

# BLUEFIN-Autonomous Underwater Vehicle

Edwina G Rodriguez<sup>1</sup>, Santhosh Raj R<sup>1</sup>, Kannan S A<sup>1</sup>, Renjith G<sup>1</sup>, Jothish V Dev<sup>2</sup>, Abhijith Ambadi S B2,  
Sreelekshmi S<sup>2</sup>, Meenakshi R Pillai<sup>2</sup>, Swathy S Mahesh<sup>2</sup>

Assistant Professor, Department of Electrical and Electronics Engineering, College of Engineering, Perumon, Kollam,  
Kerala, India<sup>1</sup>

B. Tech Scholars, Department of Electrical and Electronics Engineering, College of Engineering, Perumon, Kollam,  
Kerala, India<sup>2</sup>

**ABSTRACT:** Autonomy in robots has become a prevalent issue for industrial and environmental worldwide. This paper presents an autonomous underwater vehicle (AUV) which travels underwater without requiring input from an operator. A prototype of this type is implemented using Raspberry Pi (RPI) and an array of sensors for predicting the ocean environment. This project enhances underwater photography.

**KEYWORDS:** AUV-Autonomous Underwater Vehicle, RPI-Raspberry pi

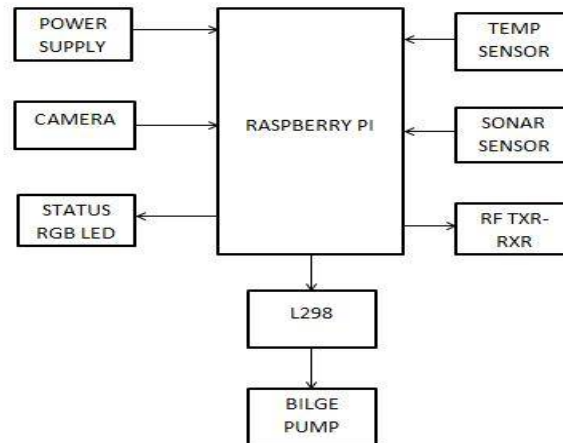
## I. INTRODUCTION

Robotics is now being implemented for different applications on different parts of the world. Mobile robots can enter voids too small or deep for a person, and can begin surveying larger voids that people are not permitted to enter. Robots can equip cameras, detectors, sensors into areas where human interference is not possible and set up communication link with human operator outside. Underwater robotic platforms become much popular among marine research industries. In this paper we present the development of a low cost underwater vehicle that can be implemented from locally available materials and easily deployable for monitoring close and open water. The vehicle can follow a pre-programmed path and collect images. An AUV is a robotic device that is driven through the underwater by propulsion system. AUV constitutes part of a larger group of undersea systems known as unmanned underwater vehicles. Autonomous underwater vehicles fall into the mobile robotic sector and are of brilliant importance to the present world military and commercial requirements. Sensors on the AUV sample the ocean as the AUV moves through it. The demands for advanced underwater technology are growing and equip it with the necessary sensors, power supply and controller to make it autonomous. Here Raspberry Pi is used as the brain. It improves the action of our project. The work is divided into model construction, testing its stability, hardware assembly, software part and final testing.

## II. MODEL AND DESCRIPTION

The design procedure starts with hull construction. Our design uses a simple box-like shape composed out of schedule PVC pipe segments. For the hull of the AUV [1], these segments are 1.25" in diameter and are cut to various lengths. These segments are interconnected using PVC connector elbows and T sections. Power supply uses Nickel cadmium batteries of 12V, 1100mAh. Three bilge pumps used each rated 12V, 3A. They are being controlled by L298. The sensors consist of temperature and sonar sensors. Raspberry Pi cam is used to capture the images.

### III. BLOCK DIAGRAM AND DISCRPTION



The block diagram[2] consists of a Raspberry pi. It is the heart of the project. It works on a 5V supply. The various sensors such as temperature sensor , sonar sensor are controlled by the microchip. A Raspberry pi cam is also included for underwater photography. Three bilge pumps are used each controlled by the motor driver board interfaced to Raspberry pi. RF is meant for radio communication.

### IV. STABILITY OF STRUCTURE

On every submerged object, a buoyancy force is acting upward facing into the opposite direction. The gravity force is pushing the object to sink. If the gravity force is bigger than buoyancy force, the object sink . If it is smaller than buoyancy force the object float. If both forces are equal object remains level. Analogous to flying vehicle, an AUV has 6 co-ordinates, 3 spatial co-ordinates x , y ,z and 3altitude defining euler angles[3] roll ,pitch, yaw. A versatile modular and durable mechanical structure is designed and developed for project AUV with simplicity and symmetry being two prime aspects sought in the design.

### V. COMPONENTS USED

#### 1. RASPBERRY PI

It is a single computer board with credit card size. Its 2nd version is used here. It has no on board memory

.Any SD card of required memory can be placed . It requires a power supply of 5V. Connections to Raspberry pi can be made by using

- a. Two USB Ports.
- b.Etheret.
- c.General purpose input /output pins.



Fig:raspberry pi

## 2. L298 MOTOR DRIVER BOARD

The board uses a 5V supply. It is a double bridge driver. It is used to drive the bilge pumps.



:Fig :L298

## 3. BILGE PUMP

It uses a 12V dc supply, its current rating is 3A and capacity is 490GPH [4].In the project 3 pumps are used, two for forward , backward, left, right movements and one for upward and downward movement.



Fig: bilge pump

## 4. TEMPERATURE SENSOR

LM35 is used as temperature sensor. The main use of this sensor is to monitor the internal temperature of the system. A change in the surrounding temperature affects the life of the electronic component used. This could be taken into account here. It produces an output voltage proportional to the Celsius temperature.

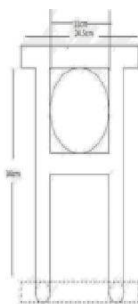
## 5. SONAR SENSOR

JSN-SR04T is used as sonar sensor. It is used to find the obstacle. Using this sensor we can find the distance from the obstacle . This actively helps our AUV to avoid obstacles. It has 4pins Vcc, trigger, echo, GND. The transceiver vibrates and creates an ultrasonic wave that is transmitted and travels until it is reflected. The basic equation: time is equal to distance divided by speed.

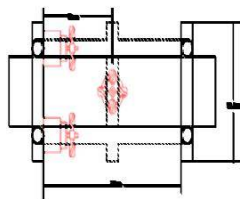
## 6. XBEE TRANSRECIEVER

XBEE pro 60MW 2.4GHz can be used as transreciever for radio communication. Its range is about 10m in under water. It has serial communication at a maximum rate of 250Kb\S.

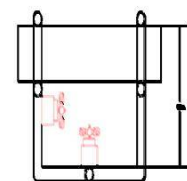
## VI.MECHANICAL DESIGN



A) Design of front view



B) Design of top view

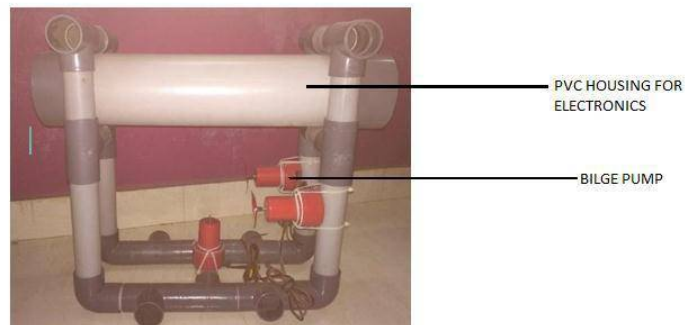


C) Design of side view

## VII. WORKING OF SYSTEM

Power supply (battery) provide regulated power for the digital electronics, including the Raspberry Pi , most sensors, wireless radio communication, and LED indicators. For processing sensor data and Controlling actuators requires a microcontroller to be integrated into the system, here we uses raspberry pi. Data communication with an AUV must be handled wirelessly using Xbee. Internal temperatures are measured in two locations using precision temperature sensors. These components are interfaced with a microcontroller chip and the collected values are sent to the central microcontroller over a TTL serial connection. Raspberry Camera is interfaced to the raspberry pi. Sonar sensor is also used to find the obstacles surrounding. There are three bilge pumps they are controlled by a driver board. It has forward, backward, right, left, up and down movements.

## VIII. STRUCTURE DEVELOPED AS PER DESIGN



## IX. CONCLUSION

An autonomous underwater vehicle is proposed as per designed structure. The structure is well tested and stable underwater. The use of variety of sensors improves the efficiency of the project. The project implemented is of low cost which proves that underwater maintenance and photography could be improved with affordable cost.

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