DESIGN AND DEVELOPMENT AN UNDERWATER GLIDER USING REMOTE CONTROL (RC)

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Bachelor of Mechatronics Engineering

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"I hereby declare that I have read through this report entitle "Design and Development an Underwater Glider using Remote Control (RC)" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronics Engineering"

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Supervisor's Name : En. Mohd Shahrieel b. Mohd Aras

Date : 12/5/2010

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A report submitted in partial fulfillment of the requirements for the degree of Bachelor of Mechatronics Engineering

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2010

I declare that this report entitle "Design and Development an Underwater Glider using Remote Control (RC)" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : Fadilah Binti Mohd Zain

Date : 11/05/2010

To my beloved husband, father, mother and family

To all my lectures and friends

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I wish to thank my project supervisor, En. Mohd Shahrieel Bin Mohd Aras for his guidance and teachings. And also would like to thank both panels for their guidance.

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ABSTRACT

Nowadays, an underwater glider being a new kind underwater vehicle which has no external propulsion system equipped on it. It's driven depending on buoyancy adjustment of itself and move horizontally wing. Underwater glider becomes more important especially in oceanographic and this project is concerned with the design and development an underwater glider using remote control (RC). This glider is designed by using a buoyancy control to make the glider become float and using an hydrodynamic concept. The main part of this an underwater glider consist of wings, tail, receiver and transmitter board, DC motor, fan and remote control. In development of underwater glider, its control system design plays an important role. This glider is controlled by using radio frequency (RF) with 4 channel. The remote control (RC) will control the movement of a glider and the DC motor will be used to rotate the fan. However, DC motor spins too fast and has too little torque to drive the loads. Thus, gear reduction is required to slow down the rotational speed and increase the torque of the motors.

ABSTRAK

Pada masa kini, peluncur dalam air merupakan sejenis kenderaan bawah air yang baru di mana ia tiada sistem penggerak luar yang dibina di dalamnya. Ia dipandu bergantung kepada pelarasan keapungan dan sayapnya bergerak secara mendatar. Peluncur bawah air menjadi lebih penting terutamanya di dalam oceanografi dan projek ini adalah berkenaan dengan pembangunan dan rekabentuk peluncur dalam air menggunakan alat kawalan jauh. Peluncur ini direkabentuk menggunakan kawalan apungan untuk membolehkan peluncur tersebut terapung dan menggunakan konsep hidrodinamik. Bahagian utama peluncur ini mengandungi sayap, ekor, papan litar penerima dan pemancar, motor DC, kipas dan alat kawalan jauh. Dalam pembangunan peluncur dalam air, rekabentuk sistem kawalan memainkan peranan penting. Peluncur bawah air ini dikawal oleh frekuensi radio dengan 4 saluran. Alat kawalan jauh akan mengawal pergerakan peluncur dan motor DC akan di gunakan untuk menggerakkan kipas. Bagaimanapun, motor DC berputar terlalu laju dan mempunyai tork yang terlalu kecil. Oleh itu, pengurangan gear diperlukan untuk mengurangkan kelajuan putaran dan meninggikan kadar tork motor.

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LIST OF SYMBOLS

AUV		Autonomous Underwater Vehicles
cm		centimeter
		meter
mm	-	milimeter
kg	-	kilograms
km	-	kilometers
Mhz	-	Megahertz
RC	-	Remote Control
RF	-	Radio Frequency
CETUS	-	Composite Endosheleton Test bad Untethered Underwater Vehicle System
MUG	-	Mini Underwater Glider
B	-	Buoyant Force
W	-	Weight
T	-	Torque
I	-	Current
k		Constant
V		Voltage
DC		Direct Current
F_b		Buoyant force
γ_f		Specific weight of the fluid
V_d		Displaced volume of the fluid
PVC		Polyvinyl Chloride
N		Newton

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This project is titled as **"Design and Development an Underwater Glider Using Remote Control (RC)".** The main purpose of this project is to design and developed and underwater glider using remote control (RC). Since nowadays there are many new kind of underwater glider have been developed till an advanced state. The development of the Underwater Gilder is presented as an example of the implementation process for a mechatronic product.

An Underwater Glider is a underwater vehicle that is driven through the water by a propulsion system and control by a remote control (RC).Radio frequency will be used as a signal between a remote control (RC) and the glider body. There have a receiver and transmitter board to transmit the signal. Motor and fan function as a thruster which being a main part for movement purpose. There have 4 channels in the remote control.

An Underwater Glider has been designed by using SOLIDWORK software before convert to the actual vehicle. The basic information about the remote control, hydrodynamic concept, buoyancy adjustment and motor driver will be implementing in this project.

1.2 Objective of project

The objectives of this project are to:

i. Design and developed an underwater glider using a remote control.

1.3 Scope of project

The scope of project in this project is stated as given:

i. Remote Control 4 channel for reverse, forward, turning right and left.
ii. DC motor to moves fan act as thruster.
iii. Solid work software to draw the design glider.
iv. PVC as material for glider body to float on the water surface.

1.4 Problem Statement

Ocean is a dangerous place for people to explore. The environment in the ocean is hard to predict such as a composition of the surrounding fluid, current speed, tidal waters and life forms in its natural habitats. So, it will give the problem for people to moves from one point to another point with a limited time and dangerous environment. Besides that, 70% of the earth recovers by water, so people need one vehicle to moves on the ocean without risking people's life.

In order to solve the problem, an underwater glider is developed to help human. An underwater glider is the one of the safest ways to explore the water is using small unmanned vehicles to carry out various missions and measurements. Its can moves from one point to another point with unlimited time to collect all data on ocean. We can control the movement of the glider by using remote control. So, people just need to monitor the condition and environment on the ocean details from far. In order to make it feasible to produce many

unmanned vehicles, a relatively simple and inexpensive underwater glider needs to be designed.

1.5 Methodology

The project methodology is an important chapter as the methodologies; design flow and constructing of the project are discussed. Brief description is given about each procedure in the completion of the project. The research work is undertaken in the following five developmental stages. For better understanding of research methodology process, flow chart of the project is shown in Figure 1.1.

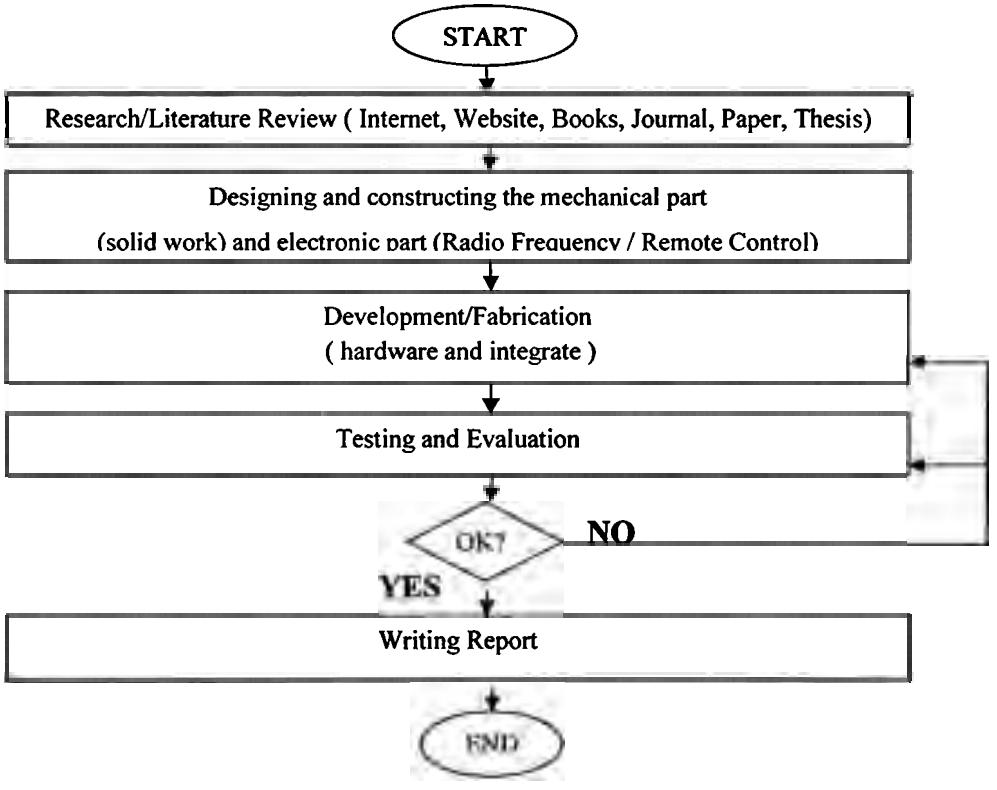

Figure 1.1 : Flow Chart of Project

1.6 Organization of report

This presentation report is divided into six chapters. Each of the following paragraphs generally described the contents of each chapter.

Chapter 1 Introduction

This chapter explained about the objectives, scopes of project, problem statement of this project, and summarized a general methodology and the main activities involved in this project.

Chapter 2 Literature Review

This chapter gives of the general description and overview of the underwater glider. Some of the literature review on An Underwater Glider such as features, design, and concept is also discussed in this chapter. It also discussed the basic idea to understanding the underwater glider such as their basic properties concept like material, controller and so on. In this chapter also explained detail about basic parameter of underwater glider such as size of underwater glider, shape and so on.

Chapter 3 Methodology

This chapter discussed the process of designing an underwater glider and shows description of the mechanical part and electronic parts.

Chapter 4 Result

This chapter shows the results of the research

Chapter 5 Analysis and Discussion of the Result

This chapter shows discussion and analysis of the result from the data collected.

Chapter 6 Conclusion

This chapter gives a summarized work and conclusion for overall of this project. Suggestion for future improvements and advancements of this study are also discussed.

1.7 Summary

In this chapter, the introduction of the project is well discussed and described by starting its objectives, scope of project, problem statement and research methodology that would help the reader to have a better understanding the general idea about the project. Consequently, literature review on underwater glider of the report are also discussed in the later chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter shows all about the research before the underwater glider have been design and develop. To build this project, it requires the knowledge that not readily offhand. There are three main parts need to be investigated in order this project will be successful, design of the glider body for mechanical part , motor and remote control for controller purpose and underwater glider concept such as a hydrodynamic shape and buoyancy adjustment. An underwater glider is a type of Autonomous Underwater Vehicle (AUV) that uses small changes in its buoyancy in conjunction with wings to convert vertical motion to horizontal, and thereby propel itself forward with very low power consumption [1]. In order to design any underwater glider it is essential to have strong background knowledge and fundamental concepts and theory about the processes and physical laws governing the underwater vehicle in its environment. With regard to an Underwater Glider, factors such as stability, hydrodynamic and buoyancy concept have to be taken into consideration. This chapter introduces some of these fundamental concepts and ideas about Underwater Glider that are as literature review. This chapter also will discuss about the theory and project background of this project. The knowledge and fundamental concepts are very essential before designing any vehicle. This chapter introduces some of these fundamental concepts and ideas about underwater glider, and also examines the general design of these vehicles. The mechanical and electronic systems of Underwater Glider are also presented and examined closely to gain insight into different designs.

2.2 Slocum Glider

In the year 2001, Teledyne Webb Research Corporation have developed and produced an underwater glider that called "Slocum" as shown in Figure 2.1. A Slocum glider uses gravity to descend and buoyancy to rise whiles its wings providing the forward motion of about one kilometer per hour. The Slocum design is more robust. The body type of Slocum is torpedo and added by wing. Slocum was optimized for shallow coastal operation. Slocum is capable of operating in water as shallow as 5 m. Slocum use a simple aluminum hulls to resist external pressure and provide a streamlined hydrodynamic shape. Slocum is designed to use alkaline batteries which are safer and less expensive than lithium have a lower possibility of explosive failure and less expensive per unit energy but Slocum can use lithium batteries to extend life. Because the only power it needs is for varying its buoyancy and running its electronics, the resulting long-range and duration make it ideal for long term data collection over large swaths of ocean. Slocum guided only by GPS and researchers' commands, it transmit scientific data via satellite to the home office and take new GPS bearings before diving again.

"What we are working toward is connecting groups of gliders into networks that can talk to each other and make decisions autonomously without the need for human intervention," Tom Swean, a scientist for the Office of Naval Research, says. "The thermal glider has a distinct advantage," Jones adds. "If you can go up and down for free, that is, you are harvesting energy from the ocean, then we can start talking about four- to five-year deployment. [1]. The Table 2.1 shows the technical specification for Slocum glider.

Table 2.1 : Technical Specification of Slocum glider

Item	Specification
Shape	Hydrodynamic
Buoyancy	Yes
Mass	52 kg
Length	150 cm
Diameter	21 cm
Payload	5 kg
Max Depth	200 m
Range	500 km
Left/Right Wing	Yes
Top Wing	Yes
Hull Material	Aluminium
Cost	$ 70,0000

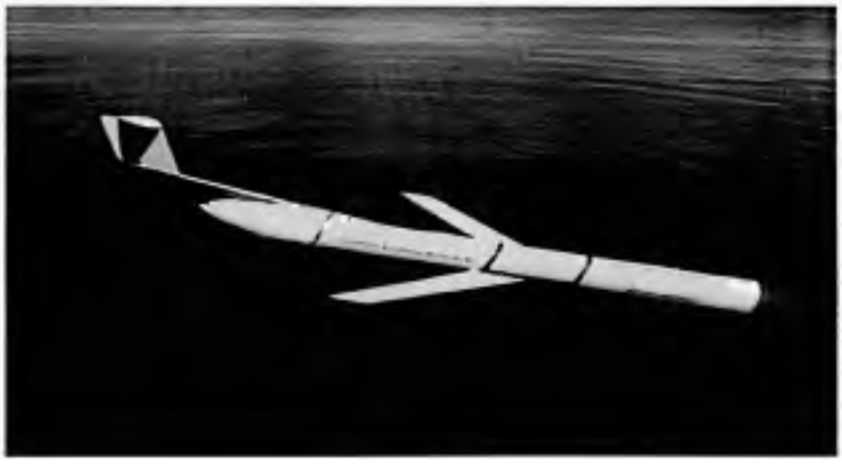

Figure 2.1 : The Slocum glider