Virtual Dashboard for Tanker Truck

by

Noor Faradila Mad Dalan

A dissertation submitted in partial fulfilment of
the requirements for the
Bachelor of Technology (Hons)
(Information System)

JUNE 2004

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CERTIFICATION OF APPROVAL

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Approved by,

(Mr Helmi Md Rais)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH PERAK
JUN 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 references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

NOOR FARADILA MAD DALAN

ABSTRACT

Society has been very concern about the new technologies that are increasing like mushroom lately. In addition, the replacement of hardware by software has been one of the major developments in the electronics industry for many years. However, it has basically been too small to be noticed by the end user. In this new age where everything is computerized, human become more curious to learn as well as make use of new application of the virtual dashboard as it grant a significant impacts on vehicle's users. Therefore, this report present information base on the research involves in Virtual Dashboard, which is purposely design for monitoring the performance of the truck. This report features the introduction that explains about background of study, problem statement, the significant of the project, objectives and the scope of study of the project research. There is also some part of studies for supporting information or reference to support the project research. Process of identification is in short talked about in order to entire the research and describe tools of hardware and software apply to design the product. The end-result of the research is the static virtual dashboard software prototype that caters the basic needs of virtual truck.

In shorts, the 2D virtual dashboard is a replacing of the collector of mechanical instruments by software-configurable display. It enabled truck driver to maintain the truck's performance while driving. Hence, the interfaces need to be simple and intuitive to use in addition to provide interaction with the users, in order to increase operation efficiency. The virtual dashboard also provides a clear visualisation from the other part of the truck, in recognizable graphics and graphs. A message window indicates the gauges' performance as well as displaying warnings when the state values approach presets limits. With this, private, secure, fast digital connection from oil tanker will be directed to the knowledge of the user.

ACKNOWLEDGEMENT

Bismillah ar-Rahmani Ar-Raheem

In the Name of Allah, The Most Compassionate, the Most Merciful

First and foremost I would like to recite my greatest gratitude to the Most Merciful Allah for giving me the opportunity in completing this manuscript on time and without much hassle or problem. Without His observance in giving me the chance in finishing the project, there might be major problem which can resulted in my delay of turning in the assignment in the time constrain.

In completing my project, there are some people that had been the backbone of the activities done in the complete of this text. I wouldn't have been able to finish up without their assistance, encouragement, and support either in terms of material, or spiritual. With this I would like to put some credit to them who has helped me through this time duration. They are as listed as beneath:

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   - Ms. Aida Fazlina
   - Ms. Azreen
   - Ms. Aznita

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INTRODUCTION

1.1 BACKGROUND OF STUDY

The substitution of hardware by software has been one of the major developments in the electronics industry for many years. Nevertheless, it has basically been too small to be noticed by the end user. In this new age where everything is computerized, human become more curious to learn as well as make use of new application of the virtual dashboard as it give a significant impacts on vehicle's users.

Even, there is a code, made up in California, that required vehicles sold in California to have an on-board computer processor for on-board self diagnostics of computer sensed emission related components, fuel metering device and EGR (exhaust gas recirculation system).

Virtual Dashboard is a user interface that resembles the dashboard of an automobile. It displays gauges and dials that are designed in a similar fashion. Means that, Virtual dashboard is the replacement of the collector of mechanical instruments of a conventional truck dashboard by a single reconfigurable display, which delivers all the required information via a single, customizable unit.

The virtual dashboard application dynamically draws the instruments on the dashboard as the platform in response to data from the engine as well as the oil tanker. The real time data logging will be displayed through the virtual indicators and the graphs. Additional information, such as images from the other parts of the truck, can also be displayed in order to recognize the performance of the parts. Any information needed from the virtual dashboard, will be provided in a specific category so that the data are saved and reported in a well positioned.

Besides, the application will also produce the alarm if there is any uncertainty happened such as collision and detection, leaking oil, and heating engine. A pop up message will appear in order to tell the user on the description of any occurrences.

1.2 PROBLEM STATEMENT

Dashboard is the panel under the windshield of the truck, containing indicator dials and control. Interface dashboards indicate performance assessment in the way physical trucks' dashboards communicate speed, fuel levels, and potential system problems.

Nevertheless, with the 'traditional dashboard' usage, it is still consider as impractically. Due to the inflexible to keep up the performance of the truck, user seems to tough to become conscious of the situation. The dashboard that does not presents in details of a storyworld from the truck, makes the users can't recognize any location that is not functioning well and the interface of the 'traditional dashboard' itself does not really sensible. Consequently, user might face the problems in analyzing trouble codes, performance, maintenance, and real time data logging. This does not actually direct securities that give connection from the truck.

With the existence of the virtual dashboard, it is become more assistance with its easy-to-use interface and analytic reporting. The computer accepts the values entered according to the sensors automatically. All values entered are converted and displayed in the selected function graphs. For that reason, computer updates count on display every time it receives a signal from the sensors. Besides, user could also look at the condition of the engine and the fuel in the tank through the movie that are attached to the virtual dashboard. The aid is too valuable and efficient for the driver when they are onboard.

Despite, the key challenge of the project is that the virtual dashboard must perform at least as well as real mechanical instruments in terms of detecting sensors as well as a performance indicator. Instead, the virtual dashboard has to be capable for supporting the end users' choice and instrumentation knowledge within the truck. This will ensure that the designed is really user friendly.

Within the time frame, it is quite hard to develop such a great Virtual Dashboard. This due to the sensors that need to be working logically parallel with the moving truck. Means, the speed and RPM should be recorded accurately along with the fuel level and temperature level of the truck. The error of calculation and recording could make the dashboard does not working realistically.

1.3 OBJECTIVE OF THE PROJECT

- To design a user-friendly virtual dashboard instruments prototype.
- To direct private, secure, fast digital connection from oil tanker to the personal computer.
- To be able to monitor and manage key performance of the engine and oil in the tanker.

1.4 SCOPE OF STUDY

A system will be designed to recognized and detect the input from the four sensors – RPM, speedometer, heat sensor, and fuel sensor - which are attached to the virtual dashboard. Hence, the scope of study is mostly based on these few areas:

- Controlling the various sensors as input and produce the output.
    - A condition of the database system should be established to handle the ever-growing flux of data and make interactive data management system possible.
- Interface at the PC for the exchange of inputs and outputs from the sensors.
    - The dashboard needs a dedicated institution that is able to maintain it with communication functionality. Clarity and userfriendly both fall into traditional areas of visual design. It requires not only a strong knowledge of visual design, but also demands a deep understanding of human factors, as well as interface design and general technology issues.
- Graphs application to automatically display the record of the real-time data logging.

- The prototype of dashboard must have the Information Design that gives the greatest impact and benefit. It must be appropriate and maximize clarity by providing visual presentation of the data and information such as excellent graphs for displaying the functionality of the performance. Therefore, the sensors that are connected to databases will be updated regularly so users aren't looking at previous information.

1.5 FEASIBILITY OF THE PROJECT (WITHIN SCOPE AND TIME FRAME)

The application will be designed to monitor and manage key performance of the truck. Due to the time constraint (given 14 weeks to study and develop the system), system's function will be limited in monitoring the truck. This is to guarantee that the system could be accomplished in the allocated time frame. In other words, it could be bring into play to presents in details of a storyworld from the truck.

Visual Basic 6.0 is used as main developing software. Visual Basic is chosen because it using easy-to-understand programming language and could provide better interface. Thus, time required to develop the Virtual Dashboard is minimized since the layout of the windows can be changed easily by dragging and dropping the object to the new location without necessitating a change in the code. In addition, Visual Basic has the ability to detect database as well as supported when integrating with other software such as 3D Studio Max, Open GL and Visual C++. Visual Basic 6.0 also provides a number of tools to analyze the Virtual Dashboard's performance when they do not work properly. Good thing, Visual Basic has the capability in generating graphs based on the data captured.

Keyboard or joy-pad would be used to sense the movement of the truck. Some button is set according to the specific function that could sense the speed, RPM, which consequently increased the temperature and heat simultaneously. The joy-pad usage is beneficial in making the movement of the truck smoothly and faster. Keyboard is always available if needed since the device is attached to the computer.

CHAPTER 2

LITERATURE REVIEW

In the era of technology, virtual dashboard is developing into more and more popular. The virtual dashboard program is available as a module for a stand-alone program truck user. User must enter and interact with the dashboard's interface, which assumes like "driver" viewpoint.

Virtual dashboard is software scan tool that can help user peer into the inner workings of the vehicle. Hooking up to the data port on the truck may be one of the most useful ways to use the computer. Therefore, user prefers to try new things and up-to-date technologies by getting a scan tool that has bi-directional control (RPM, injectors, etc), and extended body and chassis reporting, that already acknowledged made-up as virtual dashboard.

2.1 Virtual Dashboard Application

Currently, ODB (On Board Diagnostics), OzTrip Computer, and HondaLogger are some of the application that is on high demand. These applications provide lots of advantages to the user, seeing that the easiness of the application could make the user feel safer to be onboard for a long journey.

2.1.1 OBD (On Board Diagnostics)

On-Board Diagnostic systems are in most cars and light trucks on the road today. Compared with previous years, during the '70s and early 1980's, manufacturers started using electronic means to control engine functions and diagnose engine problems. This was primarily to meet EPA (Environmental Protection Agency) emission standards. At the present time, through the years on-board diagnostic systems have become more sophisticated.

OBD-1 is on-board computer processor for on-board self-diagnostics of computer sensed emission related components, fuel metering device and EGR (exhaust gas recirculation system). A partial or total malfunction that exceeded exhaust emission standard would illuminate a MIL (malfunction indicator light) and provide on-board identification of the malfunction location. To provide malfunction location information, codes are stored in on-board computer memory. To read codes manufactures use methods, such as flashing MIL light or various serial data protocols.

Whereas, OBD-2 requires a standard electrical connector, open source standardized diagnostic trouble codes (DTC), data, and communication protocol with more specific self-diagnostic on-board monitoring of emission malfunctions.

OBDII allows user to read out trouble codes when the "check engine" light comes on instead of clear these codes too. User can retrieve pretty much any piece of OBDII mandated diagnostic data from user truck. The interface supports OBDII protocols commonly used in US trucks: VPW (General Motors), PWM (Ford), and ISO9141 (Chrysler, Asian, and European), and ISO 14230 protocol (also called Keyword 2000).

Additionally, there are two 4 inch and four 2 inch diameter gauges. All gauges conform to OBD2 range specification. For example the tachometer is 16 bit providing a range to 16,000 rpm with a resolution of 0.25 revolutions. Users have a choice of selecting 22 different gauges. To set minimum, maximum and red lines, user need to click on the gauge. For example, the tach can have a range of 0-1600 or 6000-8000, or both high and low range gauges. Selectable colors are available for needle, numbers and faceplate.

When using the OBD gauges and charts can be moved, resized and mixed on the same dashboard. OBD also produce realistic gauge display with auto sizing fonts. The gauge's shapes can be selected from multiple "dial" shapes - including digital and the toolbar layout can be customized too.

Figure 1 below shows the interface of OBD II.

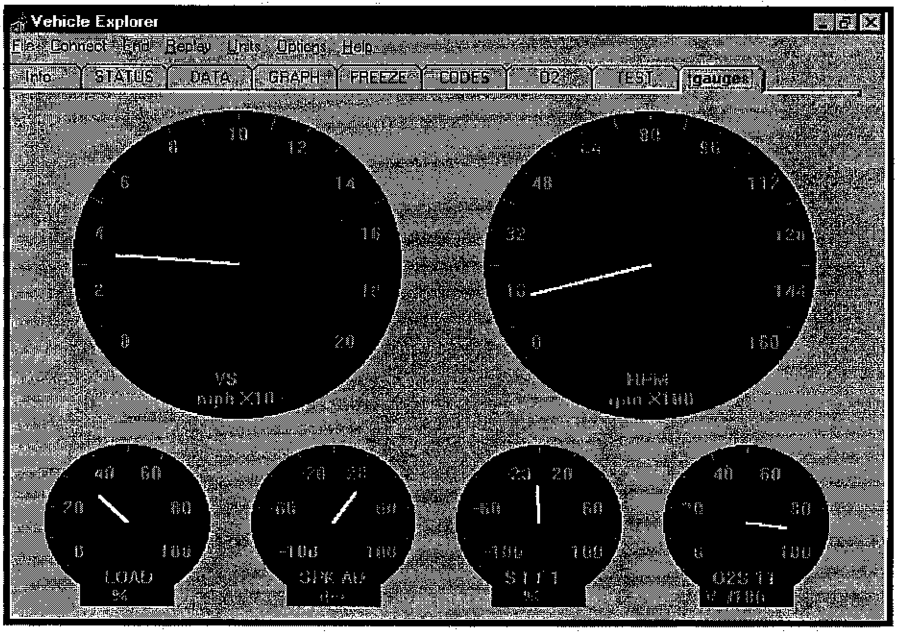

Figure 1: Interface of ODBC

2.1.2 HondaLogger

Another well-known application of virtual dashboard is HondaLogger Version 3.5.0.0 (1999-2001) which is a datalogging application for use with Hondata modified Honda engine computers. HondaLogger allowing sensors to be viewed, graphed, recorded and played back. A real time display of the sensors is shown as a digital dashboard. Errors can be retrieved and decoded.

HondaLogger will run on just about any computer than can run Windows 95/98/ME/NT/2000, but a Pentium is recommended. 10 MB free hard disk space is required and a minimum of 32MB RAM is recommended. More RAM won't affect datalogging speed but will make loading, saving and viewing recordings much quicker.

Datalogging is available with Hondata stage 4 systems. HondaLogger connects to the interface board using a standard serial cable, and retrieves sensor information from the ElectronicControlUnit via the interface board. HondaLogger can interpret and display the sensor information, or record, save and playback the sensor information.

There are two kinds of sensors – real and calculated. An example of a real sensor is the Throttle Position Sensor, which measures the throttle plate angle. An example of a calculated sensor is Gear, which is calculated from the revs and speed using the drivetrain information.

The main HondaLogger screen is made up of several tabs as shown in the **Figure 2** as shown below:

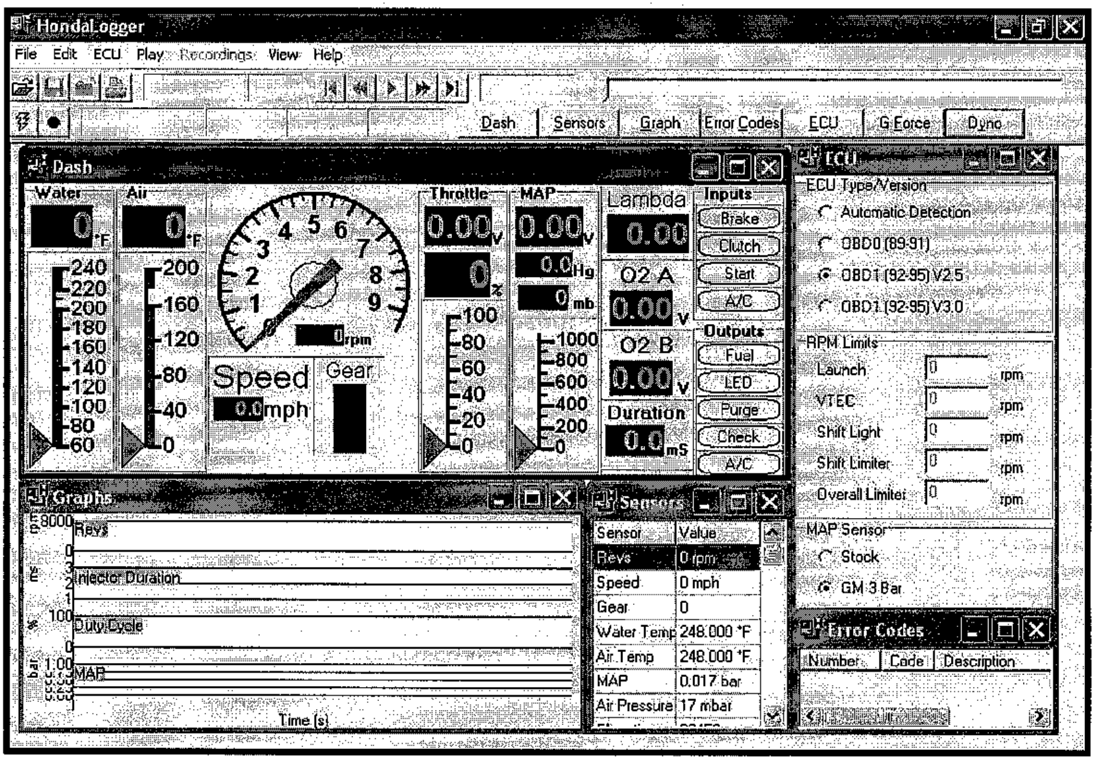

Figure 2: Interface of the Hondata Logger

Dash - The Dash tab shows a 'virtual dashboard' of instruments, active when HondaLogger is connected to an ECU or a recording is being played back. The update frequency can be set in the Settings dialog.

Sensor - The Sensor tab shows a list of current sensors, their datalog value, whether the sensor is datalogged and the datalogging frequency. The Datalog menu can also be used to select groups of sensors for datalogging.

Graphs- The Graphs tab shows graphs of sensors. Multiple sensors can be added to this tab from the Graphs menu. This is useful for showing a trend in a sensor. Graphs from previous recordings show the whole recording by default. The graphs can be zoomed in and out using the Graph menu, and scrolled left or right by moving the recording position,

Error Codes - The Error Codes tab shows a list of error codes from the ECU. Normally this list will be empty.

Recordings - The Recordings tab shows a list of recordings, either loaded from disk or new recordings that have been datalogged. Clicking on a recording will select it for playback. Right clicking on a recording will bring up a menu, which allows the recording to be closed or saved.

2.1.3 OzTrip Computer's Telemetry

OzTrip Computer's Telemetry on the other hand, is a virtual dashboard application than run on a Windows95/98. It is also possible to control the OzTrip from this application.

A 2 way serial data link is used between the OzTrip Computer and a PC. The data from the micro controller needs to be RS232 translated. This is achieved on board 3. The optional software and board 3 is available separately.

The OzTrip Computer can be used to measure parameters of Distance, Speed, Time, Fuel and engine RPM of a vehicle. The main features of the computer include 27 Functions covering Distance, Speed, Fuel, engine RPM & Time, 8 LED Function Display, 3 trip meters with 1 count down meter, and Programmable Speed Alarm, Simple 4 keypad user interface.

At the heart of the OzTrip Computer is a Motorola 68HC705C8 micro controller, which is perfect for this application. This 40 pin One Time Programmable Controller has 4 x 8 bit I/O ports, 384 bytes of RAM, 8K EPROM, 16 bit internal timer, serial port, Interrupt pin and one Timer Input Capture Pin. Just about every resource of the controller is used in this application.

The OzTrip computer has 81 display functions broken into 3 equal groups of Metric, US & Imperial display format. Every time a new function is selected, a brief message appears on the display indicating the Function Number selected.

For this reasons, the Virtual Dashboard Visual Basic source code is available so that it can be customized for individual applications.

The speed alarm can be set and cleared when the Speed is displayed, Functions 1, 28 or 55. This speed sender connection to the computer had been taken from the vehicles existing speed sensor or a speedo cable sensor or a wheel/tail shaft sensor can be installed to pick up the vehicles speed. Therefore, by pressing the Set/Clear key when the speed is above 40Km/h will set the speed alarm. When this speed is exceeded by 5 Km/hr the speed alarm is sounded and the "SLO" message is displayed on the screen. To disable the speed alarm, it is necessary to press the Set/Clear key when the speed is below 40.

The sprint timer is used to time the acceleration of the vehicle over a set distance, typically 400m (1/4 mile). When this option is selected from the Cal Menu/Option 7 the computer asks for the "Dist", distance to be timed over and then a 9 second count down starts. When the count down reaches 0000 a BEEP is heard and the timer starts. When the vehicle travels the entered distance the timer is frozen displaying the time duration down to 1/10's of a second. By pressing the Mode/Enter Key could return to normal operation.

The OzTrip Computer measures the fuel flow of an EFI engine by measuring the time one injector is open. The 68HC705C8A micro controller has a timer input pin, which is used to measure the pulse width of the injector signal. The main components of the EFI engine fuel delivery systems include the fuel pump, pressure regulator, fuel rail & fuel injector valve. The pressure in the fuel rail, which feeds the injectors, is kept at a constant by the pressure regulator. Because the pressure is kept at a constant the fuel flow through each injector, on average is the same so user only need to measure one injector to determine the total fuel flow. In other words, the fuel flow is directly proportional to the injector open time and by measuring the injector open time we can calculate the fuel consumption. This method of fuel measurement is only suitable for EFI engines with one injector per cylinder and constant fuel rail regulation.

This OzTrip Computer gives the notion to have good action in monitoring the vehicle. In addition, the advantages of using the OzTrip Computer is that the function which can be used as a Car or Rally Computer. Instead, it can also be bring into play as a Boat fuel Computer or many general applications for counting or measuring.

Figure 3 below displays the OzTrip Computer

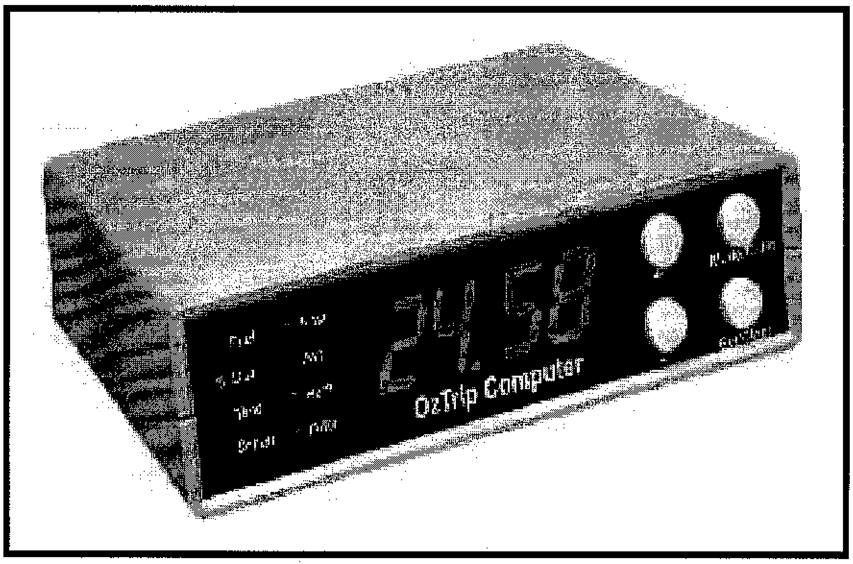

Figure 3: OzTrip Computer

2.1.4 Virtual Dashboard

With the studies on these references of virtual dashboard, this project had come up with a better application. The new user-friendly virtual dashboard is an application that could direct private, secure, fast digital connection from oil tanker to the personal computer as well as monitor and manage key performance of the truck.

A dominant factor in increasing driver performance will be to simulate, as accurately as possible, the feel of "actually being there", in the truck. Using an immersive Virtual Reality display that is integrated with the virtual dashboard will do this. The use of additional environment feedback mechanisms (such as collision and detection) will enhance the driver's ability to perform safely, but will need to be presented in a carefully organized fashion to avoid overwhelming the driver.

For this basis, the virtual dashboard should be capable in making decision instead of controlling the truck. In the truck, the control of information from the host computer must be implemented in the real world in a predictable and reliable manner. The on-board computer must maintain trouble-free and autonomous control of the truck to prevent technical hitches faced by the novice user.

In generating reliability it is important to make center of attention on the network level of the truck due to the integration of speed, fuel, engine parts, fuel tanks, etc. Full reliability can only be achieved with the realization that the network WILL fail. For that rationale, the truck needs to remain safe and under autonomous control until the network connection can be reestablished.

Besides, the virtual dashboard must also be safe from being attacked by those with malicious intent, from denial of mishandling, unauthorized viewing of the truck's sensor input, and unauthorized truck control. These could make the application becomes lousy to sense any real time data-login which is essential for the user when users are onboard.

This virtual dashboard application is a customisable viewer for user's basic Information System needs, which available at their fingertips. It provides built-in views for revolutions per minutes, speed, heat, and fuel's performance instead of producing the alarm with the aim to warn the user if any insecurity happens.

Virtual dashboard can give the user that kind of information:

In real time

The need for all interaction to be performed in real time puts the heaviest demands on the virtual dashboard impose. This is to make sure that the virtual dashboard is really monitoring the truck performance in conjunction with displaying the latest and updated information of the truck condition the user. For instance, as the delay increases, the trucks speed should automatically decrease to compensate for the lower responsiveness of the driver.

At a glance

The virtual dashboard have the self-aware connection where the dashboard connection must make information about the current real time data login available to the client, so that user could have a view of the truck condition on the spot. Here, the user could take a quick look on each condition of the truck together with engine and fuel, from the windows that are available on the screen.

Virtual dashboard that runs on the computer also uses graphs as a primary display device and is connected to databases, which are updated regularly. This is because it link to the indicators – RPM, speedometer, fuel and heat that is sensed by pressing some of the button on the keyboard. In addition, these data are also been captured from the engine and oil tanker, besides collisions and detection. This due to the function of the virtual dashboard is the dedicated institution of data collection for the entire parts of the truck. So users are not looking at previous information.

For that reason, well-designed of the virtual dashboards have the following characteristics:

1. The virtual dashboard is highly graphical in nature. It takes three seconds, not three hours; to understand the key function of the virtual dashboard.
2. The virtual dashboard is customized to the needs of the truck driver who uses them. The truck driver needs to see the entire performance of the truck when they are onboard.
3. The virtual dashboard start with indicators view (rpm, speed, fuel, heat) and, by viewing on the relevant graph, the user can be presented a real time data logging. Navigation is easy and intuitive. One working finger on a mouse can move the user to almost every performance of the truck.
4. User can use the data from multiple databases simultaneously as it provides just the right format to display the data in the best format for user.

There are many implications in using a virtual dashboard model as a truck for exploring a space since the virtual dashboard-style graphic implies usefulness, information, status, and point-to-point interaction; an end and a goal are instantly implied. In other words, linear interaction with a reward is cultivated, rather than or interrupted interaction.

Good thing, by communicating via the interface that presents a storyworld from the truck, users can believe they have a superior relationship to the game world, when in reality this is not true.

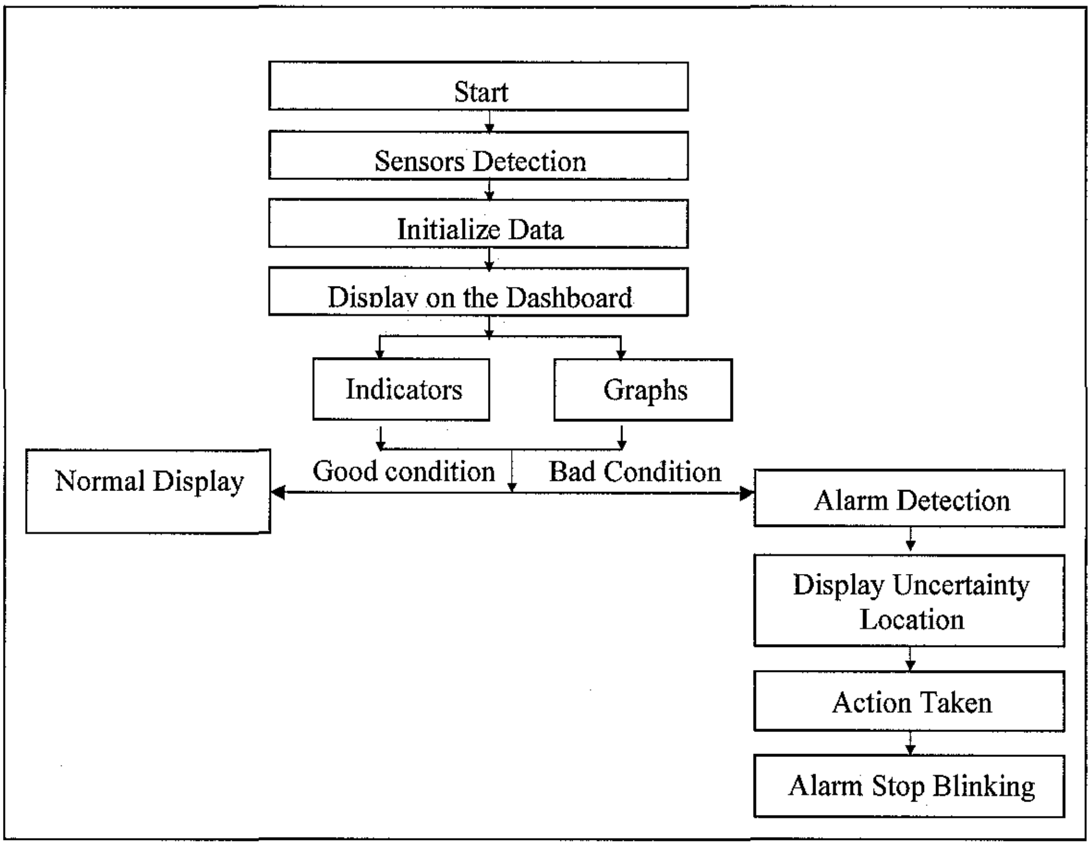

Figure 4:Procedure in Virtual Dashboard

The previous graph shows the process of how dashboard will execute. Firstly, when the user starts the virtual truck, four sensors will sense speed, revolution per minutes, fuel and heat. The sensors were sensed when the user starts pressing the button on the keyboard. When user click on the W button, the truck will move forward. Speed will be increased. Whereas, if the user click the press S button, the truck will decreased the speed slowly since the truck will slowly stop from the forward movement in order to move backward. Instead, user could turn left and right by pressing the button A and D button on the keyboard. When these sensors received the data of speed, the computer will initialize the data.

These data will then been display on the dashboard. Two ways of presenting the data are by using the indicator as well as graphs.

From the indicators provided, user could observe the speed of the truck as well as the RPM. The increasing and decreasing level of truck's fuel will also be displayed parallel with the moving truck. This goes the same to the temperature indicator.

In contrast, graph will presents the data of the temperature along with the amount of fuel. Based on the graph, user could recognize the state of the records towards the time. The reading of the temperature will be recorded for every 20 seconds that same goes to the reading of the fuel which also will be recorded for every 20 seconds. From here, user could easily get to know the performance of the truck whether the truck is in normal condition or having troubles. The display will present normal reading if the truck is in good condition.

On the other hand, if the truck is not in a good performance, alarm detection will be detected by producing pop up message to warn the user. For instance, the truck might have a collision; the engine is malfunctioning, or etc. Thus, user could view the location that is having unsteadiness from the engine view or fuel view that is provided in the truck. The graph will also plot bizarrely.

With this, user could easily detect any uncertainty as well as take some action to overcome the problem. Lastly, the user could close the pop up message and the dashboard will start displaying the normal presentation.

CHAPTER 3

METHODOLOGY/PROJECT WORK

3.1 PROCEDURE IDENTIFICATION

This section discussed the methodologies for developing the application. The methods chose should be understandable and considered the strength and weakness.

Structured analysis is a traditional systems development technique that is time-tested and easy to understand. Structures analysis includes data organization and structure, and user interface issues. Structured analysis relies on a set of process model that graphically described the application. Structured analysis uses a series of phases, called the system development life cycle (SDLC) with the intention of describing activities and functions that the Virtual Dashboard perform. The SDLC is to plan, analyze, design, implement, and support an information system. The methodology depicts real-world practice and constant dialog among users, and developer.

In general, there are three basic phases involved.

Phase 1

To carrying out the project, the first process is to plan the requirements analysis and definition of the project wisely. The task is done derived from goals, which is established by the user.

During this planning phase, it is also fundamental to recognize some tools and architecture that will be used to provide the required common details set. For this reason, the activities include defining system-level infrastructure requirements for input and output, identify any available in-use hardware and the best software that may be used in the virtual dashboard implementation (tools) plus concerning process and techniques. It is involved identifying and describing the fundamental software system and abstraction along with the relationship.

All the priorities and specifications as well as forecast and the opportunities, need to be considered and analyzed for future development. This will involves putting the results of the other planning process into a consistent, coherent document.

The development process continues with the system analysis. These studies are crucial in order to assess the impacts of a planned application. Besides, the benefit-cost analysis and time schedule could also be identified as it gives the biggest influence of the project. Hence, logical models are built to defined and described the processes that application must support. The diagrams include data modelling, process modelling, and object modelling.

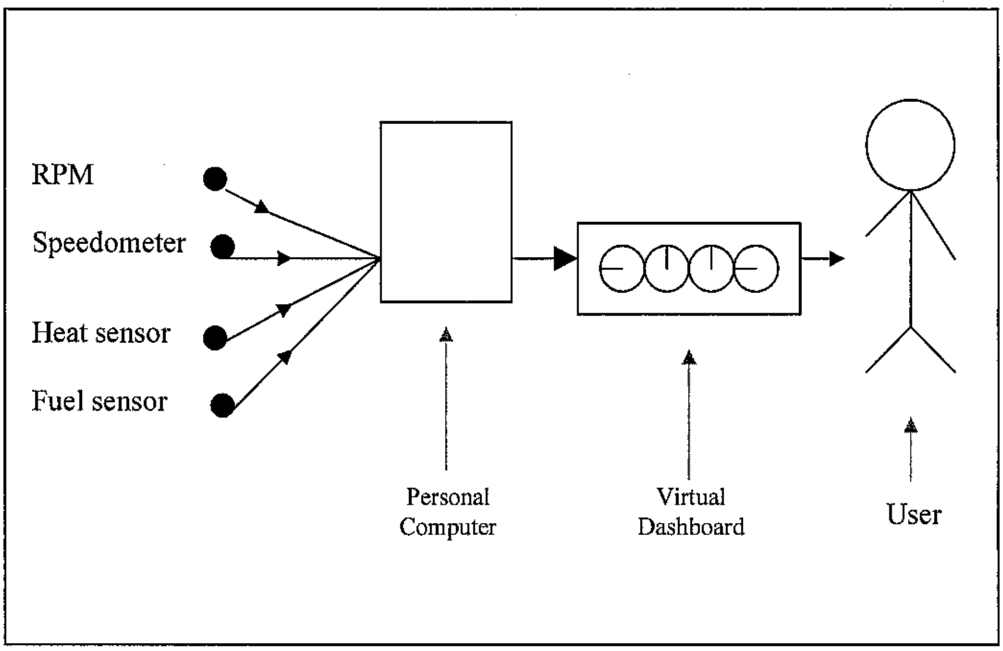

Figure 5: Diagram On How The Virtual Dashboard Works.

The flow diagram illustrate on how the Virtual Dashboard's working. The diagram shows the real-time application of the Virtual Dashboard. This real-time application is designed as a set of concurrent, cooperating processed. The architecture must be organised so that control is transferred to the appropriate handler for the stimuli as soon as it is received. Besides, this diagram allows data to be collected quickly from the sensor (before the next input become available) in addition to allow processing and associated actuator response to be carried out later.

Virtual Dashboard is a periodic stimulus as it occurs at periodic time interval and generated by sensors associated with the application. These provide information about the state of the application's environment. There are three types of process for this generic architectural model. For each type of sensors, there is a sensor management process which examine every 20 seconds; computational process to compute the required response for the stimuli received by the system that take action (respond) depending on that sensor value (the stimulus); actuator control processed manage actuator control processes manage actuator operation as the responses are directed to the sensor data buffer that control the sensors unit so as then influence the application's environment.

There are four sensors that will be used to collect data from the virtual truck. These sensors will sense only when the user start pressing the specific button on the keyboard. Button W is to move the truck forward whereas S button will move the truck backward. A button will turn the truck to the left and D button will turn the truck to the right. With this movement, the dashboard could sense the speed and the RPM. The temperature along with the fuel indicator would sense based on to the time of the truck moves.

All the data will be transmitted to the computer. Computer is used to control a wide range of real-time data logging. The computer will interact directly with the sensors. Hence, Virtual Dashboard is an embedded real-time application that must react to events generated by the sensors and issues control signals in response to these events. From here, user could observe all the performance of the truck that displayed by the indicators on the dashboard.

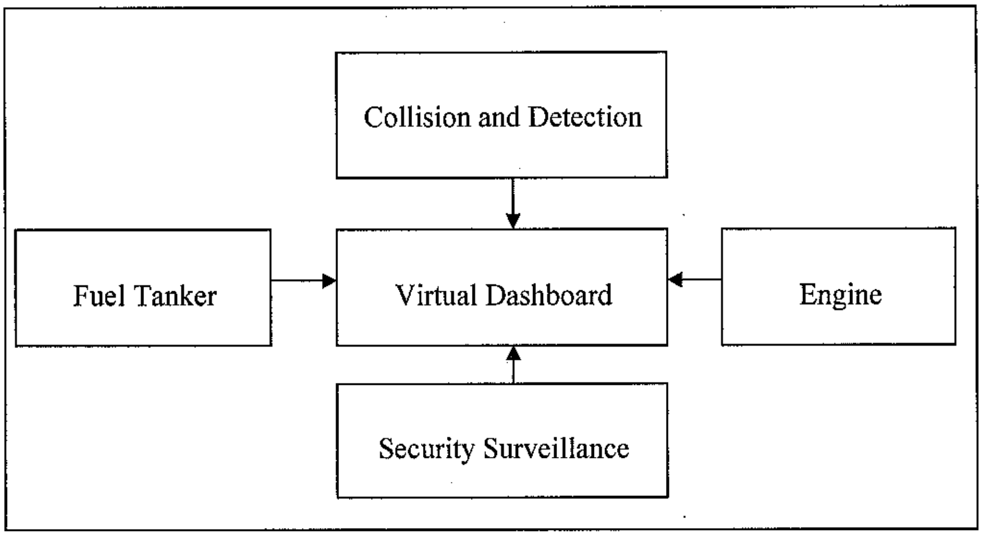

Figure 6 : Diagram of Real-Time Data Logging for Virtual Truck

Figure 6 shows the diagram that illustrates the flow diagram of the real-time data logging. The Virtual Dashboard is integrated with other four part of the truck, which are security surveillance, engine, fuel tanker, as well as the collision and detection.

By integrating with the effective and usability of vehicle alarm system's GUI, user can be informed and alerted of any uncommon behaviors happen at the parts of vehicle. This part will also help in publishing indicators and warnings of any parts error or failure component on the vehicle.

The Virtual Dashboard also is connected to the mirror of the truck that will detect the collision and detection. This application suits with the user as the virtual dashboard integrates with a scalable, real time and flexible 3d animation with good graphic quality of view. From the view, user possibly knows the effects of virtual truck collision along with the momentum and degree of angles when collision happens. This will ensure that the product looks realistic.

Besides, the data of the virtual dashboard are also been captured from the engine and oil tanker simultaneously, seeing as the virtual dashboard is the dedicated institution of data collection for the entire parts of the truck. The 3 dimensions virtual fuel tanker and engine view could aid user to view the condition directly from driver seat. These include the display of how the movement of truck influences the movement of fuel in tank behind as well as the simulation of the condition inside the engine parts. If any engine problems and breakdown user will find difficulties to move the truck. With the indicator provided the user could knows the part of the engine that is breakdown.

Therefore, the condition of the truck could be notice straightforwardly. With these connections, user could efficiently discover the performance from all particulars with a glance.

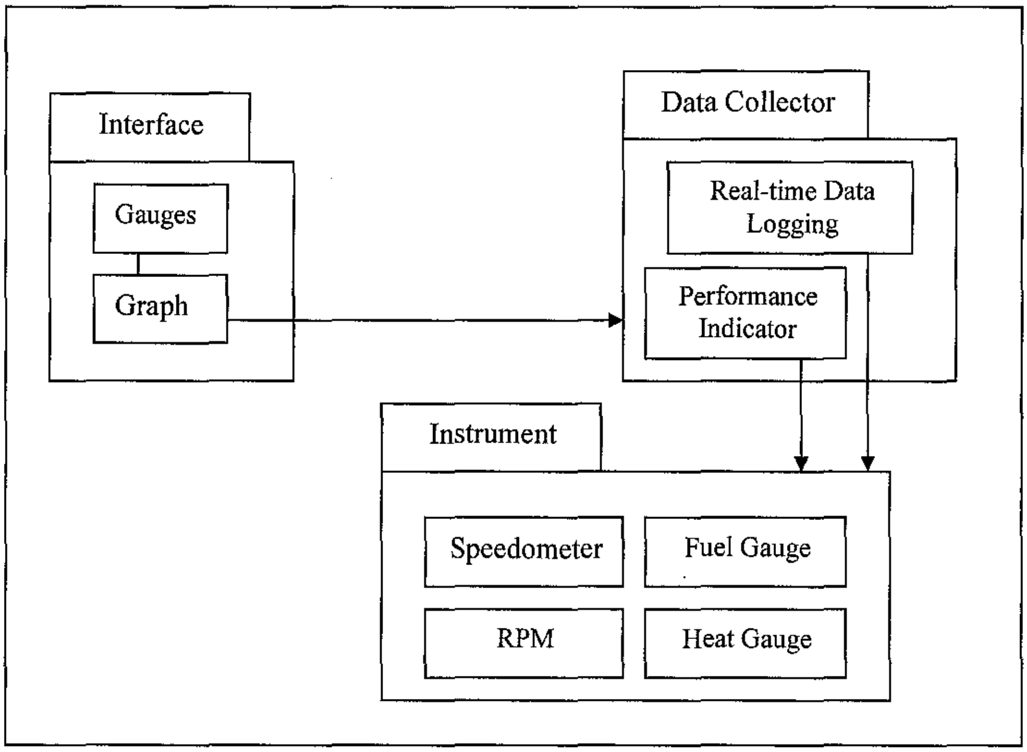

Figure 7: Object Class Model

The diagram illustrate the object in the application and where appropriate, different kind of relationships between the requirements these entities. This diagram is the bridge between the requirements for the Virtual Dashboard and its implementation.

This sub-system model shows logical groupings of objects into coherent sub-system. They are represented using form of class diagram where each sub-system is shown as a package. Sub-system is a static model that describes the static structure of the system in terms of the system object classes and their relationship. Important relationships in this diagram are generalisation relationship, used/used-by relationship and composition relationship. For instance, the Gauges object is associated with the Performance Indicator object and Performance Indicator object is associated with the Instrument package. This means that this object is associated with one another or more objects in the package.

Phase 2

This phase will consist of transferring the Phase 1 functionality into a new dashboard infrastructure (hardware, software, network, etc.) plus adding additional functionality and/or upgrading Phase 1 functionality. It is to ensure that the design will succeed in meeting goals and determine where gaps exist between goals and actual implementation. The functionality of virtual dashboard infrastructure will be set up. Data are used to evaluate deployment in relations to the initial objectives. This will help identify, at the current progress rate, what level of future deployment to be taken within the target frame.

Progress communications between the other team members of the project is required so as to sustain each task in developing the virtual truck. The information such as the software, tools and designs to be used are foremost to be revised as it relates to the project at the point of time. This could measure the progress against plans and take corrective action when necessary without any problems.

Definition and development of processes are studied through the review, detailed design, implementation, deployment process development, and sustaining support processes development. This due to the decision and action taken in one knowledge area could affect the other knowledge area. Managing these interactions requires making trade off among the project objective of scope, time and cost as well as risk.

From the research among the members, a storyboard that displayed all the integration had been set up. The aim for creation the storyboard is that it can help to establish the suitability of the interface later.

Storyboarding is a good ways for determining how a user will interact with and navigate through the content of a project. Storyboarding is good for designing and conceptualizing the Virtual Dashboard project. It is easier and quicker to complete a project when developer has the clear picture of the extent and requirements of the work. Setting up the storyboard could avoid the problem of stuck and cannot find an elegant way to end it. A storyboard maps out each section to smoothly transaction into the next.

Even though, it is time and frustration after all, but a little (enjoyable) time spent conceptualization and brainstorming at the beginning can often make the difference between smooth or frustrating project. On the other hand, this step in development process becomes a critical communication tools to ensure that everyone is "on the same page" and working toward a common finale.

From the storyboard, the designation could be more easily to plan. This could ensure that a task sequence can be completed efficiently. The storyboard design concentrates on the view and layout involved. Issues to be resolved at this level include the suitability of the integration, colours and the grouping of objects in the interface. This suitability depends heavily on the context in which the application will be used. For instance, the meaningfulness of view deal with the categorization for menus dialogues, that suits with the task, user, environment, and knowledge of technology and etc.

Figure below shows the storyboard of the Virtual Dashboard that need to be integrated with the other part in the truck.

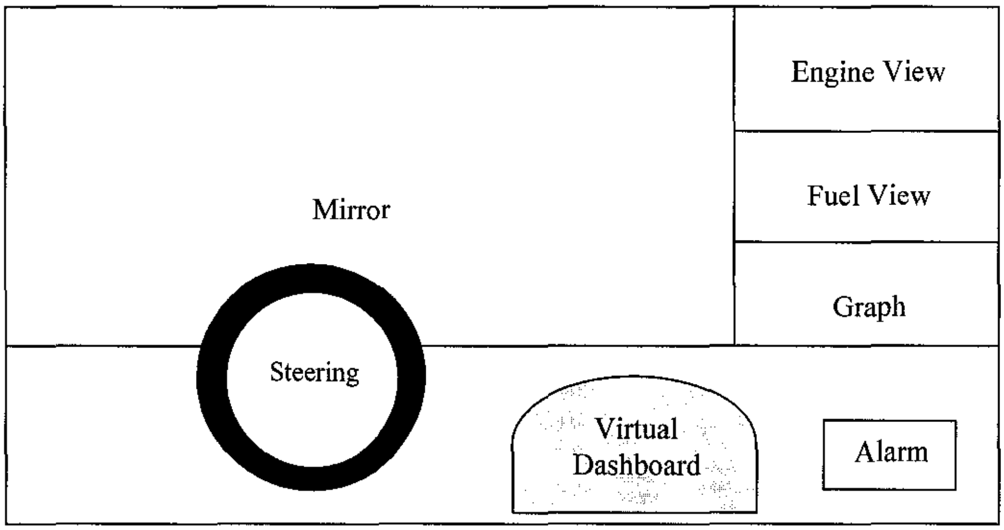

Figure 8: Storyboard of the Virtual Truck

The storyboard gives an idea about how the virtual truck will look from the user view. The dashboard will have to perform as the central for basic Information System needs, when obtainable at their fingertips. Instead of it is designed to recognized, detect and display the input from the five sensors attached –RPM, speedometer, heat sensor, and fuel sensor – the function of the Virtual Dashboard is also to control the view of the engine and fuel.

There are as well some buttons provided to popup the view of the engine, fuel and graphs. This is to give the user choices for maximizing/minimizing the view of the mirror with/without the popup view of the engine, fuel and graphs. From this storyboard, Virtual Dashboard is integrated with the steering. Once the user makes a move to the right or left, the steering would also steer accordingly.

The engine view is to show the simulation of the engine part of the vehicle. It shows and indicates the current status of the engine part. If any engine problems and breakdown will be indicating in the simulation, so that he driver knows which part of the engine that is breakdown.

The fuel view will show the simulation of the fuel tank. It will simulate the fuel tank level, so that the driver will know how much fuel the vehicle has. This is to help the driver to budget the fuel level for a long journey without having to stop frequently.

The mirror that is attached to this Virtual Dashboard is functioning as a virtual view of the vehicle driver. The view can only portray the front image or view of the driver. The mirror could detect collision and detection; the mirror will shows crashes once the truck collides with any object. The alarm that attached to the truck will also alert the user about the condition of the truck. The virtual vehicle mirror if there is any accident occur and crash the vehicle screen will be showed on the virtual screen.

Alarm indicator will be place on the GUI to point out and acknowledge the user of any unusual behavior from the overall body and parts on the vehicle.

<u>Phase 3</u>

Designing, implementing, and deploying the final set of dashboard functionality are progressed in this phase.

Designing is to create a blueprint for the application that will satisfy all document requirement. This means, the design should present information on the screen that has characteristic similar to the objects perceived in the environment as if the user were in the truck. This takes account of internal and external control to guarantee that the application will be reliable, accurate maintainable and secure. Representations of the data requirements are defined while the interface design will be based on the detail specification of all elements. This is to make sure that the design is really workings instead of userfriendly when implementing the virtual dashboard later. Therefore, code and/or script will be built too as required to implement the extraction system and related interfaces. Some formulations are jointly as the back-end of the interface, with the aim of running the application smoothly.

Lastly, the activities such as operations, maintenance, installation as well as test will be carried on. This is to ensure that the application requirements have been met. Operations, maintenance, and sustaining engineering activities transfer to the virtual dashboard system upon completion of Phase 3 operation.

Generally, this is the longest phase. The Virtual Dashboard will be installed and put into practical use. Maintenance involves correcting errors, which were not discovering in earlier phases, improving the implementation of the application, and enhancing the service as new requirements are discovered.

3.2 TOOL

To develop this project, some tools are required including the usage of software and hardware. The key for using the tools and software is that it must be relevant and it must keep the developer engaged. Tools is the first thing that should have to quest before starting building the project. Hardware is necessary to interpret the commands, queries and responses into computer activity. It is therefore essential to choose the software, which enables to execute the project with the minimum possible effort and maximum possible productivity. Before starting to select software, developer should start with an outline of the project and decide what is expected from the project. This due to the powerful features, which is continuously being added to the software that allows developers to work more smoothly and conveniently between applications. The integration will enable to use the graphics from a previous work and save time on rebuilding it.

From the studies on hardware that will be required for developing Virtual Dashboard, 4 sensors will be used which are the RPM, speedometer, fuel sensor and heat sensor. These sensors will be detected by pressing some of the button on the keyboard that has specific function for each sensor. RPM is used for calculating the revolutions per minute. A speedometer that is capable for indicating distance traveled as well as rate of speed is required. Besides, fuel sensor is used to detect the quantity of the fuel in the tank of the truck, whereas the heat sensor will determine the temperature of the truck. All these sensors will be sensed automatically once the user had pressed the button and the truck starts operating.

For the software, Adobe Photoshop a cutting-edge image processing software package that enables to create and edit images on computers in almost any desirable way. It is also an exceptional drawing and painting utility that yields professional-quality effects. Adobe Photoshop hands down, the most popular program for creating and modifying images to create Virtual Dashboard along with correct colour, retouch and composite scanned images, and prepare professional-quality separations and output with more flexibility than ever before. With a wealth of powerful painting and selection tools, plus multiple layers, special effects filters, and lighting effects, Adobe Photoshop is a camera for designing Virtual Dashboard. In practice, Photoshop *is* the single most powerful tool for the creation and editing of Virtual Dashboard images.

Besides, Blender is also suits for developing the Virtual Dashboard as it is one of the suitable software that could design the fully integrated 3D graphics creation suite which allows modeling, animation, rendering, post-production, realtime interactive 3D and game creation and playback with cross-platform compatibility. It lets users create and replay real-time, interactive 3D content. Blender suits as it is a general purpose programming language that can integrates visualisation, programming and computation in one environment. Moreover, it is more suitable for this project as

Virtual Dashboard could be easily integrated with the other parts of the truck that use the same software.

Other than Blender, WorldUp is an interactive, real time and object-oriented development that enables to quickly develop sophisticated 3D simulation and application. WorlUp will provide with rich browser with the purpose of giving specific view on simulation, simultaneously allow modifying the design. This gives the freedom to experiment the simulation parameters, when modifying scripts without interrupting the execution of simulation. For that reason, WorlUp renders the simulation in real time that give immediately see the effect. Furthermore, WorlUp is structured upon the object oriented design paradigm so as to allow creating simulation for clarity of creation and ease of mapping real world objects into data structure. The interface of the WorlUp is an integrated development environment (IDE) with the purpose of bringing together the various tools and interface needed to create the simulations. It comprises of various component that specialize in a particular function.

Visual Basic is also a software that provides visual object that can be drawn easily onto a window together with programming language that is used to write programs to make the computer perform desired task. This eliminates the need to develop the code to construct the visual interface. The layout of the windows can be changed easily by dragging and dropping the object to the new location without necessitating a change in the code. Thus, the process for program development and revision becomes much easier and requires much less time and effort.

In short, the options available are enormous. All that need to do is to choose the right hardware and software to complete Virtual Dashboard projects.

CHAPTER 4

RESULTS AND FINDINGS

Interaction among the sensors has a major impact on the design process. Due to the sensors that are independent, the design phase is not a series of clearly defined steps. In the system design, the goal that must be achieved is to make sure that the dashboard is really effective, reliable, and maintainable. It is also a must in making sure that the Virtual Dashboard could support and accepted by the user who uses it in their working everyday.

In making sure that the Virtual Dashboard is really reliable, the errors should be handled adequately, for instance the input errors, processing errors, or human mistakes. Ideally, all error can be prevented. A more realistic approach to overcome this problem is by planning the errors, detect them as early as possible, allow for their correction, and prevent from damaging the application itself.

In making sure that the application is maintainable, the design should be well, flexible and develop with future modification in mind. Modification will be necessary to correct problems, to adapt to changing user requirements, to enhance the application, or to take advantage of changing tools. The Virtual Dashboard must be capable of handling future modification or the dashboard soon will be outdated and fail to meet requirement.

Therefore, the best place to begin the development of Virtual Dashboard is with the user interface, which will affect the overall interaction between the user and the Virtual Dashboard. When designing the interface, screens, commands, controls, and features that enable users to interact with the Virtual Dashboard necessitate being located. At the same time as developing the interface, it is crucial to put account on the input and the output design tasks.

For the input process, it is essential to determine on how the input of the system and design necessary source documents. The input process includes all four sensors (speedometer, RPM, heat sensors and fuel sensors) that will be detected by pressing the specific buttons on the keyboard.

Developer found that by using the keyboard is essential for user to understand the functions. This is because, using the real sensors seems not suitable for user due to the complication when using it together with the hard to understand on how the sensor's functioning. Besides, price could go higher for user if the real sensors are used. Within the time constraint, developer also could not have enough time programmed the sensor into RS232 and integrated with the hyper terminal from the personal computer. Hence, keyboard is the replacement for these sensors as keyboard could also perform the same function as the real sensors. Instead, the keyboard is the primary input device for your computer. Keyboard contains certain standard function keys to give command on the Virtual Dashboard application. The function of the sensors are described as below :

a) Speed - Speedometer and RPM

The speedometer is a vital and integral part of Virtual Dashboard. This application provides the necessary information needed in order to determine what transmission speedometer gear is needed in order to properly standardize a speedometer. This method is purely calculations-based, and will yield very accurate results.

One important piece of information which is required is the number of revolutions it takes the speedometer to register one mile. This may be found on the left of the speedometer face, in very small numbers.

Look for something like 60, 70, 80, or 90, or something close. This number is the number of speedometer cable revolutions to increment the speedometer one mile. Speedometers are 10 revs/mile is a good starting number to use.

Another vital piece of information is the speedometer drive/driven gear ratios, the gears inside of the transmission or transaxle. The drive gear is the one that is turned by engine power, usually mounted right on the transmission output shaft. The driven gear is the one that is "driven" by the "drive" gear, and is connected to the speedometer. The gear is reckoning by the integer number of teeth it has.

By manually calculating the speed for how many miles, this number can be calculated by determining the diameter of the tyre and dividing it by the number of digit pulses per wheel revolution.

b) Temperature - Heat indicator

This Indicator uses a sensor mounted inside the truck's engine to monitor the internal temperature. The temperature is displayed for the user to verify the engine's operating temperature does not exceed bars. This prevents thermal runaway and damage to the engine and truck. If the is increasing until full, this means that the truck is on hot condition. User needs to stop from using the truck in order to coolant it. Pop up message will alert the user once the temperature is hot.

c) Fuel Indicator

The fuel indicator used on the dashboard produces pulses for every 1bar of fuel, which flows through it. The calibration amount entered into bar can calculate the fuel flow. The flow sensor should be mounted in a vertical position for optimum operation. It will reproduce the fuel tank level, so that the driver will identify how much fuel the truck has. This is to facilitate the driver to budget the fuel level for a long expedition with not having to discontinue regularly. Therefore, it is advised to fill the fuel tank to full. The "bar" represents the total pulse width time. This value must not go beyond empty. Otherwise, an error message will be displayed to show that the fuel is empty and truck will have to stop.

4.1 SOFTWARE USED

In order to develop a good application, it is ought to decide the best software that could represent the best display. From the studies on software, Visual Basic is suitable for providing visual object. The object that can be drawn easily onto a window together with programming language that is used to write programs to make the computer perform desired task. Visual Basic provides the structure for organizing and editing the elements of a project. This software also provides an integrated environment for combining the content and functions of a project that enables interactive performance for user to control over the content and flow of information in a project. Besides, Visual Basic also enables building a part of a project and then test it immediately. This means it is easy to use with (often) template provided that shorten development time.

4.2 TOOLS USED

To begin the quest with a Virtual Dashboard project, it is a must have to a decent computer. A decent computer means a set of computer that has adequate hardware. Hardware interprets the commands into computer activity. As of now, it is preferable to have a fast computer with lot of speed and storage.

There are many things that need to be familiar with like which component makes a computer fast, what is the device for storage, etc. The components are thus divided into five categories. These are the devices that are the essential components for a computer. These include microprocessor, motherboard and memory.

4.2.1 SYSTEM DEVICE

Microprocessor is basically the heart of the computer. A microprocessor is a computer processor on a small microchip. When user turn the computer on, it is the microprocessor, which performs some operations. The microprocessor gets the first instruction from the (BIOS), which is a part of its memory. BIOS actually loads the operating system into random access memory (RAM).

A motherboard is a device in the computer that contains the computer's basic circuitry and other components. Motherboard contains computer components like microprocessor, memory, basic input/output system (BIOS), expansion slots and interconnecting circuitry. Additional components can be added to a motherboard through its expansion slot.

4.2.2 MEMORY AND STORAGE DEVICE

RAM (random access memory), also called primary memory, locates the operating system, application programs, and data in current use so that the computer's processor reaches them quickly. RAM is called "random access" because any storage location can be accessed randomly or directly. RAM is much faster than the hard disk; the floppy disk and the CD-ROM. However, RAM might get slow when used to its limit. That is why, user need more memory to work on the application. It is preferable for user to have a personal computers come with 128 or more of RAM for running the Virtual Dashboard.

Users for this graphic Virtual Dashboard application usually need 128 plus megabytes of memory. A hard disk stores and provides access to large amounts of data on an electro magnetically charged surface. Currently, the popular ones are 40 GB and above. Hard disk contains a part called which is responsible for improving the time it takes to read from or write to a hard disk. The disk cache holds data that has recently been read.

4.2.3 INPUT DEVICE

The keyboard is the primary input device for your computer. Keyboard contains certain standard function keys to give command on the Virtual Dashboard application. Button W is used for moving the truck forward, whereas the button S is to move the truck backward. For button A, it is used to turn the truck on the left while button D is used for turning the truck on the right.

A mouse is also a primary input device. A mouse is a small device that user move across a pad in order to point to a place on a display screen and thus execute a command by clicking it. The mouse is an integral part of any personal computer.

Instead, the user also could use a joy pad in order to move the truck smoothly. This is because by pressing the button on the keyboard, user could not move the truck faster or turn the truck like what the user prefer. In addition, there are also button on the joy pad that could speed up the movement of the truck as if user had user the gear to speed up the truck in reality.

4.2.4 CONFIGURATION OF A COMPUTER

For a good application system, user should have a Pentium 1.6 Ghz (or the one with similar capabilities) onwards processor, at least 256 MB of RAM, 40 GB onwards hard disk drive, 17 inch onwards SVGA monitor, 32MB AGP card, 52 XCD-ROM drive, 104 PS/2 keyboard, and PS/2 mouse. Despite, there is no set rule to define the exact hardware combination of a good multimedia computer. The combination is dependent on the nature and contents of the application project.

4.2.5 PAINTING AND DRAWING TOOLS

Graphic impact of the Virtual Dashboard presentation is very important in influencing the users. It is the graphics that would create the first impression of Virtual Dashboard project. These tools are, therefore, very useful in designing the desired capability in terms of drawing and colouring.

Painting and drawing tools generally come with a graphical user interface with pull down menus for quick selection. Virtual Dashboard can be created almost all kinds of possible shapes and resize them. Brushes of different sizes and shapes can be use according to the need. One can use layers to give different treatment to each element. Once Virtual Dashboard is done with the drawing it is imported or exported in formats like .gif, .jpg, and .bmp.

With this, Adobe Photoshop is chose seeing as it is superior in designing the pictures. With Adobe Photoshop, creating and modifying images with proper colour, can make the design become more realistic in 2D object. Photoshop is the single most powerful tool for the creation and editing of Virtual Dashboard images, which does not, takes too much time. Virtual Dashboard can be illustrated from scratch. It has wide-ranging features to handle drawing with precision. It has lot of clip arts and high-quality drawings, which can be inserted into Virtual Dashboard project.

4.2.6 DESIGN

When developing the Virtual Dashboard, Visual Basic is chose. This is because of the easiness to use itself of the software. Compared to Blender, Blender seems not so userfriendly since the object could not be create easily. Instead, the image of Visual Basic is quite great too with the interaction that uses the scripting to control the objects. When comparing with the software of WorldUp, developer found that the software does not support the designation. This due to the slow movement of the image that would be move if the project uses too many imported image. Therefore, Visual Basic would be the best software to use in the project.

In order to design a good Virtual Dashboard, it is a must to consider the interactivity of the objects. Interactivity is the key component to deliver an interactive the application. This means, Virtual Dashboard should have the ability of user to interact with the program and allow the user to control what & when the elements are delivered.

Besides, a realistic simulation will also need to be created since this is important to user's learning. A realistic simulation could enhance one-to-one experience. Therefore, a Virtual Dashboard simulation program need to provide the user of an easy, clear, as well as intuitive application.

Thus, a simple, clear, userfriendly & elegant interface should be designed to achieve the design goal. Creating the appropriate image for the Virtual Dashboard involves the ability to design suit a purpose and common sense. Therefore, when planning the interface, suitable and representative of background graphics should be considered. The numbers of working buttons and controls will have to be fit within the control areas due to the space of the button will affect the possible size of the button. The consistence size, arrangements and the location of the objects are necessary too in order to making sure that the interface does not look messy.

When designing the application, developer should avoid poor screen design that forced user to guess what to do next. User will be frustrated if they find that the Virtual Dashboard waste their time try to figure out where to point. For that reason, the interface should be designed as simple as enough to avoid confusion. That is why, documentation help, as guidance for users should be provided.

From the researches that had been made, develpor had come out with the design that had been shown in the Figure 9 below.

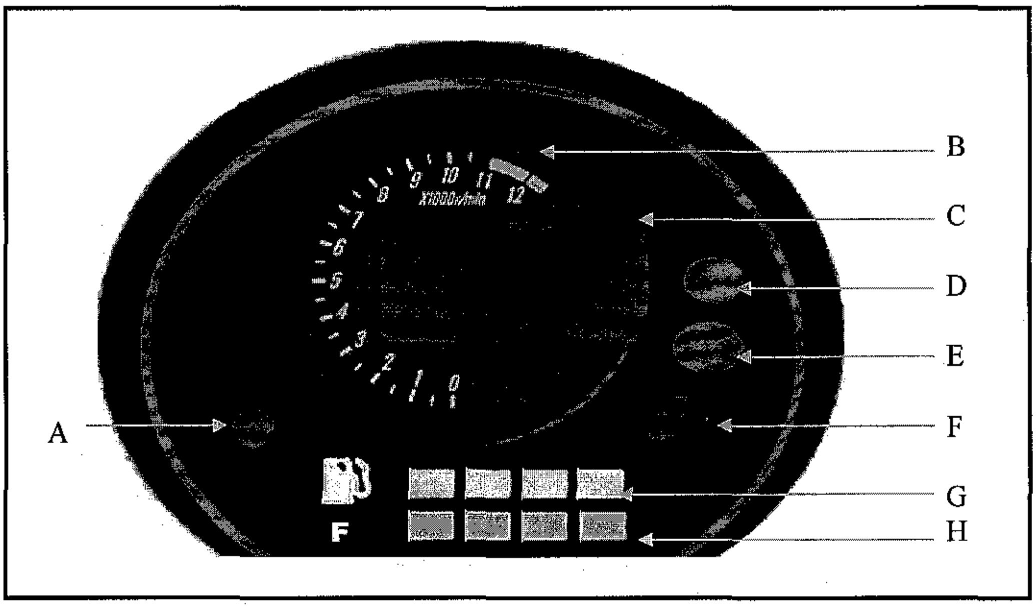

Figure 9: Design of Virtual Dashboard

From the figure 9 user could switch of the application by pressing the red button (A). Label B is the RPM, which display the increasing or decreasing the speedometer of one mile. Label C is the speedometer that detects the speed of the truck once the user move the truck. The display will be in the digital number so that user could easily determine the speed of the truck. There are also three buttons, which have different functionality. The button with the label D is for viewing graph window. This view will illustrate the performance of the temperature as well as the fuel graphs. The function of the button with the label E is to view condition of the engine, whereas the button for label F is for viewing the condition of the fuel inside the tanker at the back of the truck. There are also two bar indicator of fuel and heat. These bars will decrease slowly according to the movement of the truck. This G indicator is displaying the amount of fuel and the temperature's bar will be display at indicator H.

4.9 CALCULATION

This calculation for truck is almost as the same as simulating cars in games, in other words vehicle physics. One of the key points in simplifying vehicle physics is to handle the longtitudinal and lateral forces separately. Longtitudinal forces operate in the direction of the car body (or in the exact opposite direction). These are wheel force, braking force, rolling resistance and drag (= airresistance). Together these forces control the acceleration or deceleration of the car and therefore the speed of the car. Lateral forces allow the car to turn. These forces are caused by sideways friction on the wheels. There are also the angular moment of the car and the torque caused by lateral forces.

4.9.1 High Speed Turning

Of course, there are not many application involving trucks that drive around sedately. Users are an impatient lot and usually want to get somewhere in a hurry, preferably involving some squealing of tires, grinding of gearboxes and collateral damage to the surrounding environment. The goal is to find a physics model that will allow understeer, oversteer, skidding, turns, etc.

At high speeds, it can no longer assume that wheels are moving in the direction that user are pointing. Wheels are attached to the car body which is set as a constant number, has a certain mass and takes time to react to steering forces. The car body can also have an angular velocity. Just like linear velocity, this takes time to build up or slow down. This is determined by angular acceleration that is also set as a constant number, which is in turn dependent on torque and inertia (which are the rotational equivalents of force and mass). Also, the car itself will not always be moving in the direction it's heading. The car may be pointing one way but moving another way. The angle between the car's orientation and the car's velocity vector is known as the sideslip angle (*beta*).

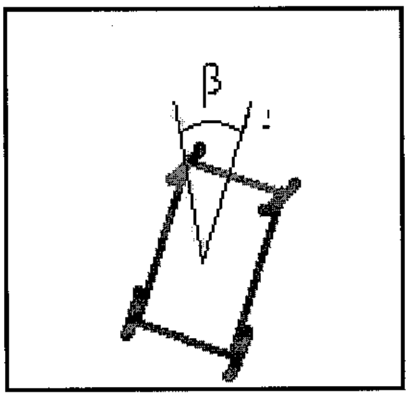

Figure 10

Here, is also discussed the theory of high speed cornering from the wheel's point of view. In this situation developer need to calculate the sideways speed of the tires. Because wheels roll, they have relatively low resistance to motion in forward or rearward direction. In the perpendicular direction, however, wheels have great resistance to motion. Try pushing a car tire sideways. This is very hard because developer need to overcome the maximum static friction force to get the wheel to slip.

In high speed cornering, the tires develop lateral forces also known as the cornering force. This force depends on the slip angle (alpha), which is the angle between the tire's heading and its direction of travel. As the slip angle grows, so does the cornering force. The cornering force per tire also depends on the weight on that tire. At low slip angles, the relationship between slip angle and cornering force is linear. Movement in this direction corresponds to the rolling motion of the wheel. The lateral vector has magnitude and causes a resistance force in the opposite direction: the cornering force.

There are three contributors to the slip angle of the wheels: the sideslip angle of the car, the angular rotation of the car around the up axis (yaw rate) and, for the front wheels, the steering angle.

The sideslip angle b (bèta) is the difference between the car orientation and the direction of movement. In other words, it's the angle between the longtitudinal axis and the actual direction of travel. So it's similar in concept to what the slip angle is for the tyres. Because the car may be moving in a different direction than where it's pointing at, it experiences a sideways motion. This is equivalent to the perpendicular component of the velocity vector.

The steering angle (delta) is the angle that the front wheels make relative to the orientation of the car. There is no steering angle for the rear wheels; these are always in line with the car body orientation. If the car is reversing, the effect of the steering is also reversed.

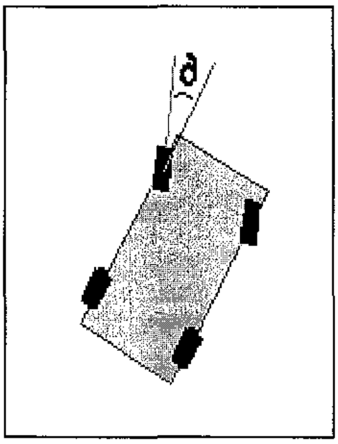

Figure 11

4.9.2 How to get the RPM?

The rpm is to calculate the engine and from there the engine's actual applied torque. In other words, a need to know the fast of the engine's crankshaft is turning.

From the research done, rpm is used to calculate this back from the drive wheel rotation speed. For this simulation, wheel is set with a constant number as the dashboard is virtual. After all, if the engine's not declutched, the engine and the drive wheels are physically connected through a set of gears. If the rpm is known, the rotation speed of the drive wheels can calculated, and vice versa.

rpm = wheel rotation rate * gear ratio * differential ratio * 60 / 2 pi

The 60 / 2 pi is a conversion factor to get from rad/s to revolutions per minute. There are 60 seconds in a minute and 2 pi radians per revolution. According to this equation, the cranckshaft rotates faster than the drive wheels.

For example, the wheel is rotating at 17 rad/s. Wheel rotates at 17 rad/s. First gear ratio is 2.66, differential ratio is 3.42 so crankshaft is rotating at 153 rad/s. That's 153*60 = 9170 rad/minute = 9170/2 pi = 1460 rpm at the engine.

This is needed to get the car into motion from a standstill. The wheels are not turning so the rpm calculation would provide zero. At zero rpm, the engine is undefined or zero, depending how torque curve lookup is implemented. That would mean user had never been able to get the car moving. In real life, user had been using the clutch in this case, gently declutching while the car starts moving. So wheel rotation and engine rpm are more or less decoupled in this situation.

There is one way to get the wheel rotation rate. It is quite easy but a bit of a quick hack. This is done by assuming that the wheel is rolling and derive the rotation rate from the car speed and the wheel radius.

For example, the truck is moving at 20 km/h = 20,000 m / 3600 s = 5.6 m/s. wheel radius is 0.33 m, so wheel angular velocity is 5.6/0.33 = 17 rad/s

4.9.3 Measuring the Fuel - Fuel Indicators

Truck is equipped with fuel indicators, which are operated along with the vehicle's electrical system. There are two types: the thermostatic type and the balancing coil type. The thermostatic type is made of a standing unit, located in the fuel tank, and the indicator itself (registering unit), which is located on the instrument panel. The fuel indicator used in some truck and trucks is of the electrically operated balanced coil type. The height of the fuel (called variations in resistance) changes the value of the bar unit coil so that the bar indicates the amount of fuel available. Basically, the real fuel sensors operated by a calibrated friction brake which is included in the tank unit to prevent the wave motions of the fuel from fluctuating the pointer on the dash unit. Current from the battery passes through the limiting coil to the common connection between the two coils, which is the lower terminal on the dash unit. The current is then offered two paths, one through the operating coil of the dash unit and the other over the wire to the tank unit. When the tank is low or empty, the sliding brush cuts out all resistance in the tank unit. Most of the current will pass through the tank unit circuit because of the low resistance and only a small portion through the operating coil to the dash unit. As a result, this coil is not magnetized enough to move the dash unit bar, which is then held at the "Empty" position by the limiting coil.

If the tank is partly full or full, the float rises on the surface of the fuel and moves the sliding brush over the rheostat, putting resistance in the tank unit circuit. More current will then pass through the operating coil to give a magnetic pull on the pointer, which overcomes some of the pull of the limiting coil. When the tank is full, the tank unit circuit contains the maximum resistance to the flow of the current. The operating coil will then receive its maximum current and exert pull of the pointer to give a "Full" reading. As the tank empties, the operating coil loses some of its magnetic pull and the limiting coil will still have about the same pull so that the pointer is pulled toward the lower reading. Variations in battery voltage will not cause an error in the indicator reading because its operation only depends on the difference in magnetic effect between the two coils.

From the researched done, the fuel indicator used on the dashboard produces pulses for every 1bar of fuel, which flows through it. The calibration amount entered into bar can calculate the fuel flow. The flow sensor should be mounted in a vertical position for optimum operation. Therefore, it is advised to fill the fuel tank to full. The "bar" represents the total pulse width time. This value must not go beyond empty. Otherwise, an error message will be displayed to show that the fuel is empty and truck will have to stop. In this project, the amount of fuel is basically reduced relating the time usage as well as the speed that the truck moves. For the normal condition of fuel in the truck, the data in the graph would be displayed as in figure 11

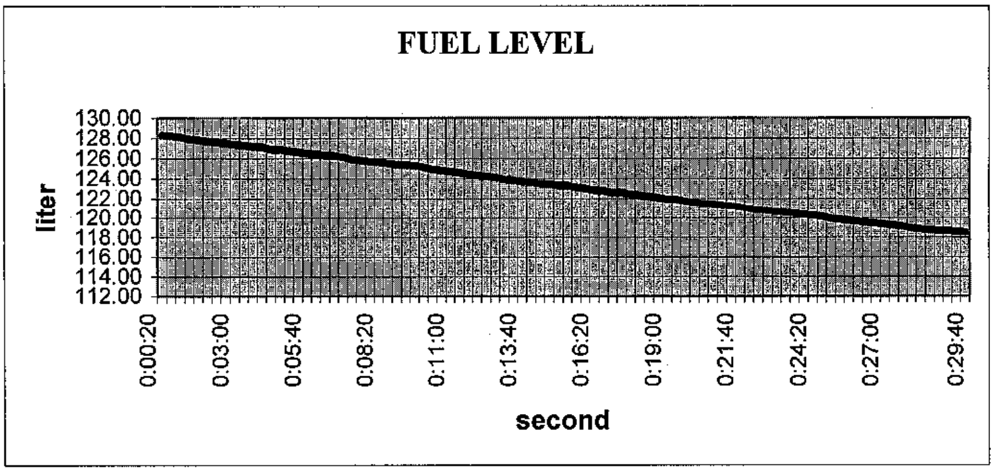

Figure 11: Fuel Level

4.9.5. Measuring the Temperature

This indicator uses a sensor mounted inside the truck's engine to monitor the internal temperature. The temperature is displayed for the user to verify the engine's operating temperature does not exceed bars. This prevents thermal runaway and damage to the engine and truck. The data will not started with 0 degrees due to the influence of the surrounding condition. The temperature will increase slowly when the truck is moving for the reason that of the condition of the engine is slowly heat up. The figure below shows the normal temperature of the truck when it is moving.

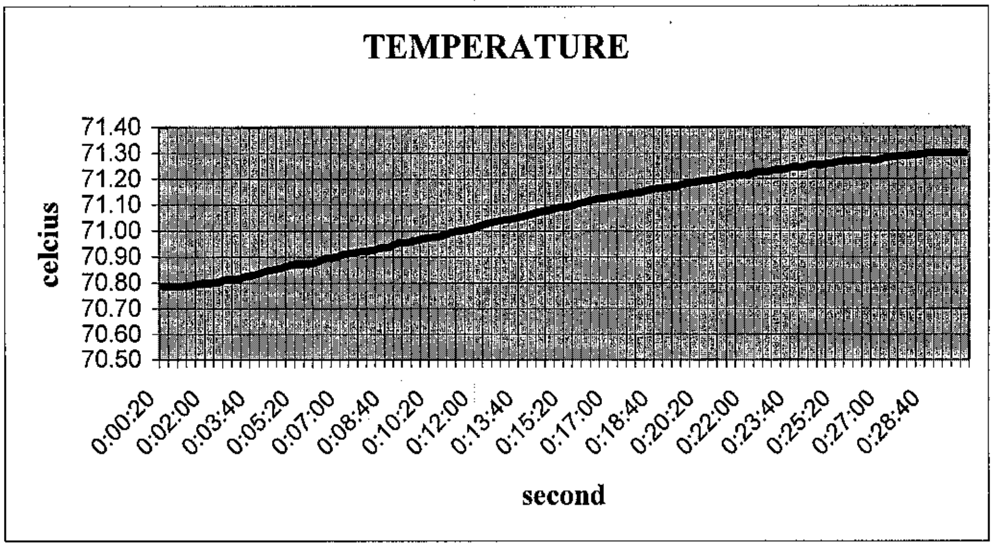

Figure 12: Temperature Level

CHAPTER 5

CONCLUSION

Virtual dashboards provide the means to quantify truck system performance and stability. By providing empower implementations, it is expected that this virtual dashboard could aid the users along with its performance indicator. Thus, this application will be eased in detecting any uncertainty that might occur to the truck. It will quickly and accurately identify changes to process performance levels and stability. This virtual dashboard might also directly address the most pressing and vital needs - such as access to relevant functioning data and information that is clear. After all, it really does operating from the entire part of the truck which available at the users' fingertips.

This benefits for a long journey as it relies on good technical functionality and quite sophisticated. Even with the advent of speedometer that shows how many miles, down to the zero, Virtual Dashboard assistance service remains busy. The final decision to stop for action taken still ultimately depends on the judgment of the users.

For this reason, the benefit of having complete control of the simulation software is that it makes the inherent unpredictability of experimental design easy to accommodate within user alone. There is no need to employ expensive consultants, as this application is really userfriendly that suits for either novice user or other normal user. This makes driving more efficient, as small uncertainties can be noticed and fixed immediately.

For future enhancements:

Some sensors or instruments could be added to simulate and detect other functionalities. For instance, the navigation system to track the geographical information system, other sensor that could limit the speed of the truck according to the highway limits speed, etc.

By using more complicated approach, the end user could upgrade as well as choose their favourite skin of the virtual dashboard that suite with their truck. This will prevent boredom of the same skin of the dashboard after driving the truck for many times.

In support of safekeeping, password for logging the Virtual Dashboard is essential due to prevent from starting the truck without permission of the owner. Perhaps, robber will find difficulties when trying to steal the truck.

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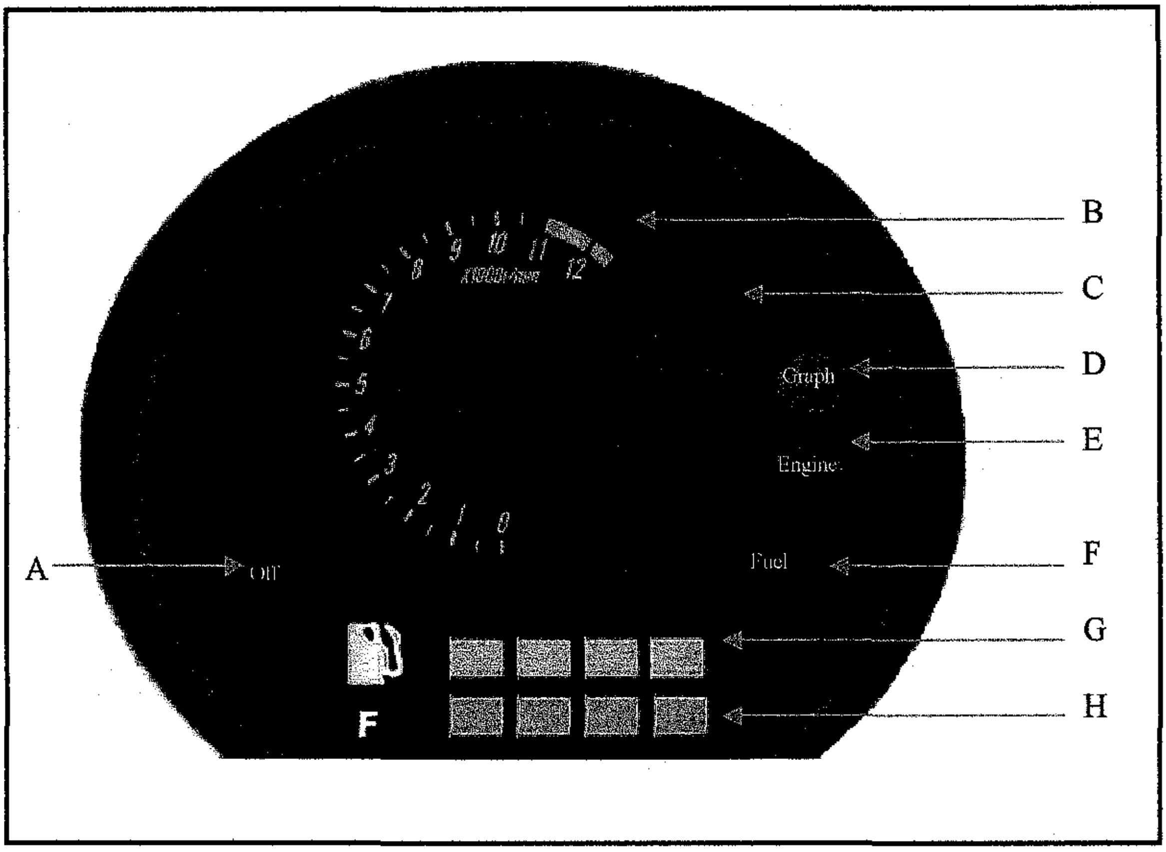
APPENDICES

Appendix A : Design of Virtual Dashboard



Label	Equipment	Function
A	Off Button	To off the dashboard application
B	RPM	Show the increment of the speedometer one mile
C	Speedometer	Display the speed of the truck
D	Graph Window Button	Illustrate the performance's graph
E	View Engine Button	View the condition of the engine
F	View Fuel Tank Button	View the condition of the fuel
G	Fuel Indicator	Show the amount of fuel for the truck
H	Heat Indicator	Show the temperature of the truck

Appendix B : Coding for Virtual Dashboard

```
Option Explicit

Private Running As Boolean
Private Value As Long
Private Direction As Boolean

Dim first As Boolean
Private Sub Command1_Click()

   Running = Not Running
   Timer2.Enabled = Running

   If Running Then
      Command1.Caption = "Stop"
   Else
      Command1.Caption = "Start"
   End If

   Timer2.Enabled = True
   Timer2.Interval = 1000

End Sub

Private Sub Form_Load()
   first = True
   Timer2.Enabled = False

End Sub

Private Sub Timer2_Timer()
   If first Then
      Shape2.Width = 135
      first = False
   End If


  Shape2.Width = Shape2.Width + 100
   If Shape2.Width >= 1600 Then
      Timer2.Enabled = False
      Shape2.Width = 0

      Exit Sub
```

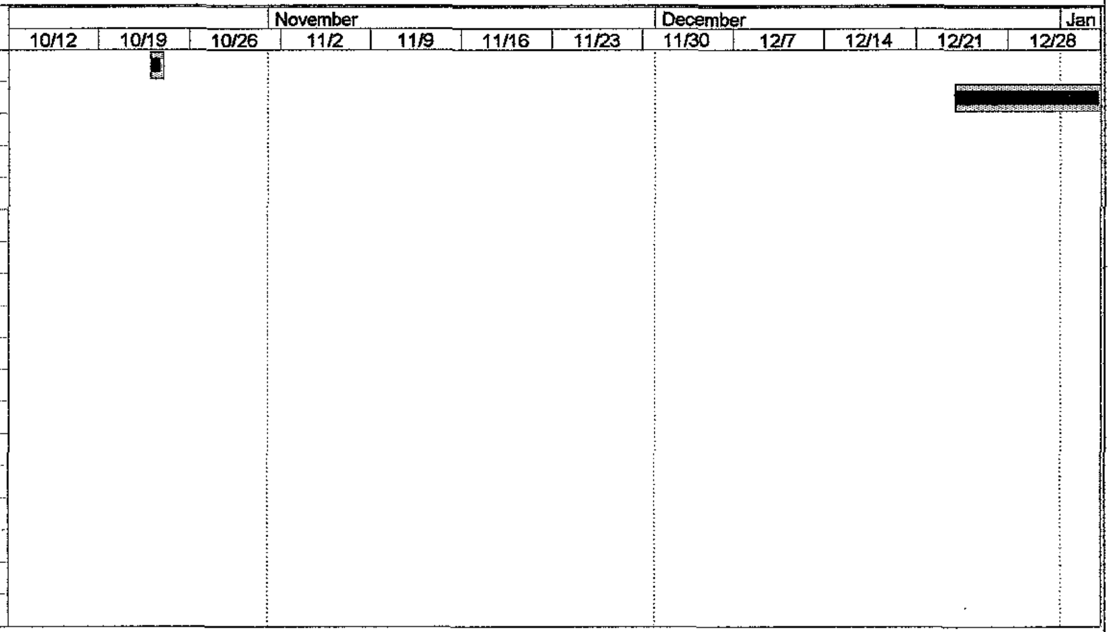
```
   End If

End Sub

Private Sub Timer1_Timer()
ProgressBar1.Value = ProgressBar1.Value + 1
If ProgressBar1 = 100 Then
   MsgBox "HOT ! HOT !", vbOKOnly, "ALERT !"
End If
If ProgressBar1 = 100 Then
   Timer1.Enabled = False
   End If
End Sub
```

FINAL YEAR PROJECT

"Virtual Dashboard for Tanker-Truck"

Jan 2004

ID		Task Name	Duration	Start	Finish
1		**Selection of Project Topic**	**8 hrs**	**Thu 10/23/03**	**Thu 10/23/03**
2		**Preliminary Research/Design Work**	**296 hrs**	**Wed 12/24/03**	**Thu 2/12/04**
3		**Submission of Preliminary Report**	**8 hrs**	**Fri 2/13/04**	**Fri 2/13/04**
4		**Project Work**	**168 hrs**	**Sat 2/14/04**	**Fri 3/12/04**
5		List of Reference/Literature	16 hrs	Sat 2/14/04	Mon 2/16/04
6		**Practical / Laboratory Work**	**152 hrs**	**Tue 2/17/04**	**Fri 3/12/04**
7		Tools and software installation	8 hrs	Tue 2/17/04	Tue 2/17/04
8		Data Gathering	144 hrs	Wed 2/18/04	Fri 3/12/04
9		**Preparation & Submission of Progress Report**	8 hrs	Mon 3/15/04	Mon 3/15/04
10		**Project work continue**	**168 hrs**	**Mon 3/1/04**	**Mon 3/29/04**
11		**Practical/ laboratory work**	**168 hrs**	**Mon 3/1/04**	**Mon 3/29/04**
12		Develop coding and Integration	136 hrs	Mon 3/1/04	Tue 3/23/04
13		Testing	24 hrs	Wed 3/24/04	Fri 3/26/04
14		Final Report Preparation	40 hrs	Tue 3/23/04	Mon 3/29/04
15		**Supervisor's Final Draft submission**	**32 hrs**	**Tue 3/30/04**	**Fri 4/2/04**
16		**Submission of Dissertation Final Draft**	**8 hrs**	**Mon 4/12/04**	**Mon 4/12/04**
17		**Oral presentation**	**32 hrs**	**Tue 4/27/04**	**Fri 4/30/04**
18		**Submission of Project Dissertation**	**32 hrs**	**Tue 6/1/04**	**Fri 6/4/04**



Project: gantt chart
Date: Mon 6/7/04

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

Prepared by:
Noor Faradila Mad Dalan
1961

FINAL YEAR PROJECT
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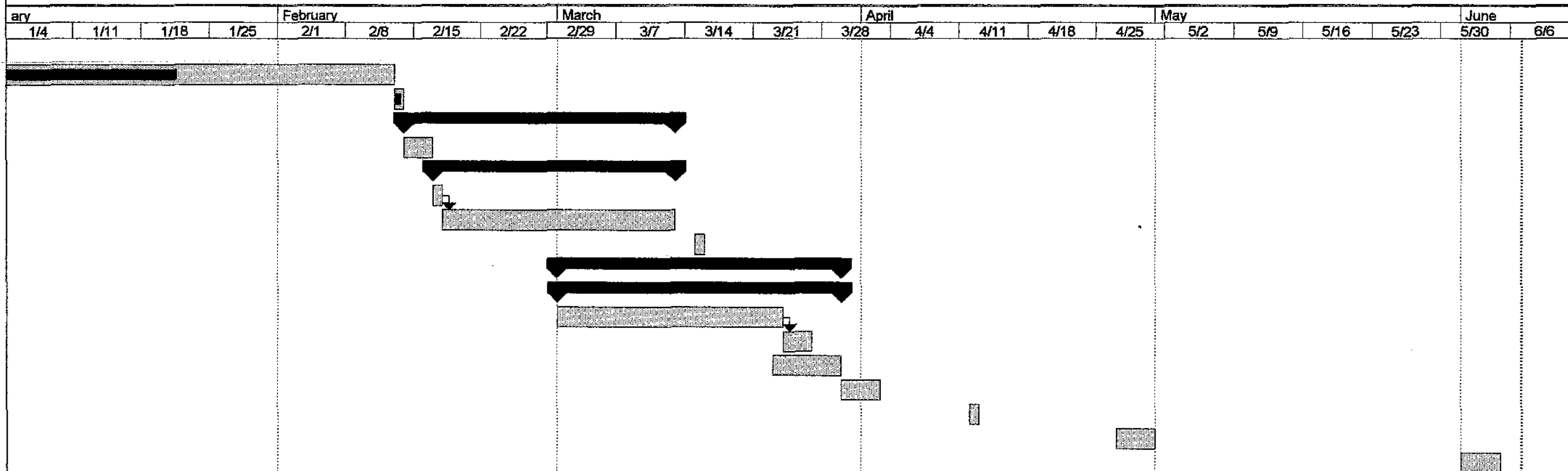

Project: gantt chart
Date: Mon 6/7/04

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

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1961