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UNDERWATER REMOTELY CONTROL VEHICLE [ROV] WITH ANALOG /RADIO MOTOR CONTROLLERS

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Abstract- this paper aims to explore the controlling methods of underwater remotely operated vehicle (ROV). An efficient low cost shallow water construction, Design, propulsion of the ROV will be introduced. The ROV presented here performs very well for analog and radio control (RC) modes.
ROV systems typically consists of

- Structure/frame to stand the under water pressure environment [1]
- Ballast to adjust the buoyancy of the ROV under water
- Propulsion to provide movement of the ROV underwater
- Power to ROV and associated equipment
- Control allows the pilot to control thrusters tools, cameras etc. by (Digital, Analog , Radio Control)
- Navigation sensors (camera, etc.) for collecting data and information of what the ROV is doing
- Payload any tools the ROV carries to achieve its mission such as manipulator, water sampling, etc.
- Tether to transmit the data, the power and controlling signal between The ROV and the surface.

Index Terms- Key words: ROV, analog control, Radio Control RC

I. INTRODUCTION

Rov's are popularly used for underwater operations, where they are tethered to the surface, and controlled by a ROV pilot. ROV 's are particularly useful because they have no depth restrictions which may limit divers, no depth time limitations, ability to enter dangerous and small spaces or contaminated water, and very good in quality real time video[2].
Ocean cover 71% of the planet and only 5% explored. With advent of underwater technologies of manned and unmanned vehicles Robotics enabled humans to carry out exploration in efficient method than conventional manned methods see fig1.

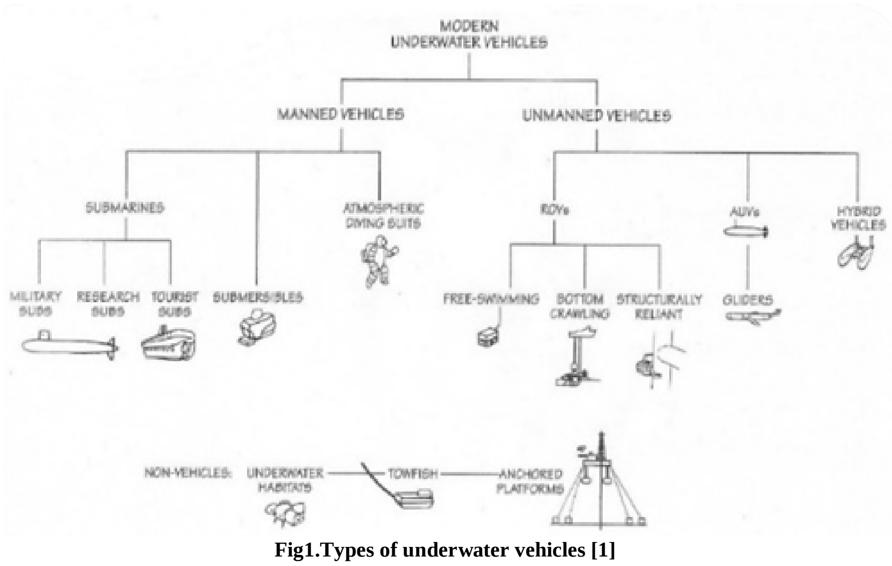

Fig1.Types of underwater vehicles [1]

II. ROV SYSTEMS

A. Structure/Frame

ROV frame is constructed of PVC pipes interconnected and constitutes the skeleton of the ROV, it provides mechanical support and attachment points for the weights, Floats, four thrusters, camera, lights, sensors, and gripper.

B. Ballast

Ballast provides floating or diving by means of changing the buoyancy which relating to adding or removing weight. The static ballast of the ROV consists of Floats and weights that maintains ROV neutral buoyancy. The ballast system is coupled with two vertical thrusters to control the depth.

C. Propulsion Systems

Four SFBP1 Seaflo 12Volt DC thrusters are used. Two thrusters for horizontal movements of forward reverse, turns right/left and two thrusters for vertical movements up / down movement. There are no need to control these vertical thrusters individually, the vertical thrusters are connected to a mixer (motor controller, electronic speed controller) the mixer overlays the mixer overlays the control of both thrusters onto a single channel of a transmitter. Horizontal thrusters are used for forward/reverse movement and turning (left, right). Both the thrusters are used the same speed for forward movement one of the thrusters are turned off (long turn) or reversed (spin) for turning [2].

D. ROV Power

The power requirement primarily are the power for propulsion to overcome the drag supplies the thrusters and satisfies the power loads of camera, temperature, and pressure sensors.

E. Control

Control systems are in two basic forms; open loop and closed loop the fundamental difference between them are in the flow of the information.

The ROV presented here is an open control systems. The pilot corrections is required to minimize any deviation from desired condition. The ROV presented here is a simple open loop control system Fig2.

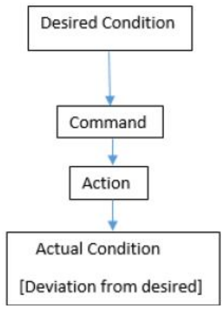

Fig 2.Open loop control [1]

Controlling the ROV done through a microcontroller [MCU], that is to control thruster motors, video light, grippers, etc. The MCU communicate with the electronic devices through a communication control protocol.

With analog signals input of joysticks uses a potentiometer as a voltage divider. This allow a variable voltage to be produced and input to the IC on the Sabretooth board. The IC will interpret the variable voltage input and output pulse width modulation (PWM) signals to the H-bridge. The H-bridgeallows motor to run at variable speed in two directions (forward and reverse).Sabretooth is a two channel motor controller will drive two terminal brushed motors and contain a microprocessor to handle the various control modes. See fig 3.

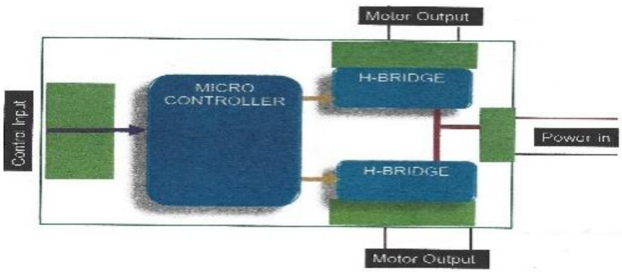

Fig 3. Motor controller MCU overview [3]

Each joystick has two potentiometer mounted on it. With two motor controller to control two of the four motors, each motor controller can take two inputs, and send output to two motors.

For the vectored ROV design, one joystick controls the left and right horizontal motors. This allows the ROV to surge (move forward and backward) and yaw (turn/rotate left and right). The second joystick controls both vertical motors, allowing the ROV to
Fig 3. Motor controller MCU overview [3]sway (crab left and right) and heave (move up and down). See fig4.

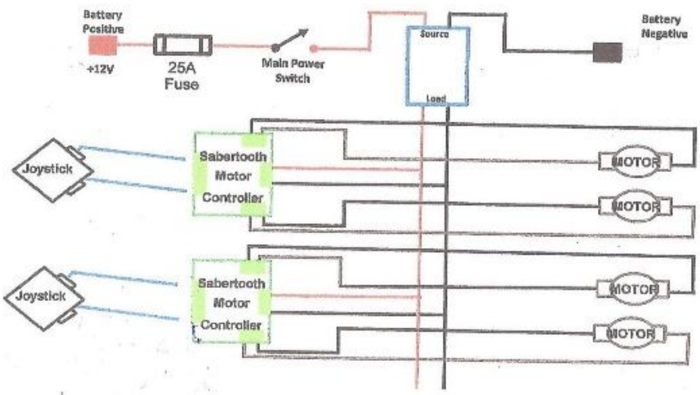

Fig 3.Motor controller MCU[3]

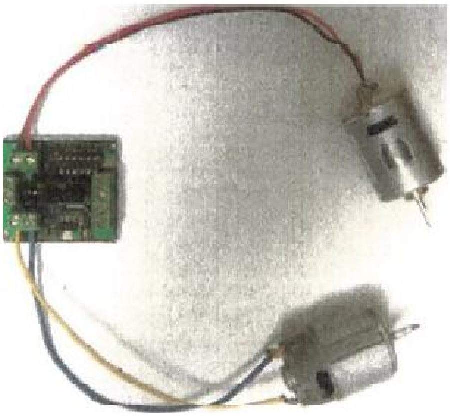

Fig 4. The motors connect to Sabertooth terminal [4]

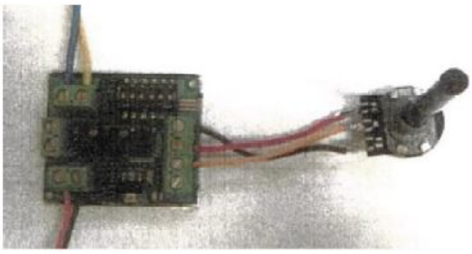

Fig 5. The input analog signals connect to Sabertooth terminals [4]

In ROV with the motor controller in mode analog input takes one or two analog inputs and uses those to set the speed and direction of the motor. This makes the Sabertooth easy control using a potentiometer, the PWM output of a microcontroller (with an RC filter) or an analog circuit [5].

And in ROV with R/C input mode it takes at standard R/C channels and uses those to set the speed and direction of the motor. In fig 7. Represents an overview of R/C arrangement.

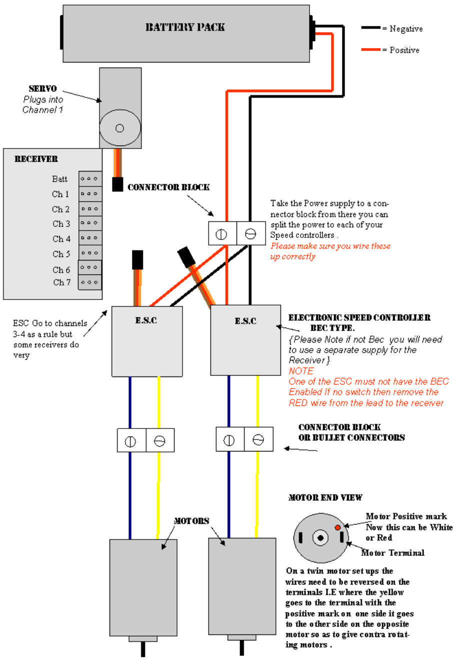

Fig 6 R/C basiccomponents[6]

And the R/C system diagram for the ROV illustrated in fig.8

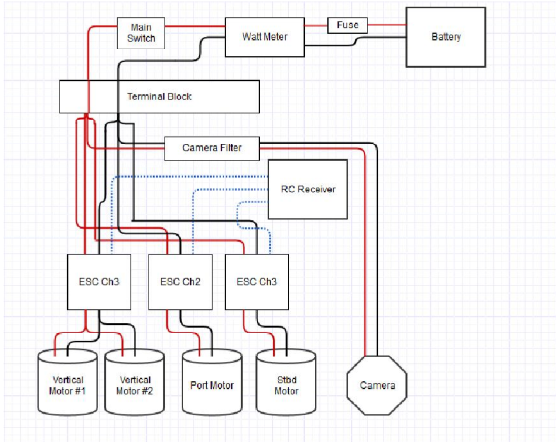

Fig 7. ROV R/C system integration diagram

REFERENCE

[1] UnderwaterRobotics,Siecnce,Design, and Fabrication.Pul.Marine Advanced Tecnology Education (MATE) Center, Monterey,CA
[2] Amar Narayan P, Bharath G,PVP Kumar “Underwater Remotely Operated Vehicle”, , WebSite docplayer.net
[3] MATE TriggrFish Summer Institute,Monterey pennisula ,Monterey, CA, July,2016
[4] Dimension Engineering, Sabertooth user’s guide, Feb, 2007
[5] Website Waters marine, 2017
[6] Website 03,Jan, 2017 ‘wiring Diagrams” wiring for electric model boats

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