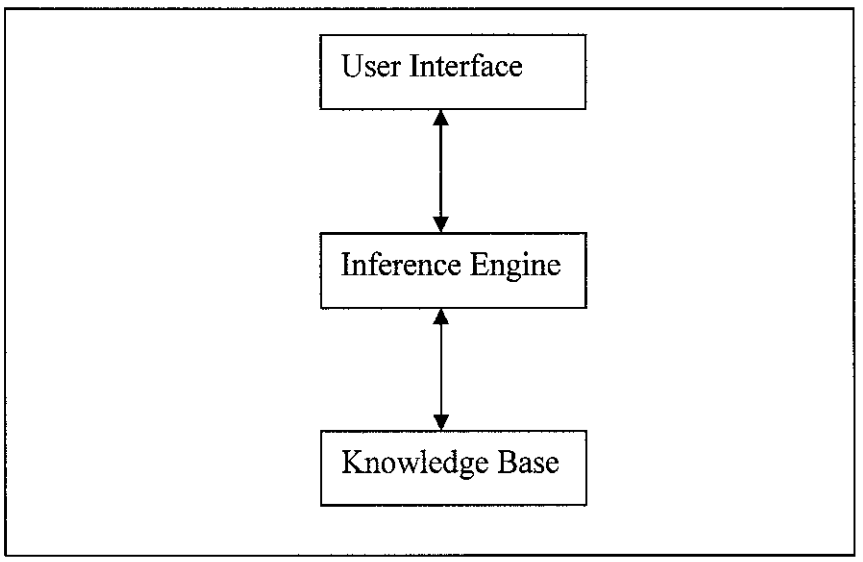

Figure 2.1 Basic Structure of Expert System

In ES there are a few issues that we need to take into account. The knowledge acquisition process always is the main threat in failing the success of an ES. This is because knowledge acquisition consumes a lot of time, effort, and often results in inconsistent rules [9] if we did not plan it properly. In order to solve this problem, the developer needs to know what he wants in his system and where to acquire the information from. Some researchers propose to use the rule induction technique called Induction eXtremely Large (IXL) databases [9] to reduce the bottleneck of this issue.

The other popular issue in ES is knowledge representation. Although we successful acquire the information or knowledge that related to the system, but representing the knowledge will be another perspective that we need to concentrate on. If we represent

the acquired knowledge wrongly, this will affect the general outcome of the system. The most common method to represent the knowledge is logics, production systems, conceptual graphs, semantic networks, scripts and frames [11].

2.3 ES and Forecasting

The usage of ES in forecasting is widespread as many experts had developed a forecasting ES to assist them in predicting the future outcome in order to increase the effectiveness and efficiency of the result. Forecasting is important in many areas, ranging from production planning and stock control to economics and management [8]. The rich variety of different forecasting techniques can be bewildering, particularly for the less experienced potential user.

The selection and implementation of the proper forecast methodology into ES has always been an important planning and control issue. Often, the financial situation of the entire company operation rely on the accuracy of the forecast since such information will likely be used to make interrelated budgetary and operative decisions in areas of personnel management, purchasing, marketing and advertising, capital financing, etc.

There are two main approaches to forecasting. Either the estimate of future value is based on an analysis of factors which are believed to influence future values or else the prediction is based on an inferred study of past general data behavior over time. For example, the belief that the sale of petrol will increase from current levels because of a recent low petrol price rather than proximity to public holiday such as Christmas, Chinese New Year or Hari Raya illustrates the difference between the two philosophies. It is possible that both approaches will lead to the creation of accurate and useful forecasts, but it must be remembered that even for a modest degree of desired accuracy the former method is often more difficult to implement and validate than the latter approach.

A good forecasting model must be flexible enough to carry on the forecasting process where the user can change the variables [10] according to their needs but not the parameters that use to derived the final output. In addition, the ability of the ES to imitate the reasoning of the expert in all aspects will make the system look more perfect. To avoid the pitfall, some researchers advise not to take the quick and convenient route during implementing the system [10].

2.4 Rule-based ES

Rule-based ES will be implemented in this project because rule-based ES is easy to implement as compare with other method. The rule-based ES will use the if...then... rules to solve the problem [11]. For example, ***if*** the underground tank is empty ***then*** place the order.

MYCIN is a very popular rule-based ES that was developed in 1973 to assist the medical staff to diagnose several kinds of blood type diseases. Shortcliffe introduced this clinical application of rule-based ES for diagnosis of antimicrobial infections. His work incorporated explanation, knowledge acquisition, teaching, and system-building facilities.

There are a few important issues concerning the performance of the rule-based ES. The most common issue is the response time of the rule-based ES [12]. A good ES will be able to response immediately upon receive the request from the users without any delay. This issue should not arise because the computer technology now a day is far more advance compare to 10 years ago. However there are a few factors that leading to this problem such as defining the rule wrongly in the system and having an unresolved problem.

Including the validation and verification phase into the development life cycle [12] will help to identify the problem before the system is implemented to the real environment. Leaving this problem behind will be fatal especially those system that require real-time

response such as airplane avionics, smart robots, space vehicles and other safety critical application. Other than that, we also can use the optimization method to solve the problem. The optimization method will use the original rule-based ES as input and derives a new optimized ES. This method will ensures the correctness of the derives ES in terms of reaching the single accurate fixed point for each launch state and faster response time in terms of the number of rule firings.

In addition, developing a maintainable rule-based ES also is another important issue because developing a new ES will waste a lot of time and money. A maintainable rule-based ES will help the company or organization to reduce their operation cost in order to increase the company profit [7].

CHAPTER 3
METHODOLOGY/PROJECT WORK

3.1 Procedure Identification

In this project, time is the main concern as the allocated time for the project completion is only 14 weeks where the situation is far from real for the developer to finalize the system on time. As a matter of fact, this project should adopt the evolutionary delivery development cycle as shown at Figure 3.1. Evolutionary delivery development cycle is a product of a rapid application development methodology where the system is rapidly builds to meet the system requirements and the date line. To further ensure the system can be completed in within 14 weeks time, this project will limit the scope which will cover the preliminary requirement analysis phase, architecture design phase, developing a version phase, and the testing and debugging phase.

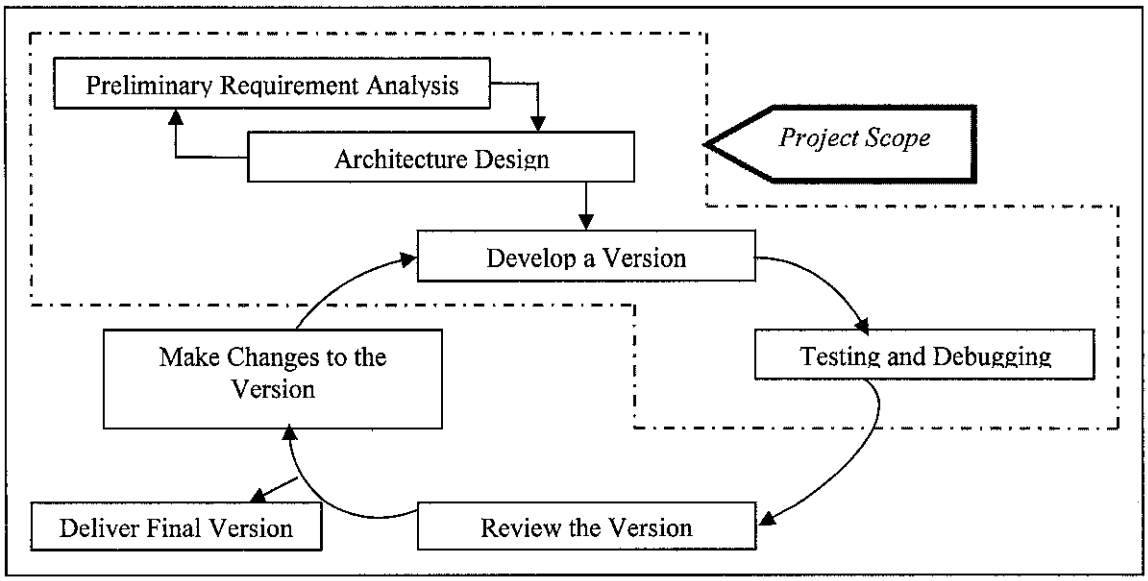

Figure 3.1 Evolutionary Delivery Development Cycle

3.1.1 Preliminary Requirement Analysis

Two set of interviews were carried out on two different people with different responsibility. The first interview is done with the operation manager of Taman Batu Gajah Perdana PETRONAS petrol station manager and the second interview is done with a PETRONAS Dagangan Berhad (PDB) staff at retail department.

From the first interview, information about the operation manager responsibility on managing the petrol station was successfully gathered. They include:-

- Customer service;
- Stock keeping;
- Oil and water dipping; and
- Prepare the preplan or petrol order forecast.

Generally, the manager relies on recorded documents and their experience in predicting the traffic flows in that area due to the certain factors. Important record documents are as follow:

- Oil and Water Dipping Record (night/morning)
- Station Weekly Order Form

A. Oil and Water Dipping Record

Usually the dipping is done twice a day (morning and night) for 24 hours petrol station and for petrol station not operating 24 hours then they will conduct the routine once every night. This record is used to determine the amount of stock available in the petrol station storage tank for sales and also can use to derive the amount of petrol sales for a particular day. Sometimes the amount of order does not reflect the amount of sales because the petrol is vaporizing into the air especially in the afternoon. For the Taman Batu Gajah Perdana petrol station, they operating 24 hours a day and they keep track the record by filling into the following form:

The form (Table 3.1) has the following columns:

a. Tank No – Shows the tank number
b. Material Type – Fuel type such as Petrol (PX1, PX2, PX3, PX4) or Diesel.
c. CM – Dipstick level in centimeters measurement.
d. Liter – Dipstick level is calibrated to determine the amount of fuel left in tank.
e. Water dip – Indicates how much water is mixed in the tank

Table 3.1 Water and Oil Dipping Record

(Ref: PETRONAS Dagangan Berhad 2004)

Date							Water Dip	
Tank No	Material Type	Night		Morning		Difference		
		CM	Liter	CM	Liter		CM	Liter
No.1	PX1	110.0	9822.12	95.0	8925.23		1.4	16.76
No.2	PX2							
No.3	PX3							
No.4	PX4							
No.5	D5							
No.6								
No.7								
No.8								

B. Station Weekly Order Form

The manager uses this form (Table 3.2) to place the petrol order for future consumption in the petrol station. Later this form will send to Mesra Link, area manager that controls that area. Then the area manager will gather all the order form from that area and send to the depot for further process. The petrol order usually is made one or two weeks before the actual date because it takes time for the depot management to schedule the delivery time. For the petrol station branch in Taman Batu Gajah Perdana, the manager sends the order form to their area manager at Ipoh and further the order will be sent to Klang Valley Distribution Terminal (KVDT) to schedule the delivery according to the time.

In the form, the manager are required to specify the date of delivery, the amount and the type of fuel (petrol, diesel or kerosene) that want to order. In this project we only

concentrate on the petrol order which is the Primax. The manager only can order maximum for two weeks petrol supply for their petrol station, more than that is not an advisable choice because it is very hard to predict the petrol consumption if the order is made for more than two weeks.

Table 3.2 Station Weekly Order Form

(Ref: PETRONAS Dagangan Berhad)

Product	**Primax**		**RON**		**Diesel**		**Kerosene**	
Material no	**50000011**		**50000009**		**50022419**		**50000018**	
Depot	020E KVDT		020E KVDT		020E KVDT		020E KVDT	
Authorized MOQ	32,700		Combined		16,380		8,190	
Date	Quantity	O/number	Quantity	O/number	Quantity	O/number	Quantity	O/number
21-June-04								
22-June-04	**21,840**							
23-June-04								
24-June-04					**10,920**			
25-June-04	**21,840**							
26-June-04								
27-June-04								
28-June-04								
29-June-04	**16,380**				**16,380**			
30-June-04								
1-July-04								
2-July-04								
3-July-04	**27,300**							
4-July-04								

The interview reveals that the past record is not the main determinant factors that use to forecast the future petrol consumption in the petrol station. According to the manager, the most important factors are to predict the traffic flow in that area and also the location of the petrol station situated. In order to predict the traffic flows there are a few factors that need to consider. These factors are:

a. School holiday;
b. Public holiday;
c. Major festival celebration;
d. Special event at that location such as concert, exhibition, expo and etc;
e. Location such as near highway expect more traffic during weekend; and
f. Normal working days consumption.

Other than the factors mentioned above, the station has the following constraints:

a. The maximum storage for petrol in the petrol station is 81,900 liters (3 tank x 27,300 liters per tank) which is the standard storage size at every PETRONAS petrol station.
b. The order amount is placed according to the tanker load capacities. Each time the manager want to place order they must follow the following standard tanker load:-
    i. 10,920 liters
    ii. 16,380 liters
    iii. 21,840 liters
    iv. 27,300 liters
    v. 32,760 liters
    vi. 38,220 liters
c. Competitors from other petrol station at the same area.

The second interview provides more information on how PDB deal with the petrol station manager especially on petrol ordering issue. In PDB the department that deals with this matter is under Retail Department which head by a manager. Under the supervision of a retail manager, they will be divided into a few regions in Malaysia and also headed by a manager. The region will include central region, northern region, southern region, eastern region, and western region. Further to smooth up the administration process, a few area managers will be assigning under the region manager to control at least 20 to 30 petrol stations.

The Retail Department also responsible to provide training to the new petrol station's manager on how to operate the petrol station. One of the courses in the training program is to teach them how to forecast the petrol order for the petrol station and further place the order. As for a newly open petrol station, the opening stock in the storage tank is 27,000 liters for every product (Primax, RON, diesel, and kerosene). Usually with the opening stock, the petrol station can survive for one week sales, then the next delivery will be on next week as specify by the manager. If the sales activity on the opening

week is active, then an emergency order will be placed to aid the petrol station from running out of stock.

After two weeks of operation, the manager should get their trend of sales and average sales for one day. In other words, the manager is able to forecast the future trend of sales at that petrol station by referring to the past sales record. From the record the manager will make decision when to order and how much to order to support the sales at the petrol station. The trend might change according to the area development because more development project in that area means more traffic flows and further increase the sales. Although, the manager can get the sales trend, they are required to maintain minimum order to avoid overload the storage tank and also need to reduce delivery from the depot. Hence, the manager knowledge in this area is a very important to make an accurate forecast.

C. Two Days Rule

The interview also reviews that the manager needs to follow the two days rule. This rule stated that the amount of storage in the petrol station tank must have enough stock to cater for two days sales. If the storage is less than the two days average sales amount then they are required to place emergency order for the depot to deliver the stock to them. For example, if the average sales for everyday are 8,000 liters then the petrol station's storage tank must have at least 16,000 liters to support for two days sales. The purpose of this rule is to avoid the petrol station tank from dry up and enable the tanker to arrive from the depot on time to fill up the tank if any emergency order is placed.

3.1.2 Architecture Design

After all, the system architecture is designed to further explain the system in a more presentable way. The design of the system architecture will include the layout of the system structure, user interface, the database structure, representing the expert knowledge with the rules and the inference engine as well. In this project a rule-based ES is implemented on the system.

The system architecture will stress on the knowledge base (KB) implementation. This mean the KB will act as the main section to ensure this system is successfully implemented. The KB is used to store all the acquired knowledge about the system which represented with rules. The rules are derived from the petrol station manager's experience and skills that they acquired when managing the petrol station. There will be more than 150 rules in the knowledge base that will make sure the system able to fully functioning according to the user needs.

There is an inference engine to apply the knowledge to the solution of actual problems. It is essential to separate the inference engine with the KB because the separation makes it possible to represent the knowledge in a more natural fashion and allow changes to be made in one part of the KB without creating side effects on the others. The responsibility of the inference engine is to acquire specific information for rule testing from the database, knowledge base, and users input data. Furthermore, the inference engine will test the rules with the acquired information and finally come out with a desired result which is the forecast amount of ordering.

This system has the advantage to allow the users to define their own rules instead of predefining the rules into the system like most of the ES did. Beside, this has further make the system become more flexible in customizing the rules according to the petrol station needs and cater all the PETRONAS petrol station in Malaysia. In order to make sure this idea can convey in this system, the system will have two types of users and support by two different interfaces which have their own functionalities.

The first types of user are "Administrator" which can be the petrol station manager or also known as the knowledge engineer. This type of user has the authority and the required experience to change or customize the system rules according to their petrol station historical data. As for the second types of user is "Operator" which can be the manager or any petrol station operator that has the required skills to use the system to forecast the ordering amounts.

Besides, the system also contains databases to store the user information such as the username and password, and some important data such as the user define rules and the final result that generated by the system. The purpose to store the username and password is to ensure the system is protected from unauthorized user to sabotage the system and change the information that store inside the database.

As for the reason to store the user defined rules is to ensure that the rules will reused when every time the users use the system to forecast the petrol order. In addition the rules will be updated if the users redefined the rules again through login the system as an Administrator mode. The reason to store the generated report is to keep track the previous record for future references.

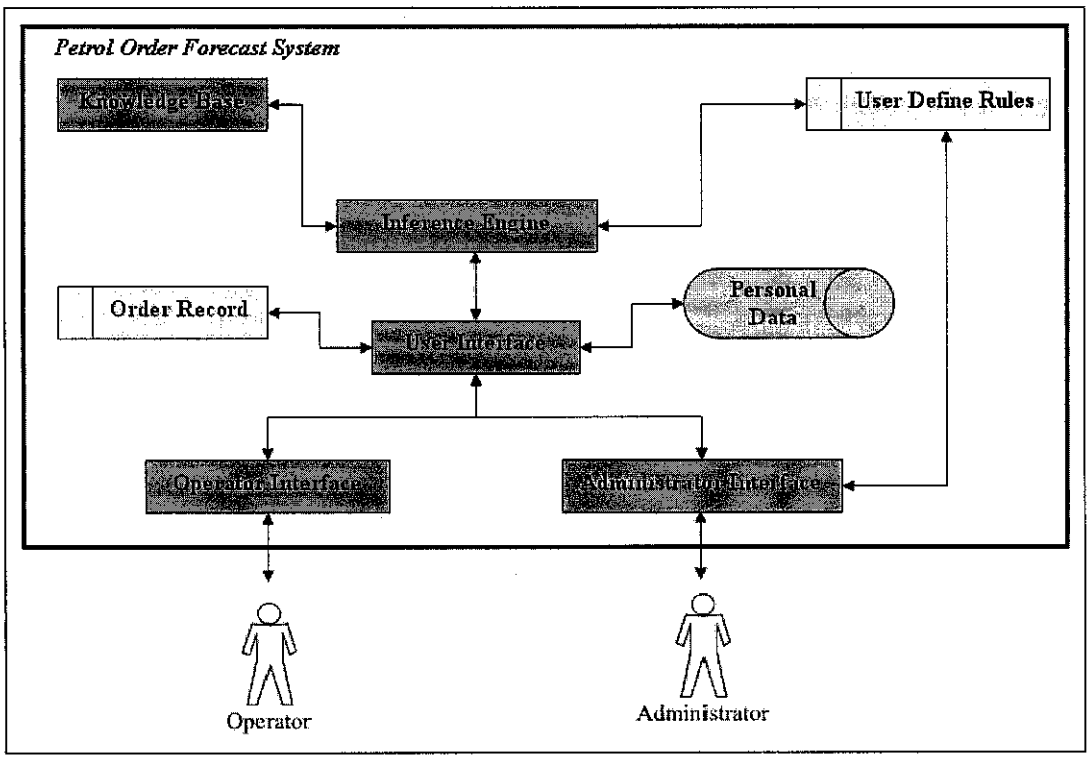

Figure 3.2 Rule-based Expert System Architecture

3.1.3 Developing a Version

The coming few phases are more into an evolution style or repetitive style where each phase will repeat more than once to deliver the final version to the client. Start from the

developing phase, the developer will start to develop the system module by module as a whole. The most famous method that applied at this stage is the prototyping method. The user interface will be build according to the specified design, the database will be created base on the structure, the rules will be coded just like the rules that define at the earlier stage and integration is done at level to make sure the system is ready to run.

A. User Interface

Figure 3.3 describe the structure of the user interface for this system. When the users run the system, the first interface they will see is the "Login" interface (Figure 3.4). At this level, the users are required to key in their username and their password to make sure different users will have different access mode to ensure the information inside the database are protected.

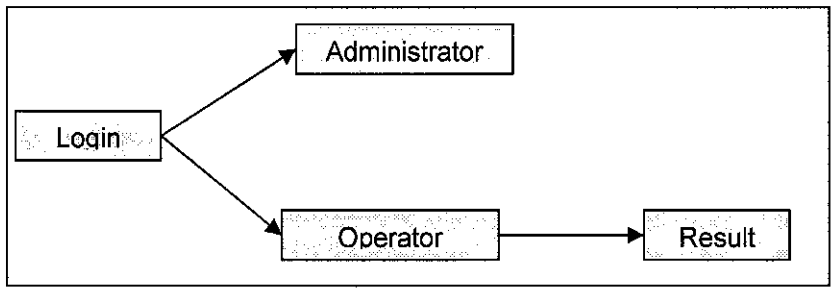

Figure 3.3 Overall Interface Structures

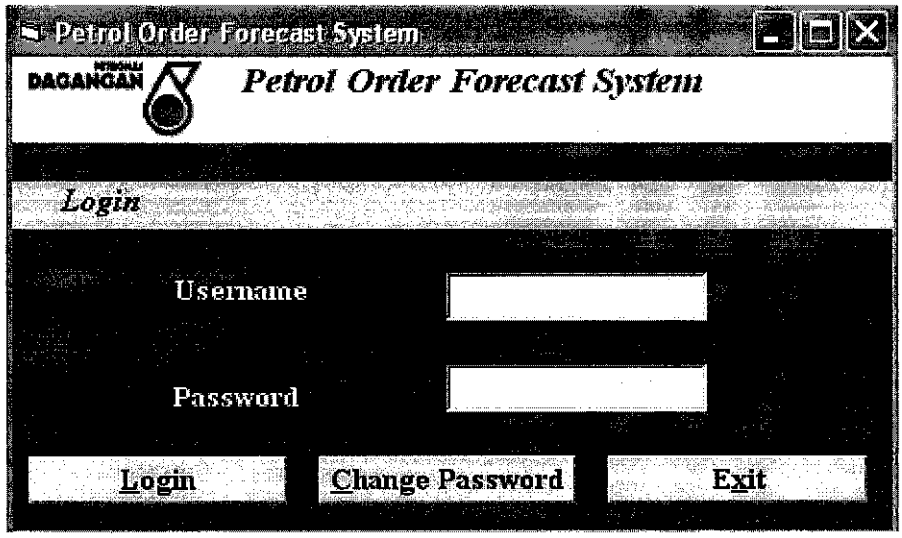

Figure 3.4 Login Interface

As mentioned in the system architecture design, basically there are two user's interface involves in this system the first interface is the administrator interface and the second interface is the operator interface, both interfaces serve different purpose in this system.

Administrator Interface

If the user login with the username "Administrator", then the administrator interface will pop up. The administrator interface will allow the authorized users (petrol station manager) to set the information of the amount of order according to certain event and constraint. The administrator is required to set:

a. the average daily sales (Figure 3.5)

   This value will allow the system to make sure the two days rule is able to implement in this system. For example, if the average daily sales amount is 9500 liters, then the order amount must exceed 19000 liters.

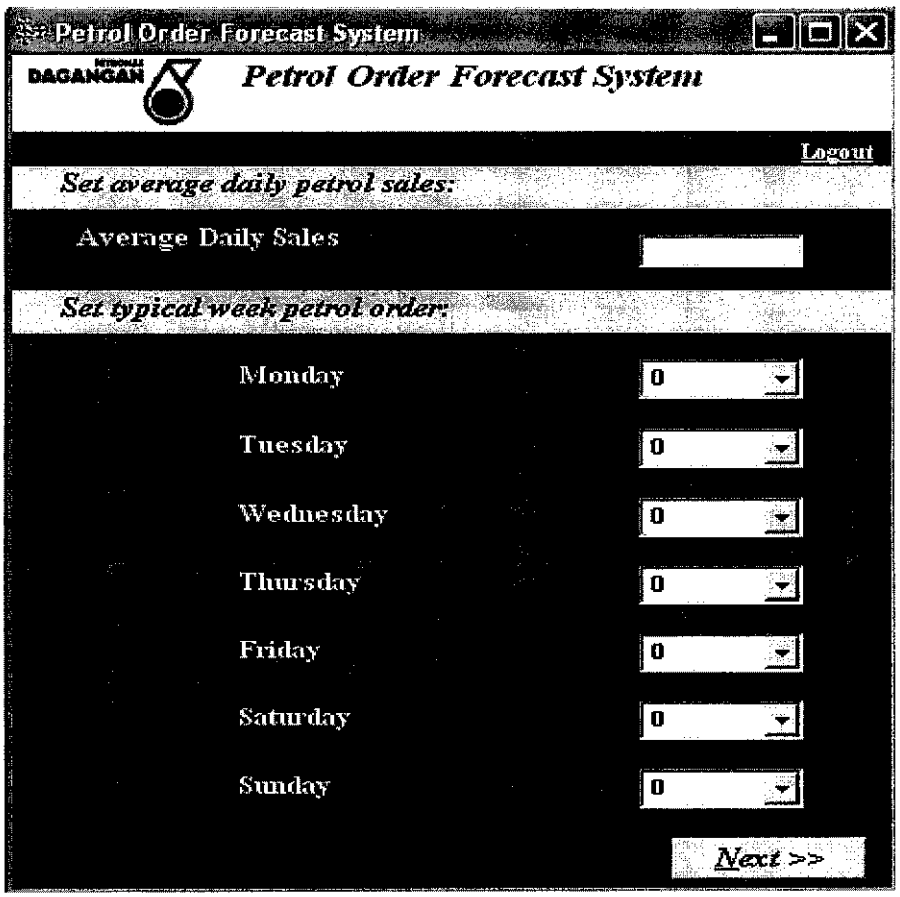

Figure 3.5 Administrator Interface to set Typical Week Petrol Order

b. the order amount for typical week without any event occurred (Figure 3.5)

   Allow the system to identify the normal order if there is no event occurred during the ordering week and also serve as a default order amount

c. the order amount for 3 days before and after the Hari Raya Aidilfitri (Figure 3.6)

   The traffic flow start to change since 3 days before the actual date of Hari Raya Aidilfitri as most of the people going back and prepare for festival celebration. After the celebration, the traffic flow again will show some changes as most people are getting back to their normal life.

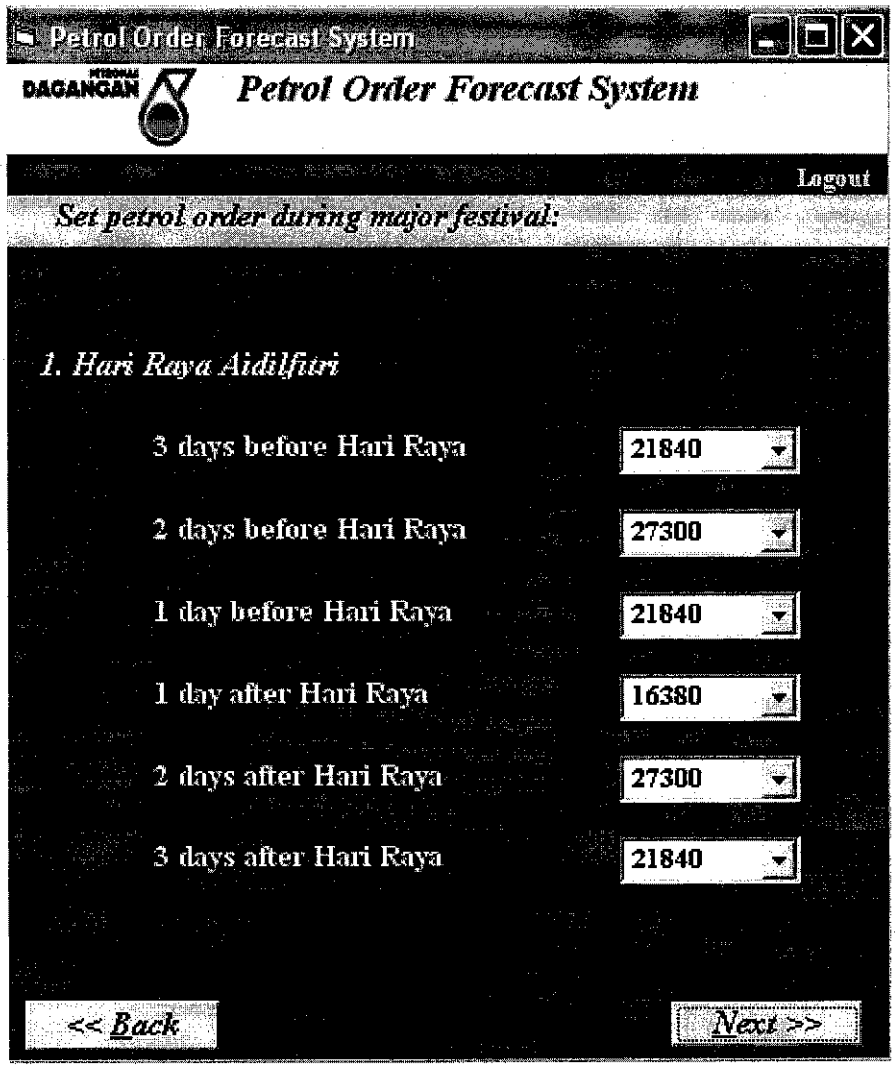

Figure 3.6 Administrator Interface to set Petrol Order for Hari Raya Aidilfitri

d. the order amount for 3 days before and after the Chinese New Year celebration (Figure 3.7)

   The traffic flow start to change since 3 days before the actual date of Chinese New Year as most of the people going back and prepare for festival celebration. After the celebration, the traffic flow again will show some changes as most people are getting back to their normal life.

e. the order amount for others major festival such as Christmas, Deepavali, Hari Gawai, and etc (Figure 3.7)

   The traffic flow for other major festival is not as high as Hari Raya Aidilfitri and Chinese New Year because most Malaysian are Muslim and Chinese.

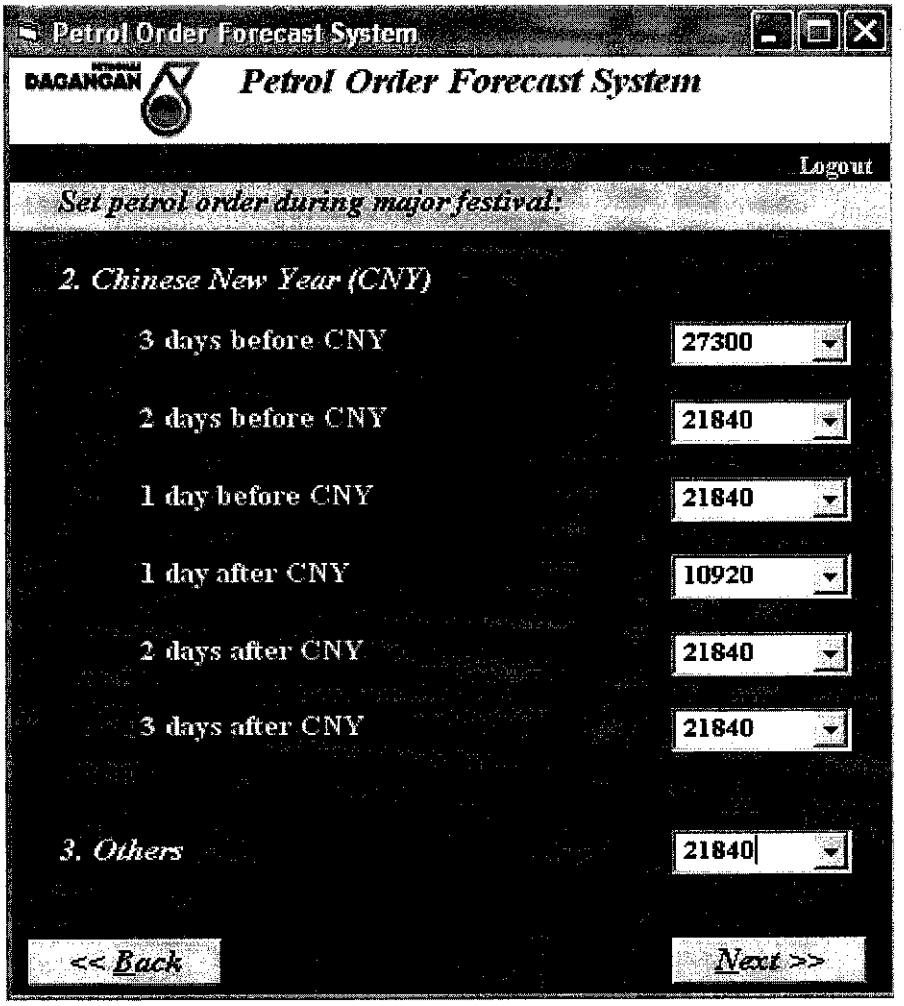

Figure 3.7 Administrator Interface to set Petrol Order for Chinese New Year and for others major festival

f. the order amount for public holiday (Figure 3.8)

If the public holiday falls on Monday/Friday then we expect the traffic flow will increase because got long holiday (including Saturday and Sunday). While if holiday fall on Saturday /Sunday then we expects the traffic flow to increase or remain the same compare to the typical Saturday and Sunday. If holiday fall on Tuesday/Wednesday/Thursday then we expect the traffic flow will slightly increase compare to typical day.

g. the order amount for school holiday according to the traffic flow (Figure 3.8)

For this situation we take into consideration of the location of the petrol station. If the petrol station situated at a popular tourist area then we expect the traffic to be high, while if the petrol station is situated near or adjacent to the tourist area then we expect the traffic flow to be medium. Then, if the petrol station situated not in the tourist area or not near or adjacent to the tourist area then we expect the traffic flow to be low.

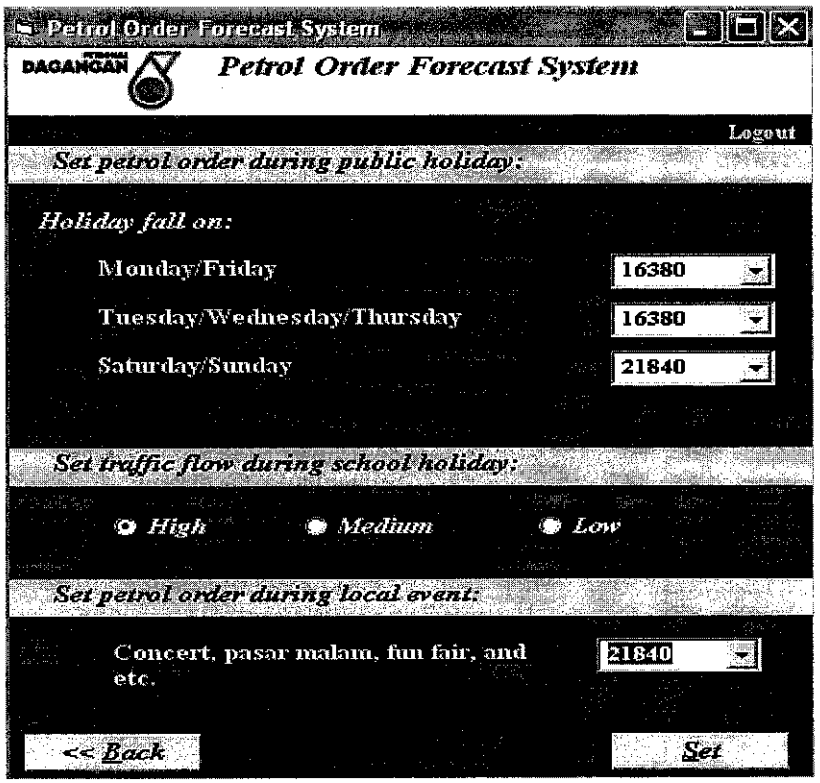

Figure 3.8 Administrator Interface to set Petrol Order for Public Holiday, School Holiday, and Local Events

h. the order amount for local event such as night market, concert, fun fair and etc (Figure 3.8)

   This is depends on the popularity of the event, the administrator must be knowledgeable enough to judge the local event to come out with a good forecast.

After the user done with all the transaction from the administrator interface, all the information will be saved into the database and a message box (Figure 3.9) will pop up to ask the user whether he want to exit the system or want to proceed to another level. If the users choose "Yes" then the system will shut down, while if the users choose "No" then the system will direct the user back to the Login interface.

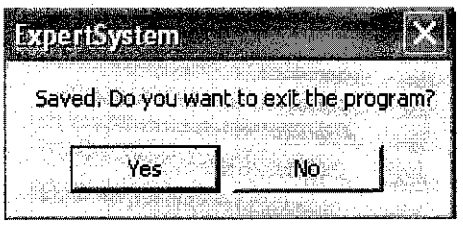

Figure 3.9 Message Box to Notify the Users and Ask the Users for Further Decision

Operator Interface

Once the operator successfully log in with their username and password, the operator is required to state the starting date of the forecast and the end date of the forecast period (Figure 3.10). When the operator press the "Start" button, a message box will pop up (Figure 3.11) to query the operator to get the operator consent whether there are any event occurred during the forecast period. If the operator chooses "Yes" then the operator will required to answer a few questions before the result is generated, while if the operator chooses "No" then the result page will show to the operator.

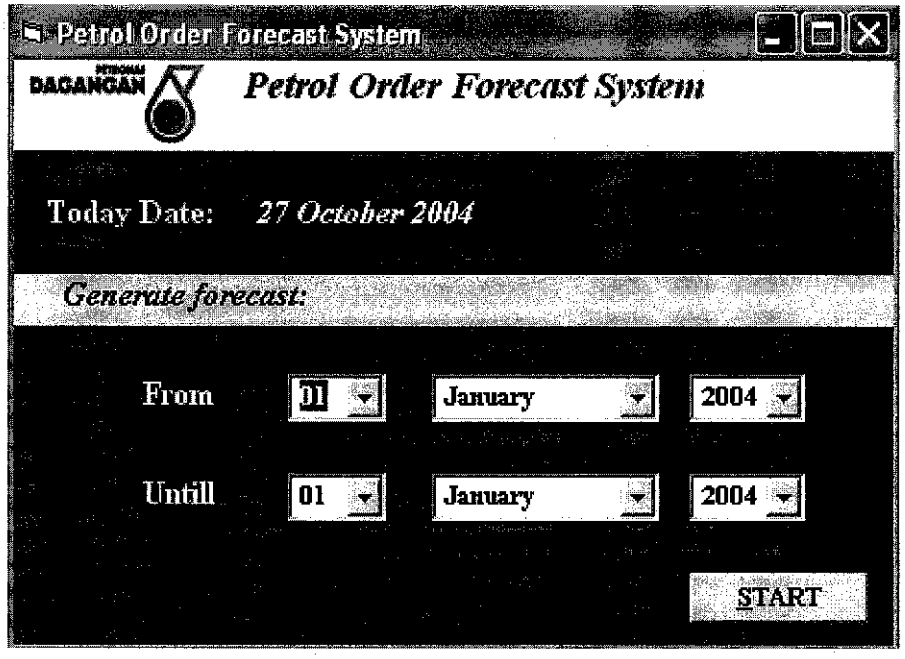

Figure 3.10 Operator Interface to set the Forecast Starting and Ending Date

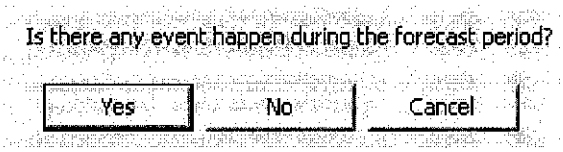

Figure 3.11 The Message Box to Confirm any Event Happening during the Forecast Period

The questions will give the operator the option to choose what event will happen during the forecast week. The questions are as follow:

Question 1:- Is there any major festival during the forecast period? (Figure 3.12)
This question is intend to query the operator to find out any festival during the forecast period because the system need to find out whether the festival event will affect the system decision to come out with the result. If there is any festival celebration during that week, then the operator will required to choose the type of festival and when is the festival (date).

Question 2:- Is there any public holiday during the forecast period? (Figure 3.12)
This question is intend to query the operator to find out whether there are any public holiday such as New Year, National Day, Royal Birthday, and etc during the forecast

period. If there is any public holiday, then the operator will required to choose the type of public holiday and when is the public holiday (date).

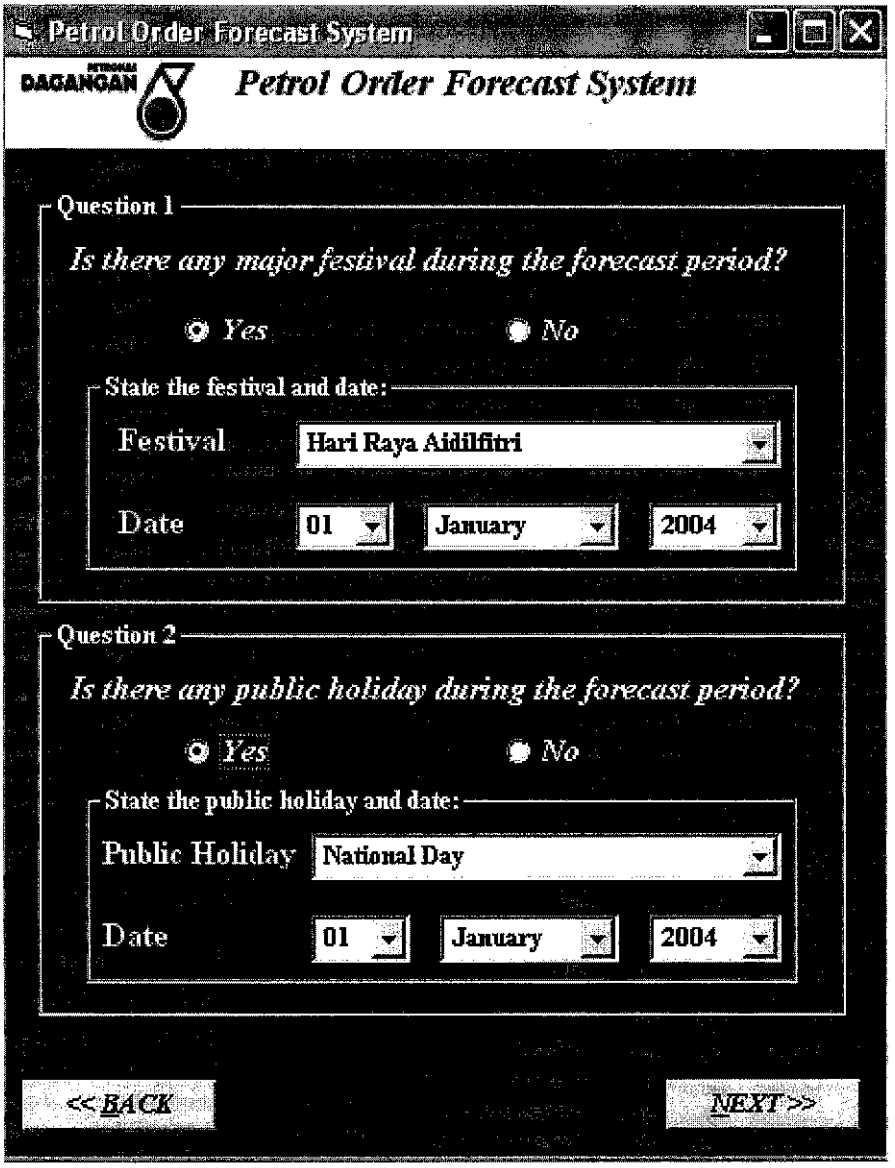

Figure 3.12 Operator Interface for Question 1 and Question 2

Question 3:- Is there any school holiday during the forecast period? (Figure 3.13)
This question is intended to query the operator to find out whether there is any school holiday during the forecast period. If there is any school holiday, then the operator will required to state the starting date of the school holiday and the duration of the school holiday.

Question 4:- Is there any local event during the forecast period? (Figure 3.13)

This question is intend to query the operator to find out whether there are any local event happen during the forecast period. If there is any local event, then the operator will required to state the local event and when is the local event (date).

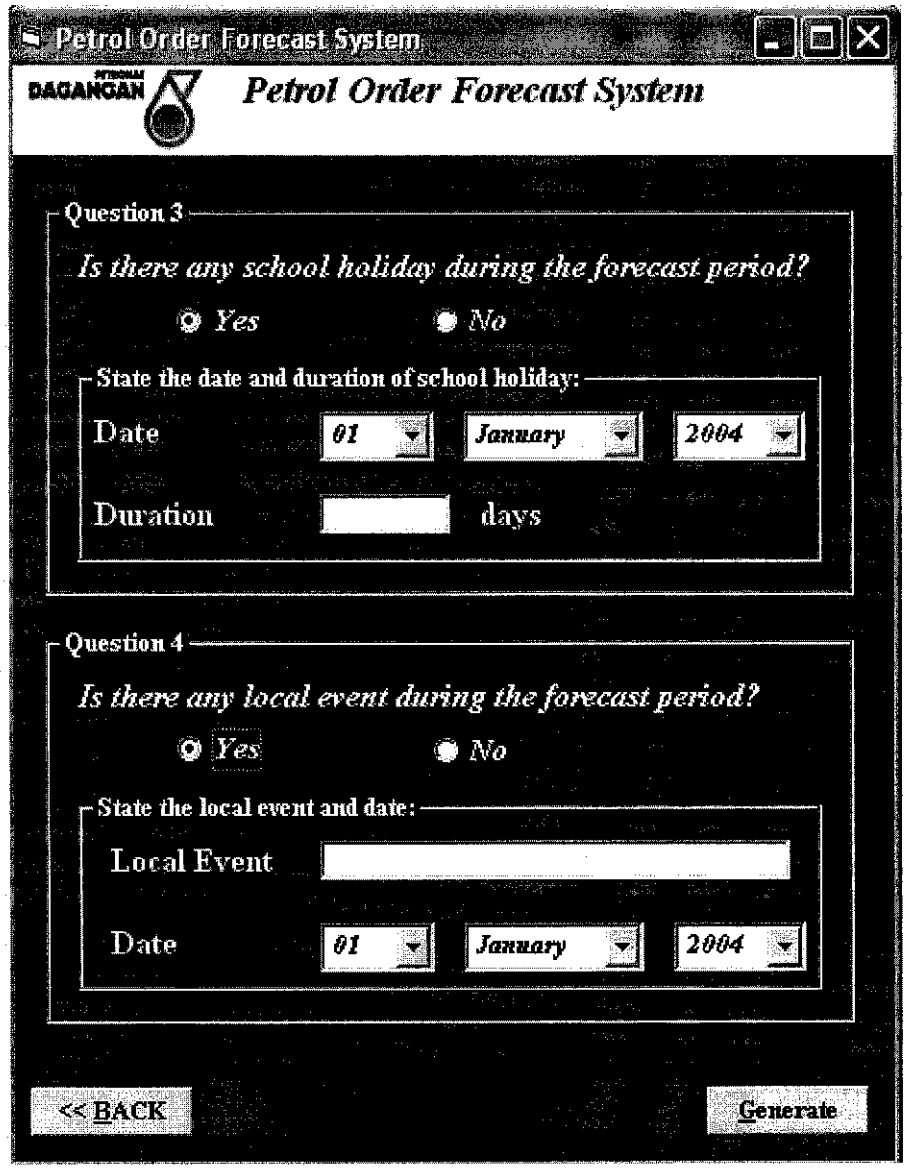

Figure 3.13 Operator Interface for Question 3 and Question 4

Result Interface

After the user successfully manage the Operator interface, a report will be generated and the result will posted on the "Result" interface, as shown on Figure 3.14. The result page will depict all the generated result to allow the users to use the information to help them to make decision. The system allow the user to print the result page out and also allow them to save the result into a text file for future reference.

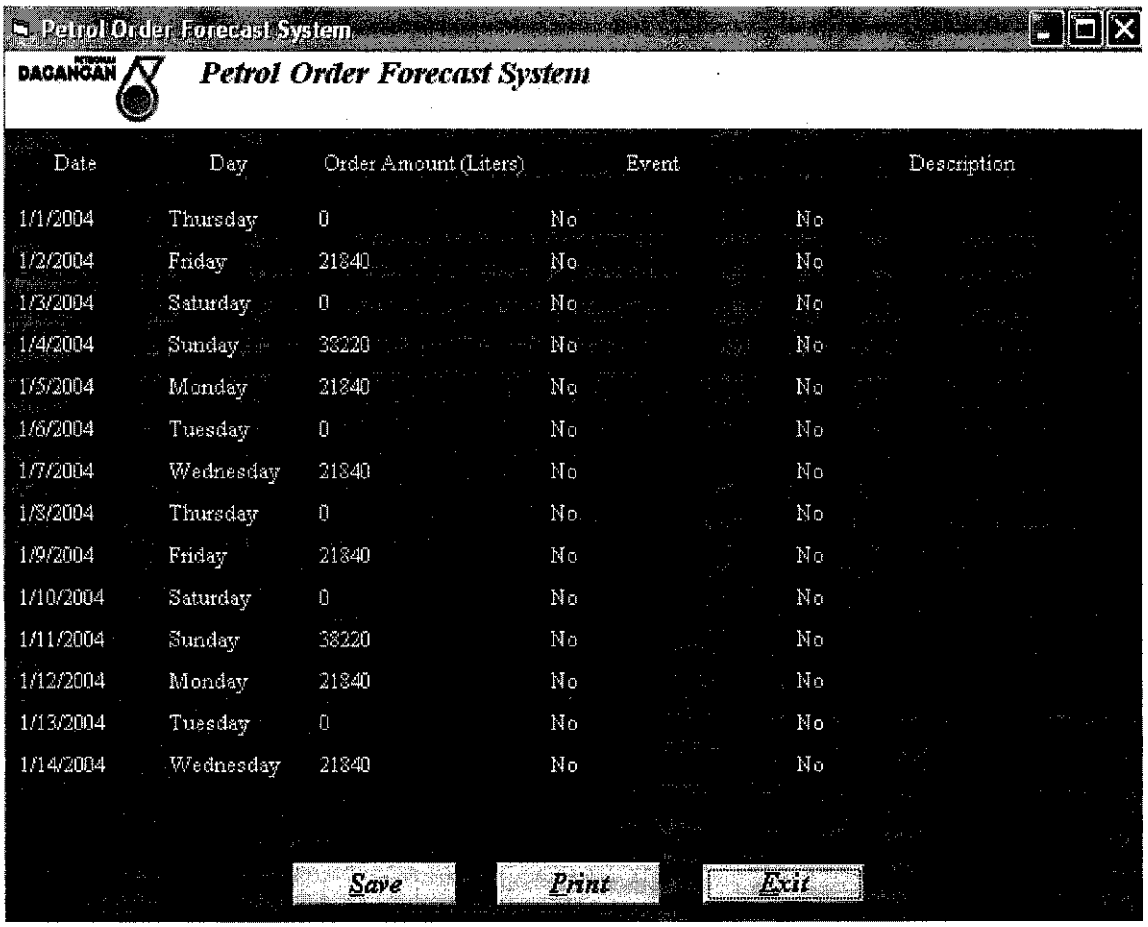

Figure 3.14 Report Interface

B. Database

Basically for this system, two types of database method had been used to store the data that key in by the users. The first method is storing the data into the text files format. Two types of data are stored using this format, which are:

- The order amount that user set when the user are required to specify the order amount according to the event. The data store in this file is in sequential format for easy identification.
- The final report when every time the users generate the forecast using the system. The data store in this file is using the random format. This will enable the system randomly access the file content and change the data for that line instead of changing the whole file content.

The reason to use this method because it is easy to manage and did not required third party software which will increase the cost of development for the system. Beside, the stored data did not require a high security level and a high end database management system (DBMS) to manage and guard the data. The second method is using the Microsoft Access as a DBMS to protect the user information such as the username and the password from being change by unauthorized user.

Primary key are set for the username field as every username will have their own unique identity. As for the password field, the password store in every column will be encrypted to avoid unauthorized person to view the password and use the password to change the data already set by the authorized users.

C. The Knowledge Base and the Inference Engine

The KB will store all the rules of the system that later manipulate by the inference engine to come out with desire result. As the system using the rule-based ES concept, all the rules store in the knowledge base will have the same structure of "if ... then ..." In this system there are 129 rules that form the entire knowledge base of the system.

The rules coded in Visual Basic syntax which used to represent the system knowledge base can be generalized and represented by two variables to describe the system parameters. The following is the general rules that store in the system's knowledge base:-

If ***RDay*** AND ***RDesc*** THEN ***OrderAmount***

Where ***RDay***, ***RDesc*** and ***OrderAmount*** can use to represent:-

RDay = Monday,
RDay = Tuesday
RDay = Wednesday
RDay = Thursday
RDay = Friday
RDay = Saturday
RDay = Sunday
RDesc = No
RDesc = 3 Days before Hari Raya Aidilfitri
RDesc = 2 Days before Hari Raya Aidilfitri
RDesc = 1 Day before Hari Raya Aidilfitri
RDesc = First day of Hari Raya Aidilfitri
RDesc = Second day of Hari Raya Aidilfitri
RDesc = 1 day after Hari Raya Aidilfitri
RDesc = 2 days after Hari Raya Aidilfitri
RDesc = 3 days after Hari Raya Aidilfitri
RDesc = 3 Days before Chinese New Year
RDesc = 2 Days before Chinese New Year
RDesc = 1 Day before Chinese New Year
RDesc = First day of Chinese New Year
RDesc = Second day of Chinese New Year
RDesc = 1 Day after Chinese New Year
RDesc = 2 Days after Chinese New Year
RDesc = 3 Days after Chinese New Year
RDesc = Celebrating other festival
RDesc = Public Holiday
RDesc = Having school holiday
RDesc = Having local event
OrderAmount = 0
OrderAmount = 10920
OrderAmount = 16380
OrderAmount = 21840
OrderAmount = 27300
OrderAmount = 32760
OrderAmount = 38220

The inference engine will retrieve the data one by one from their sources; the day of the event from the users input data, the order amount and the report description from the databases, and the system rules from the knowledge base to test the rules within the environment in order to come out with the forecast result.

3.1.4 Testing and Debugging

The next phase is the testing and debugging phase, the interface of the system will be tested by the user for approval for its user friendly features. The testing will include the color used, the layout or placement of the object, the linkage from one page to another page, the respond when the buttons are clicked, and etc.

Other than testing the user interface, the database also will be tested. During the database testing, the database will load with temporary data and will be tested for its integrity and efficiency. The test that involve in the database testing is the database connection, database definition, and the data accuracy.

System testing also will be conducted to make sure the system result is accurate and represent the real scenario at the petrol station. The test will conducted with the help of the petrol station manager whereby they provide information on the sales record and the ordering form within the same period of time. The test will not conduct for the real time basis, instead its use the past data from the petrol station to conduct the testing.

The test result will further verify and validate with the real data provided by the petrol station manager to achieve at least 90% accuracy. In order to make sure the result is accurate and reliable, the same test will conduct on different petrol station data. If the test failed to achieve 90% accuracy, the system rules will be revised and changes will be made to ensure the test result reach 90% accuracy.

If there are any error occurs in the system code, the debugging process will take place to make sure the system is free from bug. Before submitting the system to the user, the last test will be conducted on the system is testing the system robustness and efficiency after the integration process.

3.1.5 Review the Version by User

Before the system is officially hand over to the user, the system will be review by user to get the approval. The reviewing process is done by executing the evaluation process where validation and verification of the system will be done together with the users to make sure they understand the system well. If there is any dissatisfaction by the users, the comment will be jotted down as a new requirement for the project and will treat as future reference.

3.1.6 Make Changes to the Version

The requirement changes that recorded during the previous phase will review and modify to make sure its does not contradict with the overall project objectives. If the requirement has been approved, the developer will start to undergo the same process as mentioned before; developing a new version, testing and debugging, review the version

and make changes to the version. This cycle will continue to evolve until the final version of the system is delivered to the users.

3.1.7 Deliver Final Version

If there are no changes recorded by the users, the system will handover to the users and sign off.

3.2 Tools Required

3.2.1 Hardware

Minimum hardware requirements:-

- Personal computer Pentium-class processor, Pentium II 300 MHz
- 256 MB of Random Access Memory (RAM)
- 10 GB Hard Disk Drive space with 100 MB free space
- Printer

3.2.2 Software

Software requirements:-

- Microsoft Windows 2000 or Windows XP
- Microsoft Access 2000 or above
- MS Visual Basic 6.0 Professional Edition

CHAPTER 4
DISCUSSION AND FINDING

4.1 Results and Finding

4.1.1 Test Result

System testing has been conducted to petrol stations around Batu Gajah area. The purpose of this testing is to verify the system that able to meet the 90% accuracy target which serve as one of the non-functional requirement for this system. Following are the test cases that show the value that the users need to insert into the system, also the expected result for a certain period of time, and the generated result from the system.

A. Petrol Station at Batu Gajah Town

Test Case:-

1. The forecast is made for the period of 13/11/2003 to 26/11/2003 (2 weeks)
2. These dates are school holidays
3. There is a night market on the 17th of November 2003
4. Hari Raya falls on 25/11/2003
5. The average sales is 10000 liters
6. The typical weekly order:-
    - Monday = 27300 liters
    - Wednesday = 27300 liters
    - Friday = 27300 liters
    - Saturday = 21840 liters
7. Hari Raya Aidilfitri and Chinese New Year order:-
    - 3 days before festival = 21840 liters
    - 2 days before festival = 21840 liters
    - 1 day before festival = 21840 liters
    - No order for first and second day of the festival

2. There are no event occur during the forecast period
3. The average sales is 9500 liters
4. The typical weekly order:-
    - Monday = 21840 liters
    - Wednesday = 21840 liters
    - Friday = 21840 liters
    - Sunday = 21840 liters
5. Hari Raya Aidilfitri and Chinese New Year order:-
    - 3 days before festival = 21840 liters
    - 2 days before festival = 21840 liters
    - 1 day before festival = 21840 liters
    - No order for first and second day of the festival
    - 1 day after festival = 21840 liters
    - 2 days after festival = 21840 liters
    - 3 days after festival = 21840 liters
6. Others major festival order = 21840 liters
7. Public Holiday falls on:-
    - Monday/Friday = 27300 liters
    - Saturday/Sunday = 27300 liters
    - Tuesday/Wednesday/Thursday = 21840 liters
8. The traffic flow for school holiday is LOW
9. Local Event order = 21840 liters

Result is show in Table 4.2. Comparing the expected order column and the system output column from Table 4.2, there are two rows of data from system output is not match the expected order. Hence, we can conclude that the system accuracy is only 71.4% (5 / 7 * 100).

Table 4.2 The expected test result and the forecast order result for Taman Batu Gajah Perdana Branch

Date (dd/mm)	Day	Expected Order	System Output	Event
6/9/2004	Monday	21840	21840	No
7/9/2004	Tuesday	0	0	No
8/9/2004	Wednesday	16380	21840	No
9/9/2004	Thursday	0	0	No
10/9/2004	Friday	16380	21840	No
11/9/2004	Saturday	0	0	No
12/9/2004	Sunday	21840	21840	No

C. Petrol Station at Taman Saujana, Batu Gajah

Test Case:-

1. The forecast is made for the period of 06/09/2004 to 12/09/2004 (1 weeks)
2. There are no event occur during the forecast period
3. The average sales is 5000 liters
4. The typical weekly order:-
   - Monday = 21840 liters
   - Friday = 21840 liters
5. Hari Raya Aidilfitri and Chinese New Year order:-
   - 3 days before festival = 16380 liters
   - 2 days before festival = 21840 liters
   - 1 day before festival = 21840 liters
   - No order for first and second day of the festival
   - 1 day after festival = 21840 liters
   - 2 days after festival = 21840 liters
   - 3 days after festival = 16380 liters
6. Others major festival order = 21840 liters
7. Public Holiday falls on:-
   - Monday/Friday = 21840 liters
   - Saturday/Sunday = 21840 liters
   - Tuesday/Wednesday/Thursday = 21840 liters
8. The traffic flow for school holiday is LOW

9. Local Event order = 21840 liters

Result is show in Table 4.3. Comparing the expected order column and the system output column from Table 4.3, all the system output is match the expected order. Hence, we can conclude that the system is performing 100% accurately.

Table 4.3 The expected test result and the forecast order result for Taman Saujana, Batu Gajah branch

Date (dd/mm)	Day	Expected Order	System Output	Event
6/9/2004	Monday	21840	21840	No
7/9/2004	Tuesday	0	0	No
8/9/2004	Wednesday	0	0	No
9/9/2004	Thursday	0	0	No
10/9/2004	Friday	21840	21840	No
11/9/2004	Saturday	0	0	No
12/9/2004	Sunday	0	0	No

4.1.2 Finding from the test result

From the test that conducted on three different petrol stations around Batu Gajah area, we can find out the overall system accuracy from the test results.

$$\text{System accuracy} = (100 + 71.4 + 100) / 3$$
$$= 90.5\%$$

From the calculation, we can conclude that the system had met the system requirements to have an overall accuracy of more than 90%.

4.2 Discussion

4.2.1 Inaccurate forecast result

There are a few factors that can cause the system to generate inaccurate forecast order. These factors are very hard to avoid or predict because it's changed from time to time. The factors are:-

a) Unpredictable traffic flows due to unfamiliar event in the petrol station area
b) Area economic growth
c) Weather (sunny or normal day more traffic while raining day less traffic)
d) Dramatic increase of petrol price in the market

However, this problem can be solved if the petrol station manager takes active roles to periodically update themselves with latest information. They should gather more information regarding to their surrounding especially event will going to take place near the petrol station area, the area economic growth, the business activities and etc.

They also should be more aware about the government policy changes that will significantly or insignificantly affect their business operation, for example, the governments reduce or remove the petrol subsidy. This will directly affect the petrol station sales because the consumer will reduce their use in petrol by choosing other alternative such as public transport or sharing car with other people.

With the additional information gathered from the research, the petrol station manager should change their system setting according to the environment changes that can affect the forecast result. With timely changes the system will be able to generate a more perfect result to assist some more general user such as the operator.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusions

This research explores the potential of ES in preserving the skills and knowledge of an experienced PETRONAS petrol station manager in predicting the required future supply of petrol. The study concludes that forecast is a heuristic decision-making and unique to different station. This warrants the need to capture and identify the skills and knowledge of the manager to find out the underlying factors use to perform forecast on the petrol sales at general PETRONAS petrol station. This has met the first and second objectives of the project, which is to identify the factors that influence decision making process in forecasting weekly petrol order and build an ES based on the factors that can general accepted by all PETRONAS petrol station in Malaysia.

The study also discovers that the forecast skills and knowledge can be effectively mapped into production rules, thus enabling computer processing. A prototype was developed using rule-based knowledge representation. The system was tested with known condition-action inputs and outputs. The result was satisfactory but the validity of the testing can be questioned. Valid test results can be acquired from field experiment setup but unfortunately could not be achieved due to time constraint. Never the less, the project has met another two objectives of this project, which are creating a prototype; and implementing a rule-based artificial intelligence technology in it. In addition, the system also proved to be able to perform at least 90% of accuracy which meet the system objectives.

5.2 Recommendation

Suggested next moves are as the followings:

1. Revise the knowledge base so that it will consider more forecast factors and thus accuracy.

2. Acquire manager feedback on the acceptance of the user interface design.
3. To further develop the prototype for field testing. Only the manager can testify whether the forecast of the system is accurate.

Other future enhancements include the followings:

1. The system should also be able to exhibit degree of confidence and precision for its forecast. This is important for human manager to decide whether or not to accept the system's recommendation.
2. The system may include machine learning. This will allow the system to improve its accuracy.
3. Continuous research will achieve a level where the ES will mature into a fully automated system independent of human manager. It is capable of making accurate forecast and placing order to Petronas Dagangan directly.

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APPENDICES

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Appendix 1

Interview questions for PETRONAS Petrol station manager

1. How long this petrol station had been operated?
2. How long have you been an operation manager?
3. Briefly, can u describe the role of the operation manager at Petronas gas station?
4. Is forecasting fuel consumption taught in training? How long does it take to be able to make a good forecast?
5. Do you think sales forecast is important? Why?
6. How frequent do you make sales forecast?
7. How do you make a sales forecast (the process flow)?
    a. What are the factors required in making the forecast?
    b. How and where do you get the information to make the forecast?
    c. What are the outputs of your forecast? Can you show me a sample?
    d. What are the documents involved in the forecast?
    e. Do you encounter any difficulty? How about new and inexperienced manager?
8. Does pricing affects the order?
9. Who are the users of the forecast information?
10. Do you store the forecast information and how?
11. Do you monitor if the forecast diverts from the actual demand?
12. Do you measure the accuracy of the forecast?
13. If Petronas introduces a sales forecast system, how would you react to it?
14. What would you expect from the forecast system? Any idea?
15. How often do you misjudge? How about other station?

Appendix 2

Interview questions with En. Ridzuan, staff of PETRONAS Dagangan Berhad from sales department

1. How PDB deal with their customer (petrol station owner)?

   In PDB the department that in charge in this matter is under Retail Department and chair by a manager. Under the retail manager there are divided into a few region which head by a region manager and the region manager manage a few area managers. Finally the area manager will personally handle 20 to 30 petrol station managers or dealers. Whatever complain or feedback, the dealer will refer to the area manager before reach PDB head office.

2. Is any training provided by PDB to the new petrol station owner or operator to assist them in planning the petrol order (Preplan)?

   Yes. The training only teaches them how to fill in the order form.

3. If yes, can you describe in detail in how to make the forecast?
   a. The process flow.

      The dealer will fax their order to the PDB office according to the area under Mesralink program. Then Mesralink in each area will compile the order for all petrol stations located at that area and send it to depot. At depot, they will schedule the lorry tanker to deliver the petrol on the exact time and also the possible arrival time. This to ensure the petrol is delivered on time and will not interrupt the petrol sales at petrol station.

   b. What are the metric or formulae use in forecasting?

      There are no metric or formulae to follow during the forecasting process, but the dealer have to capture the daily sales for future reference.

   c. What are the factors required in making the forecast?

      No factors required.

   d. How and where do to get the information to make the forecast?

All based on historical data and the dealer knowledge and experience to make the forecast.

e. What are the outputs of the forecast?

The dealer need to fill in the order form that provided by PDB. Inside the form, they need to specify the date and amount of order for the following week.

4. Before the forecast is made, is there any others procedure to follow such as:-

a. The minimum storage in the petrol station tank before everyday business start;

At every petrol station, the minimum storage is differing from each other. This is because each petrol station is complying with the two days rule. This rules required each petrol station to have at least enough storage for two days sales.

b. Any rules to follow; and

The two days rule also apply when the dealer want to place the order. For example, if the expected daily sales is 5000 liters, the dealer need to order at least 10920 liters for every two days order to cater the petrol sales at the particular petrol station.

c. Others.

No.

5. What is the significant if the petrol station owner made a wrong order; either the ordered amount is more than the required amount or the ordered amount is less than the required amount?

There is no extra cost charge or other form of penalization incur to the dealer. If the mistake is too frequent, they will require submitting a report to the PDB. In the worst scenario, the particular petrol station is black listed from the management.

6. How to solve the problem as mentioned in Question 5? Who will be responsible on this matter?

   Usually, this kind of situation is seldom occurred because even the order already faxed to Mesralink, they can directly call them and place a new order. They will categorize this as an emergency case, but the dealer is not allowed to do it frequently. In PDB there is a rule of thumb to follow, every tanker left the depot for delivery, they required to come back with empty tank, so if the order amount is more than the required amount, the extra amount will distribute to other petrol station with their consent. While, if the order amount less than the required amount, second delivery will be made and the second delivery usually take place on the next day.

Appendix 3

Ordering form and Sales record for PETRONAS Petrol Station branch at Taman Batu Gajah Perdana (please refer to the next page)

BORANG PESANAN PREMIAN

Dari

No. Akaun	:	90032496 **Ship To:**
PSS	:	Kurnia Sempurna Enterprise (PFS Taman Batu Gajah Perdana)
Alamat	:	Lot 15613, KM12, Lebuhraya Ipoh-Lumut, Tmn Batu Gajah Perdana, 31550 Pusing, Perak
Telefon	:	05-3656543
Fax	:	05-3657348
Email	:	kse15613@tm.net.my

Kepada

Mesralink (Retail)
Tg 25, Menara 2, Menara Berkembar Petronas, KL
1300 88 8181
1300 88 8383
mesralink.retail.order@petronas.com.my
cc: aaznand@petronas.com.my

Produk	Primax				RON		Diesel			Kerosin	
Material no	50000011				50000009		50022419			50000018	
Depot	020E KVDT				020E KVDT		020E KVDT			020E KVDT	
Authorised MOQ	32,700				Combined		16,380			8,190	
Tarikh	Kuantiti 1	Kuantiti 2	Kuantiti 3	O/number	Kuantiti	O/number	Kuantiti 1	Kuantiti 2	O/number	Kuantiti	O/number
25-Oct-04											
26-Oct-04	21,840						16,380				
27-Oct-04											
28-Oct-04	21,840						16,380				
29-Oct-04											
30-Oct-04	21,840						16,380				
31-Oct-04											
1-Nov-04	21,840						16,380				
2-Nov-04											
3-Nov-04	21,840						16,380				
4-Nov-04											
5-Nov-04	21,840						16,380				
6-Nov-04											
7-Nov-04	21,840						16,380				

Fuel Inventory Movement Report by month

KURNIA SEMPURNA ENT
TAMAN BATU GAJAH PERMANA,
PUSING
BATU GAJAH , 31550
Telephone: (65) 3656543

This Report contains transactions for the following Period :
September 2004 (-)

Day	Opening	Receiving	Total	Cash	Credit	Debit	Cheque	On Account	Coupon	Driveoff	Mixed	Pump Test	Total	Balance Dip	Reading	Difference
Item:	PRIMAX							Unit	LITRES							
01-09-2004	40,777.000	0.000	40,777.000	7,867.329	1,612.467	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9,480.116	31,296.884	31,411.000	114.116
02-09-2004	31,454.000	21,840.000	53,294.000	7,832.320	1,072.215	0.000	0.000	42.000	0.000	0.000	0.000	0.000	8,947.137	44,346.863	44,454.000	9.863
03-09-2004	43,454.000	0.000	43,454.000	10,131.370	268.721	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10,399.791	33,054.209	33,050.000	-5.791
04-09-2004	33,050.000	16,380.000	49,980.000	10,157.987	1,766.863	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11,924.150	38,055.850	38,042.000	-13.850
05-09-2004	37,542.000	0.000	37,542.000	9,242.113	1,469.202	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10,709.215	26,832.785	26,832.000	-0.785
06-09-2004	27,212.000	21,840.000	49,212.000	7,945.790	1,041.675	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8,987.465	40,224.535	40,756.000	531.465
07-09-2004	39,756.000	0.000	39,756.000	8,027.939	1,114.394	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9,142.333	30,613.667	30,616.000	2.333
08-09-2004	30,946.000	16,380.000	47,326.000	8,109.250	1,210.930	0.000	0.000	43.800	0.000	0.000	0.000	0.000	9,363.010	37,962.990	37,745.000	-217.990
09-09-2004	37,745.000	0.000	37,745.000	8,349.159	1,630.959	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9,980.114	27,764.886	27,764.000	-0.886
10-09-2004	27,764.000	16,380.000	44,144.000	8,220.540	1,781.832	0.000	0.000	20.110	36.500	-7.299	0.000	0.000	10,031.653	34,112.347	34,076.000	-36.653
Sub-total	**349,987.000**	**92,820.000**	**442,807.000**	**85,881.775**	**12,969.096**	**0.000**	**0.000**	**105.912**	**36.500**	**-7.299**	**0.000**	**0.000**	**98,985.984**	**343,821.016**	**344,246.000**	**424.984**
11-09-2004	34,036.000	0.000	34,036.000	10,037.183	1,891.364	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11,928.447	22,107.553	22,259.000	151.447
12-09-2004	23,298.000	21,740.000	45,038.000	9,631.307	1,442.328	0.000	0.000	21.000	0.000	0.000	0.000	0.000	11,073.635	33,964.365	33,955.000	-9.365
13-09-2004	32,943.000	0.000	32,943.000	8,144.336	1,661.581	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9,805.917	23,137.083	23,139.000	2.917
14-09-2004	23,680.000	21,840.000	45,520.000	0.000	1,620.502	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1,620.502	43,899.498	43,878.000	-21.498
15-09-2004	35,078.000	0.000	35,078.000	15,805.371	813.844	0.000	0.000	7.300	7.300	0.000	0.000	0.000	16,626.515	18,451.485	18,443.000	-8.485
16-09-2004	26,776.000	21,840.000	48,616.000	7,670.923	1,715.712	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9,386.635	39,229.365	39,152.000	-77.365
17-09-2004	38,662.000	0.000	38,662.000	8,939.717	1,811.135	0.000	0.000	21.000	7.300	0.000	0.000	0.000	10,780.152	27,881.848	27,881.000	-0.852
18-09-2004	28,542.000	21,840.000	50,382.000	9,881.584	1,450.680	0.000	0.000	21.000	14.602	0.000	0.000	0.000	11,366.866	39,015.134	38,353.000	-660.234
19-09-2004	38,353.000	0.000	38,353.000	9,412.736	1,716.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11,128.791	27,224.209	27,299.000	74.791
20-09-2004	27,299.000	21,840.000	49,139.000	8,613.173	1,553.158	0.000	0.000	20.027	0.000	0.000	0.000	0.000	10,166.331	38,972.669	40,702.000	1,685.258
Sub-total	**308,667.000**	**109,100.000**	**417,667.000**	**88,052.630**	**15,664.559**	**0.000**	**0.000**	**90.327**	**29.202**	**0.000**	**0.000**	**0.000**	**103,872.318**	**313,894.682**	**315,333.000**	**1,438.318**
21-09-2004	40,702.000	0.000	40,702.000	8,473.617	1,523.712	0.000	0.000	21.838	21.900	0.000	0.000	0.000	9,996.187	31,605.813	29,703.000	-1,902.873
22-09-2004	29,703.000	16,380.000	46,083.000	7,338.804	1,339.186	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8,528.190	37,554.810	37,640.000	85.990
23-09-2004	37,640.000	0.000	37,640.000	7,178.089	1,296.460	0.000	0.000	42.360	0.000	0.000	0.000	0.000	8,386.549	29,253.451	29,031.000	-222.091
24-09-2004	29,031.000	27,300.000	56,331.000	9,120.279	1,623.948	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10,744.227	45,586.773	45,812.000	225.227
25-09-2004	45,812.000	0.000	45,812.000	10,712.643	1,824.975	0.000	0.000	0.000	109.433	0.000	0.000	0.000	12,647.051	33,164.949	33,281.000	116.051
26-09-2004	33,281.000	21,840.000	55,121.000	10,915.395	1,851.573	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12,766.968	42,354.032	42,611.000	256.968

Printed by: [illegible] Printed by: Checked by: Approved by:

%	Reception References:
	Month: 9 2004
0.28	
-1.60	25121647
1.26	
-1.03	25127873
1.44	
-0.95	25127876
0.08	
0.17	25137041
-0.21	
0.05	25143549
-0.43	
3.50	
-2.22	25147545
1.65	
-19.38	25152235
23.75	
-1.17	25158771
1.71	
-1.31	25164316
0.20	
3.43	25167033
1.00	
-4.68	
0.19	43
-0.59	
0.07	86
0.01	
-0.33	83

Fuel Inventory Movement Report by month

KURNIA SEMPURNA ENT
TAMAN BATU GAJAH PERDANA,
PUSING
BATU GAJAH , 31550
Telephone: (05) 3656543

Day	Opening	Receiving	Total	Cash	Credit	Debit	Cheque	On Account	Coupon	Driveoff	Mixed	Pump Test	Total	Balance	Dip Reading	Difference
Item:	PRIMAX							Unit:	LITRES							
27-09-2004	42,611.000	0.000	42,611.000	8,977.428	1,489.126	0.000	0.000	21.900	0.000	0.000	0.000	0.000	10,488.454	32,122.546	32,015.000	-107.546
28-09-2004	32,015.000	16,380.000	48,395.000	8,042.660	1,528.926	0.000	0.000	21.898	0.000	0.000	0.000	0.000	9,593.484	38,801.516	38,676.000	-125.516
29-09-2004	38,676.000	0.000	38,676.000	9,644.412	1,421.955	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11,066.367	27,609.633	27,747.000	137.367
30-09-2004	27,747.000	21,840.000	49,587.000	9,233.337	2,281.317	0.000	0.000	21.900	0.000	0.000	0.000	0.000	11,536.554	38,050.446	38,232.000	181.554
Sub-total	357,218.000	103,740.000	460,958.000	89,226.664	14,627.178	0.000	0.000	129.956	131.389	0.000	0.000	0.000	104,115.187	356,842.813	354,748.000	-2,094.813
Sub-total (month)	,015,872.000	305,660.000	,321,532.000	263,201.069	43,252.833	0.000	0.000	329.795	197.091	-7.299	0.000	0.000	306,973.489	1,014,558.511	1,013,327.000	-1,231.511
Total	,015,872.000	305,660.000	,321,532.000	263,201.069	43,252.833	0.000	0.000	329.795	197.091	-7.299	0.000	0.000	306,973.489	1,014,558.511	1,013,327.000	-1,231.511

total received for month of Sept 04

%	Reception References:
	Month: 9 2004
-0.25	
-0.26	25189375
0.36	
0.37	25196223
-1.45	
-0.36	
-0.36	

Gas Profit Report (By Month)

KURNIA SEMPURNA ENTERPRISE

ntains transactions for the following Period :

2004 (-)

t	Price Sold	Regular Price	Q-ty Sold	Total Cost	Total Sold	Profit	Profit %
7	0.788	0.788	11167.932	8342.45	8800.21	457.76	5.20%
0	0.788	0.788	8098.811	0.00	6381.82	6381.82	100.00%
6	0.788	0.788	221729.471	167627.48	174721.14	7093.66	4.06%
)			**240996.214**	**175969.93**	**189903.17**	**13933.24**	**7.34%**
2	1.370	1.370	21085.230	17753.76	28884.21	11130.45	38.53%
0	1.370	1.370	5677.927	0.00	7778.09	7778.09	100.00%
6	1.370	1.370	280227.401	363174.71	383879.03	20704.32	5.39%
)			**306990.558**	**380928.48**	**420541.33**	**39612.85**	**9.42%**
				556898.40	**610444.50**	**53546.10**	**8.77%**

Appendix 4

Ordering form and Sales record for PETRONAS Petrol Station branch at Taman Saujana, Batu Gajah (please refer to the next page)

BORANG PESANAN PREPLAN

Version: 2.3

Dari

No. Akaun	:	90032678
PSS	:	Saujana Service Station
Alamat	:	Lot PT 10158, Laluan Saujana 1, Taman Saujana, 31000 Batu Gajah, Perak
Telefon	:	05 - 288 2589
Fax	:	05 - 288 1728
Email	:	psstamansaujana@hotmail.com

Ship To:

Kepada

Mesralink (Retail)
Tg 25, Menara 2, Menara Berkembar Petronas, KL
1300 88 8181
1300 88 8383
mesralink.retail.order@petronas.com.my
cc aaznand@petronas.com.my

Produk	Primax				RON		Diesel			Kerosin	
Material no	50000011				50000009		50022419			50000018	
Depot	020E KVDT				020E KVDT		020E KVDT			020E KVDT	
Authorised MOQ	21,840				Combined		16,380			8,190	
Tarikh	Kuantiti 1	Kuantiti 2	Kuantiti 3	O/number	Kuantiti	O/number	Kuantiti 1	Kuantiti 2	O/number	Kuantiti	O/number
30-Aug-04	21,840										
31-Aug-04											
1-Sep-04											
2-Sep-04	21,840										
3-Sep-04											
4-Sep-04							10,920				
5-Sep-04											
6-Sep-04	21,840										
7-Sep-04											
8-Sep-04											
9-Sep-04							10,920				
10-Sep-04	21,840										
11-Sep-04											
12-Sep-04											

PENGURUSAN STOK & PESANAN PREPLAN

Produk	Primax							RON					Diesel					
Kapasiti Tangki	65,000	Depot:	KVDT						Depot:	KVDT			26,000	Depot:	KVDT			
Purata Jualan Harian	5,000	Allow order							Allow order				2,500	Allow order				
Buffer stock	12,000	If Komen?	Y						If Komen?	N			5,000	If Komen?	Y			
Authorised MOQ	21,840							Kongsi dgn Primax					16,380					

Hari	Tarikh	Stok Buka Sebenar	Jangkaan Stok Buka	Jualan lain dari Purata	Pesanan 1	Pesanan 2	Pesanan 3	Komen	Stok Buka Sebenar	Jangkaan Stok Buka	Jualan lain dari Purata	Pesanan	Komen	Stok Buka Sebenar	Jangkaan Stok Buka	Jualan lain dari Purata	Pesanan 1	Pesanan 2	Komen
Isnin	23-Aug-04	26,683	26,683											5,042	5,042				
Selasa	24-Aug-04		20,683												3,042		10,920		
Rabu	25-Aug-04		14,683												11,962				
Khamis	26-Aug-04		8,683		21,840										9,962				
Jumaat	27-Aug-04		24,523												7,962				
Sabtu	28-Aug-04		18,523												5,962				
Ahad	29-Aug-04		12,523												3,962		10,920		
Isnin	30-Aug-04		6,523		21,840										12,882				
Selasa	31-Aug-04		22,363												10,882				
Rabu	1-Sep-04		16,363												8,882				
Khamis	2-Sep-04		10,363		21,840										6,882				
Jumaat	3-Sep-04		26,203												4,882				
Sabtu	4-Sep-04		20,203												2,882		10,920		
Ahad	5-Sep-04		14,203												11,802				
Isnin	6-Sep-04		8,203		21,840										9,802				
Selasa	7-Sep-04		24,043												7,802				
Rabu	8-Sep-04		18,043												5,802				
Khamis	9-Sep-04		12,043												3,802		10,920		
Jumaat	10-Sep-04		6,043		21,840										12,722				
Sabtu	11-Sep-04		21,883												10,722				
Ahad	12-Sep-04		15,883												8,722				
Isnin	13-Sep-04		9,883		21,840										6,722				
Selasa	14-Sep-04		25,723												4,722				
Rabu	15-Sep-04		19,723												2,722		10,920		
Khamis	16-Sep-04		13,723												11,642				
Jumaat	17-Sep-04		7,723		21,840										9,642				
Sabtu	18-Sep-04		23,563												7,642				
Ahad	19-Sep-04		17,563												5,642				

Aug-04

DATE 2004	SALES						TOTAL SALES	CREDIT (RM)				TOTAL CREDIT	TOTAL to BANK IN
	PRIMAX		DISEL		LUB	KEDAI							
	RM	LITER	RM	LITER	RM	MESRA	RM	SMARTPAY	KUPON	VISA / MASTER			
AUG 1	8,140.54	5,942.00	472.80	600.00	-	564.90	9,178.24			677.77		677.77	8,500.47
I 2	7,591.17	5,541.00	1,239.52	1,573.00	-	652.25	9,482.94			614.31		614.31	8,868.63
S 3	6,547.23	4,779.00	1,535.02	1,948.00	-	516.20	8,598.45			632.54		632.54	7,965.91
R 4	6,767.80	4,940.00	1,243.46	1,578.00	-	513.95	8,525.21			378.52		378.52	8,146.69
K 5	6,495.17	4,741.00	1,571.27	1,994.00	-	492.35	8,558.79			590.55		590.55	7,968.24
J 6	8,554.28	6,244.00	910.93	1,156.00	-	653.70	10,118.91			1,759.06		1,759.06	8,359.85
S 7	8,337.82	6,086.00	1,884.90	2,392.00	-	654.20	10,876.92			992.34		992.34	9,884.58
A 8	8,085.74	5,902.00	591.79	751.00	-	784.45	9,461.98			624.27		624.27	8,837.71
I 9	8,111.77	5,921.00	1,359.30	1,725.00	-	505.80	9,976.87			711.40		711.40	9,265.47
S 10	7,328.13	5,349.00	2,170.15	2,754.00	-	506.95	10,005.23			795.04		795.04	9,210.19
R 11	6,347.21	4,633.00	996.03	1,264.00	-	350.55	7,693.79			597.83		597.83	7,095.96
K 12	7,087.01	5,173.00	1,632.74	2,072.00	-	399.00	9,118.75			696.90		696.90	8,421.85
J 13	6,980.15	5,095.00	1,334.87	1,694.00	-	462.30	8,777.32			667.57		667.57	8,109.75
S 14	7,878.87	5,751.00	1,134.72	1,440.00	-	502.90	9,516.49			679.75		679.75	8,836.74
A 15	7,356.90	5,370.00	583.12	740.00	-	673.74	8,613.76			667.57		667.57	7,946.19
I 16	7,317.17	5,341.00	1,650.86	2,095.00	-	596.10	9,564.13			679.75		679.75	8,884.38
S 17	6,754.10	4,930.00	1,470.41	1,866.00	-	466.30	8,690.81			614.39		614.39	8,076.42
R 18	6,773.28	4,944.00	2,210.34	2,805.00	-	469.50	9,453.12			531.00		531.00	8,922.12
K 19	6,793.83	4,959.00	1,603.58	2,035.00	-	467.85	8,865.26			659.12		659.12	8,206.14
J 20	7,744.61	5,653.00	2,103.96	2,670.00	-	586.40	10,434.97			669.02		669.02	9,765.95
S 21	7,995.32	5,836.00	1,149.69	1,459.00	-	648.80	9,793.81			713.10		713.10	9,080.71
A 22	8,398.10	6,130.00	597.30	758.00	-	833.15	9,828.55			688.00		688.00	9,140.55
I 23	7,158.25	5,225.00	1,326.20	1,683.00	-	451.90	8,936.35			983.24		983.24	7,953.11
S 24	7,300.73	5,329.00	1,572.06	1,995.00	-	530.30	9,403.09			594.79		594.79	8,808.30
R 25	8,004.91	5,843.00	2,132.33	2,706.00	-	481.30	10,618.54			1,090.68		1,090.68	9,527.86
K 26	7,411.70	5,410.00	1,680.80	2,133.00	-	734.35	9,826.85			731.84		731.84	9,095.01
J 27	7,008.92	5,116.00	1,432.58	1,818.00	-	586.50	9,028.00			351.17		351.17	8,676.83
S 28	9,281.75	6,775.00	1,541.33	1,956.00	-	787.90	11,610.98			190.01		190.01	11,420.97
A 29	7,766.53	5,669.00	372.72	473.00	-	622.00	8,761.25			144.25		144.25	8,617.00
I 30	8,637.85	6,305.00	1,054.34	1,338.00	-	782.20	10,474.39			152.51		152.51	10,321.88
S 31	7,440.47	5,431.00	743.08	943.00	-	711.45	8,895.00			162.01		162.01	8,732.99
TOTAL	233,397.31	170,363.00	41,302.23	52,414.00	-	17,989.24	292,688.78	-	-	20,040.30		20,040.30	272,648.48

DATE 2004	SALES						TOTAL SALES	CREDIT (RM)			TOTAL CREDIT	TOTAL to BANK IN
	PRIMAX		DISEL		LUB	KEDAI						
	RM	LITER	RM	LITER	RM	MESRA	RM	SMARTPAY	KUPON	VISA / MASTER		
SEPT 1	7,073.83	5,163.38	1,444.06	1,832.56	-	535.00	9,052.89			940.10	940.10	8,112.79
K 2	6,609.80	4,824.67	1,361.09	1,727.27	-	503.40	8,474.29			667.69	667.69	7,806.60
J 3	6,936.95	5,063.47	1,845.73	2,342.30	-	659.20	9,441.89			1,043.10	1,043.10	8,398.79
S 4	8,609.46	6,284.28	1,067.77	1,355.04	-	624.55	10,301.79			1,145.59	1,145.59	9,156.20
A 5	8,151.61	5,950.08	314.35	398.92	-	594.40	9,060.36			801.50	801.50	8,258.86
I 6	7,259.33	5,298.78	1,684.53	2,137.73	-	494.80	9,438.66			872.44	872.44	8,566.22
S 7	6,820.61	4,978.55	1,823.73	2,314.38	-	462.60	9,106.94			664.48	664.48	8,442.46
R 8	6,734.32	4,915.56	1,158.27	1,469.89	-	550.20	8,442.79			571.18	571.18	7,871.61
K 9	6,853.59	5,002.62	1,645.71	2,088.47	-	537.65	9,036.95			817.79	817.79	8,219.16
J 10	7,131.48	5,205.46	1,258.61	1,597.22	-	516.50	8,906.59			1,000.10	1,000.10	7,906.49
S 11	8,422.16	6,147.56	1,879.94	2,385.71	-	552.80	10,854.90			942.71	942.71	9,912.19
A 12	7,395.37	5,398.08	475.30	603.17	-	946.30	8,816.97			547.32	547.32	8,269.65
I 13	6,425.29	4,689.99	1,337.72	1,697.62	-	410.40	8,173.41			942.44	942.44	7,230.97
S 14	7,934.22	5,791.40	2,075.80	2,634.27	-	524.00	10,534.02			978.52	978.52	9,555.50
R 15	6,935.28	5,062.25	1,536.60	1,950.00	-	402.50	8,874.38			1,195.59	1,195.59	7,678.79
K 16	7,384.77	5,390.34	1,635.27	2,075.21	-	624.30	9,644.33			818.52	818.52	8,825.81
J 17	8,093.81	5,907.89	1,374.34	1,744.09	-	441.20	9,909.35			781.86	781.86	9,127.49
S 18	8,048.82	5,875.05	1,324.57	1,680.93	-	565.75	9,939.14			1,093.93	1,093.93	8,845.21
A 19	7,939.60	5,795.35	519.02	658.65	-	575.45	9,034.07			634.09	634.09	8,399.98
I 20	7,830.82	5,715.93	1,659.99	2,106.58	-	515.70	10,006.51			933.04	933.04	9,073.47
S 21	6,820.87	4,978.74	1,186.29	1,505.44	-	416.40	8,423.56			972.21	972.21	7,451.35
R 22	7,913.50	5,776.28	1,621.30	2,057.49	-	594.10	10,128.91			1,361.70	1,361.70	8,767.21
K 23	7,016.00	5,121.17	1,269.79	1,611.41	-	507.20	8,792.99			641.33	641.33	8,151.66
J 24	8,316.50	6,070.44	1,543.25	1,958.44	-	471.90	10,331.65			910.95	910.95	9,420.70
S 25	8,745.68	6,383.71	1,340.22	1,700.79	-	647.90	10,733.81			1,331.18	1,331.18	9,402.63
A 26	9,238.44	6,743.39	267.98	340.08	-	682.80	10,188.73			1,026.51	1,026.51	9,162.22
I 27	7,937.85	5,794.05	981.64	1,245.73	-	403.40	9,322.88			971.32	971.32	8,351.56
S 28	7,076.37	5,165.23	1,163.08	1,475.99	-	517.30	8,756.75			532.08	532.08	8,224.67
R 29	8,007.54	5,844.92	2,158.36	2,739.04	-	454.44	10,620.34			1,249.03	1,249.03	9,371.31
K 30	9,490.98	6,927.72	4,046.58	5,135.26	-	474.09	14,011.65			1,379.70	1,379.70	12,631.95
TOTAL	229,154.86	167,266.32	43,000.91	54,569.68	-	16,205.73	288,361.50	-	-	27,768.00	27,768.00	260,593.50

Appendix 5

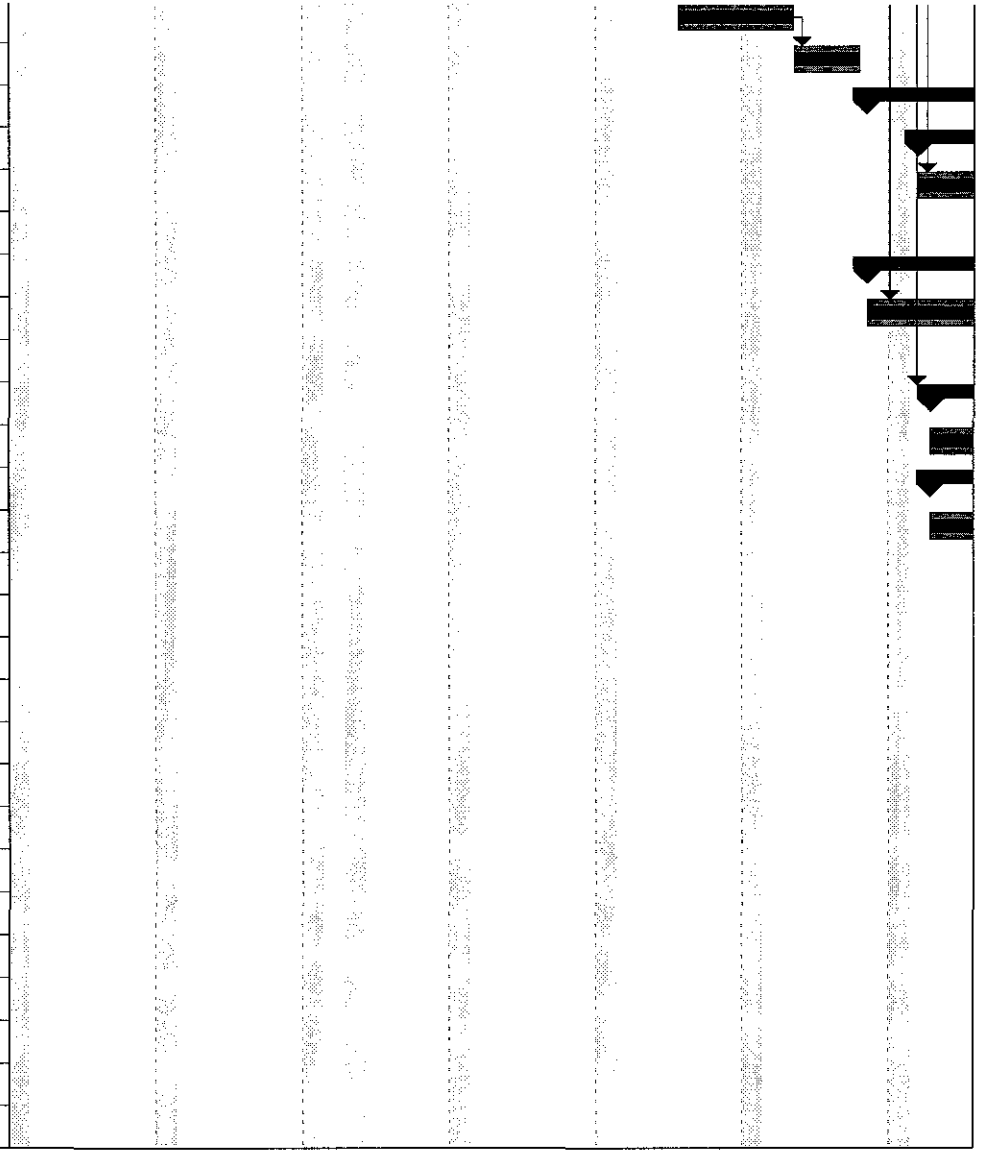
Project Gantt Chart

4	✓	**1.1 Preliminary Investigation**	**7 days**	**Mon 7/19/04**	**Tue 7/27/04**	
5	✓	1.1.1 Data and Information Gath	3 days	Mon 7/19/04	Thu 7/22/04	
6	✓	1.1.2 Problem Definition and Prc	4 days	Thu 7/22/04	Tue 7/27/04	5
7	✓	**1.2 Preliminary Report Submission**	**15 days**	**Mon 7/19/04**	**Sat 8/7/04**	
8	✓	1.2.1 Literature Review	5 days	Mon 7/19/04	Sat 7/24/04	
9	✓	1.2.2 Introduction	5 days	Mon 7/26/04	Sat 7/31/04	
10	✓	1.2.3 Project Scope	8 days	Tue 7/27/04	Sat 8/7/04	6
11	✓	1.2.4 Objectives	6 days	Wed 7/28/04	Thu 8/5/04	6
12	✓	**1.3 Schedulling**	**5 days**	**Mon 8/2/04**	**Mon 8/9/04**	
13	✓	1.3.1 Gantt Chart	5 days	Mon 8/2/04	Mon 8/9/04	
14	✓	**2. Analysis and Design**	**29 days**	**Mon 7/26/04**	**Thu 9/2/04**	
15	✓	**2.1 Survey**	**10 days**	**Mon 7/26/04**	**Mon 8/9/04**	
16	✓	2.1.1 Contact Client	3 days	Mon 7/26/04	Thu 7/29/04	
17	✓	2.1.2 Interview Client	2 days	Thu 7/29/04	Sat 7/31/04	16
18	✓	2.1.3 Analyze the Information	5 days	Sat 7/31/04	Mon 8/9/04	17
19	✓	**2.2 System Requirements**	**8 days**	**Mon 8/9/04**	**Thu 8/19/04**	
20	✓	2.2.1 Identify Functional and Nor	8 days	Mon 8/9/04	Thu 8/19/04	18
21	✓	**2.3 Hardware and Software Requir**	**16 days**	**Thu 7/29/04**	**Thu 8/19/04**	
22	✓	2.3.1 Hardware Acquirement (if a	5 days	Wed 8/11/04	Tue 8/17/04	
23	✓	**2.3.2 Software Installation**	**16 days**	**Thu 7/29/04**	**Thu 8/19/04**	
24	✓	2.3.2.1 Learning the Softwa	16 days	Thu 7/29/04	Thu 8/19/04	
25	✓	**2.4 Design User Interface**	**11 days**	**Thu 8/19/04**	**Thu 9/2/04**	
26	✓	2.4.1 Design Administrator Interf	8 days	Thu 8/19/04	Mon 8/30/04	20
27	✓	2.4.2 Design Operator Interface	11 days	Thu 8/19/04	Thu 9/2/04	20
28	✓	**2.5 Progress Report Writing and St**	**12 days**	**Thu 8/5/04**	**Fri 8/20/04**	
29	✓	**2.6 Design Database (If any)**	**8 days**	**Wed 8/18/04**	**Fri 8/27/04**	
30	✓	2.6.1 Define Relationship Table	7 days	Wed 8/18/04	Thu 8/26/04	
31	✓	2.6.1 Design Table Structure	8 days	Wed 8/18/04	Fri 8/27/04	

Project: FYP
Date: Thu 12/9/04

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

33	✓	2.7.1 Define the Rules and Para	4 days	Thu 8/19/04	Tue 8/24/04	
34	✓	2.7.2 Justify the Rules and Para	3 days	Tue 8/24/04	Fri 8/27/04	33
35	✓	**3. System Development**	**18 days**	**Sat 8/28/04**	**Tue 9/21/04**	
36	✓	**3.1 Develop Interface**	**14 days**	**Mon 8/30/04**	**Thu 9/16/04**	
37	✓	3.1.1 Develop Administrator Inte	8 days	Mon 8/30/04	Thu 9/9/04	26
38	✓	3.1.2 Develop Operator Interface	11 days	Thu 9/2/04	Thu 9/16/04	27
39	✓	**3.2 Develop Database**	**18 days**	**Sat 8/28/04**	**Tue 9/21/04**	
40	✓	3.2.1 Create Database	10 days	Sat 8/28/04	Fri 9/10/04	29
41	✓	3.2.2 Insert Data	8 days	Fri 9/10/04	Tue 9/21/04	40
42	✓	**3.3 Insert the Rules**	**8 days**	**Tue 8/31/04**	**Thu 9/9/04**	**32**
43	✓	3.3.1 Link the Rule With the Par	8 days	Tue 8/31/04	Thu 9/9/04	
44	✓	**3.4 Generate the Report**	**15 days**	**Tue 8/31/04**	**Sat 9/18/04**	
45	✓	3.4.1 List the Report Content	8 days	Tue 8/31/04	Thu 9/9/04	
46	✓	3.4.2 Verify the Report Content	7 days	Fri 9/10/04	Sat 9/18/04	45
47	✓	**4. Testing and Debugging**	**22 days**	**Fri 9/17/04**	**Fri 10/15/04**	
48	✓	**4.1 Alpha Testing**	**8 days**	**Fri 9/17/04**	**Mon 9/27/04**	
49	✓	4.1.1 User Interface Testing	7 days	Fri 9/17/04	Sat 9/25/04	36
50	✓	4.1.2 Database Testing	6 days	Fri 9/17/04	Fri 9/24/04	40
51	✓	4.1.3 Rule Testing	8 days	Fri 9/17/04	Mon 9/27/04	43
52	✓	**4.2 Debugging**	**7 days**	**Tue 9/28/04**	**Wed 10/6/04**	
53	✓	4.2.1 Run and Debug	7 days	Tue 9/28/04	Wed 10/6/04	48
54	✓	**4.3 Beta Testing**	**14 days**	**Tue 9/28/04**	**Fri 10/15/04**	**48**
55	✓	4.3.1 User Testing	14 days	Tue 9/28/04	Fri 10/15/04	
56	✓	4.3.2 Supervisor Approval	6 days	Wed 10/6/04	Thu 10/14/04	52
57	✓	**5. Final Draft Submission**	**1 day**	**Thu 10/14/04**	**Fri 10/15/04**	
58	✓	**6. Oral Presentation**	**5 days**	**Mon 10/25/04**	**Sat 10/30/04**	
59	✓	**7. Project Disertation Submission**	**1 day**	**Tue 11/30/04**	**Wed 12/1/04**	



Project: FYP
Date: Thu 12/9/04

Task — Milestone — External Tasks
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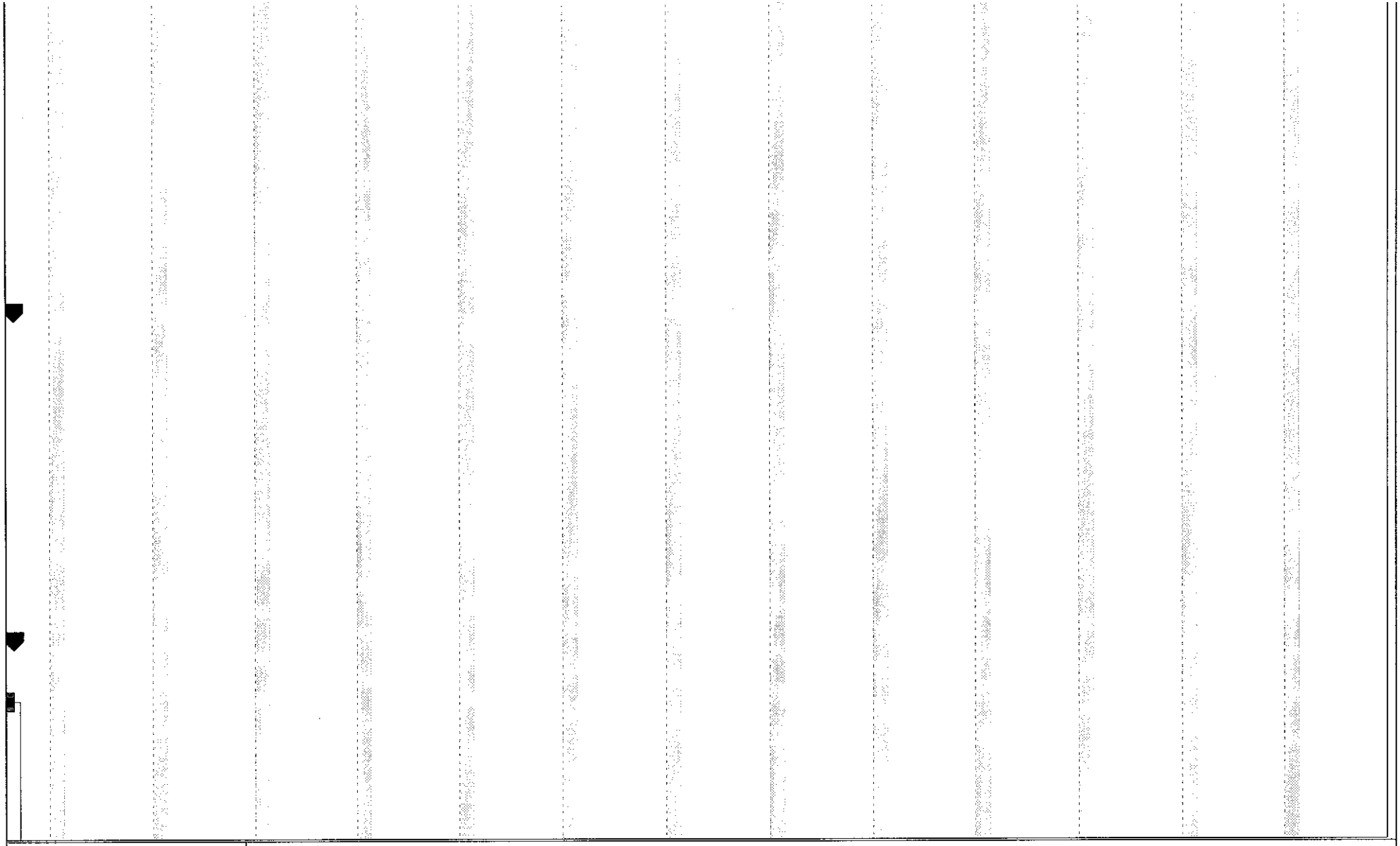
Progress — Project Summary — Deadline



Project: FYP
Date: Thu 12/9/04

Task
Split
Progress
Milestone
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Project Summary
External Tasks
External Milestone
Deadline

Project: FYP
Date: Thu 12/9/04

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	