International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 1 Volume No.7 January - February – 2023
DOI:10.46647/ijetms.2023.v07i01.047 ISSN: 2581-4621

Design & development of an acqua-robotic system for detecting objects in water

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Abstract
The purpose of this study is to build and implement an underwater robot called an Aquabot that can search for potential human presence. This robot is anticipated to be incredibly helpful in operations for underwater person detection during water accidents. The security at these borders is extremely important, and monitoring the marine borders is a very challenging undertaking. Marine exploration is required to comprehend the worldwide climatic and environmental changes. This initiative contributes to different data collection, weather monitoring, and pH sensing fields of research. Disaster prevention, including earthquake and tsunami mitigation, is possible with this data. Many locations lack garbage disposal facilities. As a result, throwing trash into neighbouring bodies of water has grown to be a serious problem. Since this kind of dumping harms the environment, Aquabot offers cleaning, weather monitoring, pH sensing, and other applications.
Keywords: Aquatic, Water, Robot, pH

1. Initialization

Due to their ability to access parts of the ocean that humans cannot, underwater robots are useful instruments for ocean exploration. They can be used to swiftly and precisely identify and locate items. Real-time detection of underwater items therefore has tremendous scientific value and significant practical potential [1]. We will be able to use underwater robot technology as it develops to identify underwater human bodies, which will enhance the dive detection system. as well as additional resource applications that help save lives [2].
The most valuable natural resource is water. It is very important for many things, including drinking and aquaculture. For each of these uses, we require high-quality water, making water quality monitoring essential [3]. In aquaculture, it's crucial to monitor water quality indicators like PH, nitrogen, dissolved oxygen, and turbidity. These sensors can be used to gather information on these parameters, which can subsequently be sent to the aqua framer via IoT. The Raspberry Pi, which comes equipped with an inbuilt WiFi module, can be used to run several IoT applications. [4] This model's Smart Bin seeks to sort objects as rapidly as possible. Domestic trash should be separated on a big scale to make it easier for the municipality and people to manage them. Two categories serve as the basis for the waste square measure classification. Perishability and non-biodegradability levels Any two-class categorization can be measured by these two main categories. assuming they will be

usable [5]. maritime bounds Although surveillance is a challenging undertaking, we can utilise robots to continuously patrol the marine limits because they have the ability to spot and engage threats at a distance. This idea addresses the problem of robots taking the place of people in surveillance [6].

2. Scopes and Goals

Deep learning-based human body detection underwater is a relatively new field of study. The main area of research right now is object detection methods based on deep learning. Convolutional neural network (CNN) is a deep learning application technique that raises the quantity of convolutional layers to enhance learning quality. The goal of this research is to find appropriate deep-learning algorithms for identification and tracking. to assess the effectiveness of particular deep learning methods. Give examples of how humans might be found in an undersea habitat [7].
Water potability is one of society's top worries, and acidity has been continuously increasing. The proposed approach is beneficial for screening water quality parameters and analysing water quality as a result of the damage this causes to aquatic species and people alike. water at a great distance without losing information to prevent its potentially fatal consequences on both people and animals. We can have a continuous system for monitoring the many parameters of water quality with the Internet of Things. The cloud is where all of the IoT data is stored and processed. As a result, the suggested solution is relatively affordable [8].

3. Underwater Human Body Detection Methodology

The two different deep learning-based object detection algorithms can basically be divided into two categories: first, two-stage methods for classification such R-CNN, Fast R-CNN, and Faster R-CNN. The other is a technique based on one-stage regression, like YOLO and SSD. [9]. Many researchers have also utilised these deep learning methods to find items beneath the surface. Although the performance of static detection improved with the inclusion of the adversarial network to the Faster R-CNN for training, it is still limited.
Yong Liu added a convolution kernel adaptive selection unit to the faster R-core, CNN's increasing detection accuracy even further [10]. However, this unit's FPS is insufficient for real-time detection at only 6.4. This thesis develops a multi-class object detector to perform the task of underwater human body component detection. First, a dataset of submerged human body parts and a DNN-based model with pre-trained weights are used to develop a multi-class object detector. In order to identify human body parts, the trained detector is then fed an underwater image of a person. This produces detection results for the arm (Da), head (Dh), torso (Dt), and leg (Dl) (Dl). Then, several rectangular bounding boxes are transferred from the detection results to the original image [11].
The recommended architecture is shown in Fig. 1. The architecture is built on top of the DNN body component detector. The faster R-CNN model, SSD, and YOLOv2 are used in the body component detector's basic model [12].

4. Monitoring Water Quality

Finding the water parameters that would give a clear signal of water pollution was the first challenge, and it was a very important one [16]. The choice of locations that will yield valuable data was the second phase. Data measurements on pristine, unspoiled seas would yield predictable findings, thus the area in issue should be subject to some chemical variations by either marine life or human involvement [13].
Which method of data logging would result in an acceptable format was the third challenge. Data logging was finally done on the hardware itself in text format since the device has an SD storage option and can be simply accessed by almost any application. Selecting a reliable, competent, and appropriate method of analysis was the last stage. Given that there are many unknowns in the sea that will quickly chemically change the parameters being tested. This will thus produce inaccurate readings [14].

5. Marine Boundary Monitoring

The flowchart for marine border surveillance is shown in Figure 3. Using an ultrasonic sensor, the camera will be continuously watching for any unidentified faces. If any are found, the robot is triggered, and the message is sent to the control centre. First, a comparison of the various AQUABOT sensors is provided. An extensive analysis of the algorithms utilised for human detection is then given [15].

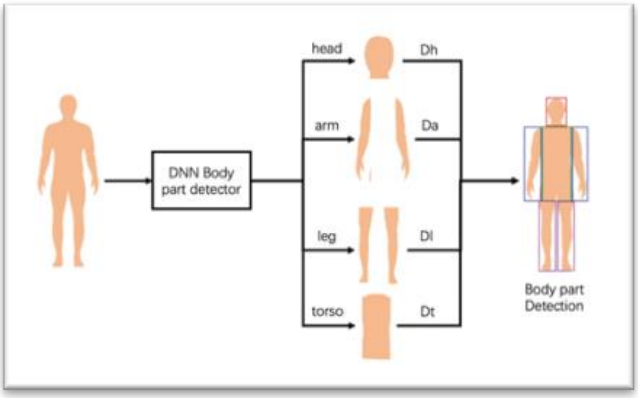

Fig. 1 : Architecture of underwater human body part detection model

6. Conclusions

According to the research, using an IR sensor and camera module can detect the body underwater. Ultrasonic sensors and AI help in marine border surveillance by training the robot to detect faces and trigger if the face is unknown. Robots can also be used for the detection of other objects and valuables apart from the human body by giving the datasets of other valuable objects. With the help of a robotic arm, it picks up floating waste. All these features in one device make it cost-effective.

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