ARDUINO BASED ROBOTIC FISH

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Abstract

This paper deals with the manufacturing of an underwater robotic fish with the surveillance application. The controlling and development of this biomimetic fish is presented in this report. This simple and efficient mechanism of robotic fish got inspired from the natural fish. This robotic fish has the provision for Bluetooth communication which will work based on the operator decision. This efficient and simple mechanism of fish navigates in the underwater and having a provision for working with four servo motors and pump assembly mechanism. The different sensors help the robot to make automatic decisions as obstacle detection, live streaming, direction changes and temperature. This robotic fish helps to perform in aquatic complex areas.

Keyword: Arduino microcontroller, servo motor, Bluetooth.

1.INTRODUCTION

The imitation of the biological creatures gives most significant understanding into the theories and applications in the field of robotics. The known thing is that ocean covers the majority of the earth's surfaces about millions of sq km, containing a huge variety of biological resources. This paper introduces the concept of robot in the form of fish developed to achieve the better efficiency, controlling mechanism of fish movement. By the improvement of robotic technology, the aquatic missions have been simplified and resolved to a greater extent. The use of robotic fish over the submarine is that their efficiency, flexible structure and operations in the critical condition. As it is not only used for underwater surveillance also can be used as a spy robot in military application.
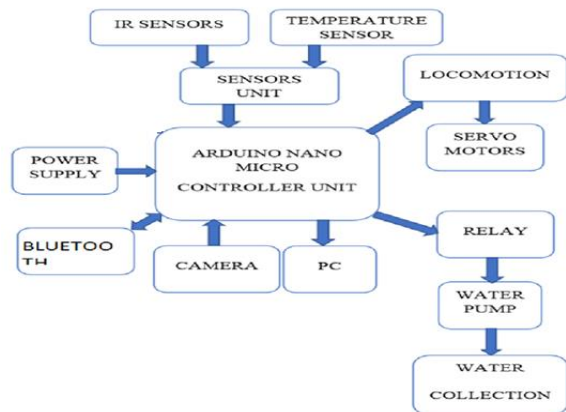

Fig 1.1 block diagram of proposed system

The sensor unit contain two sensors types, those are IR sensors and temperature sensor. These sensors are the inputs to the system. the IR sensor detects the objects and gives the signals to the microcontroller. And temperature sensor is indirectly helps to collect the water sample for the further test.

Servo motors are attached to the fish for the smooth locomotion. 4 servo motors are connected which helps for the directional changes.

The Bluetooth is the serial communication mode for the fish to move in Automatic mode or in manual mode. If the fish should move in manual mode, then there 3 ways i.e forward, left, right.

The relay is connected to the microcontroller and also to the water pump. The relay will operate according to the controller decisions based on that it will collect the sample.

For the monitoring of the water bodies the waterproof camera is attached to the fish. This wireless camera will capture the images and videos in live and that will be captured in the computer.

2.PROPOSED SYSTEM
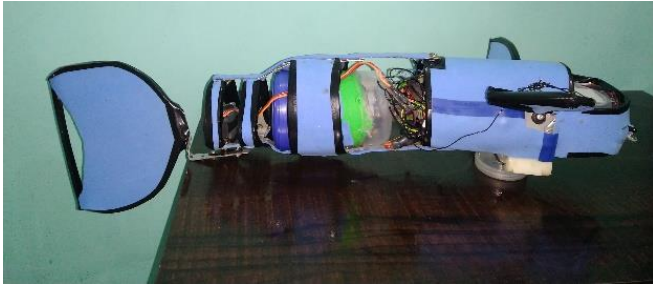
The experimental setup for proposed robotic fish system is shown in the figure 3.2. the fish is made up of PVC material. As PVC is light in weight and it is robust. The robotic fish system with four servo motors. Those servo motors are connected for the moving joints. Two motors for right and left fins and One for the body and another for tail part of the fish. The body made of multiple jointed segments, the high torque servo motors are the main concerned for position changing and high speed for robotic fish locomotion. And it gives the flexibility and robustness for stable locomotion.

Two IR sensors are attached to the eyes of the fish to detect the objects and temperature sensor is attached to the fish body. The driving circuit for the robotic fish is designed in PCB. To power up all these devices, two lithium batteries are used. And the relay is connected to the Arduino and the water pump, which controls the water intake process.
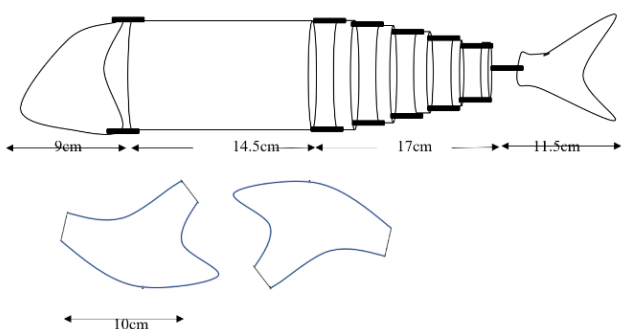
3.MECHANICAL DESIGN

Fig 1.2 mechanical design of the robotic fish

Figure 3.1 shows the side view of biomimetic fish system with dimensions. The total dimension of the fish is 52cm in length and having an approximate weight of 3kg.

According Archimedes principle, if the body to float on the water the weight of the fish should be less then 3kg when it is in water. To dive the fish inside the water the tank construction is done. If the fish to go inside the water the weight of the fish need to be increased negligibly.

The fish body is constructed with an approximate dimension for a periodic oscillation mechanism, and Obtaining of fins position for different interval of time. locomotion. In order to operate the fish manually Bluetooth communication module is provided.

4. ELECTRONIC DESIGN

Various electronic components are used to build the robotic fish. PCB designing contains sensors, controller (Atmega 328), motor driver circuit and communication device.

4.1. Embedded system

Arduino Nano board is used as a controller. Atmega 328 is a microcontroller, and with flash memory of 32Kb. Supply for the robotic fish is given from the 12V LiPo battery.

4.2. Sensors and actuators

The advantageous servo motors are used for the propulsion mechanism with specified angle of rotation. The PWM pulses control the servo motor angles for the locomotion of the fish. And DC motor is used for the water collection.

Speed of the fish is controlled by the adjusting servo motor angles. LM35 is used for the temperature measurement. The built in ADC converts signals to digital and this data can be transferred to the base station though the wireless communication.

The camera is attached to the robotic fish. This camera helps for the surveillance and monitoring of the underwater environment.

4.3. Communication System

To transfer and receive the data with the robotic fish from the base station through Bluetooth. By using Android application and Bluetooth communication module robotic fish can be work either in the manual mode or in automatic mode. The floating antenna helps to transfer the data to the computer for live streaming

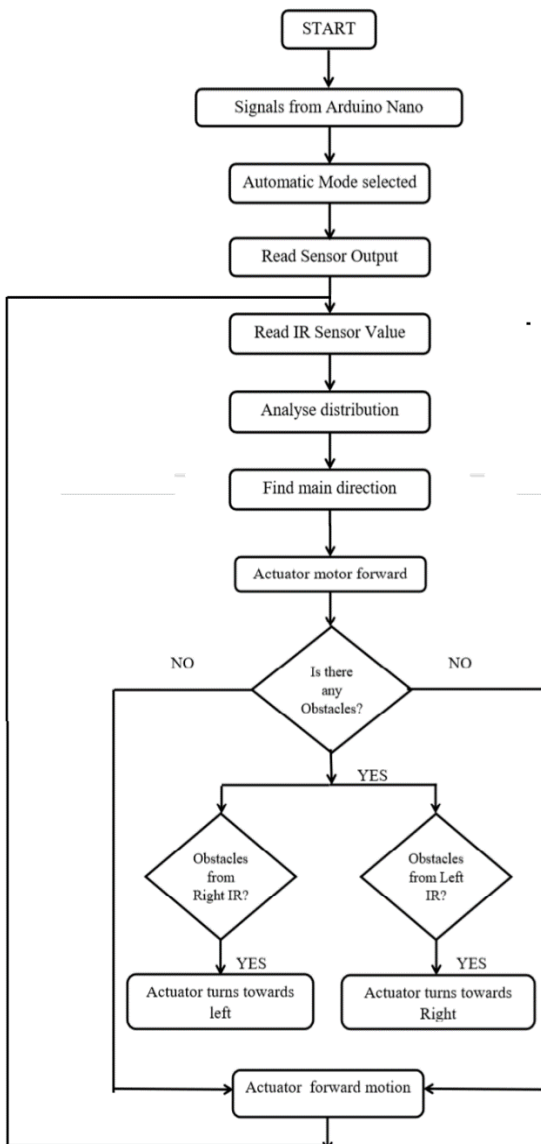Fig1.3 Bluetooth communication Android display

4.4. Flow Chart

Fig1.4 Flow chart of robot's communication protocol

5.CONCLUSION AND FUTURE SCOPE

This robotic fish project is useful for study of living organisms inside the water.

➢ Using of this we can monitor the waterbodies.
➢ Different organisms live in different temperature zone, with this robotic fish we can do the supervision.
➢ Video and image capture facility will be helpful for monitoring aquatic animals.
➢ It is easy to collect the water sample for the water pollution monitoring.

➢ As this robotic fish looks like natural fish and with the help of this, we can explore the underwater environment. This robotic fish can be further additional provision As like: ➢ The GPS tracker can be added to this robotic fish for navigation.

➢ LED light can be added to this fish for cleaning purpose also.

table itable of robot specification

SPECIFICATION	VALUE
Weight	3.4kg
Actuator	Servo motors (4)
Average speed	100rpm
Overall size	53cm×30cm×13cm

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