UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF STRUCTURE OF SMALL SCALE ROV FOR EDUCATIONAL PURPOSES (SERVICE MODULE)

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours

by

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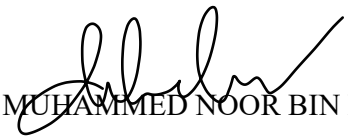

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APPROVAL

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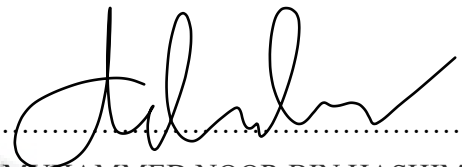

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ABSTRAK

Pada masa hadapan, teknologi kita akan berkembang dengan lebih canggih untuk menangani segala tugas yang kita lakukan, akan selalu ada mesin atau jenis teknologi bahagian yang akan membantu kita dalam kehidupan seharian. Di sini kami menetapkan prototaip Mini ROV untuk tujuan pelajar, untuk membantu pelajar memahami proses yang harus diambil ROV, dan mekanisme bagaimana ia berfungsi. Ia memberi tumpuan kepada Modul Perkhidmatan. Objektif makalah ini adalah untuk mengembangkan modul perkhidmatan ROV mini dan membuat modul perkhidmatan ROV berskala kecil yang sesuai untuk tujuan pendidikan, di mana ia memberi tumpuan kepada pengajaran pelajar sekolah menengah untuk memperoleh pengetahuan mengenai komponen, sumber tenaga Mini ROV. Modul perkhidmatan ROV berskala kecil ini dirancang berdasarkan kaedah membuat reka bentuk Lebih-lebih lagi, reka bentuk silinder ROV berskala kecil dipilih kerana jika ciri kejuruteraan, yang penting untuk daya apung dan selamat dimasukkan semua komponen elektronik, juga memungkinkan untuk menyelam di bawah air tanpa merosakkan komponen ini. Mesin SLS digunakan untuk menghasilkan dan membuat keseluruhan komponen termasuk proses penggerudian dan pemutaran. Hasil kajian yang diharapkan adalah pengembangan modul perkhidmatan untuk ROV skala kecil untuk tujuan pendidikan, menggunakan bahan plastik nilon. Sebagai hasilnya, kriteria khusus diterapkan untuk memilih modul perkhidmatan ROV yang paling tepat. Yang merangkumi bentuk, bahan yang digunakan, fabrikasi atau kaedah pembuatannya.

ABSTRACT

In the near future later on, our technology will be developing in more upscale and sophisticated to handle regarding any task we do, there will always a machine or a technology type of part that will help us in our daily life. Here we designated a prototype Mini ROV for student purposes, to help the student understand the process of the ROV have to take, and the mechanism of how it works. This paper describes the development executing or the making of mini ROV which in this paper focusing on certain part. It focusing on Service Module. The objective of this paper is to develop a mini ROV service module and to fabricate a small-scale ROV service module which suited for educational purposes, where it is focusing on teaching the high school student to gain knowledge regarding the component, the power source of Mini ROV. This small-scale ROV service module designed based on engineering design. The final dimension of the small-scale ROV was 400 mm x 110 mm x 110 mm in size. Moreover, the small-scale ROV cylinder design IS chosen because if engineering features, which is important for buoyancy and safe to be inserted all the electronic component, also allowing it to dive underwater without damaging this component attach to it. The SLS was utilize to produce and fabricate the entire component including drilling and threading process. The study expected outcome is the development of a service module for a small-scale ROV for educational purposes, using a nylon plastic material. Which as a result, specific criteria were applied to select the most appropriate ROV service module. Which include their shape, material used, fabrication or manufacturing method.

DEDICATION

I dedicate all of my work to my family and to my friends. In this semester, I realize that once you have someone who is trust of you and believe in you will give us the strength to move forward and accomplishing our goal. Every challenge that I face today may not be compare what I am going to face in the real world. But I know for a fact, that I will always have their support in anything I may do in future. Apart from that, with a humble heart, I would to sincerely dedicate my work to my supervisor who guided me from beginning until now. Last but not least, to all my amazing wonderful helpful friends, thank you for the information you have gave me thorough out this semester and completing this project, regarding my PSM Project, they also help in giving mt guidance and helpful tips to complete this PSM Project. Without their support, and guidance I wouldn't be here today finishing this PSM Project and be where I am now, almost in the end of the Journey of Degree student. Thank you once again.

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Firstly, I want to express my utmost gratitude to Allah S.W.T The almighty who giving me his blessing and giving me the health in order to finish this project. Making it smooth journey with a lot of experiences and knowledge that I can use in the future later on. Secondly, I would like to express my utmost gratitude my PSM Supervisor, TS Muhammed Noor Bin Hashim and my Co-Supervisor, Dr Mohd Khairi Mohamed Nor. Thank you for all your support and guidance regarding this PSM project. While thank you for understanding and the blessing they have gave me and my team mates regarding this PSM project. Giving us a full trust to finish this Project. Without the guidance and assistance, I and my fellow team mates may not finish this PSM project by our own. Also thank you to all my friends, team mates who are dearly helpful by helping me to finish this project, guiding me where I do wrong in the making of PSM project or executing this PSM report. Without their guidance and helps, I won't be able to finish the project on my own. Thank you for all the information they have share either directly or indirectly to complete this PSM Project. Thank you. Once again.

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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

ROV	Remotely Operated Vehicle
DC	Direct Current
AC	Alternate Current
LiPo	Lithium Polymer
HOQ	House Of Quality
3D	Three Dimension
CNC	Computer Numeric Control
CURV	Cable-controlled Underwater Research Vehicle
US	United State
PVC	Polyvinyl Chloride
GTM	Global tech Serve Marine
SSC	Seahorse Service
WROV	Work Class
LWROV	Light Work Class
SLS	Selective Laser Sintering
PDB	Power Distribution Board
ESC	Electronic Speed Control

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Introduction

In the past year, ROV has being used and have increase in uses following their usefulness in getting job done. Many of the vehicles being used for underwater activities of in many different genre of companies such as oil and gas installations, structures pipeline and as surveillance of the underwater surrounding (M.Said, 2015). For starter, the vehicle being stated are ROV which indicated remotely operated vehicles which are operated by a crew either aboard or floating vessel on proximate land. These vehicles are used for research and observation of underwater activities. Recently, several works on ROV have been reported for applications in ocean research. While this may have been the focus of application being used, some use ROVs to capture underwater images, of which nowadays there are open research line. However, despite the significant advance that has being achieved in different areas of application and development of ROVs, it is more likely having a wide range of specialties that come into play in achieving optimal functionality. (Aguirre-Castro, 2019). None to say the least, ROVs are unoccupied, highly useful and can be operated by one person where they can be safe from any dangerous surrounding. Moreover, ROVs is essential where its action as surveillance for the human eyes in watery region are helpful in getting data analysis based on the picture that they take where, the ROV is imparted with cameras and recording data. In addition, the ROVs are built in many different ways, either from their sizes or shape their main features is still act as monitoring devices towards the human to help understand better the aquatic life. The main point for having ROV is having the view of underwater surrounding while

being safe from danger. (Azis, 2012). In addition, most of ROVs are equipped with buoyancy units that provide sufficient lift force and vehicle stability, and a number of thruster/ impellers provide manipulation of movement of the whole units. While the above-mentioned units of the ROV, though in many cases, the effective accomplishment of specific task highly depend on the effective design of the manipulator units. The design of ROVs in designated in terms of diverse specifications such as minimum outreach, lifting capacity and wrist torque. Mostly during underwater task such as picking objects and manipulating mechanical parts or turning handles to close or opening the valves, for instance cannot be conducted without an appropriated designated and regulated manipulator. Thus, particular focus in onto the designation of the ROVs body and its mechanical properties. This does include manipulator arm, water sampler, instrument that measure clarity, light penetration, temperature and depth. (Oygarden, 2016).

In addition, small ROVs are especially suited for underwater natural resources agencies and academic institutions operating with affordable prices and easy to get resources. A small ROV can be operated from vessels as small as six meters with a minimum of equipment and crew. In contrast, unlike a large ROVs that typically require large, dedicated support vessel, a small ROV can be deployed from range of platforms that can be tailored to match the scale of operations and expected working conditions. More research being stated that small ROVs are capable of working at depth beyond scuba safe limits (~25 m) and also in complex habitats inaccessible to other nets, furthermore can be transported promptly and deployed in response towards acute or very short –term events. In any case, small ROV is perfect to conduct non-destructive sampling for monitored rare or fragile species. (Pacunski, 2008). Either way, the Value of ROVs for educational purposes is widely recognized as “ROV in a bag”. Educational kits and international student ROV competition. (Stefanie Rettig, 2009).

Never the less, ROV play a major part in researching and many more uses of it. One thing for sure is that the ROV making live better for those marine incorporation while going towards it, the ROV provided varies option to help in discovered more hidden places between the ocean. While at it, it helps in development of engineering problem such as reaching towards part which the diver unable to submerge into the depth. With the help ROV, they should be able to monitored and explore the subsea to go in deeper than one hundred meters. In addition, ROVs have so many advantages of it when It comes to inspection, capturing image of underwater level and many more, this project created due to obtaining knowledge that the student able to apply and understand the mechanism of ROV itself. The way it moves and how to operated it. Building and operating ROVs uniquely combines element of physics, science, engineering, programming, oceanography, and biology.

1.2 Background

Remotely Operated Vehicle (ROV) is a tethered robot, often employed for underwater operations. ROV is performed through a remote control while the pilot who is in control is far away from the scene. For example, on onshore or on a floating vessel. Below is description of a basic of Remotely Operated Vehicle which consists of:

i. Control Navigation and Control System

ii. Thruster (Propulsion)

iii. Light

iv. Camera

v. Body Structure

vi. Service Module