Laporan Penelitian

Design and Build Underwater Robot Control System Based on PID (Proportional Integral Derivative)

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Abstrak

Indonesia memiliki perairan yang luas dan didalamnya terdapat potensi perikanan yang sangat melimpah seperti berbagai spesies ikan air tawar dan biota perairan lainnya. Besarnya peranan perairan Indonesia ini tentu perlu didukung dengan adanya sistem monitoring yang mampu mengontrol dan memantau kondisi di dalam air, seperti underwater robot. Pada penelitian ini dilakukan rancang bangun underwater robot berbasis PID (Proportional Integral Derivative). Kestabilan robot dikontrol menggunakan PID dengan feedback dari IMU MPU6050 untuk kontrol kemiringan dan feedback dari sensor tekanan MS5803 untuk kontrol posisi kedalaman. Underwater robot ini dilengkapi dengan enam buah motor DC, dimana empat buah motor DC digunakan sebagai penggerak robot pada arah vertical (ke atas dan ke bawah) sedangkan dua buah motor DC lainnya digunakan untuk menggerakn robot pada arah horizontal (maju, mundur dan berbelok). Selain itu, robot juga dilengkapi dengan dua buah lampu sebagai penerangan robot. Dalam penelitian ini, underwater robot dapat menjaga kestabilan ketika nilai parameter PID yang diberikan adalah Kproll sebesar 0.001, Kiroll sebesar 0.001, Kdroll sebesar 1, Kppitch sebesar 0.001, Kipitch sebesar 0.001, Kdpitch sebesar 1, Kpdepth sebesar 5, Kidepth, sebesar 1 dan Kddepth sebesar 1.

Kata Kunci: MPU6050, MS5803, PID, Underwater Robot

***Abstract*.**

Indonesia has wide waters and in it there is very abundant fishery potential such as various species of freshwater and other aquatic biota. The large role of Indonesian waters certainly needs to be supported by a monitoring system that is able to control and monitor conditions underwater, like underwater robot. In this research, the design of an underwater robot based on PID (Proportional Integral Derivative). Robot stability is controlled using PID with feedback from IMU MPU6050 for tilt angle control and feedback from MS5803 pressure sensor for depth position control. This underwater robot is requipped with six DC motors, four DC motors are used to drive the robot in a horizontal direction (forward, backward and turn). In addition, the robot is also equipped with two lamps for lighting the robot. In this research, the underwater robot can maintain stability when given PID parameter values are 0.001 for Kproll, 0.001 for Kiroll, 1 for Kdroll, 0.001 for Kppitch, 0.001 for Kipitch, 1 for Kdpitch, 5 for Kpdepth, 1 for Kidepth and 1 Kddepth.

Keywords: MPU6050, MS5803, PID, Underwater Robot

INTRODUCTION

Indonesia is one of the largest archipelagic countries in the world which has a strategic location. Where the area of inland waters and Indonesian archipelagic waters reaches more than 3000000 km2, one of the types is lakes [1]. The lake is one of the waters in Indonesia which is located in a basin area and is surrounded by land. Besides having beautiful view, the lake also has abundant fishery potential such as various species of freshwater fish and other freshwater biota. The role of Indonesian waters is so large, of course it needs to be supported by a well it grated monitoring system in order to maintain the underwater ecosystem. One solution is to use an underwater robot to find out how the conditions and situations of the underwater environment area.

Underwater robot is a robot that can maneuver in water. Where this robot is usually used to make observations of underwater environmental conditions. Based on working system, underwater robots consist of two types, namely ROV (Remotely Operated Vehicle) and AUV (Autonomous Underwater Vehicle). Remotely Operated System (ROV) is an unmanned underwater robot that can maneuver in water controlled by an operator above the water surface [2]. ROVs are usually equipped with underwater positioning systems, video cameras and others according to the needs and engineering activities in the water, such as laying pipes and cables under the sea and surveying coral reefs and other marine biota [3]. Autonomous Underwater Vehicle (AUV) is an underwater robot that is autonomous, where this robot can move and carry out all activities under its own water sensors to support the work of the robot [4]. The autonomous system applied to the AUV can make it easier for users to operate, such as maneuvering the robot, avoiding other objects, taking pictures and videos and sending data to users wirelessly [5].

METHODOLOGY

Hardware Design

The following is the design of the entire hardware circuit on the underwater robot

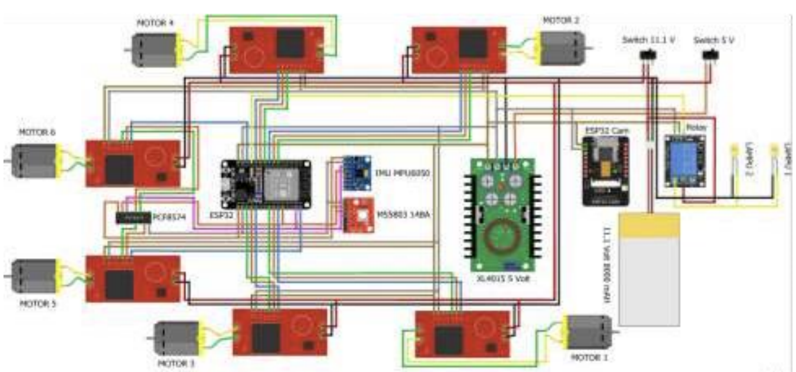

Figure. 1 The Overall Circuit of Underwater Robot Hardware

1. DOIT ESP32 DEVKIT digunakan sebagai pengontrol utama sistem kontrol.
2. ESP32 Cam and OV2640 cam digunakan sebagai pengambilan data gambar dan video.

3. PCF8574 IO module digunakan sebagai pin GPIO tambahan.
4. MS5803 pressure sensor digunakan untuk mengukur kedalaman posisi robot.
5. IMPU MPU6050 sensor igunakan untuk mengukur kemiringan robot dan menjaga stabilitas robot.
6. VNH2SP30 motor driver digunakan sebagai driver motor DC.
7. A 1100gph bilge pump DC motor digunakan untuk menggerakkan robot.
8. Relay digunakan sebagai pengatur kondisi lampu.
9. Lampu ini digunakan sebagai penerangan robot.
10. Buck converter XL4015 digunakan untuk menurunkan tegangan dari 11,1 V menjadi 5 V.
11. On-off switch digunakan untuk memutuskan dan menghubungkan arus listrik.
12. LiPo (Lithium Ion Polymer) battery digunakan sebagai sumber tegangan pada robot.

RESULTS AND DISCUSSIONS

Underwater Robot Design Results

In designing the robot,1/2 inch PVC pipe and several pipe connections are used which are to form a robot frame. To protect the robot components that are not waterproof a watertight control box is used which has dimensions of 27 cm x 18.4 cm x 9.4 cm.

Figure. 2 Underwater Robot Design Result

CONCLUSION

The outcome of the number of layers study can be concluded that there are significant differences in the mechanical properties result. Tensile strength and bend ability of the welded metal show optimal when the layers increased. The results for tensile test shows that the highest point recorded is 460,831 MPa for 4 layers, while bend test without any defects recorded was 919.544 MPa for 4 layers, both using electrode ER70S- 6. Based on the response optimizer done by this research, electrode ER70S-6 is the ideal electrode used in this study for tensile and bend.

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