Virtual Tank Method for Tanker-Truck

By

Aznita Binti Ariffin

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

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Universiti Teknologi PETRONAS
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CERTIFICATION OF APPROVAL

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(VTM)

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Aznita Binti Ariffin (1914)

Dissertation Report
Submitted to Information System Programme
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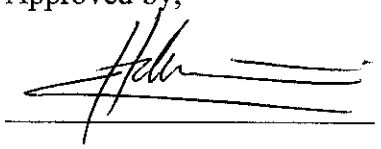
Approved by,



(Mr. Helmi Md Rais)

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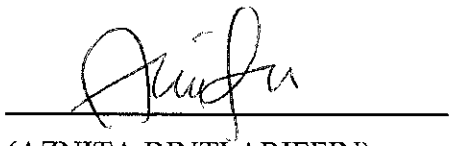
CERTIFICATION OF ORIGINALITY

This is 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 source of persons.



(AZNITA BINTI ARIFFIN)

ABSTRACT

This report focus mostly about the project title, Virtual Tank Method (VTM). Randomly, VTM is about virtual tanker that can be view in front of the truck and also plus the movement of the fuel concurrently with the truck movement. Basically, it is like one small game that children play visually but for this project it is apply in the truck industry or truck movement for safety and real live time. Overall, objective of this project is to develop the 3 dimensions virtual fuel tanker in helping user to view fuel condition in tanker directly from driver seat (truck). And also to show how the movement of truck influences the movement of fuel in tank behind. Most projects have its own problem statement to achieve or to proof in reaches part in the project. Overall there are there simple problem statements for this project. There are to figure out new technique to view tanker and fuel level and also movement directly from in front or from the seat, to research what 3D can do to help the people around the world and lastly to solve the graphic problem. The scope of study for this project is randomly more to movement of the track influence the movement fuel in the tank. Through the report, there is no specific methodology such as waterfall or spirals used but as to develop the project, there are several steps that had been following. There are such as planning, searching and analyzing, developing, documenting, implementing and testing. As the result of finding and searching for report, finally the report come out with five big chapters and follows by its children to give information about the project.

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TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND OF STUDY

In today's world where everything is computerized, human become more curious to learn and create everything in 3 dimensions, which we call 3-D visualization. Now a day all can be virtualizes and with all the study and experience, it's transfer to real life. Today in life, computer-generated special effects of object in 3D are so well done until it is look like a real life object. Sometime people have to look very well and careful to differentiate between 3D objects and the real life objects.

1.1.1 Concept

Driving a truck is common for certain people in the world. There are many type of trucks such as fuel trucks, vegetable trucks, nitrogen gas trucks and so on. The project is build or creates the fuel tanker for fuel truck in 3D object.

The concept is simple. How movement of truck influence the movement of the fuel at the back of the truck and inside the tank. It's mean that visualize all the connection involve and make it in 3 dimensions (3-D) for user to view.

Randomly it is like game but the concept here is to show the user what 3D visualization can do to help people. What is means by help people is 3D help user to visualize thing that they cannot reach to see. In this case, 3D help user to visualize what exactly can be view in the tanker. The visual of fuel tanker show what happen when the truck turn right, left or crash. The level and movement of fuel in the tank is shown concurrently with movement of the truck.

1.2 PROBLEM STATEMENTS

Generally, there are many problem statements will occur when we going trough the process of made documentation and the product finally. However, there are only several problem statement that has been highlight to be proof in this documentation. There are to figure out new technique to view tanker and fuel level and also the movement directly from the seat. Its give opportunities to the driver to view the movement of fuel in front or directly from the driver seat. So, driver can control the speed of truck and can know how the fuel flows or changes of fuel movement when the trucks move. All can happen in one click at dashboard and it will pop up the screen that shows the fuel movement or generally the tanker situation behind.

Then, it is to research what 3-D can do to help the people around the world. Why this research was done? This is because; most of the product using the 3D visualization concept and actually the product itself display in 3D form. 3D help user to visualize the fuel in the tanker by implement the object of tanker and fuel exactly same as the real life tanker and fuel. So users get the picture of what happen to the fuel in tank when the trucks move. When designing 3D object, we are dealing with the graphic where it is the basic part in the designing the object. The most significant component of 3D visualization is its graphics. Good graphic design is as crucial to a 3D product as the combination of all the remaining elements of the works. Means that, the combination object created from mixing graphic object, for the project are some pleasing images to become one good 3D object.

1.3 OBJECTIVES AND SCOPE OF STUDY

In order to develop a system, clearly stated objectives is needed. This is because developer needs to have clear vision of what is being developed. It is common that in every project, the scope is defined to ensure that project could be completed within the predefined constraints (i.e. time, cost and resources). For Virtual Tank Method for Tanker Truck, all the objectives and scope of study are within the time frame.

1.3.1 Objectives

To develop the 3 dimensions virtual fuel tanker to help user to view fuel condition in tanker directly from driver seat (truck). And also to show how the movement of truck influences the movement of fuel in tank behind. So, this is the relevancy of the project.

1.3.2 Scope of Study

The product or the graphic designed to show how the movement of truck, in this case truck momentum give impact to the fuel in the tanker behind the truck. The fuel move concurrently with the truck movement when it turn to right, left and crash. User can 'jump' into the fuel tank from above the tanker, dive in the fuel and come out from the bottom of the tanker. So, overall the main scope of study for the Virtual Tank Method for Tanker Truck is more to movement of the fuel in the tank.

CHAPTER 2

LITERATURE REVIEW

In era of technology, 3 dimensions and virtual environment is becoming more and more popular. Many works have been done in years by researchers to improve the techniques in 3D visualization. The animation and movement now a day do in 3 dimensions. Film industries also mostly use the 3 dimensions visualization and graphic such as Sherk, Bug's Life and also Antz.

2.1 ARCHITECTURE

Most of the systems developed by developers used a many different architectures. For example, the Astronomical Software and Documentation Service (ASDS) project has 2 part in it project architecture. There are the searchable indexes and distributed document collection. The searchable indexes are accessible through the World Wide Web.

What is computer architecture? Computer architecture is the science and art of selecting and interconnecting hardware components to create computers that meet functional, performance and cost goals. For the Virtual Tank Method for Tanker Truck the architecture needed to fulfill functional, performance and goal of the project. There are several parts or phase involved such as capturing the image, pre-processing and storing database.

2.1.1 Capturing Image

In capturing image, graphics are taken in form of images. The images mostly digitized using scanner. When digitizing the image using scanner, the resolution should be stress most because resolution is most often associated with an image's degree of detail. There are several resolutions such as color resolution, image resolution and device resolution. Color resolution is also called color depth, specifies the number of bits used in an image file to store color information. A bit, or binary digit, is the smallest unit of data in the computer world. In the other words, color resolution is the number of color displayable in any image file format or computer screen display setting. So, it is important so that the bit of image will give good result for color of the object. Image resolution is the number of pixels used to display an image – usually given by pixel width times pixel height. The greater the number of pixels used to display an image, the better the image detail definition will be out, but the file size will also increase. Pixels are a dot of colored light that, when grouped together with many other pixels in a large array, represents an image on a computer screen. In device resolution, there are two parts such as input device and display device. Input device mostly is scanner. Scanner resolution is defined in dots per inch (dpi) at which we choose to scan an image. This is the number of discrete points of color information the scanner can see in a given inch. Display devise is more to adapter and monitor. The color resolution and pixel dimension that are used for images also are used to describe a computer's onscreen display. If a computer displays a full screen that is 640 x 480 pixels in dimension, this means that the biggest image the computer can completely show while using those setting. There are several image sources and input. There are scanners, digital cameras, the web, clip art, and last is create the wanted image.

2.1.2 Pre-processing

After that, the pre-processing phase take place, where the images are processed based on image algorithm. For purposes of color allocation, an image is a set of pixels, where each pixel is a point in RGB space. RGB space is a 3-dimensional vector space, and each pixel, is defined by an ordered triple of red, green, and blue coordinates .The algorithm maps this domain onto a tank in which each node represents a cube within that domain. The basic algorithm operates in three phases:

- Classification,
- Reduction, and
- Assignment.

Classification builds a color description tank for the image. Reduction collapses the tank until the number it represents, at most, is the number of colors desired in the output image. Assignment defines the output image's color map and sets each pixel's color by reclassification in the reduced tank. The image of tanker and fuel will be connect or concurrently with the momentum of truck.

2.1.3 Storing Database

Then, the storing database phase takes place where the image stored in database. The data of momentum also stored n the simple database. This is sample of calculating the momentum when car crush or hitting tree or object doing by researcher (sources in reference).

Data Calculations: Momentum conservation

Collision :

Po refers to the momentum of the hitting car and Pf refers to the momentum of the hit car. All P calculations are in kg*m/s

P_o=.70m/.81s * .5kg
P_o=.4320

P_f=.40/.59 *.52kg
P_f=.352

Difference of momentum = .07

Po=.289
Pf = .212
Difference of momentum = .07675

Po = .50
Pf= .424

Difference of momentum = .076

Po = .813
Pf = .635

Difference of momentum = .178

Po = 1.167
Pf = .69
[ERRONEOUS DATA]

Po = .603
Pf = .520

Difference of momentum = .08

Due to this data, and the systemic error of around .07kg*m/s difference in momentum before and after collision, must not have taken into account the slight movement of the first car which would have been around:

P = mv

V = P/m
V = (.07kg*m/s) /.5kg
V = .14 m/s

All the calculation stored in the database. The fuel move according to the calculation of the momentum that stored in the database calling by truck. The flow of architecture shown in the *Figure 2.1.1 Flow Of Architecture*.

2.2 WHAT IS 3D

In computers, 3-D (three dimensions or three-dimensional) describes an image that provides the perception of depth. 3D on a computer screen is, perhaps, a misnomer. Misnomer is when users touch the screen, it is flat and not really in three-dimensional. Users get confuse with the display screen as it is shown object in 3D as real life. This is because computer-generated 3D image, animation and objects are all illusion. The developer creates images that look as if they are in 3D, even though they are on a flat surface. When 3-D images are made interactive so that users feel involved with the scene, the experience is called virtual reality. We usually need a special plug-in viewer for your Web browser to view and interact with 3-D images. Virtual reality experiences may also require additional equipment.

3-D image creation can be viewed as a three-phase process of: tessellation, geometry, and rendering. In the first phase, models are created of individual objects using linked points that are made into a number of individual polygons (tiles). In the next stage, the polygons are transformed in various ways and lighting effects are applied. In the third stage, the transformed images are rendered into objects with very fine detail.
Popular products for creating 3-D effects include 3-D Studio Max, Extreme 3-D, Light Wave 3-D, Ray Dream Studio and Visual Reality. 3D Studio Max is one of the software that allow user to create or capture any object in there-dimensional. It allow user to

make animation such as walkthrough. Extreme 3D allows 3D images to be viewed in breathtaking clarity. It is also enhances ordinary 3D by adding depth information to the perspective view. LightWave has many versions so far. The latest version for LightWave now is LightWave 6. LightWave 6 is the program third's generation. Besides of drawing or built the 3D objects, it cans customizable interface, groupable interfaces, multiple viewport configuration, shortcut navigation and redesigned panels. Ray Dream Studio is design and rendering package by Metacreations. It also contains an animator and the shaders worked automatically so that it helps the new beginner user when using this product. The Virtual Reality Modeling Language (VRML) allows the creator to specify images and the rules for their display and interaction using textual language statements.

2.3 WHAT IS VIRTUAL REALITY

Webster's New Universal Unabridged Dictionary (1989) defines virtual as "being in essence or effect, but not in fact". Webster's also defines reality as "the state or quality of being real. Something that exists independently of ideas concerning it. Something that constitutes a real or actual thing as distinguished from something that is merely apparent". To simplify is a place that exist and can be experience. Virtual reality is the simulation of a real or imagined environment that can be experienced visually in the three dimensions of width, height, and depth and that may additionally provide an interactive experience visually in full real-time motion with sound and possibly with tactile and other forms of feedback. The simplest form of virtual reality is a 3-D image that can be explored interactively at a personal computer, usually by manipulating keys or the mouse so that the content of the image moves in some direction or zooms in or out. Most of these images require installing a plug-in for your browser. As the images become larger and interactive controls more complex, the perception of "reality" increases. More sophisticated efforts involve such approaches as wrap-around display

screens, actual rooms augmented with wearable computers, and joystick devices that let you feel the display images. According to Grigore C . Burdea, virtual reality is a simulation in which computer graphic is used to create a realistic looking world. Moreover, the synthetic world is not static, but responds to the user's input. It is interactivity. Finally, it is a high-end user-computer interface that involves real-time simulation and interaction through multiple sensorial channels. These sensorial modalities are visual, auditory, tactile, smell and taste.

2.4 WHAT IS PHYSIC

Physic is a major science, dealing with the fundamental constituents of the universe, the forces they exert on one another, and the results produced by these forces. In physic area, the momentum is the important element in the Virtual Tank Method for Tanker Truck.

2.4.1 What is momentum

Momentum, also known as linear momentum, in physic, fundamental quantity characterizing the motion of any object. It is the product of the mass of a moving particle multiplied by its linear velocity. Momentum is a vector quantity, which means that it has both magnitude and direction. The total momentum of a system made up of a collection of objects is the vector sum of the entire individual objects' momentum. For an isolated system, total momentum remains unchanged over time; this is called conservation of momentum.

Conservation of momentum is one of the most important and universal of the conservation laws of physics; it holds true even in situations where modern theories of physics apply. Generally, conservation of momentum is valid in

quantum mechanics, which describes atomic and nuclear phenomena, and in relativistic mechanics, which must be used when systems move with velocities that approach the speed of light.

2.5 WHAT IS GRAPHIC

Graphic design basically is visual problem solving using text and/or graphical elements. The aim is to create something that is pleasing to the eye, and gets the attention of the viewer. But things can't just look cool. They have to work as well. According to the About.com, "graphic design is the process and art of combining text and graphics and communicating an effective message in the design of logos, graphics, brochures, newsletters, posters, signs, and any other type of visual communication". Today's graphic designers often use desktop publishing software and techniques to achieve their goals. According to the dictionary.com, graphic design is "the practice or profession of designing print or electronic forms of visual information, as for an advertisement, publication, or website."

For graphic, user must use a variety of print, electronic, and film media to create designs that meet their clients' needs. They use computer software to develop the layout and design of magazines, newspapers, journals, corporate reports, and publications. They also produce promotional displays and marketing brochures for a variety of products and services. They design unique company logos for products and businesses. There are many graphic designers who develop material to appear on web pages, too. Another interesting task some graphic designers have is to produce the credits that appear before and after television programs and movies. That is one example that often goes unnoticed by the public

2.6 PEOPLE OPINION / DEMANDING

People or users want the best result for any projects done by researchers and developer. Users like to have very simple features or output but very sophisticated and intelligent.

2.6.1 Tank and Fuel

There are several models that have similarity with the Virtual Tank Method for Tanker-Truck in the tank and fuel point of view.

- There are researches about the fuel system in the truck. All modern fuel systems are fed through a pump, so the fuel tank is usually at the rear of the chassis under the trunk compartment. Some vehicles have a rear engine with the tank in the forward compartment. The fuel tank stores the excess fuel until it is needed for operation of the vehicle. The fuel tank has an inlet pipe and an outlet pipe. The outlet pipe has a fitting for fuel line connection and may be located in the top or in the side of the tank. The lower end is about one-half inch above the bottom of the tank so that collected sediment will not be flushed out into the carburetor. The bottom of the tank contains a drain plug so that tank may be drained and cleaned. The concept is same but the fuel in this project is not for truck usage but it is about the truck which is carrying the fuel in the tanker.

- CFD stands for Computer Fluid Dynamic. CFD is a computational technology that enables user to study the dynamics of things that flow. Using CFD, user can build a computational model that represents a system or device that user want to study. Then user applies the fluid flow

physics to this virtual prototype, and the software outputs a prediction of the fluid dynamics. CFD is a sophisticated analysis technique. It not only predicts fluid flow behavior, but also the transfer of heat, mass (such as in perspiration or dissolution), phase change (such as in freezing or boiling), chemical reaction (such as combustion), mechanical movement (such as an impeller turning), and stress or deformation of related solid structures (such as a mast bending in the wind). Basically, the compelling reasons to use CFD are these three:

Insight

There are many devices and systems that are very difficult to prototype. Often, CFD analysis shows parts of the system or phenomena happening within the system that would not otherwise be visible through any other means. CFD gives a means of visualizing and enhanced understanding of designs.

Foresight

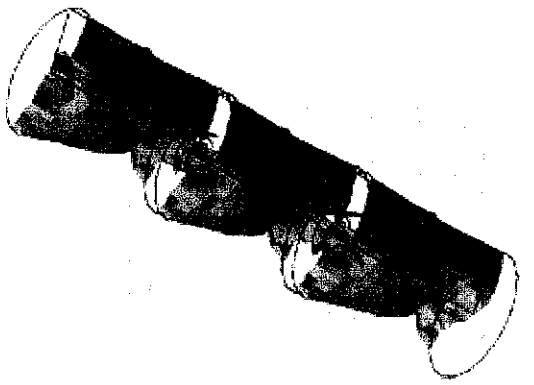
Because CFD is a tool for predicting what will happen under a given set of circumstances, it can answer many 'what if?' questions very quickly. User gives it variables. It gives user outcomes. In a short time, user can predict how the design will perform, and test many variations until user arrive at an optimal result. All of this is done before physical prototyping and testing. The foresight gain from CFD helps to design better and faster.

Efficiency

Better and faster design or analysis leads to shorter design cycles. Time and money are saved. Products get to market faster. Equipment

improvements are built and installed with minimal downtime. CFD is a tool for compressing the design and development cycle.

CFD can be used to model flows in a sloshing fuel tank. Liquids inside the fuel tank are prone to sloshing due to a range of internal and gravitational forces that the fluid may experience during acceleration and vehicle or aircraft movement. CFD allows designers to estimate the range of forces on the walls of the container of the fuel tank for all the possible operational conditions that the vehicle or aircraft may experience. With its powerful abilities to model time-dependent free-surface flows, FLUENT validates its use as a strong CFD tool to model such complex transient flows.



Free surface fuel at T=0.123s

Fuel tank technology promises to be an environmentally friendly power source with broad applications in many industries including transportation, and both portable and stationary power generation. Manufacturing and operation costs can be reduced by optimizing the efficiency of fuel tank through detailed analysis of complex electrochemical and mass transport phenomena taking place inside the tank. Fluent's consulting team has developed fuel tank modeling tools to

assist fuel tank designers in optimizing their designs and fuel tank performance. Tools with detailed models for Solid Oxide Fuel Cells (SOFC) and Polymer Electrolyte Membrane Fuel Cells (PEMFC) have been developed that are fully coupled with FLUENT CFD software. These tools are fully parallelized. This, in conjunction with parallel FLUENT, decrease the analysis turns-around time considerably. Based upon prescribed total fuel tank current, the fuel tank model provides local current density, local voltage, species concentration, and temperature distribution in the fuel tank. Fluent's fuel tank analysis tool models the following processes :

Electrochemistry : Appropriate chemical reactions for SOFC and PEMFC are used to predict the local current density and voltage distributions at the electrolyte surfaces. The ionic transport across the electrolyte is assumed to be one-dimensional. The electrochemical model takes into account the losses due to activation overpotential (kinetic losses), ohmic overpotential (losses due to ionic transport in the electrolyte), and concentration overpotential (losses due to inadequate diffusion of species through the electrodes). Binary diffusion coefficients are used to calculate the molecular diffusion of the (gaseous) species throughout the domain

Potential Field : There are model predicts the current, voltage, and ohmic heating in all conducting solid and porous regions of the SOFC and PEMFC. Additionally, contact resistance at the appropriate interfaces can be included in the model.

Membrane-Electrode Assembly : In modeling PEMFC, the thin polymer membrane and catalyst layers are combined and treated as a single layer called the MEA layer. The MEA model predicts the net transfer of liquid water and electrical losses across the membrane-electrode assembly in PEMFC. Liquid water travels across the membrane due to electroosmatic drag and molecular diffusion. Protonic conductivity of MEA is calculated as a function of water concentration and temperature.

Liquid Water Flow in Porous Diffusion Layers : Water is produced at the interface between the MEA and the cathode porous diffusion layer as a result of electrochemistry and water transport due to water drag in PEMFC. If the cathode gas flow is saturated, this water is produced in liquid form. A multiphase mixture model has been incorporated to predict the flow of liquid water through the porous diffusion layers and into the flow channels. The multiphase mixture model solves for conservation of mass, momentum, energy, and species in the porous diffusion layer. In addition to describing the liquid water flow, this model will produce local values of the liquid volume fraction within the porous media. The resultant effect on local void fraction will be used to modify the local values of gas phase diffusivity, thermal conductivity, and electrical conductivity throughout the cathode diffusion layer. This modification to the transport properties for local water concentration will accurately model the effect of water

production on mass diffusion, heat conduction, and electrical conduction though the cathode diffusion layer.

Liquid Water in Flow Channels : Liquid water leaving the porous diffusion layer enters the flow channels as a thin liquid film in PEMFC. A multiphase model is used to describe the flow of liquid water as a thin film along the flow passage walls. As liquid water reaches the surface of the diffusion layer, it is introduced into the gas flow passage as a thin liquid film of drops, where shear between the gas flow and film surface can move the film. Gravitational and surface tension forces are taken into account. Reentry of liquid water from the thin film back into the diffusion layer is permitted.

The concept here is similar with the project. It is just that the model is not in the 3 dimension visualization.

- On a monthly basis, it is shows the analysis of the last three year's fuel carried by tanker for the ScotSystems Inc

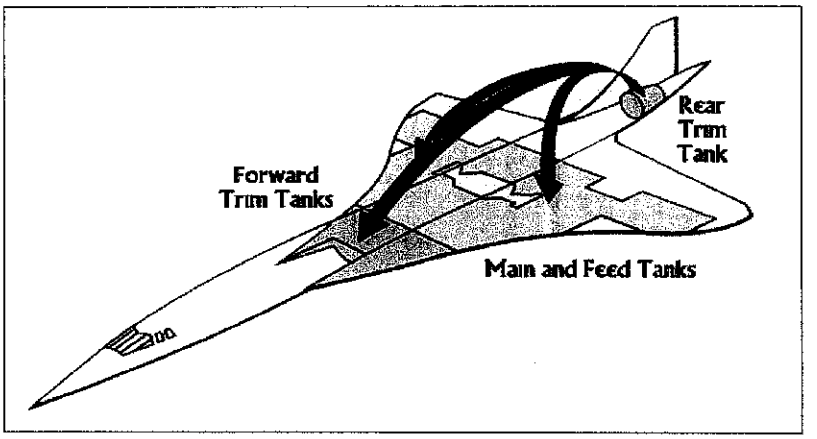
	Monthly Gallons 1997	Y-T-D Gallons 1997	Monthly Gallons 1998	Y-T-D Gallons 1998	Monthly Gallons 1999	Y-T-D Gallons 1999	Monthly Increase/ Decrease	Y-T-D Increase/ Decrease
Jan	63,200	63,200	65,200	65,200	67,133	67,133	1,933	1,933
Feb	57,280	120,480	61,254	126,454	63,122	130,255	1,868	3,801
Mar	45,213	165,693	47,851	174,305	55,876	186,131	8,025	9,893
Apr	62,100	277,793	63,458	237,763	67,865	253,996	4,407	14,300
May	75,000	302,793	77,943	315,706	79,677	333,673	1,734	16,034
Jun	72,300	375,093	76,986	392,692	79,888	413,561	2,902	18,936

Jul	70,321	445,414	78,980	471,672	79,130	492,691	150	19,086
Aug	78,543	523,957	81,833	553,505	83,851	576,542	2,018	21,104
Sep	61,000	584,957	63,800	617,305	65,566	642,108	1,766	22,870
Oct	55,237	640,194	60,226	677,531	67,644	709,752	7,418	30,288
Nov	48,376	688,570	49,456	726,987	51,786	761,538	2,330	32,618
Dec	59,873	748,443	69,654	796,641	71,577	833,115	1,923	34,541

Comparison of Fuel Carried in the Tanker

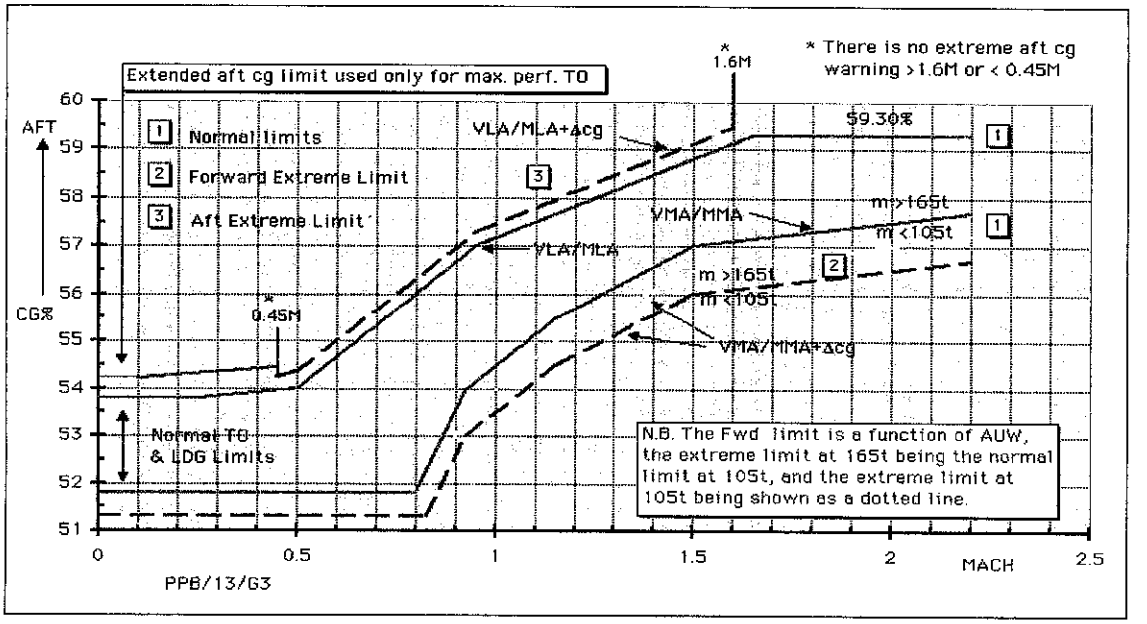
(ScotSystems Inc & StoreReport are trademarks of ScotSystems Inc)

- There is research of the movement of fuel made for Concorde system. At the end of the Cruise during the deceleration fuel is pumped forward to the wing transfer and even the forward trim tanks is necessary thus moving the CofG forward again as the centre of lift moves reward. Once on the ground it is standard practice to then pump more fuel into the forward trim tanks to correctly balance the aircraft, so it can be unloaded without any stability problems and the chance of it becoming a "tailsitter" The Movement of fuel also provides additional benefits at lower speeds: By making the aircraft rearward heavy during take off and landing, this causes the elevons control surfaces to move downwards to counteract this weight and in so doing so increases the camber of the wing generating more lift at slower speeds. This allows the aircraft roll trim to be set without having slightly different deflection on the elevons, which again adds drag and reduces performance.



Illusion of Fuel Movement in the Concorde System

The full transfers on Concorde are carried out by the flight engineer from his fuel control panel. On Concorde this is one of the most important and time consuming jobs for the engineer. The panel allows the engineer to set up the transfers to be carried out automatically and stop when the relevant quantities of fuel have been moved to the correct tanks.



The following table shows the corridor for where the center of gravity on Concorde must be for different speed profiles. Fuel movement diagrams and specific information based on an extract from "Flying Concorde" by Brian Calvert.CofG corridor diagram supplied by Peter Baker, former Concorde test pilot.

2.6.2 Softwares and Languages

3D Studio Max

For the software, 3D Studio Max is one of the suitable software that could design the fully integrated 3D graphics creation suite which allows modeling, animation, rendering, post-production, real-time interactive 3D and game creation and playback with cross-platform compatibility. It lets users create and replay real-time, interactive 3D content. 3D Studio Max suits as it is a general purpose programming language that can integrate visualization, programming and computation in one environment.

Open GL

OpenGL is a powerful software interface for graphics hardware that allows producing high-quality color images of 3D objects. The functions in the OpenGL library enable to build geometric models, view models interactively in 3D space, control color and lighting, manipulate images, and perform such tasks as alpha blending, antialiasing, depth cueing, and texture mapping. OpenGL supported and best documented 2D/3D graphics making it inexpensive & easy to obtain information on implementing OpenGL in hardware and software.

World Up

WorldUp is an interactive, real time and object-oriented development that enables to quickly develop sophisticated 3D simulation and application. WorlUp also provides 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

Visual Basic is 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.

C++

C++ is a general purpose programming language with a bias towards systems programming that is a better C, supports data abstraction, supports object-oriented programming and supports generic programming. The C++ language is in a middle term, since it can interact directly with the hardware almost without any limitation, as well as with the support of suitable specific libraries, works like one of the more powerful high-level languages. User can practically compile the same C++ code in almost any type of computer and operating system without hardly making changes. C++ is one of the most used and ported to different platforms programming language. Code written in C++ is very short in comparison with other languages, since the use of special characters is preferred before key words, saving effort (and prolonging the life of our keyboards).

CHAPTER 3

PROJECT WORK AND METHODOLOGY

3.1 PROCEDURE IDENTIFICATION

This project is divided into 2 parts. There are on the image part and secondly on physic part. From the image part, what is needed is 3 dimensions graphic of tank and also fuel in tank. These entire images are done or capture in 3 dimensions. The object of tank and fuel made in 3 dimensions. Then, the movement of fuel in tanker created.

In physic part, the movement of fuel must concurrent with the movement of the truck. Example: What will be the movement of fuel when the truck crash. Here, physic plays roles. A large number of references of momentum of truck stored for later comparison.

Basically, this is how the project works. When user press button that available in dashboard, it pop up one screen of tanker graphic or virtual in 3 dimensions view. It turns around to show the detail view of tanker from outside. When user clicks at inside of the tanker, one visual or figure act like monitor or camera; take user into the tanker from above the tanker. Here, user can view the surface of fuel and how it's move. The figure or monitor or camera go inside the fuel and come out at the bottom of the tanker. User also can view fuel level and graphic when they desire at the same time.

But after several researches has been done thought internet, reading and asking people who master in this field especially in 3D Studio Max (software used to created the

project), the project become less complicated especially in the database part. The product will run as planning but the database part will be reducing from the project.

3.2 METHODOLOGY

Every project must have its won methodology to complete the given tasks. There are many kind of methodology such as waterfall, spiral and so on. For this project, there is no specific methodology chosen. It's followed several steps that suitable and leaves the unsuitable step behind. There are planning, analysis, development and implementing.

3.2.1 Planning

For planning, first of all storyboard was built to be a guidelines through the project. It's come out with 3 important parts of project that been created in the development part. It is called the layout of the oil tanker. First the tanker able to turn right and left. It is show the 3D visualization of the object. Here, user cannot view the fuel yet. Just the tanker in 3D visualization can be view by the user. See ***Figure 3.2.1 3-D Tanker***. Secondly, the image turns to transparent. Now user can view the fuel level and movement in the tanker. It show how the movement of the truck concurrently with the fuel. Means that, when the truck turn left, the fuel will move concurrently with the truck movement. See ***Figure 3.2.2 Transparent 3 Dimensions***. Then finally, if the users wish to go into the tanker, they can just click to the tanker and the animation start. It bring user to the top of the tanker and jump inside the tanker. User virtually be in the fuel in the tanker. Then, come out from the bottom of the tanker. Here, the movement is like one game play by the user. See ***Figure 3.2.3 Inside Tanker and Get Outside From Below.***

3.2.2 Analysis

The second phase is analysis part. It analysis theory and method that should be used. Then, it is come out with several diagrams in arranging the project flow. In *Figure 3.2.4 Whole Product Layout* and *Figure 3.2.9 Flow Diagram On How The Virtual Truck Work*, it's show the whole truck that had been integrate part by part. There are dashboard, alarm, graph, engine view and tanker view. In the dashboard, there are several buttons that link to the graph, engine view and tanker view. When user click the button on the dashboard, then the tanker or engine or graph view come out for user to view. The main part in the Virtual Tank Method for Tanker View is the tanker view and the fuel movement. *Figure 3.2.5 Object Relationship* shows the relation between the user and the oil tanker. It is link by the dashboard as the main input device. *Figure 3.2.6 Use Case Diagram* show the oil tanker process. It is show what the process involve, input momentum and database. When user clicks to the button available in the dashboard, dashboard read the momentum that had been created of truck engine and movement. Then the fuel movement is according to the variable read just now. User can view the tanker from every position. For Oil Tanker, there are several processes that it can do or performs. It show the performance of 3D dimension. Then it creates to do some action or animated. User view is not focus at the outside of the tanker but also in the tanker. User can virtually go inside the tanker and view the fuel from there. In this case from the top of the tanker. Then, they can virtually jump into the fuel and come out from the bottom of the tanker. As the use case diagram show several task that the product can perform. There are show performance, show 3D graphic, animation action, show fuel level, show fuel movement and also show the object movement. Show performance means that the product able to turn around without any command from user. Show 3D graphic means that the product also able to show the best 3D visual from various

position. Animation action is when the user can go through the tanker and also go trough the fuel. Than after that come out from the bottom of the tanker. The product also can be view transparently. So that it is clearly to show the fuel movement in the tanker. Show fuel level and fuel movement is the main function of the product. So, the final product able to perform the task. Last but not least, the product able to show the object movement. This can be seen when the object move to show every part of the tank. It is just like one game play by the user. It also can be move without control from the user. *Figure 3.2.7 Flow Diagram of Real-Time data Logging for Virtual Truck* illustrates the flow diagram of the real-time data logging. The Virtual Tank Method for Tanker connect with the dashboard where user used to select the button provided. With these connections, user could efficiently discover the performance from all particulars with a glance. *Figure 3.2.8 Activity Diagram* resembles horizontal flow charts that show the action and events as they occur. It is show the order in which the actions take place and identify the outcomes. It is also can display multiple use cases in the form of a grid, where classes are shown as vertical bars and actions appear as horizontal arrows. Here, it is show the flow of the project. It is starting from the user and end to the user also.

3.2.3 Developing

The third phase is developing phase. Here the tanker created in the 3D visualization using the 3D Studio Max as the software. There are 2 main parts in this phase. There are creating object and coding. The base object for the tanker is the boxes and the cylinders. From both object, it's come out the tanker object. Both objects had been texturing, modifying and shading to become the tanker. Texturing is put the real tanker texture on the object to make sure it is look like the real tanker. Modifying is cutting several put of the both symmetry to become

tanker object and look like tanker. Shading is to make the reflect and make the tanker more beautiful so that user can see it as the real tanker. Here, coding writing happen by using Open GL and C++. Coding is needed to make the movement of the tanker and also the movement of the fuel. There are two set of files that had been create. There are sources file and header file. Sources file is set in C++ language and have five files such as camera.cpp, GLTexture.cpp, Init.cpp, Main.cpp and Model3DS.cpp.The sources file create for make or call the function. It is in the C++ because it has more function. The view page is loaded from the camera.cpp. It is call the viewer. The header file also has five files which is set in Open GL language. There are camera.h, GLTexture.h, lobj.h, main.h, and model3ds.h. The header files is using for declare the function. All coding and variable declaration are declare here. For header files, any language can be use to create the coding but the file must be save in .h format. Here, open GL used because there are one files name glut.h that only in the open GL languages. Glut.h is like the big libraries and script for graphic. It has all the movement function such as rotates, scale and so on.

3.2.4 Implementation

In implementing phase, the product is tested whether it is work as plan or not. Here the tester is the developers and several users that randomly pick to test the product. If any unsatisfaction happen, then the modifying the product happen. There are no specific questionnaires done as it is virtual reality object, not systems.

3.3 TOOLS

To develop this project, same tools are required including the usage of software and hardware. For hardware, a workstation that is capable to run and execute the program is required. Since images are needed, any ordinary scanner / digital camera with enough resolution can be used to acquire image. These all the tools that involve in the project. The components are thus divided into five categories such as *System devices, Memory and storage devices, Input devices, Output devices, and Communication devices.*

3-D Max is used as main software. I choose both of software because it is general purpose programming language and integrate visualization, programming and computation in one environment. Instead of using 3D Studio Max, C++ and OpenGL language were used to move the several element in the product such as fuel and the rotation of the tanker that user can view from different view. 3D studio Max is a tool for making 3D models and designs that can be converted into 3-dimensional animations. There are many websites with animated symbols. In fact many of such symbols are made by using this tool. It virtually leads user imagination to go wild and visualize any symbol easily with the help of this *3D Studio Max* tool. It has applications in creating web pages; designing advertisements; making cartoon films and in creating multimedia based training programmers. One can gives special effects to the design especially in terms of sound and animation. It is suitable to the project as there are part where the walkthrough created for user usage.

3.3.1 System device

For the system device, these are the devices that are the essential components for a computer. These include microprocessor, motherboard and memory. Microprocessor is basically the heart of the computer. A is a computer processor on a small microchip. When turning 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 load 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. User can add additional components to a motherboard through its expansion slot.

3.3.2 Memory and Storage Device

These are for the 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. RAM can be taken as short-term memory and the hard disk as the long-term memory of a computer. However, RAM might get slow when used to its limit. That is why, more memory needed to work on multimedia. Today's personal computers come with 128 or more of RAM. Users of graphic applications usually need 128 plus megabytes of memory.

A stores and provides access to large amounts of data on an electromagnetically charged surface. Today's computers typically come with a hard disk that contains several billion bytes (gigabytes) of storage. The popular ones currently 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. The other type of hardware cache inside computer is cache memory. A (CD) is a small medium that can store data

pertaining to audio, video, text, and other information in digital form. Initially, CDs were read-only, but newer technology allows users to record as well. (Compact Disc, read-only memory) can store computer data in the form of text, graphics and sound. To record data into a CD, you need a . Normally this type of CD is either (CD-R) or (CD-RW). For the latter you can use the CD as a floppy disk write, erase and again write data into the same disk.

3.3.3 Input Device

In the Input Device, the keyboard is the primary text input device for your computer. It was very popular when DOS was the popular operating system. After the emergence of Windows, its role became limited to dealing with text and for some commands only. The keyboard contains certain standard function keys, such as the escape key, tab, cursor and escape key, tab, cursor. A mouse is also a primary input device but it is not suitable for dealing with text. A mouse is a small device that you 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. A cable connects the mouse to the computer. A digital camera records and stores photographic images in digital form that can be fed to a computer as the impressions are recorded or stored in the camera for later loading into computer.

3.3.4 Output Device

These are the several output device for the project. The printer is a device, which on receiving the signal from computer transfers the information to paper. Earlier the printer was a popular low-cost personal computer printer; now printers have taken its place. Dot-matrix printer strikes the paper a line at a time while inkjet

sprays ink and laser printer uses a laser beam to attract ink .The monitor is a device for display. It is just like a television set and is measured diagonally from two opposing corners of the picture tube. The standard monitor size is 14 inches. Very large monitors can measure 21inches diagonal or greater. An amplifier is an electronic device that increases the power of a signal. Amplifiers are used in audio equipments. They are also called power amplifiers. Speakers with built-in amplifiers have become an integral part of the computers today and are important for any multimedia project.

3.3.5 Communication Device

These are the communication device. A modem modulates digital signals going out from a computer or other digital device to analog signals for a telephone line and demodulates the analog signal to convert it to a digital signal to be inputted in a computer. Most new personal computers come with 56 Kbps modems. Modems help your computer to connect to a network.

CHAPTER 4

RESULTS AND DISCUSSION

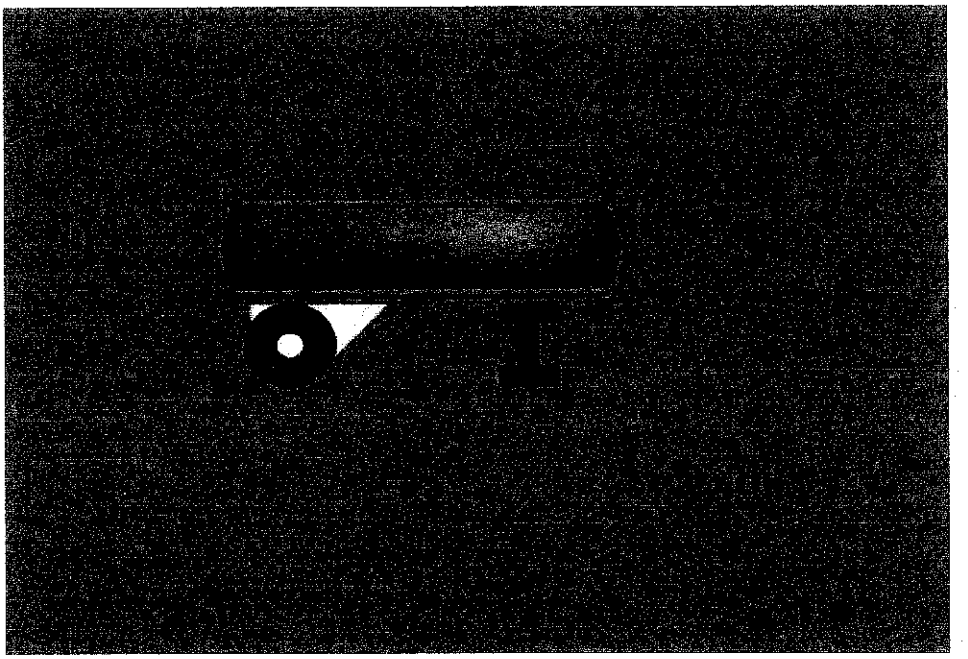
4.1 FINDINGS AND RESULT

Overall, the objective and problem statement has been achieve. The objective is to develop the 3 dimensions virtual fuel tanker to help user to view fuel condition in tanker directly from driver seat (truck) and also to show how the movement of truck influences the movement of fuel in tank behind.

4.1.1 PROCDUCT

For first objectives, the product had been built in 3 Dimension visualization. The entire picture is the static object. This object created using the 3D Studio Max. In the software, user can view the object from 4 point of view. There are from the top, left, front and perspective. All the view help developer and user to see what the tanker looks like when viewing from these four angles.

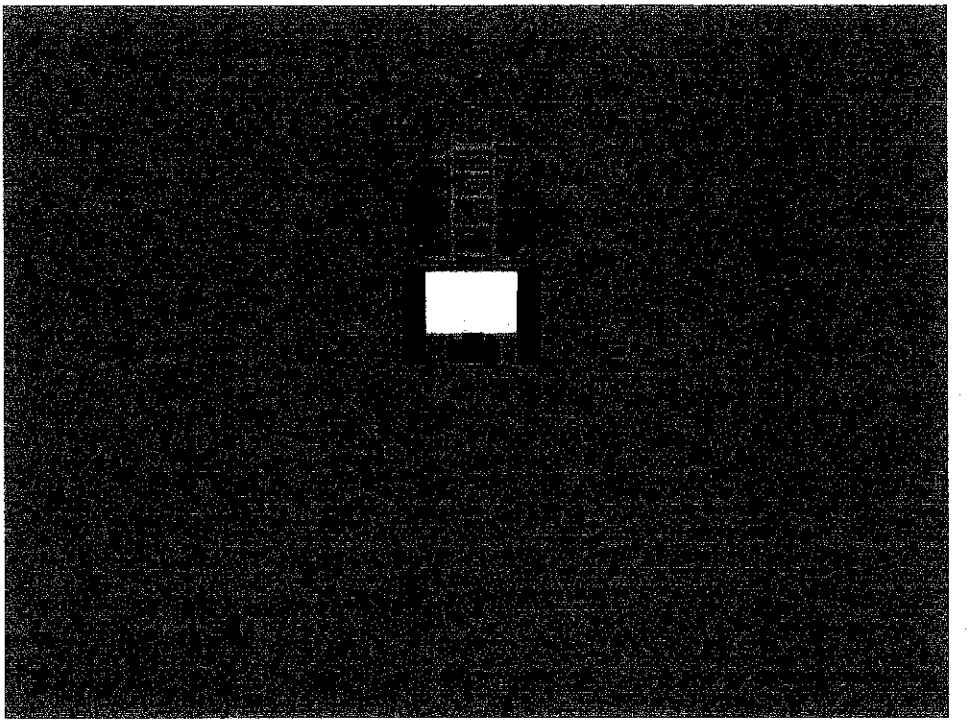
Front View



This is the view from front of the objects in the application software. It help developer and also user to get the overview when the tanker viewing from the front. The tanker only shows the solid tanker with pipe around it. Then there are the tires and the metal as the tanker is not with the truck head. Below is what user will see exactly from the front point of view. The texture is in rust form to show the similarity with the real tanker.

Left View

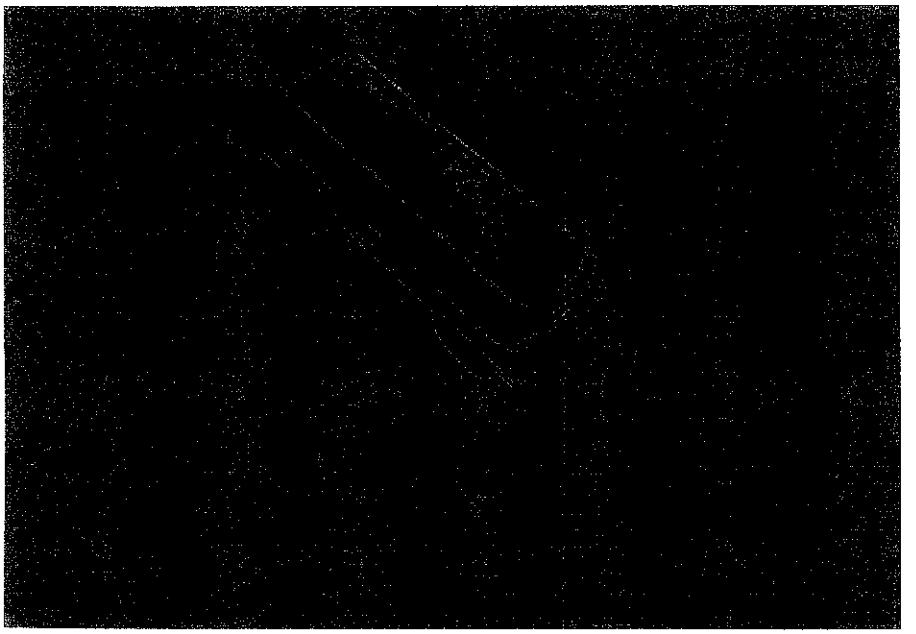
This is view from the left in the application software. User can see the back of the tanker, the pipe and also the tanker stair. The picture below the application software is the view in the user point of view without application software. The pipe is object from cylinder symmetry which has been blend. So that it is easily can be bent around the tanker and become similar to pipe in the real tanker point of view.



Top View

This is the view from the top of the tanker from the application software. Developer and user can view what exactly could be seen when viewing from the top of the tanker. This is where user can go in the tanker and come out from the bottom of the tanker. Below is the view from the viewing without application software. This is the user view page.

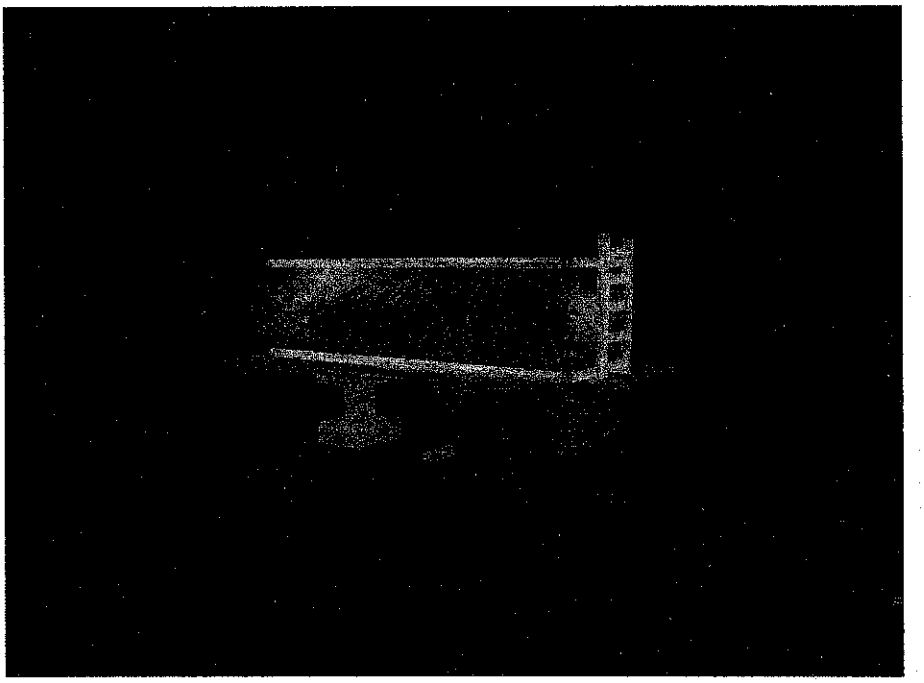
Perspective View

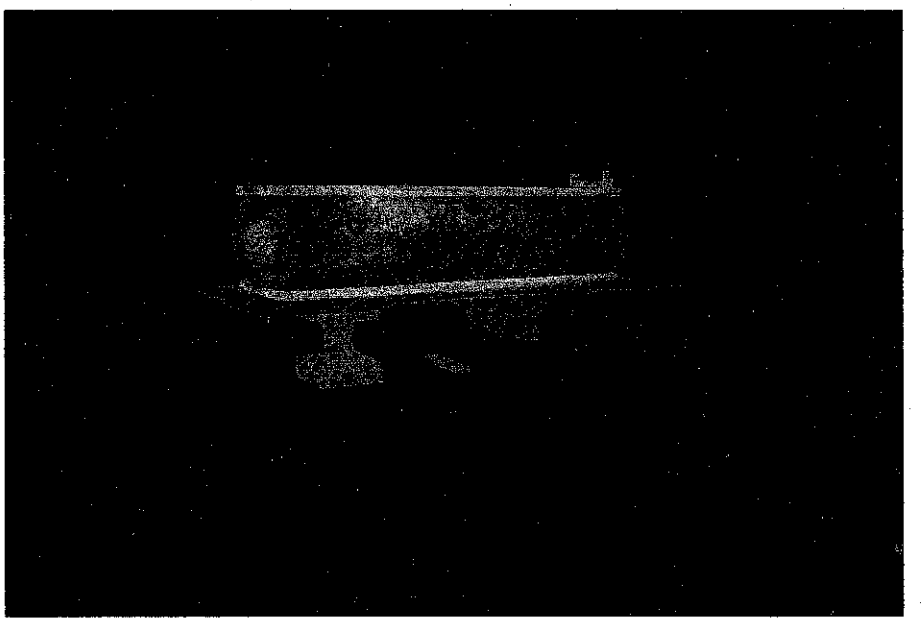


This is view from the perspective point in the application software. It is like the combination of left point of view and top point of view. It is show what is picture or image when the tanker be view from the left and top at the same time in the same page. Below is the view from the same angel but in the picture without the application software.

Solid 3D Tanker

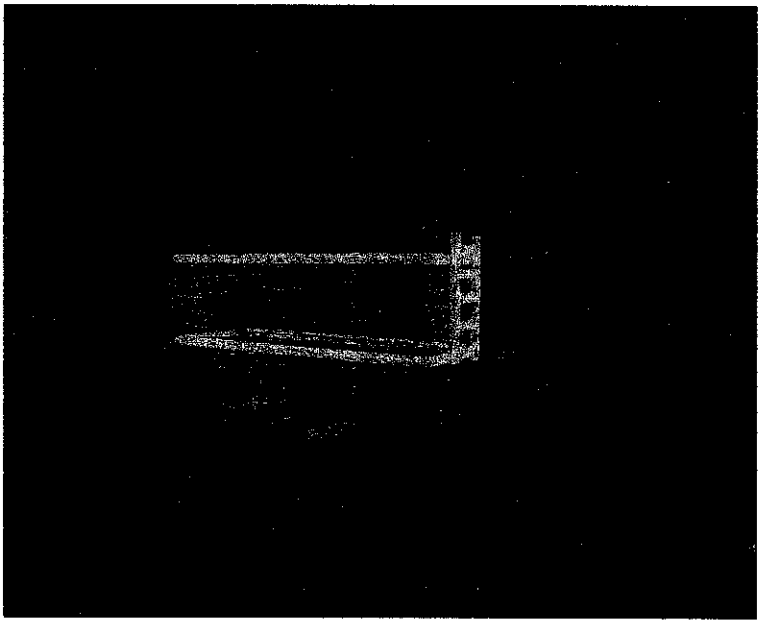
The image below show the running application of the Virtual Tank method for Tanker Truck project. It is the image from the user platform point of view. Here, user can view solid 3D tanker from every angle they like. This is because the graphic of the tanker in 3 dimension can turning around by control the keyboard on 'r'. When users control the 'r' at the keyboard, user can look at any angle they desire to see. Below are several

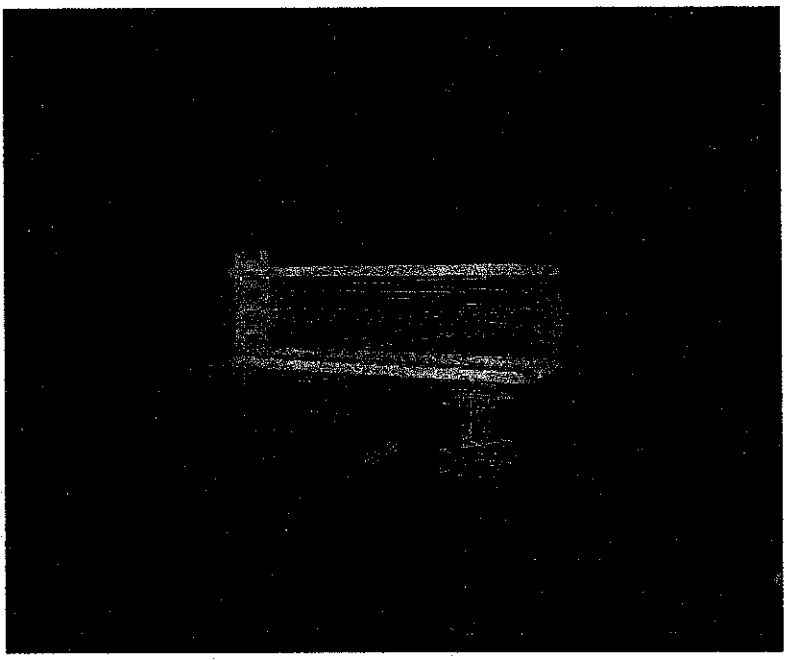


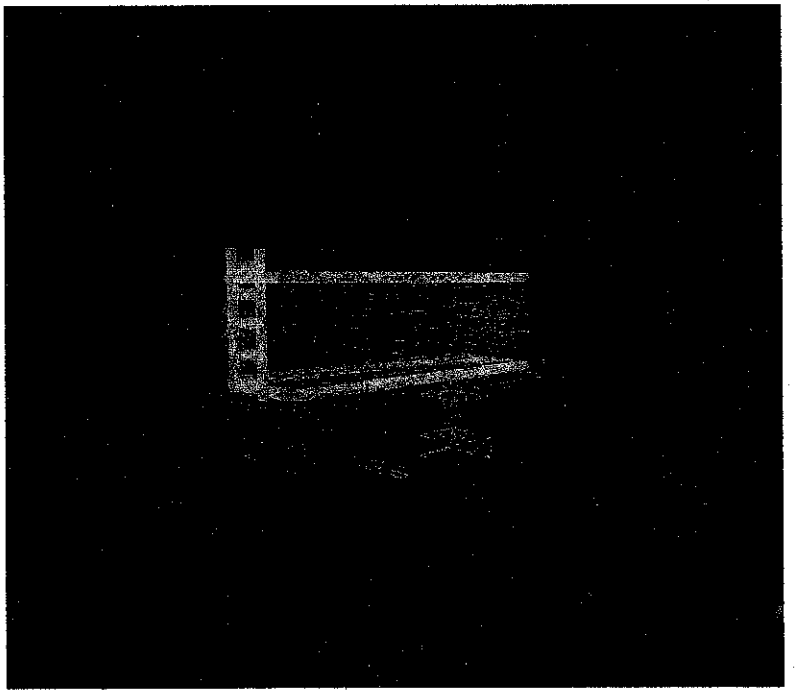


Transparent 3D Tanker

These pictures is in the second part of the project; transparent tanker with the fuel view in the tanker. It is also can be view from various angles. Now user can see the level of fuel in the tanker as the tanker is transparent. The movement of the fuel also can be view from the tanker. The movement of the fuel is concurrently with the movement of the truck. Hit the 'f1' key at the keyboard to make the object of the tanker transparent and hit the 'f2' key to transform it back to the solid 3D tanker. The transparent tanker object also can be view from every angle as user desire as the solid 3D tanker just now. The procedure is same. Hit the 'r' key to turn around the tanker objects. The different between 3D solid tanker and transparent 3D tanker is transparent 3D tanker show the level and movement of fuel. The solid 3D tanker is just to show the 3 dimension object. The level of fuel is shown with the black mix with blue in color.

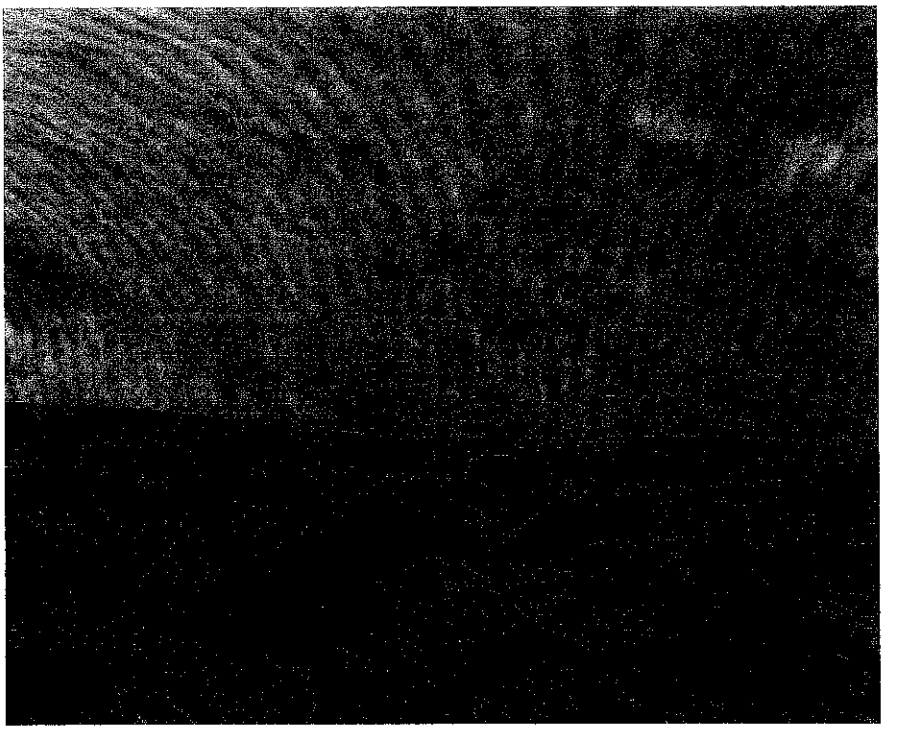






Inside Tanker and Get Outside From Below

This part is walkthrough the tanker to see the level of fuel and the movement of the fuel. At this stage user can walkthrough from top of tanker, jump into the fuel and come out from the bottom. This is view in the tank while the fuel moves concurrently with the movement of the trucks. The technique to get the movement of fuel concurrently with the truck movement is quite simple. It's doesn't need any complicated data to be stored in any database. What is needed is variable. Here, variable change in the coding of the project. For the project, C++ and Open GL is used as the back coding for every movement. There are sources file and header file. Sources file is set in C++ language. The sources files create for make or call the function. It is in the C++ because it has more functions. Here the changing of variable can be use to replace the momentum part in the project. So, no need any database as the movement and the level of fuel can be handling by changing the variable in the source files. The declaration of function and variable has been done in the header files. The header files come in Open GL language. The header files is using for declare the function. All coding and variable declaration is declared here. For header files, any language can be use to create the coding but the file must be save in .h format. Here, open GL used because there are one files name glut.h that only in the open GL languages. Glut.h is like the big libraries and script for graphic. It has all the movement function such as rotates, scale and so on. So, picture or image below show the walkthrough function applies for the tanker. User can get into the tanker and view the fuel from the very near view. User can go into the tanker by controlling the up, down, left and right error at the keyboard.



4.1.2 SOFTWARE and LANGUAGE

For software, 3D Studio Max is the chosen software for the project. It could design the fully integrated 3D graphics creation suite which allows modeling, animation, rendering, post-production, real-time interactive 3D and game creation and playback with cross-platform compatibility. It lets users create and replay real-time, interactive 3D content. 3D Studio Max suits as it is a general purpose programming language that can integrate visualization, programming and computation in one environment.

For language, OpenGL is a powerful software interface for graphics hardware that allows producing high-quality color images of 3D objects. The functions in the OpenGL library enable to build geometric models, view models interactively in 3D space, control color and lighting, manipulate images, and perform such tasks as alpha blending, antialiasing, depth cueing, and texture mapping. OpenGL supported and best documented 2D/3D graphics making it inexpensive & easy to obtain information on implementing OpenGL in hardware and software. C++ is a general purpose programming language with a bias towards systems programming that is a better C, supports data abstraction, supports object-oriented programming and supports generic programming. The C++ language is in a middle term, since it can interact directly with the hardware almost without any limitation, as well as with the support of suitable specific libraries, works like one of the more powerful high-level languages. User can practically compile the same C++ code in almost any type of computer and operating system without hardly making changes. C++ is one of the most used and ported to different platforms programming language. Code written in C++ is very short in comparison with other languages, since the use of special characters is preferred before key words, saving effort (and prolonging the life of our keyboards).

4.2 DISCUSSIONS

From all the researches, there are several things that can be discussed. There are discussion on objectives and also problem statements

4.2.1 OBJECTIVES

There are two main objectives for the Virtual Tank Method for Tanker Truck project. Here, after finding and doing some researches, it is show that the objective of the project is achieved.

- To develop the 3 dimensions virtual fuel tanker to help user to view fuel condition in tanker directly from driver seat (truck).
    - The 3 dimension virtual fuel tanker has successfully developed and user can view the tanker from the driver seat . It is by integrating with the virtual dashboard as can see in the *Figure 4.* For achieving this objective there are several software use such as 3D Studio Max, Open GL and C++ as the language and also the Visual Basic as the platform of the dashboard. Methodology used is as describe in the chapter 3 before.

- To show how the movement of truck influences the movement of fuel in tank behind.
    - This objective also achieved as the movement of fuel now is concurrent with the movement of the truck. All can be seen in the product above. To make it concurrent with both of the movement, the coding part is the strong part in the project. There is no need any database. It is just changing at the variable in the coding, the movement can be created.

4.2.2 PROBLEM STATEMENT

For this project, there are three problem statement has to be solve. There are;

- to figure out new technique to view tanker and fuel level and also the movement directly from the seat.
    - The techniques or more specifically how to view tanker and fuel level and movement directly from the seat. The software used for created or build the tanker is 3D Studio Max. This is because; it is the good software that can do many applications such as animation and motion. How to view from the front seat? It is by integrating with the virtual dashboard as can see in the *Figure 3.1.* It is also allow user view the fuel level and also its movement.

- to research what 3-D can do to help the people around the world.
    - Overall, we can see that most of the application in the internet prefer to use 3D object as it is beautiful and look like real-life. In the film industry also they like to use 3d animation or object in several films like Shrek, Antz and Bug's Life. Here it is show that the applications of 3D help a lot in the world. Take the tanker for example. Now driver of the truck can view tanker and movement of fuel and its level from in front at the seat. So that the driver will always know about the condition of the fuel behind. It is helping the truck driver a lots.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

As conclusion, the project and the report has meet it objectives and it problem statements. From all the findings, the objectives of the report have been reaches and the objectives is relevancy. It is said that because in the researches itself help lots of the thing. The product also had been [produce according to the objectives and problem statement. The project could help user in virtualizes the fuel in the tanker without any difficulty to go or jump into the real one. Thus, it could help the user especially the driver of the truck to know what actually happen to the fuel in the tanker when the truck moves. Many theory and methodology had been researches to find the best method and techniques to build a sophisticated 3D object without having much trouble. Moreover, it is like a game. Furthermore, it is help the truck driver notice the condition of the fuel in the tanker whether it is overflow or something happen at back of the truck. User can experience the usage of the 3D themselves.

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 user friendly that suits for either novice user or other normal user. This makes driving more efficient, as small uncertainties can be noticed and fixed immediately.

The project only can show certain movement happen when truck move. So, it is recommended that for future enhancements, some method could be added. By using more complicated approach the project could be upgraded to be more beautiful, virtual, modern, technology and has more function and so on. As 3D visualization is one of the popular technology usages now a day, there is much software that available to be used.

So, student should know about the software such as trueSpace, Infini-D and so on. It is also recommend that the system or project could be implementing in real life. Not as a virtual anymore.

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APENDIX 1

Flow of Architecture

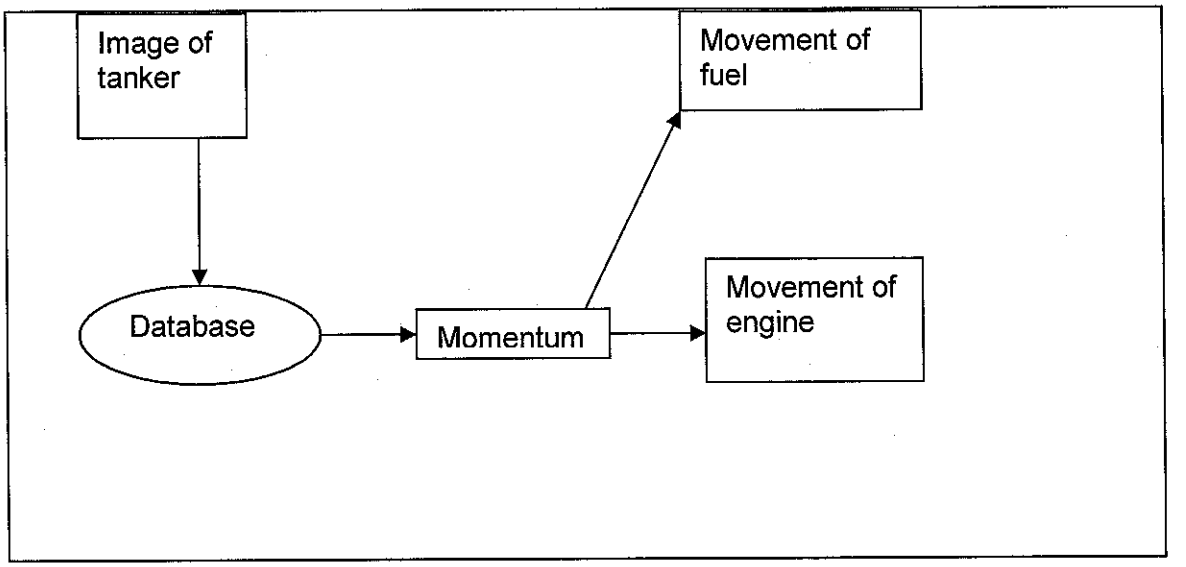


Figure 2.1.1 Flow of Architecture

APPENDIX 2

Layout of Oil Tanker

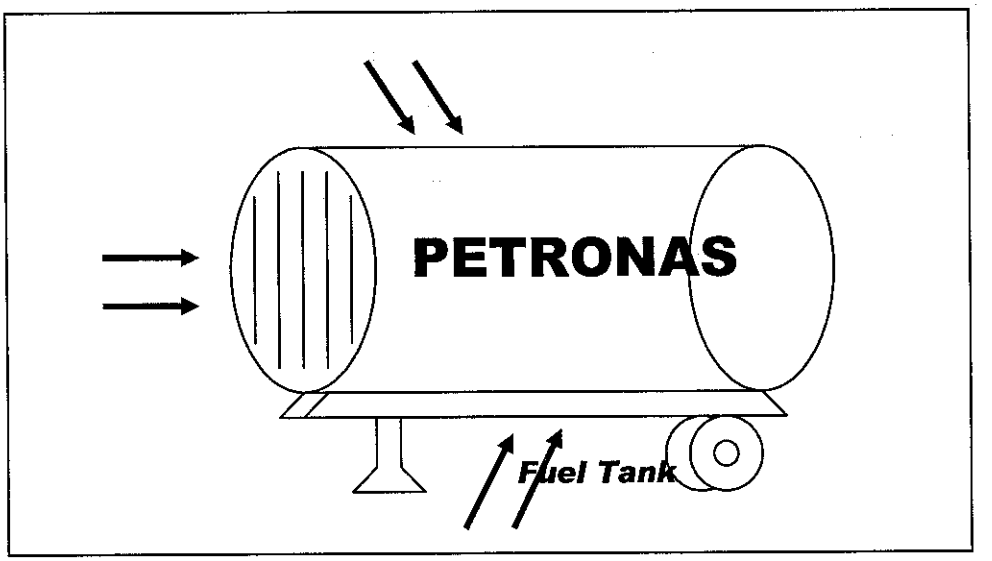


Figure 3.2.1 3-D Tanker

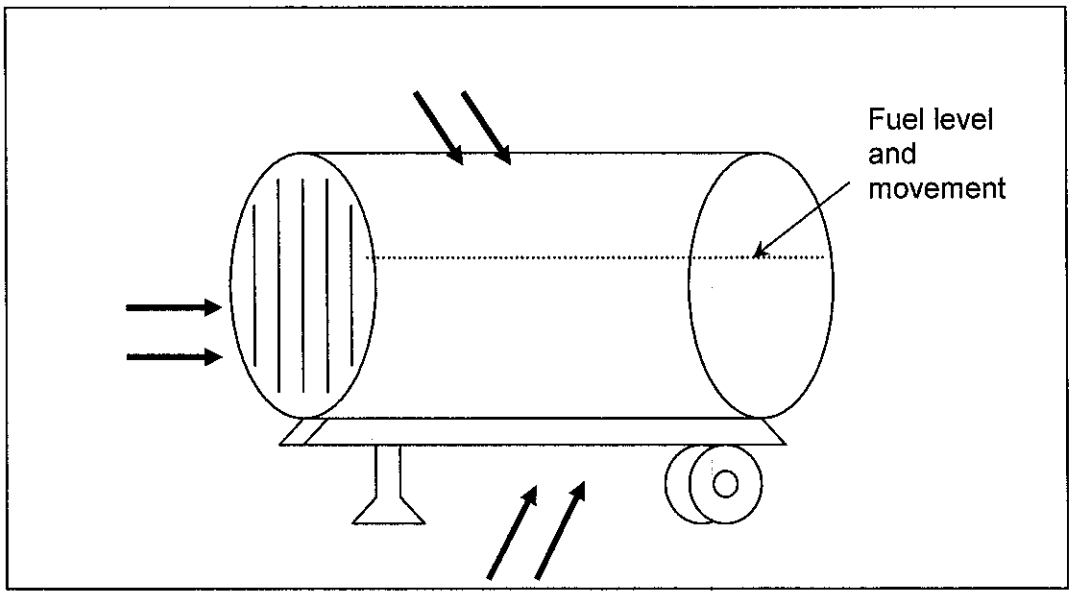


Figure 3.2.2 Transparent 3 Dimensions

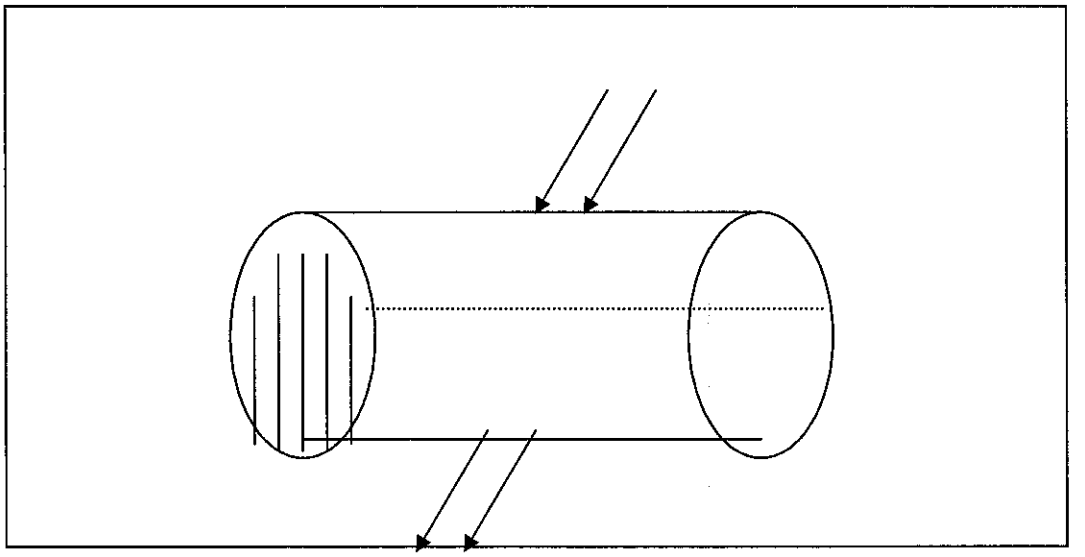
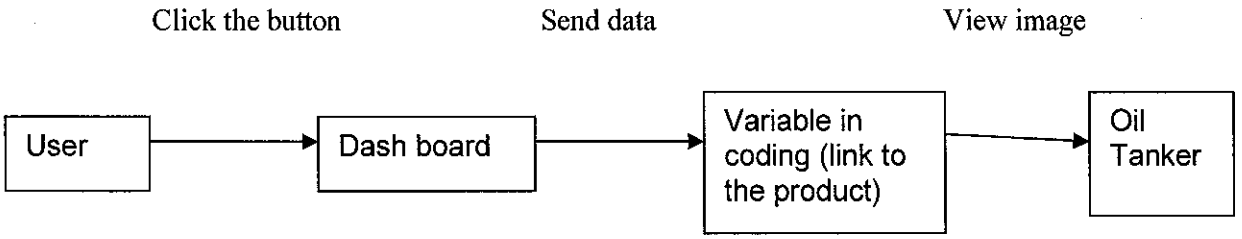


Figure 3.2.3 Inside Tanker and Get Outside From Below

Object Relationship AFTER researches



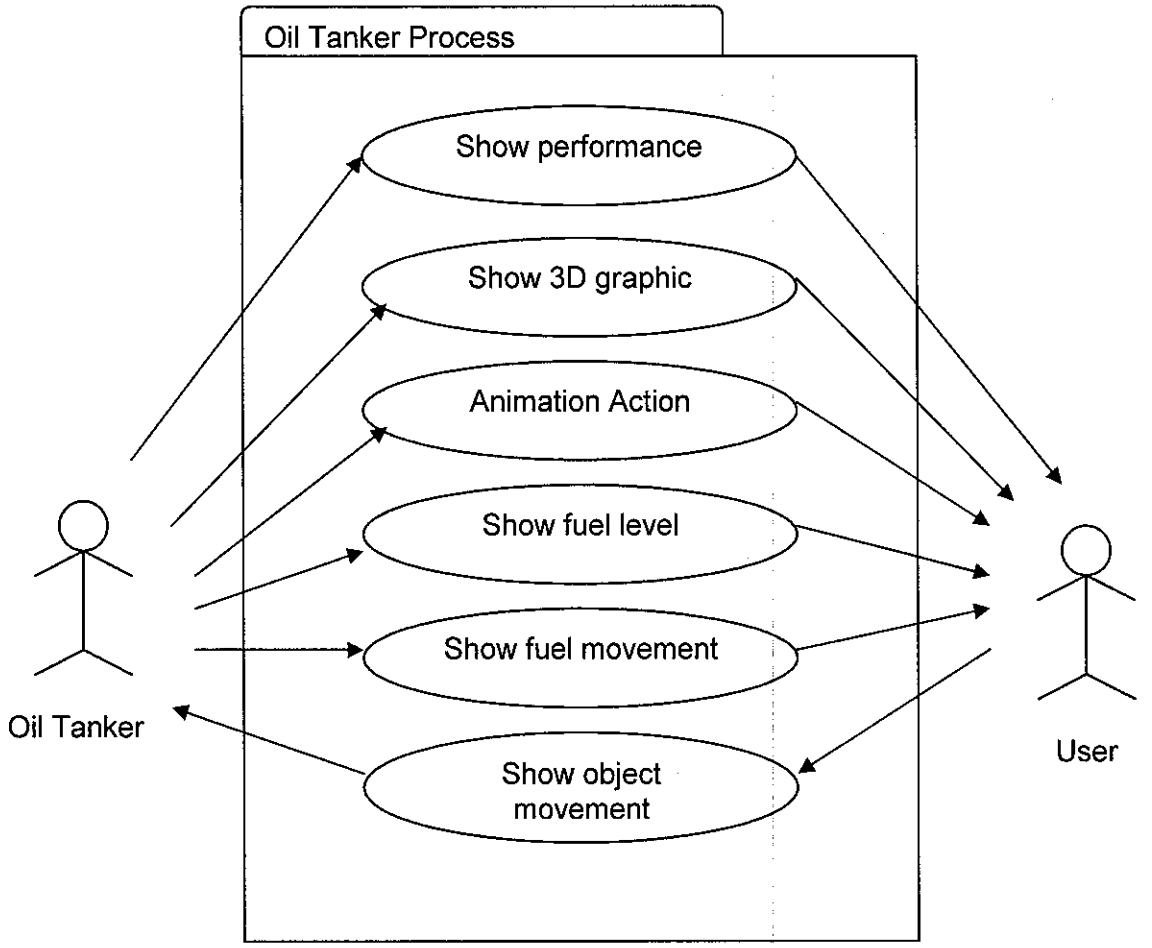


Figure 3.2.6 Use Case Diagram

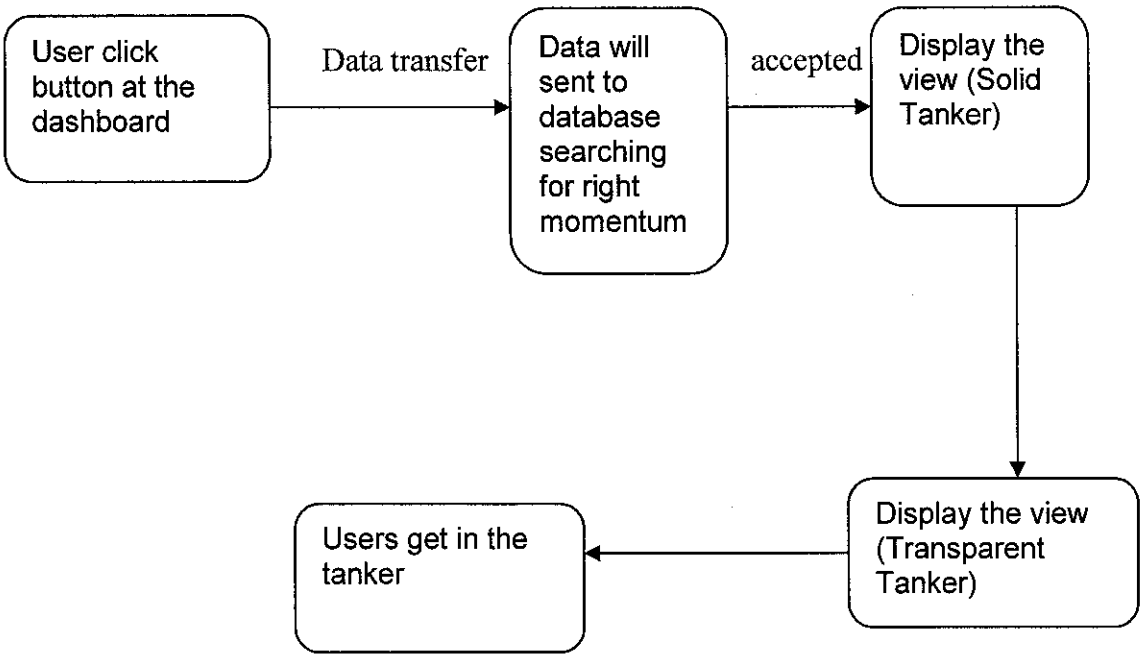


Figure 3.2.8 Activity Diagram

APPENDIX 3

Whole Product Layout

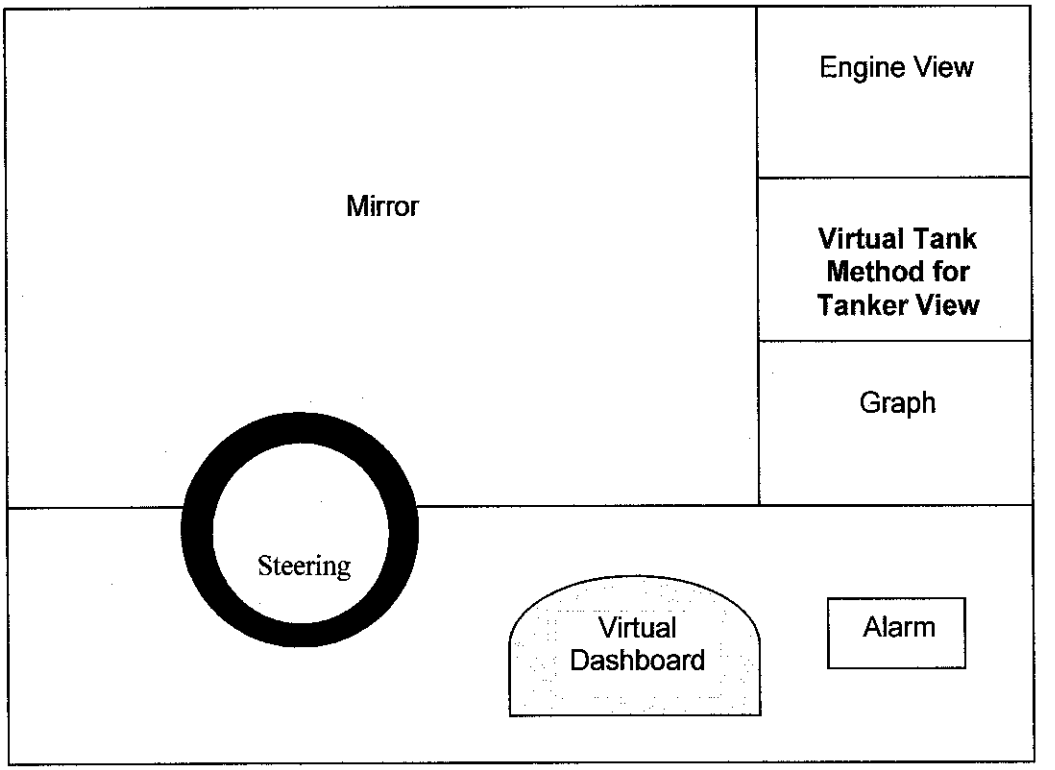


Figure 3.2.4 Whole Product Layout

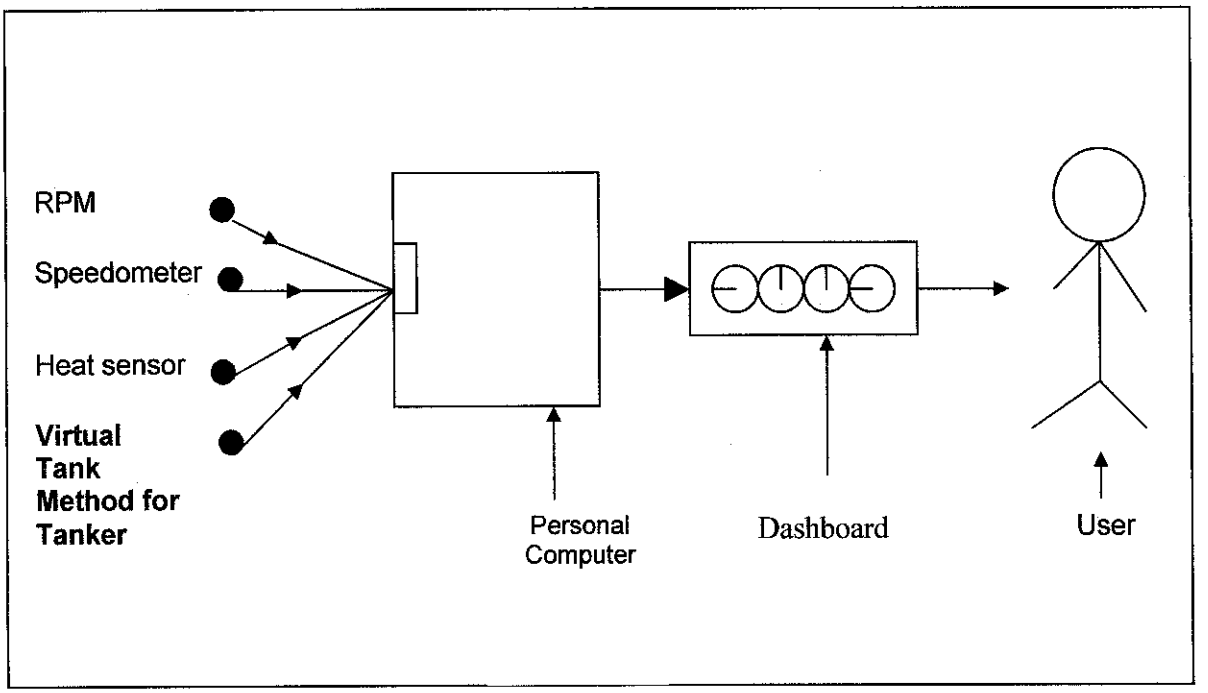


Figure 3.2.9 Flow Diagram On How The Virtual Truck Work.

APPENDIX 4

Diagrams

Object Relationship BEFORE researches

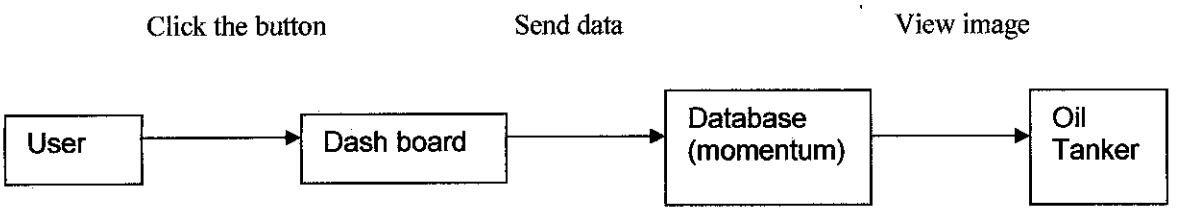


Figure 3.2.5 Object Diagram

APPENDIX 5

Flow Diagram of Real-Time Data Logging

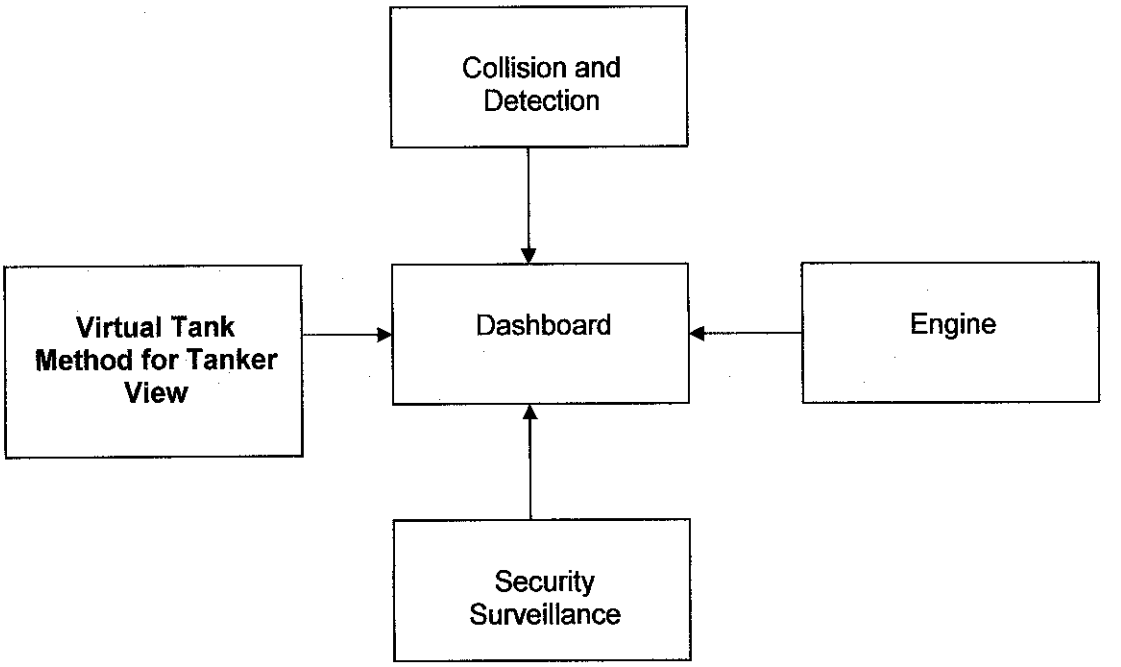


Figure 3.2.7 Flow Diagram of Real-Time Data Logging for Virtual Truck

APPENDIX 6

Virtual Dashboard

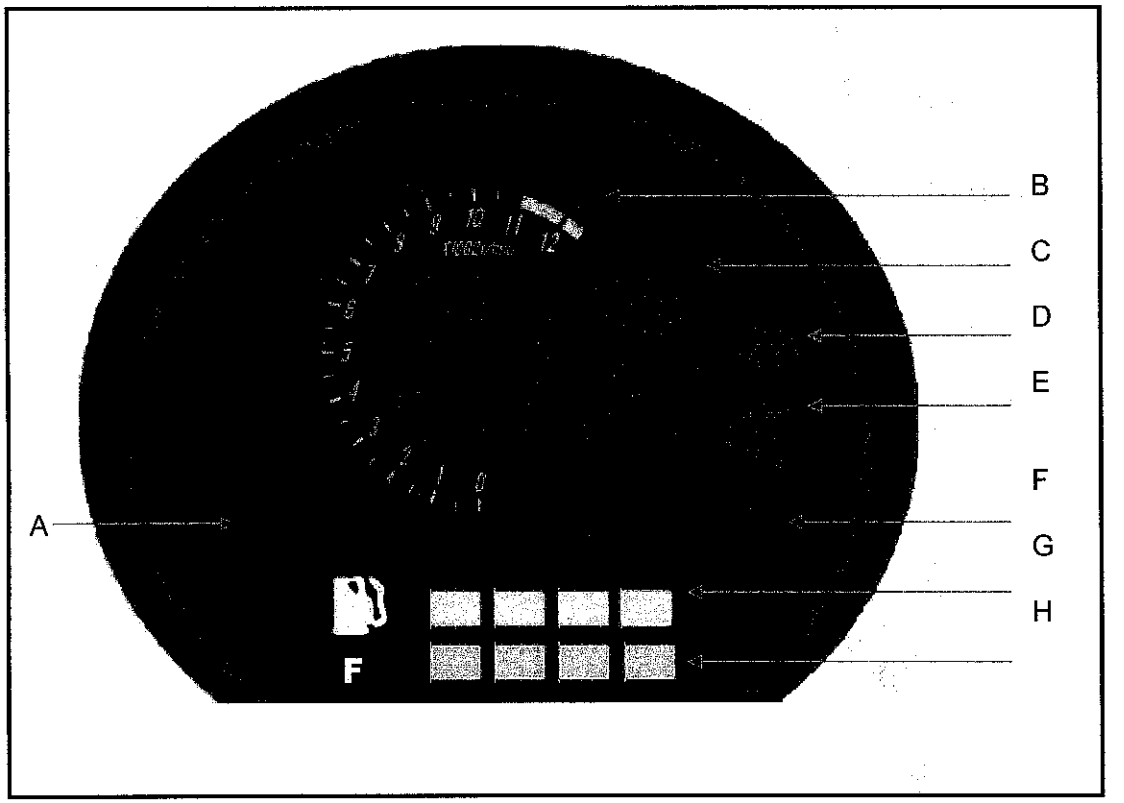


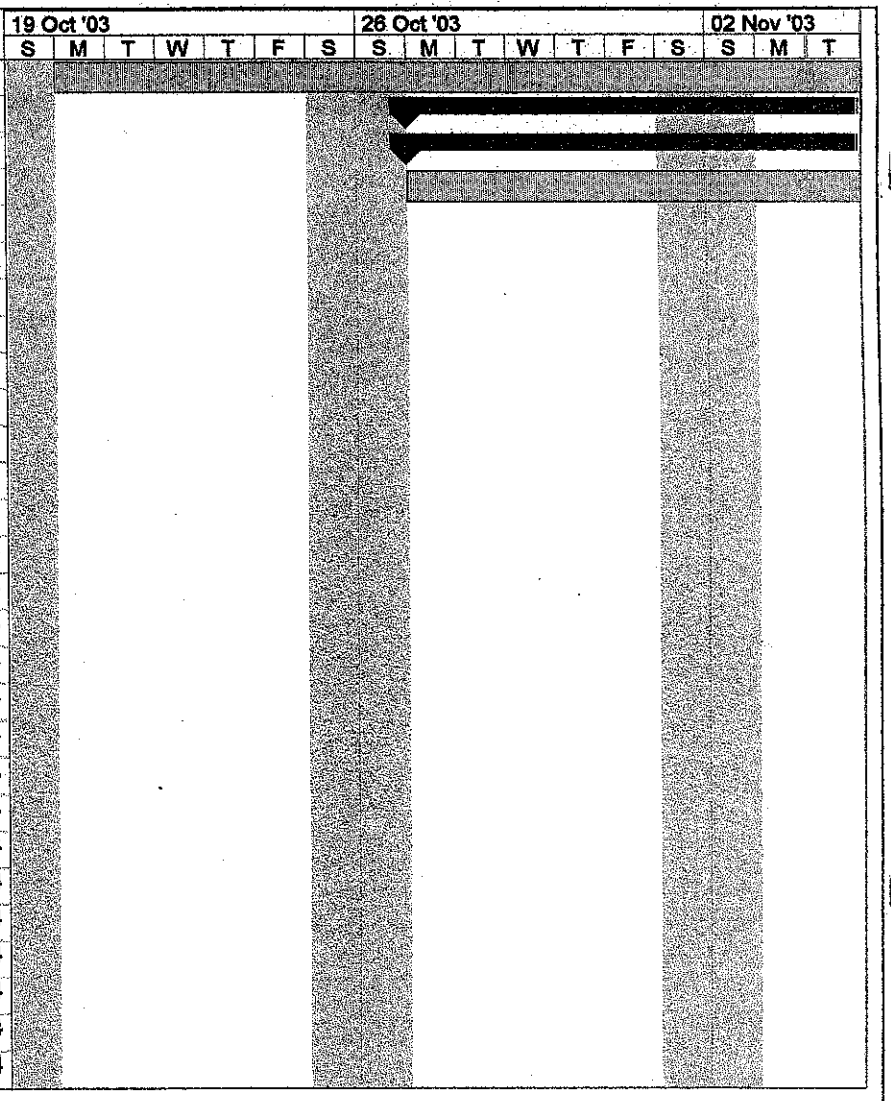
Figure 4 Virtual Dashboard

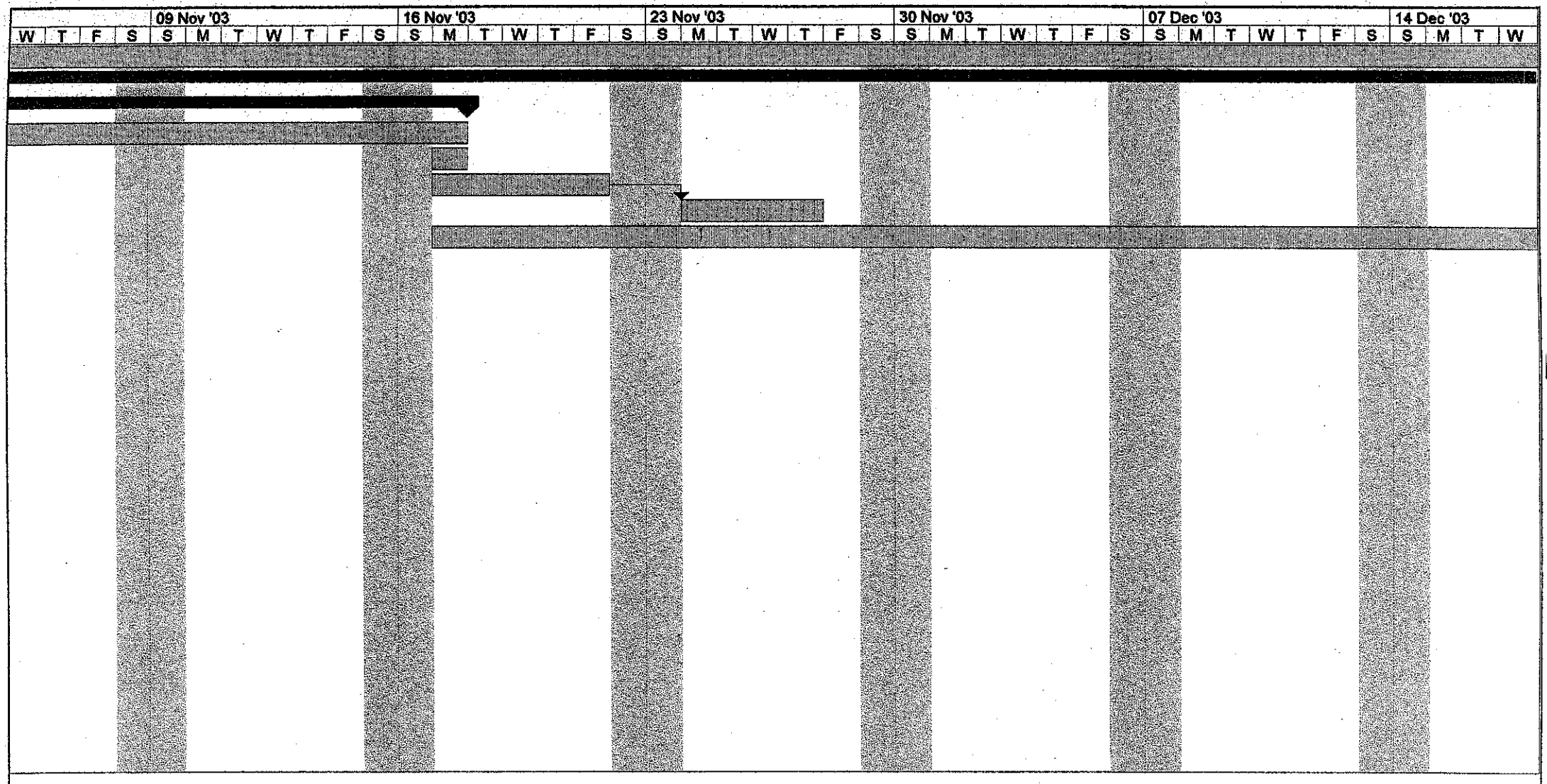
Label	Equipment	Function
A	Off Button	To off the dashboard application
B	RPM	Show the increment of the speedometer one mile
C	Speedometer	Display the speed of the truck
D	Graph Window Button	Illustrate the performance's graph
E	View Engine Button	View the condition of the engine
F	View Fuel Tank Button	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 7

Gantt Chart

ID	Task Name	Duration	Start	Finish
1	**VIRTUAL TANK METHOD FOR TANKER TRUCK**	165 days	Mon 20/10/03	Fri 04/06/04
2	**PLANNING**	100 days	Mon 27/10/03	Fri 12/03/04
3	Project Title Selection	16 days	Mon 27/10/03	Mon 17/11/03
4	Propose Topic	16 days	Mon 27/10/03	Mon 17/11/03
5	Topic Approval	1 day	Mon 17/11/03	Mon 17/11/03
6	Define problem statement	5 days	Mon 17/11/03	Fri 21/11/03
7	Objective and scope identification	4 days	Mon 24/11/03	Thu 27/11/03
8	Information Gathering	85 days	Mon 17/11/03	Fri 12/03/04
9	**Preliminary Report Submission**	5 days	Mon 19/01/04	Fri 23/01/04
10	**Log Book Submission**	70 days	Mon 19/01/04	Fri 23/04/04
11	**Development**	23 days	Mon 01/03/04	Wed 31/03/04
12	Design Workflow and Protocols	5 days	Mon 01/03/04	Fri 05/03/04
13	Develop an Application	10 days	Mon 08/03/04	Fri 19/03/04
14	Design Database	5 days	Mon 15/03/04	Fri 19/03/04
15	Integrate Application with Database	8 days	Mon 22/03/04	Wed 31/03/04
16	**Progress Report Submission**	40 days	Mon 02/02/04	Fri 26/03/04
17	**Testing**	27 days	Mon 01/03/04	Tue 06/04/04
18	Minor testing	23 days	Mon 01/03/04	Wed 31/03/04
19	Major Testing	4 days	Thu 01/04/04	Tue 06/04/04
20	**Result Analysis**	41 days	Tue 10/02/04	Tue 06/04/04
21	Analyze Questionnaires	9 days	Tue 10/02/04	Fri 20/02/04
22	Analyze Development Tasks	23 days	Mon 01/03/04	Wed 31/03/04
23	Analyze Testing Tasks	27 days	Mon 01/03/04	Tue 06/04/04
24	**Final Draft Submission**	4 days	Mon 12/04/04	Thu 15/04/04
25	**IT/IS Exhibition**	1 day	Wed 21/04/04	Wed 21/04/04
26	**EDX Exhibition**	1 day	Thu 29/04/04	Thu 29/04/04
27	**Oral Presentation**	3 days	Wed 05/05/04	Fri 07/05/04
28	**Project Dissertion Submission**	23 days	Wed 05/05/04	Fri 04/06/04

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16 Nov '03
23 Nov '03
30 Nov '03
07 Dec '03
14 Dec '03
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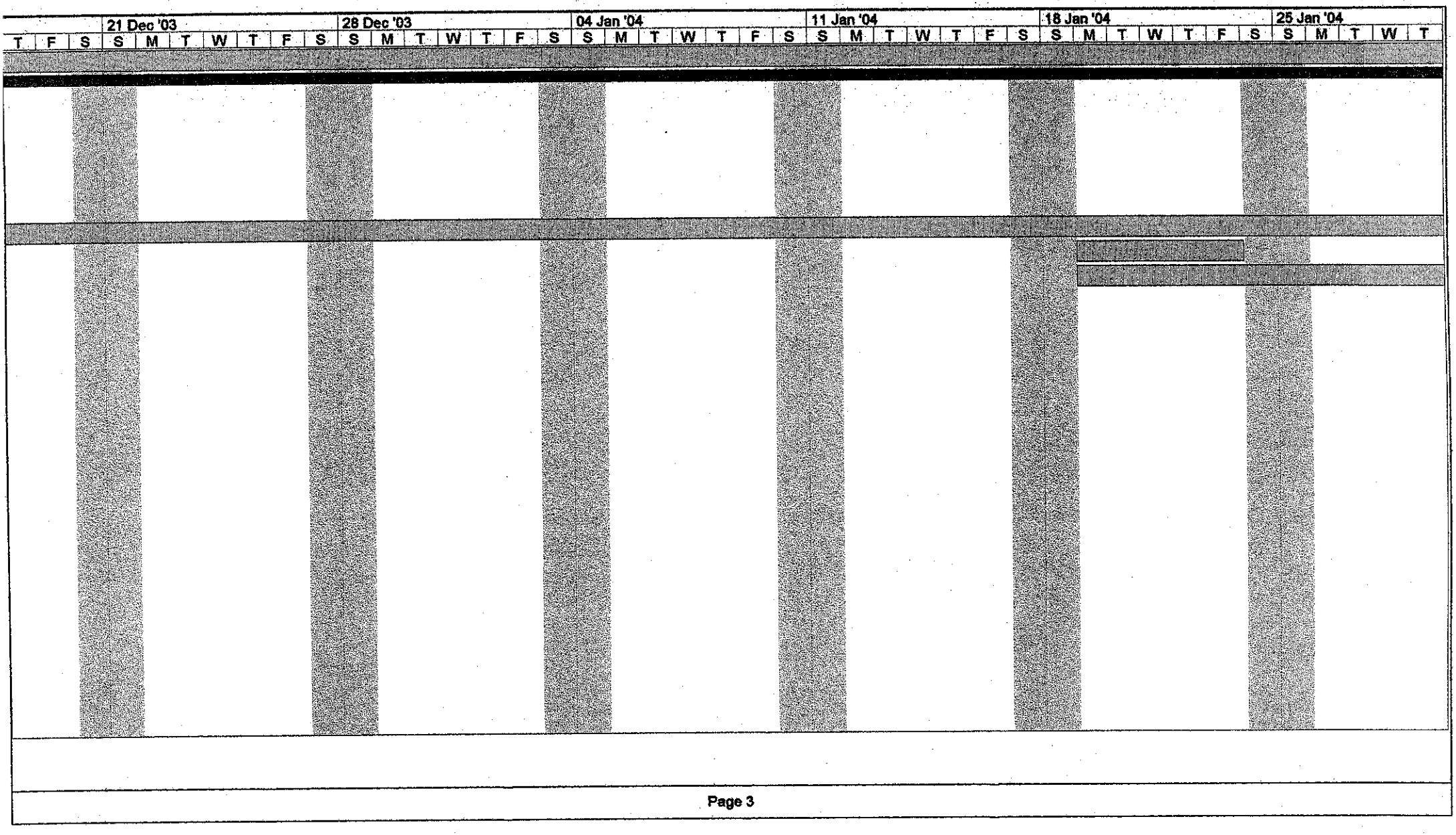
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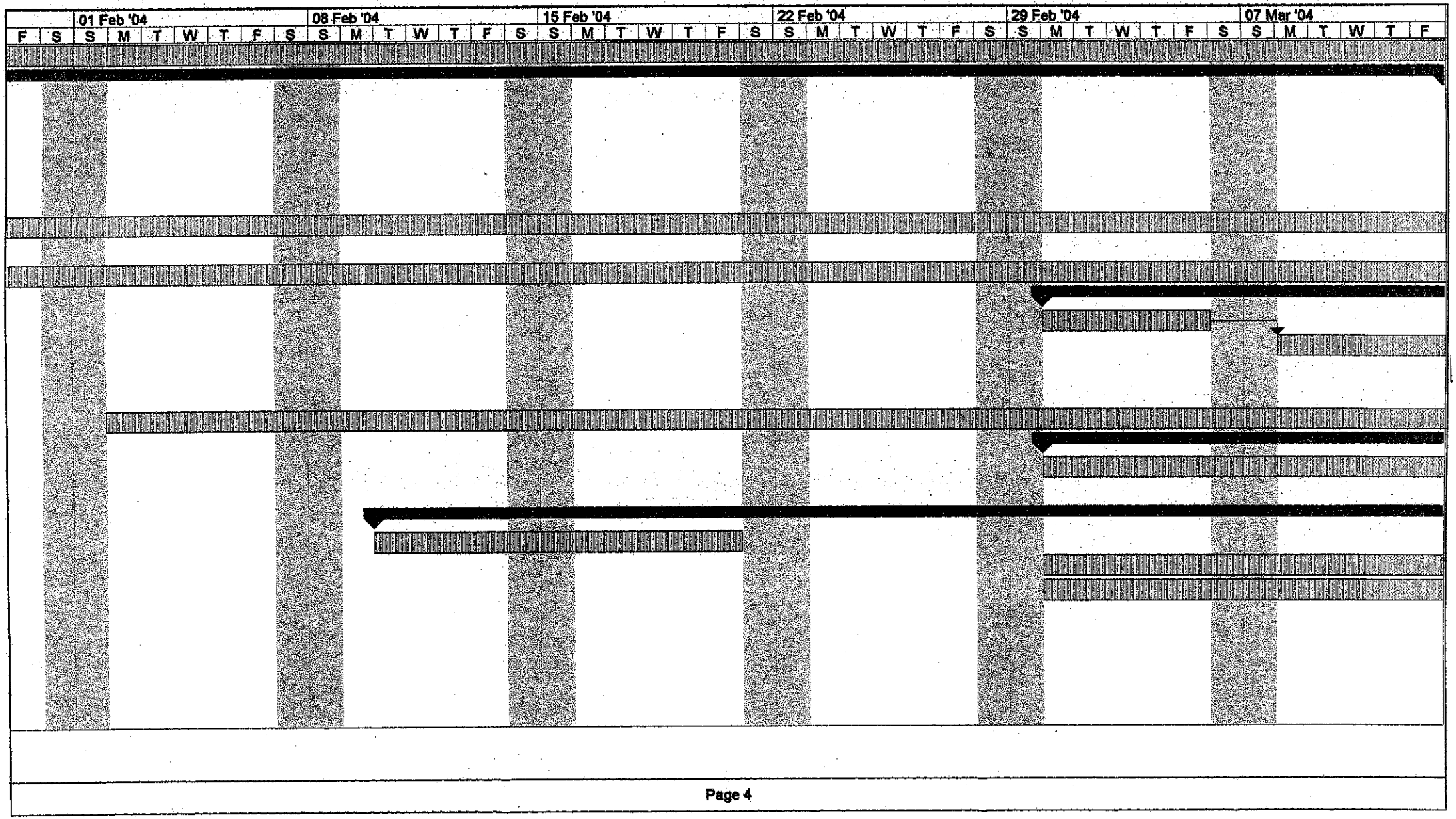
28 Dec '03
04 Jan '04
11 Jan '04
18 Jan '04
25 Jan '04
T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T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22 Feb '04
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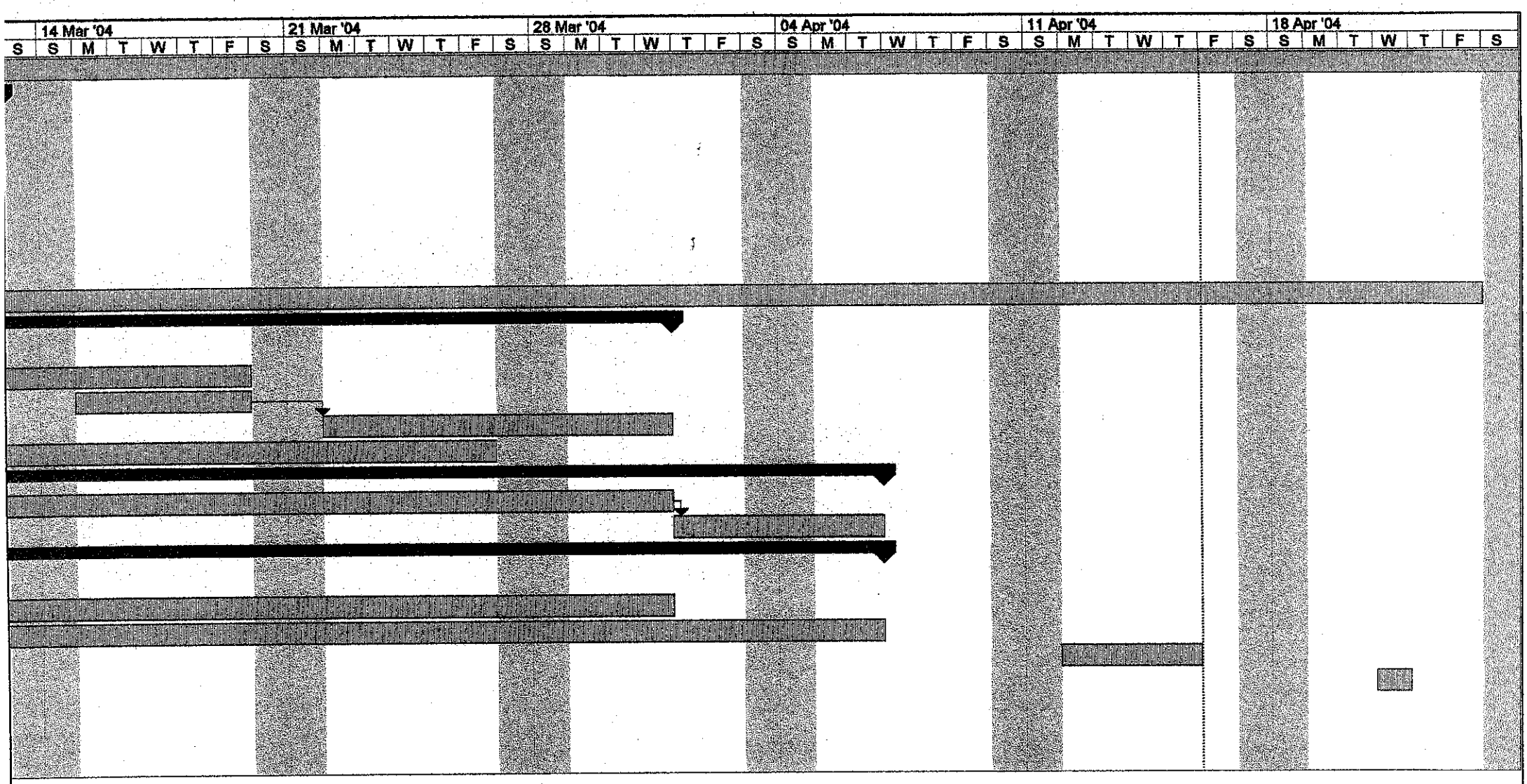
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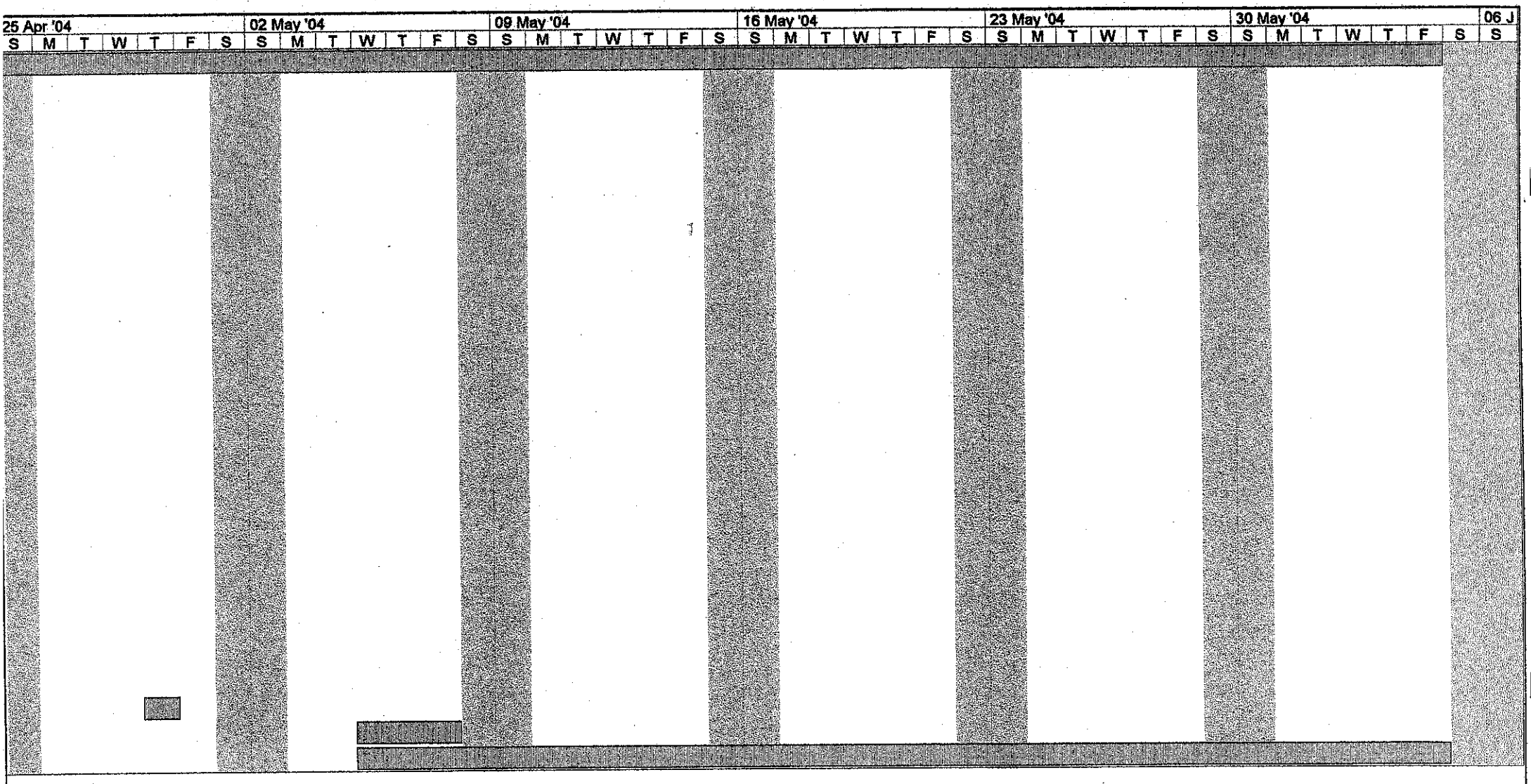
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23 May '04
30 May '04
06 J
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