DEVELOPMENT OF REMOTELY OPERATED UNDERWATER VEHICLE MANEUVERS CONTROL SYSTEM

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Dedicated, in thankful appreciation for support, encouragement, understanding to my beloved mother and father

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ABSTRACT

This project report describes the development of remotely operated vehicles in water (ROV) to the control system in terms of how an ROV operating concept works and components and materials used. ROV is a robotic vehicle that is used at present specifically to handle the development work on the coast. ROV's creation caused some problems among humans have a limited ability to perform activities especially in the water. In addition, the factor of safety to humans when doing work related to oil and gas which can be harmful to human health. Due to that, ROV was introduced to replace human services. By the result, my main purpose of doing this project for the design and development of remotely operated vehicles in water (ROV) to the control system to facilitate human in doing work related to coastal development. Then, the methodology used for design this project is to use a control that connects directly to the PIC by using wire and thus control the motor that serves as the driving ROV movement in underwater. By using PIC, I will design a program to allow the PIC to read input from the control. The result of tests performed, the ROV moves forward, backward, left, right, down and up after controlled by the controller. In addition, it is also waterproof even in the water completely. A conclusion, the ROV can surely be used in underwater without worrying for leaking the water and it also function as well to move in underwater by given the command from controller.

ABSTRAK

Laporan projek ini menerangkan tentang pembangunan kenderaan dikendalikan dari jauh di dalam air (ROV) dengan sistem kawalan dari segi konsep operasi bagaimana sesebuah ROV itu berfungsi dan komponen serta bahan yang digunakan. ROV merupakan sebuah robot kenderaan yang diguna pada masa kini khususnya untuk mengendalikan kerja-kerja pembangunan di pesisir pantai. Terciptanya ROV ini disebabkan beberapa masalah yang timbul antaranya manusia mempunyai kebolehan yang terhad terutamanya melakukan aktiviti di dalam air. Selain itu, faktor keselamatan kepada manusia ketika melakukan kerja berkaitan minyak dan gas yang mana boleh memudaratkan kesihatan manusia. disebabkan itu ROV diperkenalkan untuk menggantikan khidmat manusia. Oleh itu sebab itu, tujuan utama saya melakukan projek ini untuk reka dan pembangunan kenderaan dikendalikan dari jauh di dalam air (ROV) dengan sistem kawalan untuk memudahkan manusia dalam melakukan kerja berkaitan dengan pembangunan di pesisir pantai. metodologi yang digunakan untuk reka projek ini adalah dengan menggunakan kawalan yang menghubungkan terus kepada PIC dengan menggunakan wayar dan seterusnya mengawal pergerakan motor yang berfungsi sebagai penggerak ROV. dengan menggunakan PIC, saya akan reka satu program untuk membolehkan PIC membaca input dari kawalan. Hasil dari ujian yang dilakukan, ROV bergerak ke hadapan, ke belakang, ke kiri, ke kanan, ke bawah dan ke atas setelah dikawal dengan controller. Di samping itu, ia juga kalis air walaupun dalam air sepenuhnya. Kesimpulannya, ROV pasti boleh digunakan di dalam air tanpa perlu bimbang untuk bocor air dan ia juga berfungsi sebagai yang baik untuk bergerak di dalam air dengan diberi arahan dari pengawal.

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CHAPTER 1

INTRODUCTION

1.1   Introduction

Nowadays, the use of robotic vehicles for exploration in the water associated with the rapid development of technology that is increasingly growing from year to year where, prior to the introduction of robot vehicles for underwater exploration, human nature is fully utilized to perform a variety of related activity in the water as an example to explore in the water. However, today, human services are no longer used because as we know human ability is limited especially related to the underwater and that why human services was replaced with robot vehicle called as Remotely Operated underwater Vehicle (ROV). With the ROV, it can replace the services of divers perform tasks that may pose a risk to humans and it is a mobile robot that is designed especially for aquaculture. In addition, ROVs are also used to perform underwater research especially for the scientist's research, installation telecommunications cable under the sea, doing work related to gas and oil and the discovery and development of oil and gas resources which lie underwater through drilling a well in addition, users can control the ROV's vehicle while he was on a ship or boat. Besides, most of the ROV in use today are built with video camera equipment to allow users to see and take diagrams was based on the development of the sea and for others activities.

For this project which is Development of Remotely Operated Underwater Vehicle Maneuvers Control System, the ROVs are controlled by the human located outside the sea by using the controller. The controller then connected to the PIC and PIC will process the data input from controller to produce the data output. The output then connects to the thrusters that enables the ROV to navigate and transfer in a smooth and efficient way. All the connection is connected with the wire cable. The high resolution camera video and also power light was provided in order to enable the person in charge at the surface will see and hear what has happened under the water. ROV movements can be controlled by the PIC that limited to dive under the water, move up to surface, forward, backward, to the right, and to the left by using the thrusters and propellers as hardware.

1.2   Problem statement

In this part, will describe the problem statement that occurs nowadays and because of that problem, this project was created. In countries other than Malaysia, they already know and use this ROV ever since *ROVs* were first used by the United States Navy in the 1960s. But recently, this ROV has been used widely in underwater task especially for the new offshore development. Because of the new offshore was exceed the human divers ability, then they use the ROV to do their task where their task range from Inspection of subsea structures, Pipeline and platforms to connecting pipelines in the sea, Placing underwater manifolds in the sea, and Construction of a sub-sea development and also the repair and maintenance. In fact, more than half of the ocean structure at present has never been explored due to the lack of technology where that ocean structure has the potential for the human to get the raw material especially oil and gas.

Besides that, for the researchers and scientist related to the underwater, they have to discover and survey the underwater world to do their research because it is their main objective. But, they have to develop and build new technological device which is ROV that can do the tasks because human ability to dive under the water is limited. Then, one

of the major obstacle is cost to build that device is expensive where the cost to build the ROV currently in current market value is approximately about RM5000. Among to the factors that affecting high cost of ROV includes construction costs. Possibility there is only certain countries that are able to build the ROV and that why it is expensive because when the need for the ROV are high but the production is low, so the price will be expensive . In addition, others factor is material and equipment that used to make the ROV are expensive or difficult to be found, ROV maintenance costs are high, the cost to employ human to program movements of ROV and etc. One of the main reasons I make this ROV project is to build and develop the ROV using a low cost. With the development of low cost ROV, this may be a starting point for this technology was developed in Malaysia, which we already know the advantages of this ROV is indeed very good when compared with humans.

ROV is underwater vehicle that can move freely in water under manual control by consumer. To build ROV, waterproof capability must be assumed as essential point that must be reached first due to reason that operation of ROV is under water. Structural ROV body should be fully sealed in order to be watertight so that internal electronic circuit that placed within him will not be damage because of water. The main accident that will cause if there is have leak deep water ROV is short circuit. Apart from that, structure ROV body must be tough enough to hold water pressure and to avoid occurrence of water leakages.

1.3   Objectives

In countries other than Malaysia, they already know and use this ROV ever since where the *ROVs* were first used by the United States Navy in the 1960s. But in Malaysia, the ROV is still a new technology for Malaysian people to know and learn this ROV. Then the objective for this project is:

a) To design and develop of a remotely operated underwater vehicle (ROV) with maneuvers control system.

b) To design the maneuver control system for ROV by using Programmable Interface Controller (PIC).

c) To design the develop hardware for the ROV with waterproof.

1.4   Scope of the Project

The scopes of this project are:

a) Research about the Remotely Operated Underwater Vehicle (ROV) by read others people journal, book, paper, or thesis to more understand how the system ROV was function and identify how the using of this ROV in others countries.

b) To determine the component that will be used for the ROV where the component used is Programmable Interface Controller (PIC) Microcontroller as the main process, motor to move the ROV and controller to control the ROV movement.

c) Design the programming coding for controlling ROV

d) Design the hardware for the ROV with the waterproofing where the ROV have to seal to make sure it is waterproof.

e) To ensure that ROV's operation has good cooperation with surveillance system and surface controller which is joystick controller.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter contains general information and study the literature review about Development of Remotely Operated Underwater Vehicle Maneuvers Control System and brief to go into detail about the control system involved in this project. All the information and the facts were collected from reliable source and elaborated based on understanding of the review in order take out the basic idea in producing the best Remotely Operated Underwater Vehicle (ROV) either it is in term of a practical theory or a valuable prototype.

2.1.1   Definition of ROV

ROV can be defined as an underwater remotely operated vehicle (ROV) is a mobile robot designed for aquatic work environments. Remote control is usually carried out through copper work environments. Remote control is usually carried out through copper or fiber optic cables. A human operator sits in a shore-based station, boat or submarine bubble while watching a display that shows what the robot "sees." The

operator can also maneuver the robot. Sophisticated underwater ROVs incorporate telepresence to give the operator a sense of being in the place of the machine.[1]
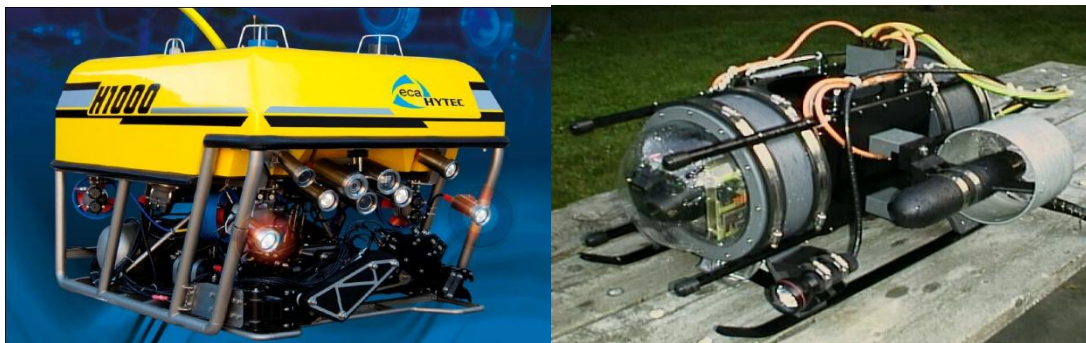

Figure 2.1: Example of ROV used in nowadays

The definition above shows that the concept how the ROV will be function. The basic ROV will have the remote control that will control by human and that remote carried out through the wire connect to the ROV system. For example from figure 2.1 above shows example of ROV used in nowadays where they used wired to connect it with human at above the water. Human just only control it by using controller.

Then, from another source as shown in figure 2.2 below., ROV also can be defined as An ROV control system includes two discrete structures, a topside and vehicle or bottom side system connected by an umbilical. The topside system is the user interface and is made up of a graphical/video display and user controls such as joysticks, switches, paddles, etc. These user inputs are constructed into a data string that is transmitted to the vehicle via the umbilical. Any processing of data typically takes place on the topside controller/processor. The bottom side system receives the user inputs and executes the command via the various subsystems and components such as manipulators, thrusters, and cameras. It will relay information back to the topside unit including sensor data and current component settings (for instance the power setting of a particular thruster).[2]

From the second source, ROV will have two system which is topside and bottom side system where the topside system will have user interface and user control such camera/video and joystick/switch. Then, for the bottom side system will receive commands from the surface system, carry out the required functions via input/output capabilities, and the deliver status information back to the surface. Figure below shows the ROV for topside and bottom side system.
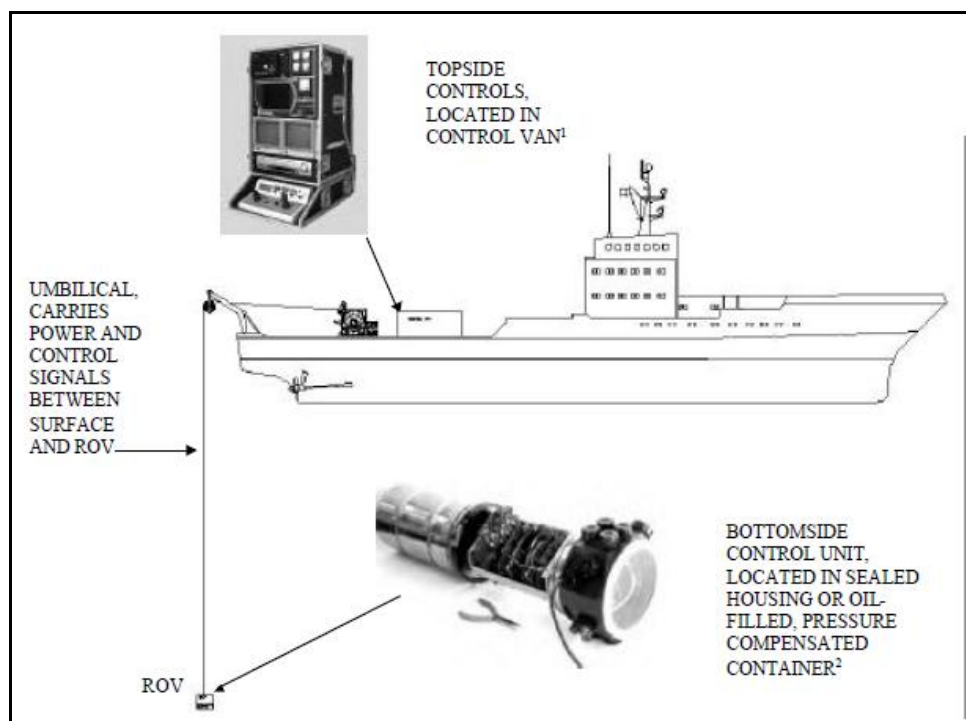

Figure 2.2: ROV Topside and Bottom Side System Operated from a Ship

Because of ROV can be control throughout on ship or boat, it is widely used and utilized used for the research of subsea and other task like oil and gas extraction, installation of underwater telecommunication cables, installation of pipelines in the sea, maintenance in offshore industries and also for military services.

Various duties carried out by offshore industry which requires usage ROV from drilling exploration (examination subsea, operation valve, riser examination, hydraulic BOP operation) for field development and production (used at platform and pipeline, examination, subsea hardware installation, infrastructure, repair and maintenance) for

decommissioning. For example in figure 2.3 below is application of ROV used in nowadays where it have been used to inspection, installation some work in underwater.
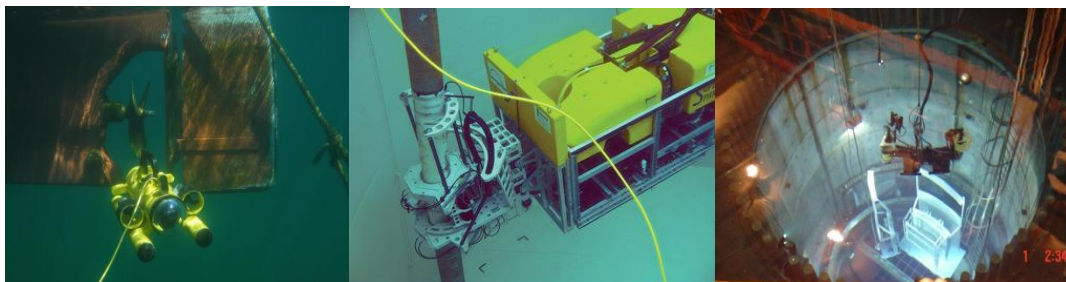

Figure 2.3: Inspection, and Installation using ROV

There are different types of underwater vehicles. One method of categorizing these vehicles is to identify them as members one of two classes of vehicles; manned and unmanned systems [3]. As we know, we all familiar with the manned system where this manned system is basically controlled by man in the vehicle. It can be described simply as falling into two sub-classes; military submarines and non-military submersibles such as those operated to support underwater investigations and assessment. The navies of the world utilize a number of different classes of submarines to conduct their missions.

Unmanned submersibles also fall in to a number of different sub-classes. The simplest and most easily described are those submersibles that called a Remotely Operated Vehicle (ROV). An ROV is a tethered vehicle. The tether supplies power and communication to the ROV and is controlled directly by a remote operator. A second type of unmanned submersible is an Unmanned Untethered Vehicle (UUV). This untethered vehicle contains its own onboard power, but is controlled by a remote operator via some type of a communications link. An AUV is an undersea system containing its own power and controlling itself while accomplishing a pre-defined task. A further distinction between the AUV and UUV is that the AUV requires no communication during its mission whereas the UUV requires some level of communication for it to complete its assigned mission. Then, figure 2.4 below shown the different between AUV, UUV and ROV in term of their body structure. ROV basically