THE DEVELOPMENT OF STATIC DIVING SYSTEM USING BALLAST TANK

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UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

THE DEVELOPMENT OF STATIC DIVING

Tajuk Projek :   **SYSTEM USING BALLAST TANK**

Sesi
Pengajian   : | 1 | 2 | / | 1 | 3 |

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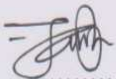76100 Durian Tunggal, Melaka

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

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ABSTRACT

This project report is to have a static diving in underwater. One of the movements in the water is static movement. Static movement is a movement which in vertical. Static diving is important to ROV because it maintain their stability when dive into water.This stability is important for maintaining human safety and prevents any harm and damage. For example, the ROV bring an equipment to install it in underwater. If that ROV can't control their stability, the component probably will fall. To achieve this stability, an application that name ballast tank can be used to dive in static movement or vertical. The submarine, ROV or other prototype also used a ballast tank to have a static diving. An air compressor, motor pump, syringe and much more can be used together with a ballast tank to have a static movement. A static diving technology which used a ballast tank to make the prototype submerge and float into water by controlled by PIC. The PIC will be used to control the ballast tank by adjusting which port being used and apply it to ballast tank.

ABSTRAK

Laporan projek ini adalah untuk membolehkan pergerakan ROV secara menegak didalam air. Salah satupergerakandi dalam airadalah pergerakanstatik.Pergerakanstatik adalahsebuah gerakanyang menegak.Penyelaman dalam keadaan statik iniadalah penting untukROVkerana ia dapat mengekalkan kestabilanmereka apabilaberada di dalamair.Kestabilan iniadalah penting untuk mengekalkankeselamatan manusia danmenghalang mana-manabahaya dan kerosakan.Sebagai contoh, sebuah ROVmembawa peralatanuntuk dipasang di dalam air. JikaROV tersebut tidak dapat mengawalkestabilanya, komponen tersebut berkemungkinanakan jatuh.Untukmencapai kestabilanini,penggunaantangki air bolehdigunakanuntuk menyelamdalam pergerakanstatik ataumenegak.Kapal selam, ROVdan prototaip yang lainjuga menggunakantangki air untukmenyelam secara statik.Sebuah pemampat udara, motor pam,picagaridan banyaklagi bolehdigunakan bersama tangki air untuk mendapat pergerakan statik. Teknoloi menyelam secara statik yang menggunakantangkiuntukmenenggelam dan menerapungkan prototaipke dalamair dapatdikawal dengan menggunakanPIC. Dengan menggunakan PIC, ia dapat mengawaltangki air dengan menetapkan kaki mana pada PIC tersebut yang mahu digunakan dan memasangnya pada tangki air.

TABLE OF CONTENTS

III   **METHODOLOGY**

IV   **RESULT AND DISCUSSION**

V   **CONCLUSION AND RECOMMENDATION**

LIST OF FIGURE

LIST OF TABLE

LIST OF ABBREVIATIONS

DC	–	Direct Current
PIC	–	Peripheral Interface Controller
BT	–	Ballast Tank
I/O	–	Input Output
CPU	–	Central Processing Unit
RAM	–	Random Access Memory
PC	–	Personal Computer
ROM	–	Random Only Memory
PCB	–	Printed Circuit Board
PSM	–	Projek Sarjana Muda

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

In this chapter 1, it will include chapter overview, Introduction, problem statement, objective and scope of the project.

1.1   Chapter Overview

To start this project, the first term that must be known is about a ballast tank. What is ballast tank? Which these ballast tanks apply to? How these ballast tanks work? And much more. A theory about buoyancy must be understands and find the previous journal that related to this project. Then from that journal, design the project based on researched from previous journal.

1.2   Introduction

Submarine is a vehicle underwater that used to diving to the sea and one of term on their diving is a static diving. Static diving is a concept that can dive in a horizontal movement inside the underwater. The submarine got a problem to have a diving in static movement if it not used a ballast tank control system. To have this static diving, it used a concept of Buoyancy of the submarine. A concept of

buoyancy is difficult to adjust and if wrong, it will not make the submarine/ROV diving in static movement.

This buoyancy will relate to the ballast tank which a concept. When water start entering into the ballast tanks it can change from positive buoyancy, neutral and to negative buoyancy. To bring the water entering into ballast tank it can be used a motor, syringe, pump and much more. All the equipment which in mechanical, electric and electronic part that being apply to control the ballast tank submarine/ROV must be in good condition when it apply to the water.

To achieve this prototype successfully, the equipment that being used to equipped this ballast tank must be in suitable tools. The model design of ballast tank must be suitable design because in underwater, to have a static diving is difficult. From the previous journal, many ballast tank used a piston, air compressor and much more. But all of the ballast tank didn't had any of sensor to calculate their depth of position.

1.3   Problem Statement

This project had a problem statement that must be face which is:

a)   The submarine got a problem to have a diving in static movement if it not used a ballast tank control system.

b)   A concept of buoyancy is difficult to adjust and if wrong, it will not make the submarine ROV diving in static movement.

c)   All the equipment which is mechanical, electric and electronic part that being apply to control the ballast tank submarine/ROV must be in good condition when it apply to the underwater.

d)   Don't have a proper sensor that can be used in underwater part. Furthermore, this sensor and transducer play an important role in this control system. Sensor can be applied to calculate the depth of the underwater base and

transducer can be applied to underwater vehicle to calculate the position and measure the position o prototype inside the water.

1.4   Objectives

a)   To develop and produce this ROV to had a static diving in underwater using ballast tank.

b)   To understands the concept of buoyancy which a concept to make sure this static movement easy to conduct and successful.

c)   To understands the concept of ballast tank which used motor to bring the water in and out. Then by using a controller to control the ballast tank.

d)   To design a control system in PIC to conduct the submarine/ROV vehicle and the ballast tank.

1.5   Scope of Project

This scope of project is a flow to achieve of each objective. First is to start study the theoretical about underwater vehicle and ballast tank. Then design the body structure of submarine/ROV together with the ballast tank and used a good material on it. Next is applying the circuit of ballast tank and write the program code for PIC. If both concepts which are body structure and circuit are complete, apply the theory buoyant on that structure. If the buoyant is good than apply and test the PIC to conduct the ballast tank.

First is to study the theoretical about underwater vehicle and ballast tank. This theory will determine the body structure of prototype underwater vehicle and body structure of ballast tank. Furthermore, a theory about buoyancy and how to conduct a motor when it applies to underwater also being determined. To find all knowledge is from the internet, researched previous journal and small group discussion with supervisor.

Next is design the body structure. To design this body structure, software that name sketch up will be used to design this ballast tank. Make sure when designing this body structure, the hardware when it apply to build this ballast tank must be in good material.

Then apply a circuit together with the code of PIC. To conduct the circuit, a motor being used conduct either forward or reverse direction. The PIC being used to make the circuit more easily to control. From this circuit, a controller being used to determine the direction of the motor. The controller that being used is joystick play station 2.

After both circuit and body structure are successful, apply a theory of buoyancy to that prototype. This buoyancy is a finally method because this buoyancy only can be determine in a water. This concept of buoyancy will enable the prototype to have a static diving.

1.6   Thesis Outline

First chapter for this report is introduction, In this introduction there will have a sub topic which include a background study, objectives, problem statement and scope of project. In this first chapter, it will explain about the problem that found in diving underwater than the purpose on this project will clearly explain in objective part. To achieve this objective, the scope of the project will clearly explain in this chapter. On second chapter is the literature review, on this chapter it will explain about the previous-previous journal about the ballast tank. All the advantages and disadvantages will be explained clearly in this topic. On third chapter is methodology, it shows a flow on beginning to start this project until the project is finished. Each of flows and step will clearly explain what should be taken for this project. The fourth chapter is result and discussion, this part will cover about the result and analysis of this ballast tank project. Then it will discuss about time when ROV sink and float. Furthermore an analysis about the theory and calculation of buoyancy also being explain. The last chapter is conclusion, in this part, the achievement of this project objectives will be concluded either it achieved or not.

CHAPTER II

LITERATURE REVIEW

2.1   Background ballast tank

In submarine structure, had 3 different ways to locate this ballast tank.

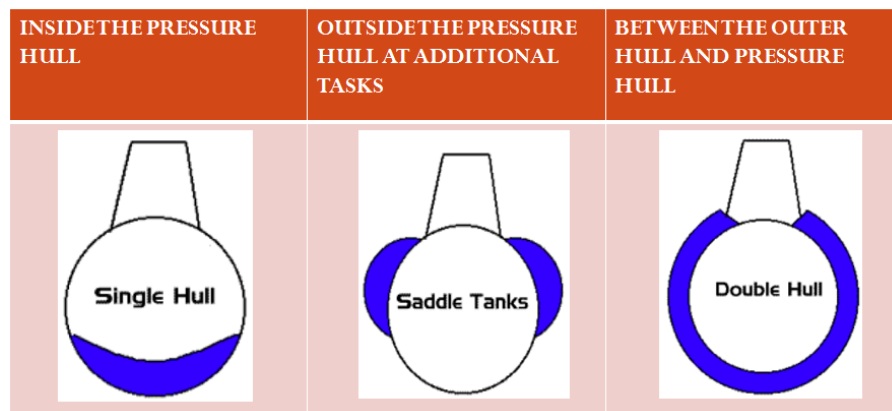| INSIDE THE PRESSURE HULL	OUTSIDE THE PRESSURE HULL AT ADDITIONAL TASKS	BETWEEN THE OUTER HULL AND PRESSURE HULL
Single Hull	Saddle Tanks	Double Hull

Figure 2.1: Ballast Tank

In these 3 different ways to locate the ballast tank, each of the ways had their advantages and disadvantages. For method one which in single hull their ballast tank is inside the submarine and it will make the size of the submarine is smaller. These ballast tanks have their own limit to bring the water in and out. This ballast tank is good to dive but not in a deep sea diving.

For the second method is a saddle tank, this saddle tanks will make the submarine larger but hard to adjust the quantity of the water to bring the submarine in a static diving. Many submarine didn't used this method because this method is expensive, high maintenance but it good in diving but not well in a deep sea diving.

Method three is a double hull, this double hull is good static diving for submarine because their ballast tank is surrounding around submarine. It hard to maintenance and can used many types of ballast tank to bring the water in and out which is flexible ballast tank, air pressure tank or air compressor.

2.2 Concept of Buoyancy

A theory of buoyancy is a force to determine by a fluid, that change the weight of an sink object. When it applies to fluid, a pressure increases with a depth and as a result the weight of the fluid decrease. Thus a column of fluid, or an object submerged in the fluid, experiences heavy pressure at the bottom of the column than at the top. This difference in pressure results in a net force that tends to accelerate an object upwards. The magnitude of that force is proportional to the difference in the pressure between the top and the bottom of the column, and it is also equivalent to the weight of the fluid that would otherwise occupy the column. In this reason, an object whose density is greater than that of the fluid in which it is submerged tends to sink.
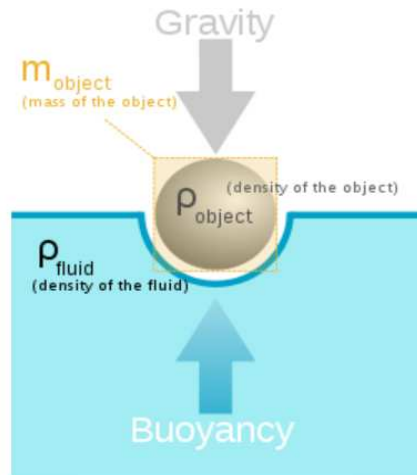
Figure 2.2: Buoyancy

2.3   Types of ballast tank

2.3.1   Enclosed ballast tank

The tank will keep in shape and its used pump fills to bring the water in. To use this ballast tank, it possible to use a large tank than a small tank because it must used a better material of submarine to bring this tank inside the submarine.

Figure 2.3: Enclosed Ballast Tank