Retraction

Retraction: Underwater cable monitoring system using Bot (J. Phys.: Conf. Ser. 1916 012051)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751

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Underwater cable monitoring system using Bot

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Abstract. Underwater fiber cable carries lot of sensitive information between countries so, it is important to continuously monitor the quality of the cable. The principle of reflection of an echo signal is proposed for detecting damages in the submarine cable. Through the process of an ultrasonic sensor, the faulty part can be identified and monitored. It describes a wireless controlled submarine bot that can move underwater, and can be controlled by a mobile application. An Arduino-based IoT platform is used to process, transmit and receive all the information to the control room, about the submarine cables. A camera is used to detect the status of the cables. The damaged spot and the distance of the fiber cable’s dislocation are also measured and indicated to the control room for further analysis. This robot can be used for various purposes such as oceanographic surveys, underwater monitoring, pipeline monitoring, and subsea inspection.

1. Introduction
India has been one of those countries that are seriously impacted by a blackout on the internet. The southeastern coast of India has been hit by the Hurricane, and this is the main reason why Internet services have been interrupted on the whole continent. Chennai was the main landing place for underwater telecommunications routes in India. The storm and cyclone have also caused significant damage to the submarine cables. Most of the Internet passes through submarine cables and very few go via satellites. Mumbai, Tamil Nadu, and Kerala are the top three landing locations where India gets its data to connect. Internet data reach India via a network of subsea fiber optic cables belonging to telecommunication giants like Etisalat, Singtel, France Telecommand China Telecom. The cables travel thousands of kilometers on the seabed, linking various nations with the Internet circuit. When a fiber-optic submarine cable is damaged, it must be repaired as a matter of priority since many countries rely on Internet networks for data communication. Telecommunication fiber cables damaged by earthquakes, fishing trawls, ship anchors, etc., are often necessary for repair and maintenance purposes. The conventional way to repair the fiber optic cables takes up to 16 hours or longer. As a result, there is a need for an inexpensive and highly efficient underwater BOT which reduces the repairing time. This BOT significantly enhances the effectiveness of flaw detection operations by eliminating the requirement for human presence in the marine environment.

2. Proposed Prototype
The proposed system is a wireless controlled submarine bot that can move in underwater to receive, process and transmit all the information to the control room about the submarine fiber cable through a mobile application. The repairing time will be reduced. It also reduces the operating cost. The main advantage is that it can identify the status of the cable and give timely information. Since the system is
wireless, it is possible to reduce manpower for monitoring Figure 1.

The following are the elements in the system:

A. Sensor perception
B. Object Detection Phase
C. Interactive Virtual Assistant

![Block diagram of proposed model](image)

**Figure 1.** Block diagram of proposed model

**A. Sensor Perception**
Sensor nodes and cameras are used to determine the fault, status of the cable, measure its location, and calculate its distance. To use ultrasonic sensors to calculate the distance and location of the fault, and then to trigger information to microcontroller. The surface configuration of an underwater fiber-optic cable may be identified and the damaged part of the cable is determined using data collected from the sensor.

**B. Fault detection phase**
The sensor is fixed in a certain distance from submarine cable. Ultra sonic sensor may sense the distance according to its property. This sensor should maintain the same distance as fixed by the control persons. If fault happens, there creates a small gap between fiber cable and sensor returns with a distance more than the specified length.

**C. Alert phase**
Mobile application is also integrated into the arduino and ESP-01 module which uses mobile notification and g-mail notification to alert when fault occurs. When the fault is detected by the sensor, the motor driver will make the motor to halt, so that bot stops in the fault occurred location.
3. Methodology of monitoring underwater cable

The BOT is mainly controlled by the mobile application. If the ON button is pressed, the microcontroller will get turned ON. Then, the signal gets triggered to the motor driver and the BOT starts to move. The ultrasonic sensor gets triggered and the sensor starts to sense the cable immediately. In case if the fault is detected in the cable then, the signal goes to the arduino microcontroller to stop the BOT immediately. The damaged part is seen through the camera which is interfaced with the control room. This is the main action of the BOT. By this operation, the cable’s problem can be fixed immediately as per the methodology shown in Figure 2.

![Flowchart of Underwater Bot](image)

**Figure 2.** Flowchart of Underwater Bot

4. Comparative study

Autonomous Underwater Vehicle (AUV) that uses a detection method that can be performed in hard-to-see spot locations, using the magnetic field cameras. This design is based on high-cost flexible sensors, which provide full, real-time underwater cable detection. To assess the accuracy of the detection, analysis of the average absolute error and similarity were carried out using the observation data and sensor data obtained from the water reservoir test [1]. The study of the guidance of submarine vehicles subjected to cable disturbances caused by the action of currents and harmonic waves. The overall case includes a variable cable length which is generally extended during the vehicle tactics. The control situations shall be taken into consideration, in particular the surveillance of the path and the regulation of the position where the reference path of the vehicle is given in advance [2].

Underwater Acoustic Sensor Networks (UW-ASNs) are made up of fixed and mobile nodes such as Autonomous Underwater Vehicles (AUVs), which can be categorized as propeller-powered vehicles and sailplanes, which are equipped with various sensors to carry out surveillance tasks in collaboration [3]. The study of the dynamical aspects of the degree of coverage and detection of target in the submarine environment resulting from the given displacement scenarios for the Autonomous submarine Vehicles (AUVs). With the assistance of the continuously moving Unmanned Aerial Vehicles, that is UAVs the submarine targets, which are not detectable by the stationary Underwater Acoustic Sensor Network or Array (UASN), that may be detected with a projected likelihood that is determined based on the selected Unmanned Aerial Vehicle scenario [4].
Underwater bot is introduced in this paper as a more effective fault detection model for submarine cables. It reduces the detecting time and man power while maintaining high detection precision and real-time efficiency [5]. This bot is much more efficient and much faster than its predecessor and has been improved to a significant amount. In this paper, the usage of the mobile application has made the processing of the huge ocean of data's in a higher pace with minimal expenses. This paper comprises the system description, experimental values, the methodology used and simulation results of overall accomplishment of the system.

5. Simulation model

The circuit elements are connected as per Figure 3 shown below. The BOT has two motors which is designed specially to run in a desired direction. The ultrasonic sensor senses the cable and its fault. A motor drive circuit is used to interface the arduino with the motor.

![Figure 3. Simulation Model](image)

During normal operation, the BOT operates as shown in Figure 4. The Arduino commands the motor to move in a particular direction through the mobile application. The ultrasonic sensor monitors the cable and provide lively information through camera.
Figure 4. During No fault Condition

When fault occurs, the sensor senses and stops the BOT immediately as shown in Figure 5-8. When fault occurs during the normal operation of the BOT, the BOT stops immediately at the fault location of the cable and shows the cable’s error lively.

Figure 5. During Fault condition

6. Experimental Outcome

Figure 6. Hardware setup

Figure 7. Control box setup
7. Conclusion
In this paper, we described a wireless underwater BOT that allows real time control of submarine cable fault. This BOT is a high speed, low cost and time diminishing system that can be used in underwater where human presence would be impossible. We briefly described both hardware and software system. The disadvantage of traditional fault replacing technique is much time consuming which may take up to 16 hours and more. The further disadvantage of old method is high operating cost and it needs more man power for maintenance. Finally, our presented system helps to overcome all the demerits of the existing system. The next immediate step of this research project is to test the performance of the sensors in a wide variety of field condition. The robot will have to work in many different weather conditions of the ocean. Therefore, the improvement of mechanical mobility of the robot is the important area for further research.

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