Underwater recon device

D A Anshuman¹, T Bhuvana Teja², Ssameer Kumar³, Rohit Dasgupta⁴

¹Dept. of Mechatronics Engineering, SRM IST, Kattankulathur, Tamil Nadu
²Dept. of Automobile Engineering, SRM IST, Kattankulathur, Tamil Nadu
³Dept. of Mechanical Engineering, SRM IST, Kattankulathur, Tamil Nadu
⁴Dept. of EIE, SRM IST, Kattankulathur, Tamil Nadu

*Corresponding author: dasarianshumanaditya@gmail.com

Abstract. The purpose of this project is to create a Floating Platform which can be used in open waters for underwater reconnaissance. The platform will be powered using Solar Power and will be able to work for long durations of time. It uses an underwater “float” connected to the floating platform, via a shaft, to which a set of Hydrophones are connected. The platform is propelled by a set of flappers attached to its sides. The basic idea of the project is to create a device which can float in international waters for indefinite periods of time, which can be used to track the movement of underwater objects which emit sound (whales, dolphins, submarines, etc.)

1. INTRODUCTION

Our project aims to create a Recon Device for the open seas, which can provide a platform for reception-and-transmission of real time data about motion of bodies underwater – both natural (schools of fish) and artificial (submarines) – to a separate platform (either on a ship, a rig or an airplane). The Recon Device will consist of a Float (for propulsion, charging and data transmission), a Rod (a mechanical link for connecting the Float to the Detection Platform) and a Detection Platform (for acquiring data from the seas). This Recon Device can operate for indefinite amounts of time with little or no interference from the controller (the device can be remotely controlled). The Platform of the device uses the motion of oceanic waves to propel itself, so no external propulsion device has to be used. [2][5]

The Recon Device can be used in various sectors like naval reconnaissance, tracking the movements of whales, dolphins and other large aquatic life, and underwater environmental assessment.

2. CONCEPTS IMPLEMENTED IN PROJECT

2.1. Propulsion

The Platform for the device has three main purposes – Propulsion, Charging the device and Data Transmission. We will be discussing the Propulsion of the Recon Device in this section.
Propulsion can be achieved by harnessing wave motion via flaps connected to the sides of the Platform. The flaps will propel the Device forward based on the direction of ocean waves. The device can be positioned in a desired direction (via remote control) and can be propelled by the motion of waves. The platform also contains a rudder (which can be controlled remotely) to change the direction of motion of the platform (i.e. to Steer the Device in the intended direction). The Platform is also designed in a streamlined manner so that it can cut through water easily. [2][3]

2.2. Charging The Device

The Device can be operated for indefinite periods of time in open waters as it can be charged directly via solar energy. A series of solar panels are affixed on the Float, which are connected to a battery. The solar panels charge the battery, the battery itself being stored in a waterproof casing. A system of two batteries can be utilised for running the device. While one battery gets charged via the solar panels, the other battery can charge the Device. [2][3]

2.3. Data Transmission

The main purpose of the Float Platform is to act like a platform from which Data (the sounds captured by the Hydrophones, converted into digital form) is transmitted to a receiving platform – which can be mounted on a ship, rig or an aeroplane. This is achieved by a RF antenna mounted on the platform. An ADC (Analog-to-Digital Converter) Module converts the analog signals (sounds), captured by the Hydrophones, into digital signals, which are then transmitted to a station via the RF (Radio Frequency) Antenna on the Float Platform. [1]

2.4. Hydrophones

A hydrophone is a microphone designed to be used underwater for recording or listening to underwater sound. Most hydrophones are based on a piezoelectric transducer that generates electricity when subjected to a pressure change. Such piezoelectric materials, or transducers, can convert a sound signal into an electrical signal since sound is a pressure wave. A hydrophone contains a small single cylindrical ceramic transducer that can achieve near perfect omnidirectional reception. We are planning to use multiple hydrophones arranged in an array so that it will add the signals from the desired direction while subtracting signals from other directions. Some of the commonly used hydrophones are CR1, CR2, CR3, SQ26-H15, etc. [4]

3. COMPONENTS OF THE PROJECT

3.1. Float Platform

The Float Platform is the main component of the Device, responsible for the Propulsion, Data Transmission and housing the Charging System of the Device. This device – as its name suggests – floats on the surface of the ocean. The detection platform is connected to the float platform via a mechanical linkage (i.e. the Rod). The float platform contains Flaps at its sides and a rudder at the back (for Propulsion and Steering), a system of two batteries linked with solar panels (this system charges the system – so that it can operate for indefinite periods of time) and an ADC Module linked with an RF transmission Antenna (Data Transmission System)

3.2. Detection Platform
The Detection Platform is located underwater, connected to the Floating Platform via a mechanical linkage (the Rod). It has a streamlined shape so that it can cut through underwater currents easily. The Detection Platform has a set of Hydrophones connected to it. These hydrophones capture the sounds emitted by the various bodies underwater – both natural (schools of fish) and artificial (submarines, ships, motor boats). This data is converted into digital information by the Platform, and is then transmitted to a separate receiving platform.

4. WORKING

The Recon Device can work for indefinite periods of time (as it runs on solar power). The device is propelled by oceanic wave motion via the flaps attached to the Floating Platform. It can be remotely controlled to move as well (by connecting its flaps with motors and linking its operation to a remote control). The Hydrophones connected to the Detection Platform will detect the sounds emitted underwater and convert them to digital data, which will be transmitted to a receiving platform (which will analyse the data).

5. CONCLUSION

The Recon Device can work for indefinite periods of time as it can generate its own power. It will be able to cut through open waters easily due to its streamlined shape.

The Device can be utilised in various sectors, the major ones being:

Defence. the Recon Device can act as a surveillance device to patrol the waters. It is a durable, unmanned surface vehicle which can host an array of sensing devices (hydrophones) to check the waters for enemy vessels.

Maritime surveillance. The ocean remains a vast area to monitor. World governments can use this device to control maritime borders, detect illegal trafficking routes and can monitor ocean ecosystems.

Monitor Ocean Ecosystems. the device can be used to monitor schools of fish, aquatic mammals, barrier reefs, and other ecological systems.
6. REFERENCES

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