

**Virtual Helicopter Landing Platform  
(V-HELP)**

by

Maria Binti Mustapa

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

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**CERTIFICATION OF APPROVAL**

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A project dissertation submitted to the  
Information Technology Programme  
Universiti Teknologi PETRONAS  
in partial fulfillment of the requirement for the  
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(INFORMATION SYSTEM)

Approved By,




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DECEMBER 2004

## CERTIFICATION OF ORIGINALITY

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



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(Maria Mustapa)

## ABSTRACT

The research project focused on how virtual reality (VR) could create a non-immersive environment and improve in increasing safety awareness at offshore platform. The main problem is the typical training talk usually use video and audio presentation which cannot provide the walkthrough movement. The aim of this project is to develop and design Virtual Helicopter Landing Platform (V-HELP) application which allows users to explore the virtual platform environment. The objectives of this project are to design and develop helicopter landing platform; to visualize movement and facilitate understanding in VR; and at the same time identify components and characteristics of the virtual environment for adequate realism. In completion the project, the framework used is based on part of the waterfall modeling theory. The phases involved in the framework used for project development is the analysis phase, design and development phase, integration and testing phase and lastly evaluation phase. Developments tools have been used in the project are 3D Maya 5..0.1 and Macromedia Flash MX software. As a result from the evaluation conducted, shows that most of the evaluators are satisfied with the project. They think that the realism of the prototype can be improved in virtual environment through enhancement on chosen the suitable textures materials and enable user control during walkthrough. As a conclusion, the research project show that Virtual Environment are very useful and more effective for the offshore safety training compared to the conventional method.

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## **CHAPTER 1**

### **INTRODUCTION**

Virtual Reality (VR) has received an enormous amount of publicity over the past few years. Potentials of VR applications have been realized in many disciplines. VR with its increasing dynamic, interactive and experiential characteristics becomes able to simulate real environments with various degrees of realism.

VR is a technology that began in military and university laboratories more than 20 years ago, also called as Artificial Reality, Cyberspace, or Synthetic Reality. VR is a computer-created sensory experience that allows a participant to believe and barely distinguish a "virtual" experience from a real one. VR uses computer graphics, sounds, and images to reproduce electronic versions of real-life situations.

VR is now a new medium used for visualization. It is used in military training, scientific studies, industrial designs, entertainment and many more. The rapid utilization of this technology reflects its effectiveness in the field which it has been applied to.

Virtual Helicopter Landing Platform (V-HELP) shows virtually the procedure to take off personnel from land to the offshore platform. The focus of the study is to further utilize VR technology to instill the safety awareness to the offshore personnel and train them to quickly adapt to the new environment especially those who are the first timer. An expansion of VR technology is going to be incorporated to provide better visualization and presentation of the offshore platform infrastructure, specifically the helicopter platform. The helicopter platform will be the transit platform for the workers before they are transferred to the operation platform. Therefore, the workers must have an early view

about the landing platform because anything can be accidentally happen if the personnel did not take serious precaution regarding the safety matters.

Safety education through visualization provides greater significant benefits over other method. Computer software provides the flexibility to structure training program and even monitor and measure the progress of a training session. Personnel can experience and understand in the first-hand why certain procedures must be followed when being at the platform.

### **1.1 Background of Study**

Safety performance within the industry is one of the most important elements in terms of social sustainability. Nothing has a higher priority than safety. Safety is always the principal concern in every aspect of the offshore oil and gas industry's activities. There are many cases which show tragedy at the offshore. For example, the Piper Alpha tragedy in 1988 had claimed 167 lives. Thus, this reinforces the need for industry to take effective measures to eliminate and reduce risks. Every installation platforms has a Safety Case setting out how risks will be managed. The oil and gas industry always try to improve the sharing of safety information and good practice across the whole industry.

In Malaysia, there are many companies are involved in exploring for and producing oil such as PETRONAS, SHELL and British Petroleum (BP). Those oil and gas industry employs a number of people offshore and contract workers. The personnel work at remote place which depend on helicopter transportation. Their work is usually in continuous shifts of 12 hours on, 12 hours off for two weeks, followed by a two to three week rest period on shore. This is the reason why safety awareness should be deliver to the personnel especially to those contract workers who is often change and the higher level management that is rarely went to the offshore.

#### **1.1.1 Who is responsible for Helicopter platform safety?**

While the Health and Safety Executive (HSE) and the Civil Aviation Authority (CAA) are responsible for regulating safety, the actual achievement of safety is the responsibility of all of those on whom the law places a duty, including:

- helicopter operators
- flightcrews
- platform operators

Helicopter operators must satisfy CAA that they continue to meet the requirements for public transport of passengers. They therefore need to hold an Air Operator's Certificate (AOC). Helicopter operators have a duty under the Air Navigation Order (ANO) to permit flights only to suitable landing areas. They are also responsible for the safety briefing of passengers and for providing certain personal safety equipment aboard the aircraft.

Flightcrews are regulated by CAA in various aspects including licensing, training requirements, and flight and duty-time limitations.

Platforms operators are responsible for the safety of the entire installation, including the helideck and helideck operations. They are required to ensure that the helideck operating environment is safe such that helicopter operators can discharge their duty. They have direct control over the physical characteristics of the helideck, the levels and manning of the rescue and fire-fighting facilities and provision of communications. They are required to ensure that competent personnel control all activities on the helideck during helicopter operations. Installation operators can suggest routes to be flown and must have in place a weather policy for passenger safety on the helideck and for passenger survival and rescue. It is very important that offshore personnel act in a responsible way and comply with requirements specified by helicopter operators and installation operators.

### **1.1.2 The use of Virtual Reality**

Virtual reality describes an environment that is simulated by a computer. Most virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic goggles, but some simulations include additional sensory information, such as sound through speakers.

Users can often interactively manipulate a VR environment, either through standard input devices like a keyboard, or through specially designed devices like a cyberglove. The simulated environment can be similar to the real world, for example, in simulations for pilot or combat training or it can differ significantly from reality, as in VR games.

Most human activities carry specific risks. The risk profiles of industries change with time as certain dangers are overcome and new ones appear. Therefore, to reduce accidents in shifting operating procedures, effective training methods must be developed to educate the offshore personnel about the danger. In the past, the objective of personnel training was only to prevent direct damage and to reduce the loss of lives and property from accidents but at present it includes the wider meaning of developing human resources and increasing the productivity, safety and efficiency of industries. The importance of workers education is emphasized now more than ever.

Training should involve an introduction to basic risk and platform procedures in which the safety and emergency processes should be incorporated. These training methods in combination with available computer packages can be used to help the trainee to understand specialized aspects of process hazards such as emergency exit and action that should be taken.

Three-dimensional simulation systems allow users to navigate in any direction within a computer-generated environment, decide what actions to take and immediately see the impact of those actions. These virtual reality systems allow personnel to explore around the platforms as to increase the safety awareness and procedures.

## **1.2 Problem Statement**

### **1.2.1 Problem Identification**

Safety is the paramount concern to all companies working in the oil & gas industry. The current market climate is forcing companies to minimize their operating costs while increasing maximum levels of safety. Operating an offshore platform demands maximum attention and focus on important key factors like in risk-decision making, explosion hazard process integrity, leaks, dispersion, ventilation and detection, fires and fire protection.

Thus, the oil & gas company is responsible to conduct a safety briefing for personnel before they are going offshore. The briefing purpose is to educate and train personnel about the safety awareness when they are at the platforms area. This project will focus on the helicopter platform since it is the first gateway before they are being transited to the operation platforms.

Generally, communication and demonstration of safety training concepts are being displayed through video, audio, or with 2D pictures. However, the use of Virtual Environment (VE) will allow for repeated training in time critical situations that may otherwise be inaccessible. The interactions with VE would allow for the continuity of information flow at real-time speed.

## **1.2.2 Significant of the project**

VE has become so many great in many areas and fields that several major IT specialists form groups to share and expand their knowledge in adapting VE to any application and discipline. Nevertheless, adapting VR to any application is one way of making an effective learning, which could attract everyone's attention and imagination.

Virtual Reality is the only tool able to place people in the middle of the action without leaving their working place. It provides with all the systematic feedback needed to control safety and manage reliability issues by recreating specific conditions. It helps reduce the risks of working in this hazardous environment and ensuring maximum levels of safety on the installations.

## **1.3 Objectives and Scope of Study**

### **1.3.1 Objectives**

The overall aim of this project is to develop virtual environment to help improve the safety of helicopter platform. It is believed that the use of such systems will increase safety awareness and knowledge of safety procedures and therefore hopefully lead to reducing the platform accident rate. The objectives for this project are:

- To design and develop helicopter landing platforms
- To visualize movement and facilitate understanding in VR
- To identify components and characteristics of the virtual environments for adequate realism.



### 1.3.2 Scope of Study

#### *Virtual Environment*

This project is more concern on giving the virtual environment to the offshore platform. A virtual platform is developed to support the study. The prototype covers the helicopter platform which including the landing based of the helicopter as the transit platform before bring the personnel to the operation platforms.

The prototype is a non-immersive virtual systems using Desktop virtual reality application that enable walkthrough in the virtual environment. Desktop walkthrough is a system where the environment develops is displayed using monitor or 3D projector. The user can use the mouse as the interactivity with the application and in exploring the virtual helicopter platforms.

Apart from that, the study also focuses on how to create a realistic VE for convenient walkthrough. The usefulness of the project had been made by conducting prototype trial session for the user and distribute the questionnaire. The data gathered then is analyzed.

The author use various software such as the 3D Maya 5.0.1 and Macromedia Flash MX for creating the object and virtual environment. By using this software, it makes the creating of the object become easier and look realistic to enable the user to felt that they are in real world.

### **1.3.3 Feasibility of the project within the Scope and Time Frame**

The project development is part of the learning environment where both allow the user to experience a real life situation in an artificial environment. Through this project, users will obtain the realistic impression like a real word. This development process should be completed within the four months.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Virtual Reality**

There is almost no standard definition to the term Virtual Reality. It is describe as the illusion of participation in a synthetic environment rather than external observation of such an environment. It is the component of communication which takes place in a computer generated synthetic space and embeds human as an integral part of the system. (Regenbrecht & Donath ,1997)

Virtual reality technology shares a lot in common with computer-generated visual simulation systems but virtual reality applications generally support more intensive interaction between the human participants and the simulation system. The common capability among virtual reality systems is that they all use computers and other spatial digital hardware to present a simulation to a human participant via visual and other sensory outputs such that the humans experiences an interaction with the virtual world.

Virtual reality is a significant extension to the way we interact with computer systems, improving individual and shared understanding of real or imaginary environments. Applications of its use in the business community have been emerging for the last decade and have given competitive business advantages. Users are able to interact in real time with computer-generated environments in a simple, natural manner, without the need for extensive training (Kalawsky, 1993).

## **2.2 Historical Background**

Roots of virtual reality began at 1962 with the “Sensorama” of Morton Heilig. At 1968, Ivan Sutherland described the head-mounted display which tracked the viewer and updated a graphic display. Military investigation during the cold war added numerous contributions to the field of Virtual Reality by development of flight simulators by the “US Air Force”. In 1984, “NASA” presented “VIVED” (Virtual Visual Environmental Display), and later the “VIEW” (Virtual Interactive Environment Workstation) (Gigante, 1993).

## **2.3 3D Environment**

The virtual model is produced using 3D packages, 3D modeling toolkits and libraries or VRML (Li-Ron, 1997). Although there is research and development in progress for using VR packages as modeling tools as well as visualizing tools the way of procedure today is to produce the 3D model in a 3D modeling software and convert it into VR. The main characteristics of a 3D environment are as follows:

- The environment is modeled using 3D vector geometry, meaning that objects are represented using x, y and z coordinates describing their shape and position in 3D space.
- The user’s view of the environment is rendered dynamically according to their current position in 3D space, that is, the user has the ability to move freely through the environment and their view is updated as they move.
- At least some of the objects within the environment respond to user action, for example, doors might open when approached and information may be displayed when an object is selected with a mouse.

- Some environments include 3D audio, that is, audio that appears to be emitted from a source at a particular location within the environment. The volume of sound played from each speaker depends on the position and orientation of the user within the environment.

## **2.4 Virtual Reality Systems**

It is important to note that a virtual reality system is essentially an interactive simulation that can represent a real or abstract system. The simulation is a representative computer based model, which provides appropriate data for visualization or representation of the system (IMO, 1995).

A virtual reality system allows a participant to:

- Become immersed in a completely synthetic computer generated environment.
- Achieve a sense of presence in the environment.
- Become un-inhibited where conventional laws of physics can be controlled in a way that assists greater understanding.
- Achieve a sense of non-real time, where situations can be presented in slow or fast time.
- Achieve a high degree of interaction that can equal or exceed that achievable in the real world.
- Interact in a completely natural and intuitive manner with the synthetic environment.
- Repeat the task until the desired level of proficiency or skill has been achieved.
- Perform in a safe environment

The virtual environment can take many forms and for example, it could be a realistic representation of a physical system. Geometric accuracy and the attributes of color, texture and lighting are very important. Three-dimensional software may be used to construct such an environment employing engineering drawings, architectural plans and the incorporation of important physical dimensions (Vince, 1995).

### 2.4.1 Types of virtual reality systems

Virtual Reality could be classified into two main types according to the degree of immersion and interface in the synthetic environment. The two types include Immersive and Non-immersive Virtual Reality systems (Figure 2.1). Immersive VR is an application in terms of quasi-physical experiences. Non-immersive VR is a screen based or desktop based which enables users through screen interface using special tools such as eye glasses, to feel the simulated spatial environment. (Morgan and Zampi, 1995).

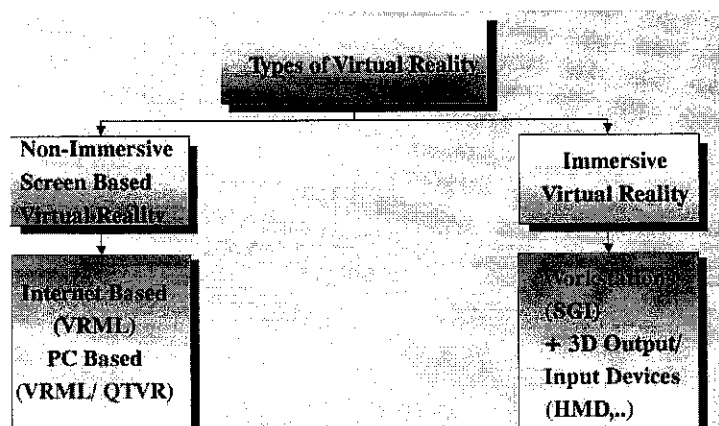


Figure 2.1: Types of virtual reality

A major distinction of virtual reality system is the mode in which they are interfaced to the users. The participant in a virtual reality system has both a physical and a cognitive interaction with the virtual reality system. The physical interaction is provided by the hardware interface, which comprises the senses, which allow the users to update the virtual environment and the effectors via which they obtain information from it. The cognitive interaction is via the virtual world, which is built within the virtual reality system.

### *Immersive virtual reality systems*

In such experiences, fuller contact between users and the virtual space is maintained. Examples of these VR interactive experiences could be achieved by using data gloves and multi-media head mounted devices (HMD).

Immersive virtual reality systems use output devices to map as directly as possible to user's perceptual organs. The user in an immersive virtual reality system is required to wear a HMD that tracks the wearers movements and conveys them to the computer which responds accordingly relaying the information (both audio and visual) back to the headset. Head mounted display encases the audio and visual perception of the user in the virtual environment and cuts out all outside information. HMD may be stereoscopic which means that two lenses present slightly different information to each eye or binocular which refers to two screens presenting the same display or monocular. However, head mounted display technology is fairly crude, and rather expensive, and has a number of disadvantages including encumbrance, isolating experience and occasional simulator sickness (Hitchner, 1995).

### *Non-immersive*

Desktop virtual reality systems are the most popular type of virtual reality systems and are based upon the concept that the potential user interacts with the computer screen without being fully immersed and surrounded by the computer generated environment. They provide a lower level of presence and perhaps interaction, than immersive systems but they have many advantages. The greater graphics quality, the flexibility of world building toolkits and lower capital cost of hardware, software and peripherals give many advantages to desktop virtual reality systems making them an attractive compromise to many end users.

Desktop systems utilize standard computer hardware using a mouse, joystick or three-dimensional space mouse as the input medium to interact and manipulate the virtual environment using a monitor and speakers to view and listen to the results. The feeling of subjective immersion in desktop virtual reality systems can be improved through some form of shutter glasses, which give the extra dimension of stereoscopic three-dimensional space. Desktop virtual reality systems provide a low cost option for high-resolution visualization for design, training and education applications (Pimentel & Teixeira ,1995)



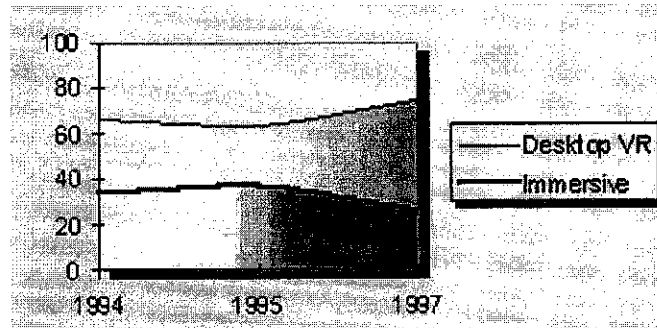


Figure 2.2: Comparison between types of VR systems usage

In a survey conducted by the University of Loughborough into using VR in United Kingdom (between 1994 and 1997) it was clear that the majority of VR systems are desktop PC based (Figure 2.2). It was suggested that a powerful PC based system could produce VR if the need for a stereo-scopic system and use a mono-scopic system instead is eliminate.

The rapid development in personal computer technology and the huge potential market for desktop virtual reality systems in a wide range of fields means that this is the area where some of the fastest developments are occurring. Multi-national corporations are investing hundreds of millions of pounds in ensuring that desktop virtual reality system performance increases. Whilst the technology drive has largely been focused on the home computer games market the spin-offs into engineering have resulted in high quality systems becoming available for serious applications (Aukstakalnis and Blatner, 1992).

### *Emerging of Virtual reality System*

A recent emerging type of Virtual reality is the network VR. It is a result of the massive progress in the Internet and the World Wide Web in particular. It is indicated that the technology of Virtual Reality and the Internet continue to integrate, as the online culture is now the fastest growing demographic on the planet (Campbell, 1996).

The standard virtual reality format on the web is VRML (Virtual Reality Modelling Language) or (Virtual Reality Mark up Language) created by “Silicon Graphics Inc.”. VRML, as a phenomenon that is universally accessible, hyper-linked, is becoming common place on the World Wide Web. It is a file format for describing 3D interactive 3 dimensional virtual environments. It is capable of representing static and animated objects and it can have hyperlinks to other media such as sound, movies and images. (VRML 2.0, 1998)

## 2.5 Peripheral Technologies

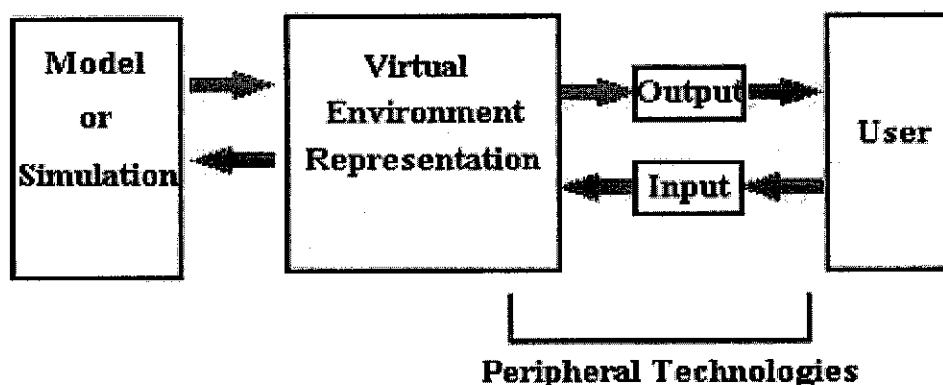


Figure 2.3: Generic model of a Virtual Environment System

It is the peripheral technologies that most people closely associate with virtual reality since they represent the user’s interface with the virtual reality system. The peripheral technologies are the input and output devices, which allow the user to interact with and control the actions in a virtual reality system (Figure 2.3). The input devices refer to the interaction devices that are used to input the position and orientations of the user’s head and hand. They include a standard mouse, keyboard, joystick, space ball, touch screen monitor, data glove and tracker devices. The selection of the input devices depends on level of interaction and flexibility of movement required. (Beier, 1994)

The output devices provide stimuli to user and include standard or touch screen monitors, HMD, three-dimensional shutter glasses combined with a monitor and three-dimensional sound systems (Figure 2.4 and 2.5). The advantages of this types of output devices such as HMD is that it completely blocks any external any external influences from the real world by enclosing the user's visual and auditory senses . This creates a strong sense of immersion and presence, as the user is unaware of any other environment than virtual environment. The choice of the output devices depends on the level of immersion and the resolution of image required.



Figure 2.4 : HMD - output device

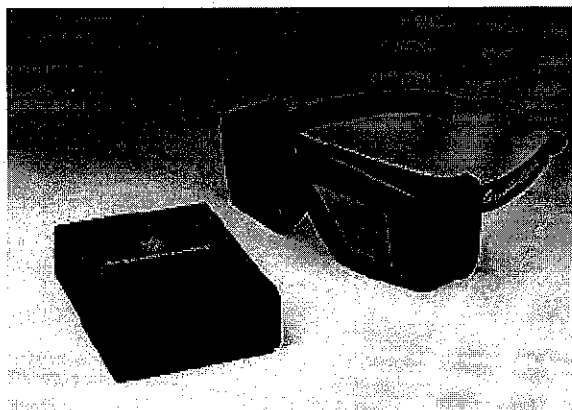


Figure 2.5: Shutter glasses - output devices

## **2.6 Virtual Reality in Training**

A number of virtual reality applications have been developed including environmental visualization, safety awareness training systems, ergonomic design, simulation systems, driving simulators, training systems and hazard awareness systems (Schofield, 1997).

There has been a steady increase in the potential for virtual reality techniques for many training applications. In particular, the ability to provide cost effective access to high fidelity computer simulations is a very important attribute. The potential of a virtual reality based system can be very impressive and as costs for the enabling technologies fall there is likely to be acceleration in the uses of this technology. It is not too difficult to see that virtual reality will have a major influence on training processes by providing training establishments with a powerful new approach to training and research. It will soon be feasible to provide access to sophisticated platform facilities in a virtual format. The exact form that virtual training aids will take depends very much on the nature of the training program to be delivered. A broad spectrum of technology based concepts are available and it will be extremely important to understand where and how to apply these to achieve an effective training medium (Kalawsky,1993).

Virtual reality is a powerful tool for training since people comprehend images much faster than they grasp lines of text or columns of number. Some aspects of training can be acquired in a classroom or from a book but there is no substitute for training with the real thing. It is believed that virtual reality is an excellent substitute of the real thing and many industries have produced virtual reality training simulators, which are used for planes, submarines, power plants, tanks, helicopters, ships, trains, surgery, and air traffic control. These simulators use a replica of the real operational environment and real time computer simulations to model its dynamics.

Virtual reality training through simulation provides significant benefits over other methods because the simulators allow the trainees to make mistakes having the opportunity to experience first hand why certain procedures must not be used in the real world. Virtual reality training systems have also the flexibility to structure different training scenarios and they can monitor and measure the progress of every training session.

Many companies have taken advantage of the advances in hardware and software to research and develop a variety of graphical based systems for safety and training in a variety of industries. It has found that systems developed using PC technology are more easily ported into industry due to the reduced costs, the existing user base and the familiarity of PC technology. In particular it now appears that the technologies have developed sufficiently and costs reduced to levels that mean that even the smallest companies can consider them seriously.

## **2.7 Advantages of Virtual Reality Training**

The major applications areas of virtual reality can be broadly classified into understanding, experiencing, entertainment and learning. In all four cases, virtual reality provides a safe and frequently highly cost effective environment for individuals to fulfill their professional, training or recreational needs. There are many areas where virtual reality could be used to support training. The advantages of virtual reality training compared to traditional methods of training can be summarized in the following section:

- Ability to observe system operation from a number of perspectives aided by high quality visualization and interaction.
- Observation of system features that would be either too small or too large to be seen on normal scale system.
- Ability to control timescale in a dynamic event. This feature could operate like the fast forward or rewind preview in a modern video recorder. Most people learn faster by “doing” and virtual reality systems provide much greater levels of interactivity than other computer based system.
- Provided that the interfaces are intuitive and easy to use then the degree of interactivity can be very beneficial.
- The inherent flexibility of a virtual reality system comes from the underlying software nature of the virtual environment. A virtual reality system can be put variety of uses by loading different application environments. This means that it is feasible to use a virtual reality system for a range of training applications.

- Virtual reality training systems can allow trainees to experience unusual or potentially dangerous occurrences from a position of safety. Conventional training must be very careful when putting trainees into situations, which could be hazardous. An example might be brake failure or a potential derailment situation.

The above points show how virtual reality systems are ideal for demonstrating to trainees the correct or incorrect procedures that they should follow. Codes of practice or local rules can be demonstrated and virtual reality also allows for testing of retained knowledge (Cydata Limited, 2000).

## CHAPTER 3

### METHODOLOGY

#### 3.0 Procedure Identification

Part of Waterfall Model methodology had been used to conduct this project. This framework was chosen because it provides a systematic approach to the system development. The core main phases are Analysis, Design and Development, Integration and Testing, and Evaluation (Figure 3.1).

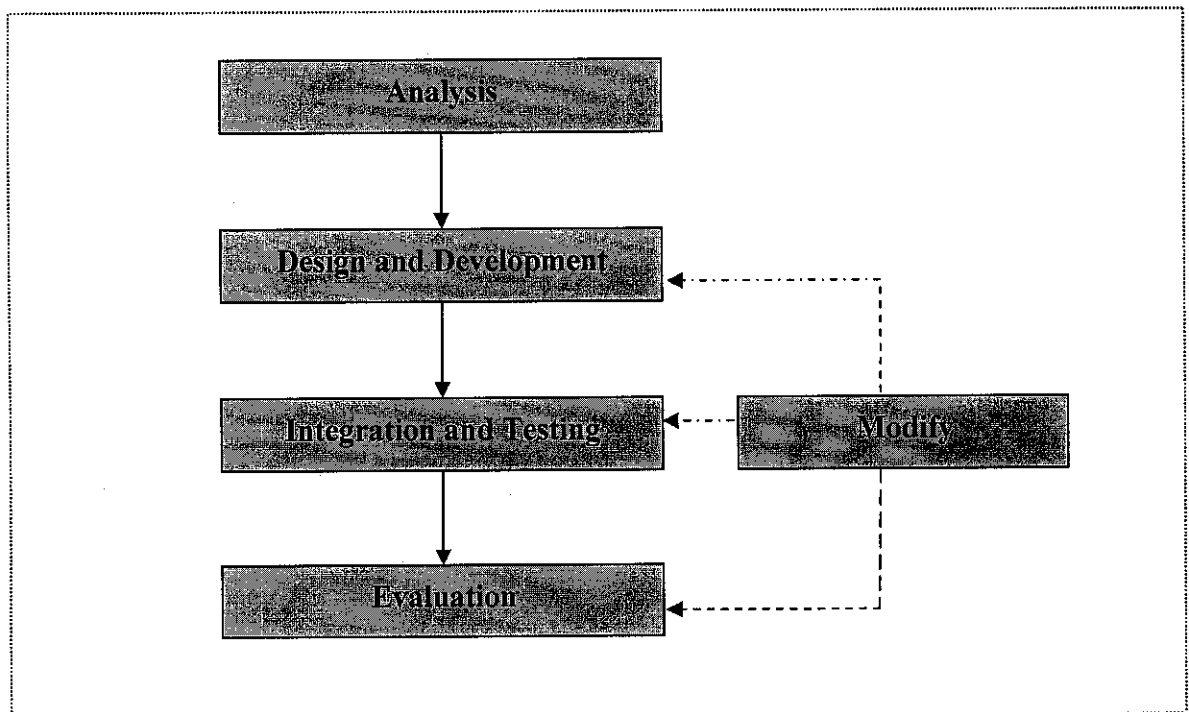


Figure 3.1 – Methodology Framework



### **3.1 Analysis Phase**

Analysis phase consists of information gathering and information analysis stage. During the information gathering stage, data and information related to the field of study is being gathered for references and also as research supporting documents.

#### **3.1.1 Information Gathering**

The data and information gathered mostly focused on virtual reality and also the virtual reality elements such as interaction in virtual reality applications. This stage is an ongoing process where it is being carried along the throughout the project phases. Various methods are used to gather the information:

- Collecting facts, information and supporting research documents from Internet, journals, books and previous research paper.
- Testing and observation on existing virtual reality application. Throughout the testing, the author can experience the feel of virtual reality application and how interaction techniques are applied to the application.

#### **3.1.2 Information Analysis**

The information that has been gathered earlier is examined and analyze. Besides that, the specification of the prototype is also specified in this stage. This is done after the information is filtered and used the information available to aid the Design and Development Phase. From here, detailed information gathered about virtual reality helps to specify the types of virtual reality application to developed and also the tools and equipment that can be used for the project.

This is the phase where the author undertakes involves analyzing project needs. Special tools and techniques help the author make requirement determination. All the data had been gathered and analyze to:

- develop problem statement
- identify objectives and scope of studies
- develop project specification
- identify criteria to measure realism of the prototype

### **3.2 Design and Development**

Visual representation of the designs and workflow were developed at this stage. It will focus on the basic process which common to all components of a project. In developing and designing the system, many different activities were going on. Construction of the virtual environment passes through two main phases: modeling and rendering.

#### **3.2.1 Modeling**

Modelling is the process of building the geometry and physical attributes of the platform that constitute the virtual environment This project is concentrating on 3D computer graphics. These systems allowed 3D models of real-world objects to be constructed as geometric descriptions of their structure. The difficulties of such a process that depends on the information database, and the computer hardware configuration. The platform was constructed based on the real platform with some modification to simplify the design process.

A typical offshore structure supported by piles will have a deck structure containing a Main Deck, a Cellar Deck, and a Helideck (Figure 3.2 ) The deck structure is supported by deck legs connected to the top of the piles. The piles extend from above the Mean Low Water (MLW) through the mudline and into the soil for many tens of meters. Underwater, the piles are contained inside the legs of a “jacket” structure which serves as bracing for the piles against lateral loads. The jacket also serves as a template for the initial driving of the piles. The piles are driven through the inside of the legs of the jacket structure. The top of the jacket is placed near the water level where a boat landing will be located for accessing the platform by boat.

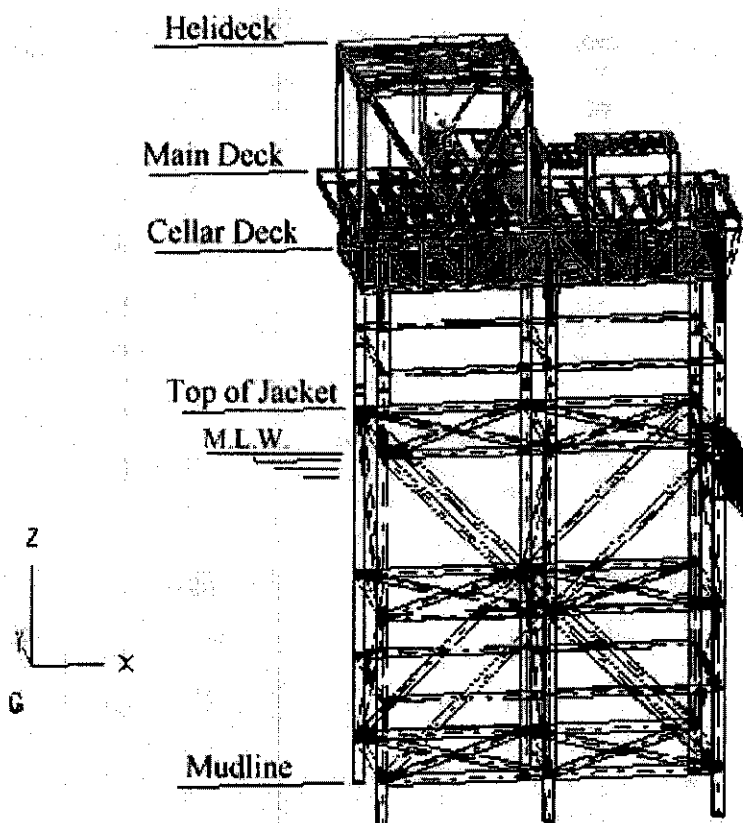


Figure 3.2 : 3D Structure of helicopter platform

The platform modeling began by applying the basic polygon available such as cylinder, box, pyramid, plane, line and others. From here, the Spline and Nurbs function is used to extrude and transform the polygons to 3D image using x and y axis (Figure 4.1). Then, appropriate color was attached to the platform structure for adequate realism. A high number of texture maps were used in order to bring a sense of reality to the virtual environment. By supplying other information such as the position, size, color and orientation of these objects it is possible to render realistic images of a prototype product.

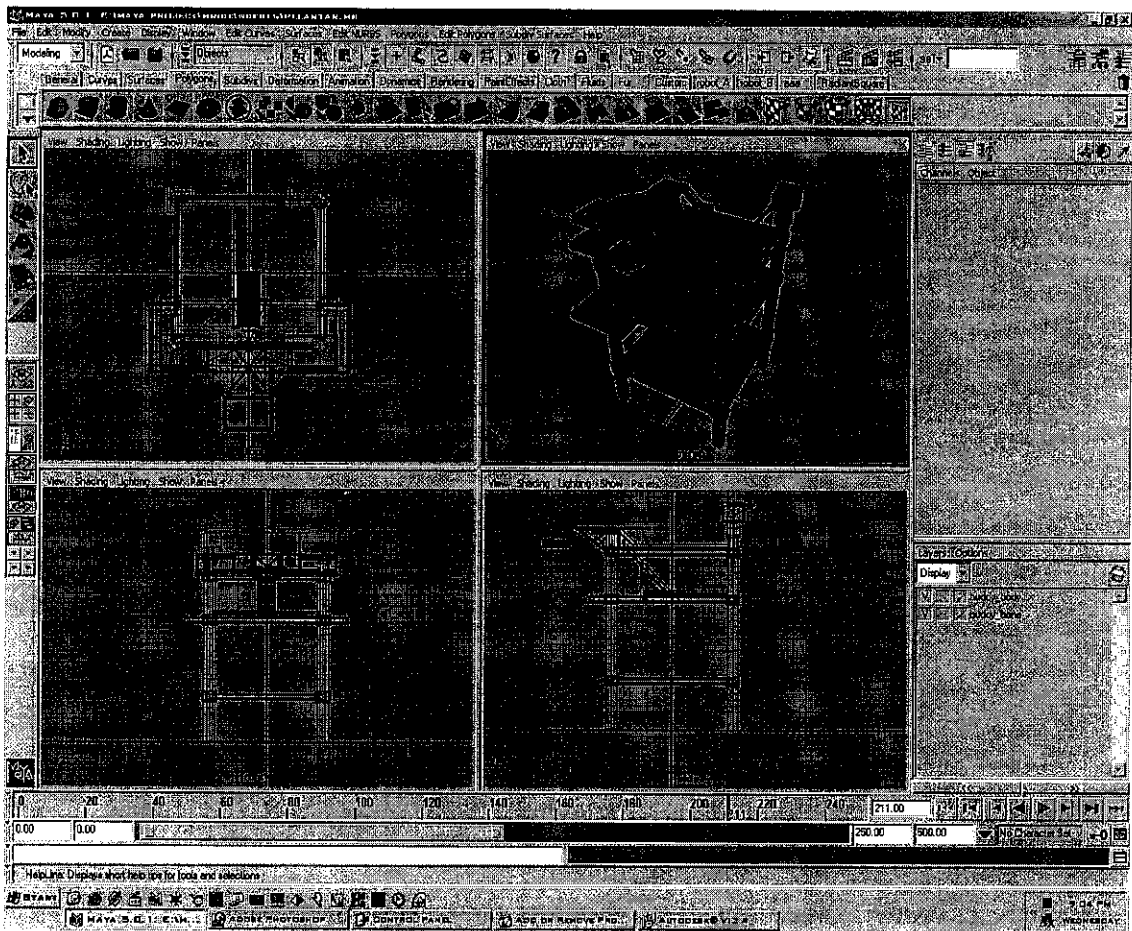


Figure 4.1 : Different view for V-HELP structure

### **3.2.2 Rendering**

Rendering is the process that includes applying texture maps and defining lighting parameters. Time of rendering depends on quality of rendering, complexity of the model, and speed of computer hardware. The guidelines for choosing the texture-input medium include quality, speed, versatility, and file size. The quality depends on the output resolution required for presentation.

A graphics engine constructs an image of the scene, which can be viewed from any angle or position as if looking through a camera. Rendering a 3D scene is a complex and time consuming process. This made the user could control the viewpoint or camera and explore the virtual world.

Camera Track function is used to create the walkthrough path within the platform structure. Subsequently, batch render is applied to the platform structure to generate the image sequence in jpeg file.

The total number of polygons has been kept to a minimum as this has an impact on the rendering speed of each frame. Objects needed to be constructed with appropriate number of details in order to be easily recognizable.

### **3.3 Integration and Testing Phase**

Sequence image from rendering process is import to the Flash Macromedia MX for the movement animation. Those images were insert into the keyframe by sequel. Every frame is set to 15 seconds for continuation display. This is where the default movement is enabled. Then, it is save in movie format to suit with the briefing session. The prototype application is built-in with the Flash software. Therefore, the application can be run directly in any computers by considering the hardware and software requirements stated earlier.

Throughout the integration process, testing process were carried out to ensure the requirements and objectives are met. It helps ensure the quality of the final product. It is far less disruptive to test beforehand than to have a poor tested system failed.

### **3.4 Evaluation Phase**

The evaluation phase is conduct as an indicator whether the interactivity of virtual walkthrough meet the requirement. The evaluator are the Final Year Students. During the evaluation, they were asked to explore the prototype and evaluate the prototype using the checklist provided. Moreover, an informal interview has been conduct to get direct feedback from the user. Through this feedback, a necessary modification can be made.

### 3.5 Tools Required

Tools and equipments are important in performing this project. This tools and equipments assist to make the development process become easier.

#### 3.5.1 Hardware requirements

Table 3.1 – Hardware requirements

Device	Requirement
Operating system	Microsoft Windows
Processor	Intel Pentium 1.7
Memory	256 MB
Disk Space	20 GB
Other peripherals	Monitor,keyboard,mouse,CD-ROM drive, 32 graphics card

#### 3.5.2 Software Requirement specifications

Table 3.2 –Software requirements

Software	Functions
3D Maya 4	Used to model 3D objects and create scenes for the project.
Macromedia Flash MX	Used to create interactivity for the walkthrough.
Microsoft Word 2003	Used for writing report
Microsoft PowerPoint 2003	Used for oral presentation aids.



Maya® 5.0.1 is a professional 3D animation and visual effects software. This software myriad enhancements and optimizations that improve Maya's overall ease-of-use and efficiency throughout-most particularly in the areas of rendering, character animation, brush and paint tools and related functionality, such as per pixel shading. With Maya, designer can :

- Model, texture, and add paint effects based on supplied photography.
- Create a complete architectural scene based on drawings, then light, texture, and render it.
- Learn to use Mental Ray for photorealistic lighting and complex materials.
- Model complex objects - build a platform model from photos using NURBS, then create a realistic rendering of it.



Macromedia Flash MX is the professional standard authoring tool for producing high-impact user interface. Whether creating animated logos, navigation controls, long-form animations or systems applications, the power and flexibility of Flash is ideal for own creativity.

New features in Flash MX enhance the approachability, creativity, and power of Flash. Designers who require a higher level of control and integration with industry-standard design tools now have an unparalleled creative application for creating media-rich content. Powerful new features build on this creativity, giving application developers access to new capabilities that make Flash MX a robust and exciting application development environment. Developers can work with advanced scripting and debugging tools, built-in code reference, and predefined components to rapidly deploy rich user interface applications.



## CHAPTER 4

### RESULTS AND DISCUSSION

#### 4.1. Final prototype product

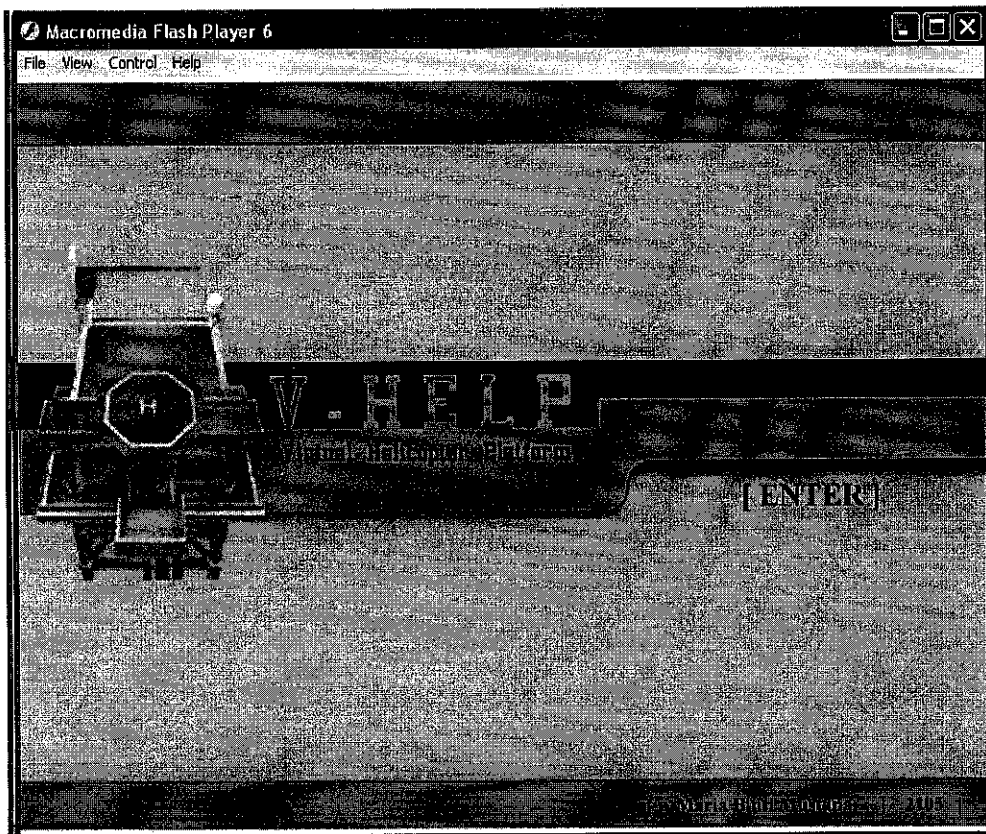


Figure 4.2 : V-HELP interface – Front Page

The V-HELP prototype has the interface to ease the coordinator doing the safety talk (Figure 4.2). While browsing the prototype, coordinator can emphasize the important procedure and alert the required act to enable the personnel grasp the learning process in a short time.

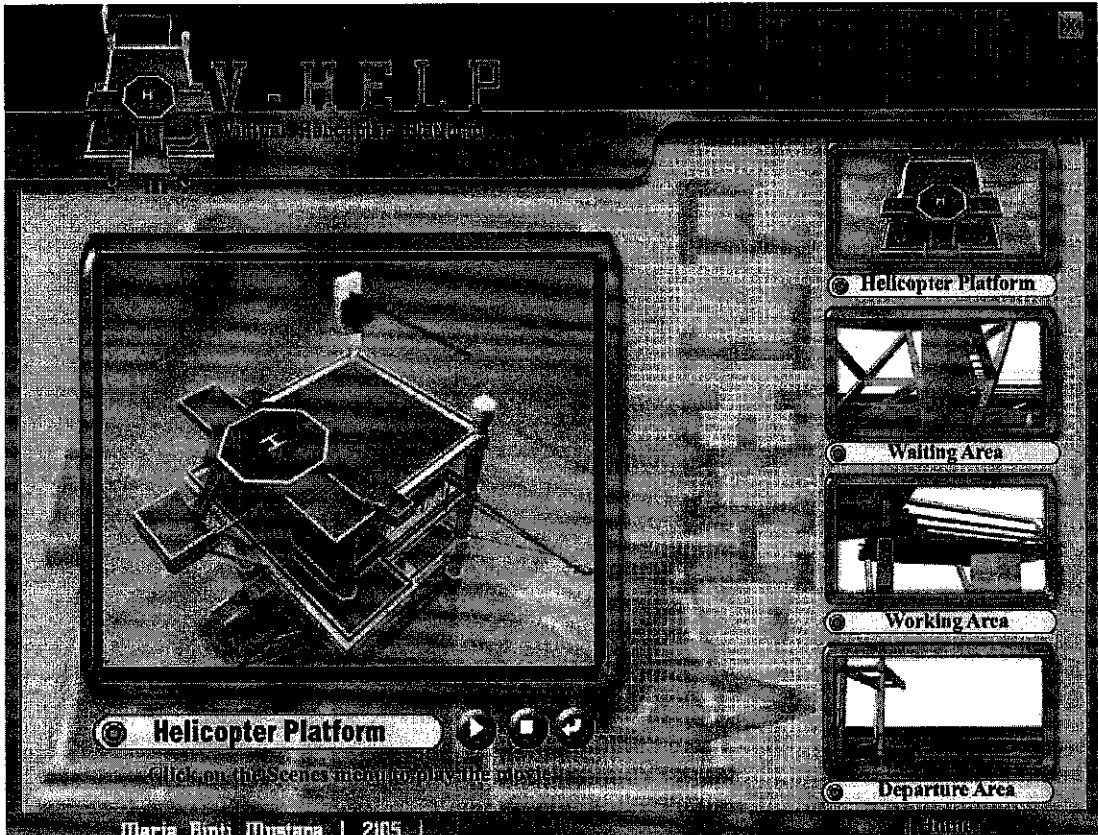


Figure 4.3 : V-HELP Main Menu

The main menu is the area to display the walkthrough movement of the prototype. (Figure 4.3) The overall movement is develop using default walkthrough. The interactivity available including the play, stop, repeat, home and exit button. All the interactivity is controlled by the coordinator. The screen will be displayed at the projector for better view.

There are 4 sights available for display mode. The Helicopter Platform screen shows the sight from the helicopter when moving around the platform on the air. The other three screens including the waiting area, working area and departure area are the level in the platform. The walkthrough throughout this three level illustrate the path that should be taken by the personnel to the lifeboat exit if disaster or accident happens at the platform.

## 4.2 Results of Evaluation Phase

Evaluation phase has been conducted to gather data about the realism of the prototype. The evaluation is closely linked to the development of the platform and is ultimately concerned with measuring how far the development has achieved the objectives defined in terms of realism.

The main methods, which are used for user analysis during the evaluation of training tends to be the interview and questionnaires. Both methods can administer data and need to be carefully designed in order to be effective.

### 4.2.1 The Evaluator profile

20 evaluators of Final Year student from Information Systems and Information Technology Programme of Universiti Teknologi PETRONAS were chosen to evaluate the V-HELP prototype. 10 of them are students who take the Virtual Reality course and another 10 are not. The category is identified as follow:

Table 4.1 : Evaluator Category

Category	Type
Group A	VR students
Group B	Not VR students

### **Characteristics of Evaluator :**

Evaluators who are taking VR course have additional exposure to the VE. Hence, they are more concern about the characteristics that should be include in the VE development. They require details design in VE since they have learned it during class. Therefore, their expectation and prospects are higher than the evaluators who gain knowledge about VR informally and by themselves.

#### **4.2.2 Methods of conducting evaluation:**

The evaluation session is conducted at the Intro Programming Lab 2. The prototype application is saved in 20 computer directory earlier to enable the evaluation process being run at the same time. Before the evaluation began, the author give some instruction and teach them how to go explore the prototype using the available button. Then, the evaluator is asked to explore the V-HELP prototype for themselves. They are given 5-10 minutes to do the exploration. A questionnaire is given to them as a checklist while do the evaluation. The data from the questionnaire will be analyzed. The questionnaire is included in the Appendix A.

### 4.2.3 Results of Evaluation

Table 4.2 : Statistic of Evaluation for Group A

Group A					
Attributes	Rating				
	1	2	3	4	5
1. Realism of prototype	0	2	3	4	1
2. Suitability of color and textures	0	1	3	5	1
3. Lighting in the environment	0	1	4	5	0
4. Placement of object	1	0	6	3	0
5. Overall movement in platform	1	2	5	2	0

Table 4.1 : Statistic of Evaluation for Group B

Group B					
Attributes	Rating				
	1	2	3	4	5
1. Realism of prototype	0	0	2	3	5
2. Suitability of color and textures	0	0	2	4	4
3. Lighting in the environment	0	0	1	3	6
4. Placement of object	0	0	2	4	4
5. Overall movement in platform	0	0	2	2	6

#### 4.2.4 Histogram of result for the Evaluation

##### (i) Realism

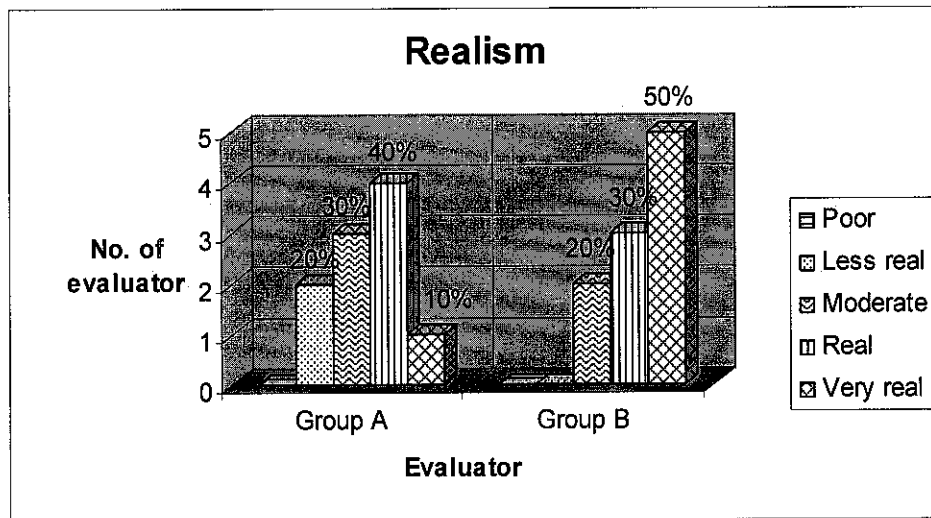


Figure 4.4 : Realism Chart

40% of evaluator from Group A feels that the prototype is real and 50% from Group B thoughts that it is very real. The realism is achieved through the design structure of the platform which is really looks like the real one at the offshore platform.

*(ii) Color and Texture*

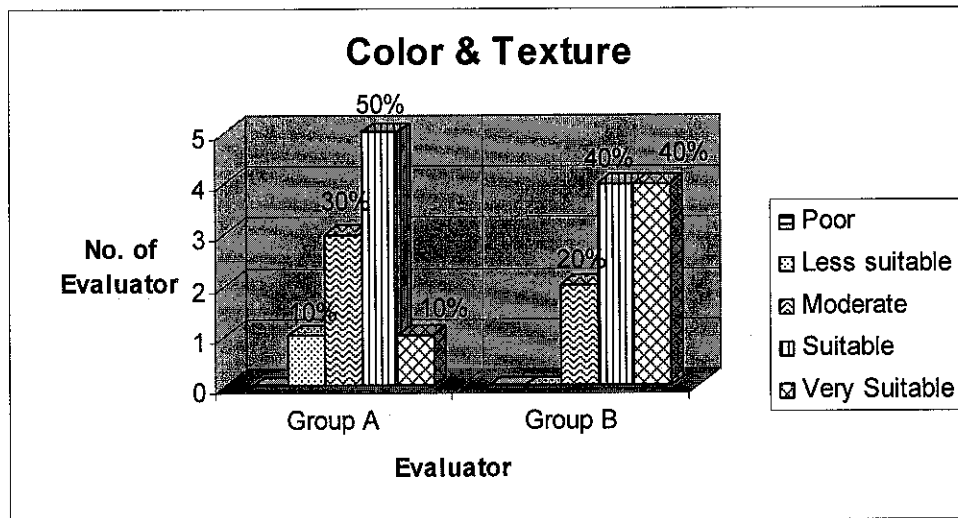


Figure 4.5 : Color and texture chart

50% from Group A think that the color and texture applied in the platform prototype is suitable. As Group B, 40% of them feels that the color and texture is very suitable with the V-HELP prototype. The yellow color is chosen because it is the standard and procedure color that must be followed when installing platform at offshore. Yellow color can be seen from a distance and simplify the pilot to land the helicopter at the landing based provided. However, the texture can be improved by carefully obtained a suitable portion of scanned-in photographs in order to bring a sense of reality to the virtual environment.

*(iii) Lighting*

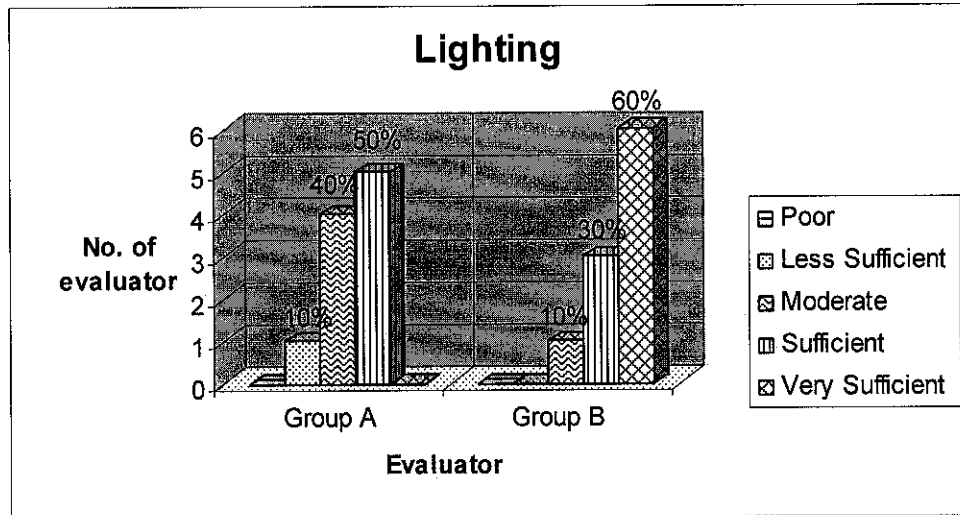


Figure 4.6 : Lighting chart

50% evaluator from Group A believe that the lighting provide for the prototype is sufficient and 60% from Group B think that it is very sufficient. Lighting is important in developing VE since if it is not applied properly, the surrounding area will be dark and it will be hard to view clearly the object created. Somehow, the shadow created for the platform really impress them because it improve the realism of the prototype.



(iv) Placement of Object

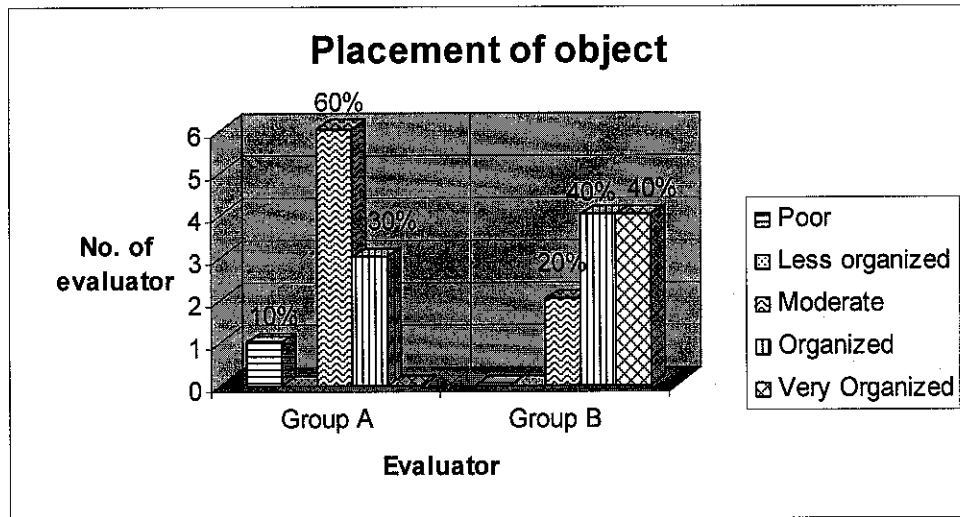


Figure 4.7: Placement of Object chart

The placement of object is moderate according to the evaluator from group A with 60% rating. The evaluator from Group B is satisfied with it and 40% of them thinks the objects is very organized. The objects is scattered all around the platform and not being at one place only. However, more offshore object such as machinery, piping, and safety equipment can be added to bring better feel to the environment. The sounds or audio parts such as the helicopter engine can be included to improve the environment.

(v) Movement

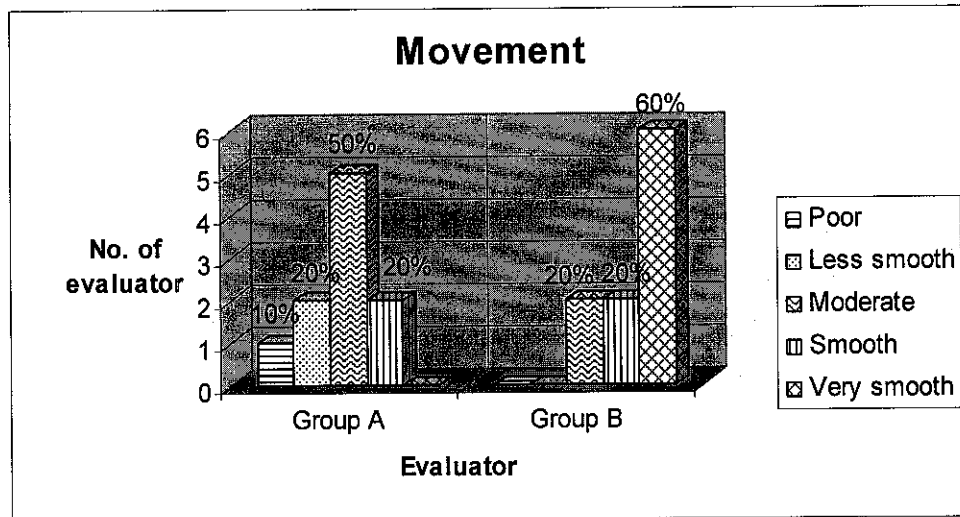


Figure 4.8: Movement chart

50% evaluator from Group A feels like the overall movement for the prototype is moderate since the walkthrough is set as default. They will more satisfy if they can control and explore the prototype by their own. But, for the Group B, there are really satisfied and 60% of them feel that the movement is very smooth.

#### 4.2.5 Interview

A part from evaluate the prototype using checklist, the author also conduct an informal interview with a few numbers of the evaluator to get some feedback and comments. This feedback is important as a reference for further modification.

Table 4.3 : Evaluators Feedback

<b>ELEMENT</b>	<b>COMMENTS</b>	<b>MODIFICATION</b>
Color and texture	Inappropriate texture for some parts and objects.	Apply the suitable color and texture to object to increase the level of realism.
Lighting	Some part of the platform did not locate proper light.	Apply the appropriate lighting to create a realistic atmosphere.
Movement	The view for walkthrough is limited to default area	Future enhancement
Interactivity	<ul style="list-style-type: none"><li>- Have simple interaction. User cannot control and explore the area by using input devices. (E.g. mouse, keyboard)</li><li>- Should provide interactivity with the safety equipment.</li></ul>	Future enhancement

Interface	<ul style="list-style-type: none"> <li>- Did not provide much functions for browsing and navigation.</li> <li>- The screen to display the walkthrough for every level is small.</li> </ul>	<ul style="list-style-type: none"> <li>- Provide more attractive functions.</li> <li>- Apply the suitable coding at Flash to enable the screen in full screen.</li> </ul>
Sound	<p>No audio is provided to increase the surrounding of the environment. (E.g. Helicopter sound)</p>	Future Enhancement

As overall performance of this prototype, the evaluators are satisfied with the end product. They enjoyed the interactive nature of the virtual reality system and the acceptable realism of the VE. The questionnaire and interview process for the prototype evaluation produced encouraging feedback from the evaluator in representing the suitability and effectiveness of virtual reality technology and concepts.

## **CHAPTER 5**

### **RECOMMENDATION AND CONCLUSION**

#### **5.0 Summary of Project**

By incorporate the V-HELP walkthrough, it is believe that the author have achieve the initial aims and objectives as specified earlier. This project is able to facilitate offshore personnel gain basic knowledge in safety and get familiar with the platform area. A lot of precious experiences are gain and new things are learnt throughout the project which is helpful in the future.

Towards the completion of the prototype, the framework methodology is used as the guideline to the project. The design and development phase and also the integration and testing phase is the most crucial stage since the prototype need to be develop according to the requirement.

#### **5.1 Recommendation**

There are many way this project could be broaden for future enhancement as follows:

- Since this project only demonstrate a simple and basic procedures for the safety such as walkthrough to the emergency exit to lifeboat, it is suggested to increase the level of safety by enabling the simulation of high-risk situations and hazardous events in real-time. It can deliver effectiveness training to the personnel .

- To make the platform more realistic, more safety equipments and people should be added. Besides, it would be better if lifelike scene such as sun in the sky, cloudy day or wave of the sea included in the virtual environment.
- It is also suggests that personnel can navigate, manipulate and experiment the equipment there. Such interactivity can increase the personnel knowledge better.
- It would be better if users are able to interact with autonomous agents such as virtual teammates or human team members. Various combinations of multiple trainees, human or virtual, and trainers, may be brought together for a training exercise in a simulated environment
- The project can be enhance by using other virtual devices such as HMD and data glove. The usage of the devices can enlarge the interaction between the V-HELP and personnel.
- The VE of V-HELP should be accessed by the most common web browsers like Netscape and Explorer. Therefore, it can be access by anyone who is interested to explore the virtual platform and learn about the crucial safety there since the outgoing to offshore is restricted to unauthorized personnel.

## 5.2 Conclusion

Virtual reality aims to provide a three-dimensional computer generated representation of a real or imaginary world with which the user can have real time interaction and experience some feeling of being present in that world. Computer graphics and virtual reality technology is currently well developed and can be cost effective even for small organizations or companies which are considering their use. The flexibility of virtual reality based training systems makes them so competitive and valuable that the majority of them can be configured quickly and produced relatively cheaply.

Virtual reality is neither not appropriate for all users nor for all situations. While virtual reality appears to have significant potential in some cases, it is clear that it must accomplish a particular objective in a substantially better way than traditional techniques. Virtual reality may save staff time and money and be a superior way to train staff as compared to accomplishing a goal by more traditional approaches.

In conclusion, this project has managed to develop a V-HELP prototype. It has proved that Virtual Environment can give new perspectives for the personnel in the safety training. The virtual platform can help to improve the personnel understanding and make the personnel more aware towards their safety. This project had contributed to expand the virtual reality application to the training area especially in the oil and gas field. Therefore, it can be as the benchmark for further enhancement. With this, the project undertaken is considered had accomplished the initial objectives.

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## APPENDIX 1

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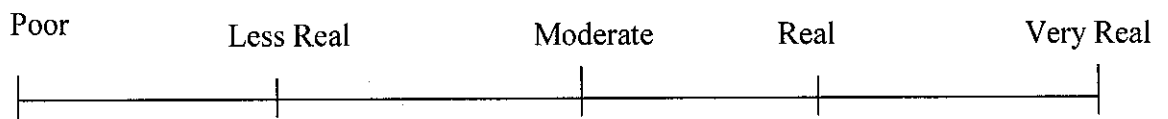
### PROTOTYPE EVALUATION

*This survey is for Final Year Project paper of Universiti Teknologi PETRONAS students. Please answer as appropriate to assist developer in understanding the requirement towards the prototype to be developed. Your cooperation is highly appreciated.*

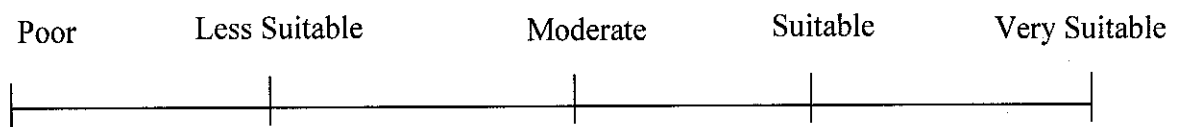
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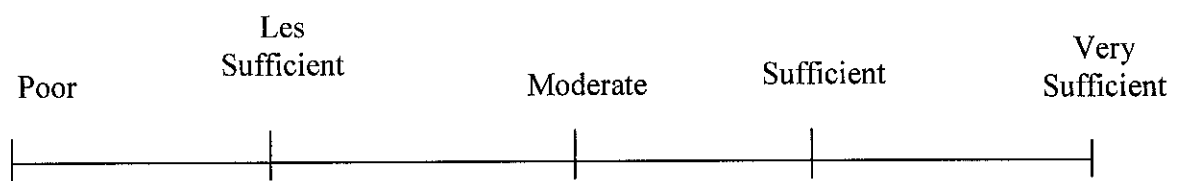
#### 1. Realism of prototype



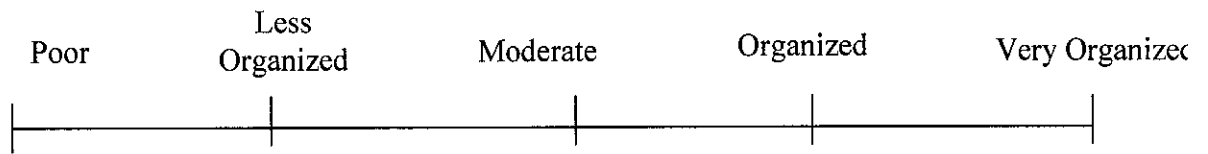
#### 2. The suitability of color and textures



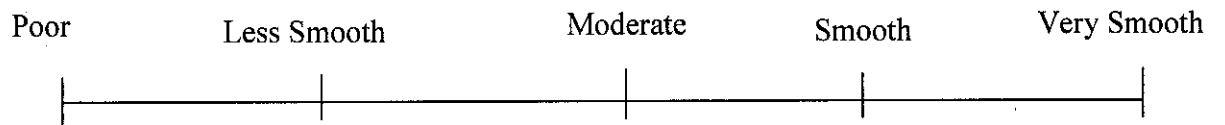
#### 3. Lighting in the environment

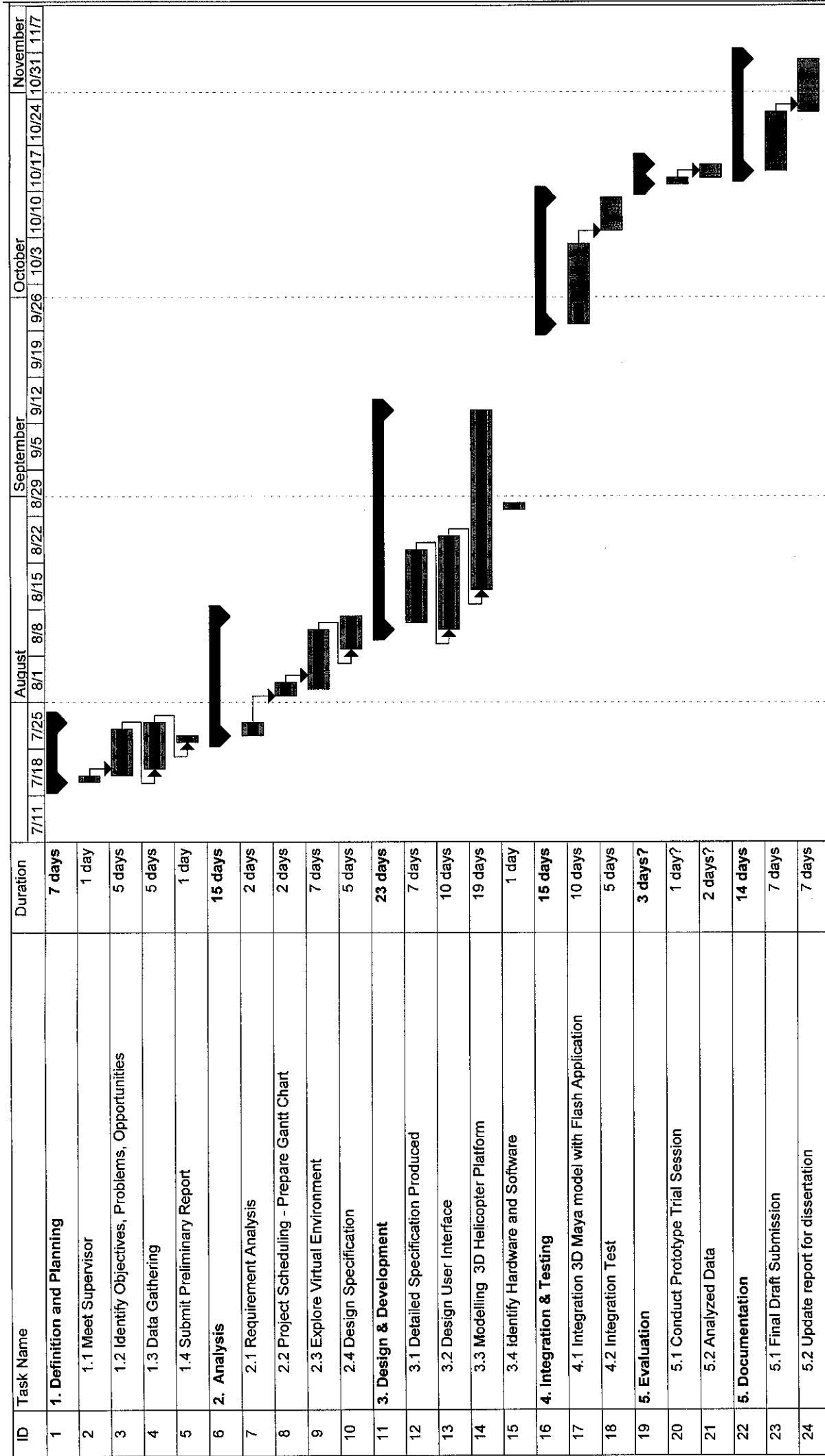


4. Placement of object at platform












5. Ease of movement in platform





Project: Gantt Chart  
Date: 1 NOVEMBER 2004

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