UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AUTONOMOUS UNDERWATER VEHICLE (AUV) ATTITUDE CONTROL SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Projek ini menerangkan pembangunan Kenderaan Bawah Air Autonomatik (AUV) untuk sistem kawalan sikap di bawah air. Antara pilihan kaedah pemeriksaan di bawah air, menggunakan robot bawah air menjadi terkenal dan lebih cekap. AUV adalah robot yang tenggelam yang dapat bergerak secara automatik di dalam air dan tanpa dikawal oleh manusia di dalamnya. AUV adalah jenis kenderaan bawah laut yang selamat dan digunakan secara meluas dalam pelbagai keperluan ketenteraan, komersil, saintifik dan direka untuk persekitaran kerja akuatik. Projek ini melibatkan reka bentuk mekanikal, elektronik dan perisian AUV. Masalah dengan AUV ini ialah ianya terlalu besar dan berat. AUV memerlukan kestabilan yang hebat untuk bergerak secara automatik di mana-mana keadaan permukaan di bawah air dan kestabilan ini di kawal oleh pengawal PID untuk memudahkan AUV sentiasa stabil. Selain itu, litar pengawal AUV berada di dalam badan supaya litar tidak akan dirosakkan oleh air. Akhirnya, AUV ini diuji dalam beberapa eksperimen untuk memastikan ia dapat berfungsi dengan baik dalam keadaan di bawah air.

ABSTRACT

This project describes development of Autonomous Underwater Vehicle (AUV) for attitude control system. Among varies inspection methods of underwater, using underwater robot becomes famous and more efficiency. AUV is a submerged robot which is able to move automatically underwater and without having the human maneuver inside it. AUV is a safe and widely used type of underwater vehicle serving a range of military, commercial, scientific needs and designed for aquatic work environments. This project involves mechanical, electronic and software design of AUV. The problem with this AUV is too big and heavy weight. The AUV needs the positive buoyant and the great stability to move automatically in any surface condition underwater so that PID controller was applied to give more stability. Besides that, the controller circuit of the AUV is in the body so that the circuit will not be spoilt by water. As a result, the AUV is tested in few experiments to make sure it can perform well in underwater condition.

DEDICATION

From love, dreams and sacrifice from my whole life, I acknowledge it not enough to be proud without my father, Zakaria Bin Shafie that I have learned more valuable thing from him. Thus, dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, Che Rahmah Binti Yaacob who taught me that even the biggest task can be accomplished with step by step at a time. I never expected this far my journey to get the knowledge. A big thanks for all that always support me and believing in me. Thank you.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

LIST OF ABBREVIATIONS

PCA	Principal Component Analysis

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter 1, it explained about introduction of this project. The introduction contains the background of the project, problem statement, objective, work scope and conclusion of development of autonomous underwater vehicle (AUV) for attitude control system.

1.2 Project Background

Recently, the study of underwater vehicle is now a lot more famous with the rise of the ocean advancement. In particularly, a huge amount of the ocean vehicle researches, like the inspection of undersea pipeline, fishing assets, and the mineral assets are being completed. Since humans cannot gain access to the underwater environment straight, there is a raising demand of underwater automobile, which is hoped to build up such vehicles with an increased ability also. Therefore, AUV were create since it mainly function to greatly help human being to attain underwater if wish to accomplish something job. AUV operate with automated, nor use any cables for connecting with vehicle move without limit area. When compared to ROV which include power conversation and cables, when the probe is definitely manually operated by humans, the visual details of the undersea camcorder is narrowed, to ensure that it needs to get a more impressive range technology.

1.3 Problem Statement

Nowadays, Autonomous Underwater Vehicle (AUV) is very famous vehicle that were used in ocean or under the water to help human to do some task. AUV is a robotic device that is driven through the water using propulsion system, controlled by computer and of course the cost to make this AUV will be very expensive. After that, Operation underwater certainly is one of the most challenging environments due to nonlinear disturbances like ocean waves and currents which make control and navigation very difficult to handle.

1.4 Objective Research:

1. To develop an autonomous underwater vehicle (AUV) attitude control system using PID controller
2. To design electronics, mechanicals and software of AUV
3. To stabilize the roll angle of AUV