Design of an ROV to find Dead Bodies Underwater

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ABSTRACT - If we look at the current scenario of drowning in the world, we will be astonished to know that according to a WHO report, 650 people die every day, that is 26 per hour and as per the WHO'S 2021 Regional Status Report on Drowning in South-East Asia, nearly 48,000 drowning deaths were observed in India alone, of which 30% were children. To understand and address this problem on a local level, a system is needed to be designed to be better and more efficient at finding these bodies. To lower the danger of mortality brought on by unintentional drowning it is crucial to design a system that can detect and monitor persons in an underwater environment.

Hence, we present our solution of an underwater ROV (Remotely operated Vehicle) in which we will fit the camera to detect the human body in optimal time. For underwater operations, computer vision is one of the most important technologies. For an Underwater environment, weak lighting, and dissolved particles are tough for a pre-processing procedure, which is necessary for underwater vision. After the image pre-processing a Neural Network is proposed to perform the underwater body detection and classification, according to the characteristics of the underwater environment. The program will be used with an underwater robot, the results must be accurate and fast enough to help the robot achieve underwater working operation.

Keywords- Computer Vision, Image Processing, Classification, Neural Network, Deep Learning, Microcontroller.

I. INTRODUCTION

Due to deep learning's scientific achievements over the last few years, classification and detection abilities have dramatically improved. To enhance the classification and detection capabilities, numerous novel strategies, and enhancements to already-existing algorithms have been put forth. Due to deep learning's scientific achievements over the last few years, classification and detection abilities have dramatically improved. To enhance the categorization and detection capabilities, numerous novel strategies and enhancements to already-existing algorithms have been put forth. Computer vision can be used to determine if an object is human or not. Unfortunately, marine ecosystems and underwater environments won't benefit greatly from conventional methods like Histogram Oriented Gradients (HOG) and Scale Invariant Feature Transform (SIFT) algorithms. This is because underwater environmental factors, such as distortions caused by water movement, changes in viewpoint, various lighting conditions, etc., have an impact on how underwater picture and video data are acquired.

II. LITERATURE REVIEW

A. Dr S. Nithya and team developed a remotely operated vehicle (ROV) that could work both on water and land for error rectifying purposes with the help of Raspberry Pi powered by micro-USB input. The paper's main consideration was making a combined technology for land and water rover by designing an ROV that could be operated by a host ship in water or humans on land. They focused on the vehicle's movement in all directions, adding sensors to sense faults and a camera to get live feed even if the sensors fail so that all the outputs can be seen on a computer screen attached to it. The developed vehicle is supposed to meet the requirement of finding errors in underwater HDVC transmission lines, oil leakage and ships or to find damage to structures of buildings and bridges.

B. Oscar Adrian Aguirre-Castro and his team developed an ROV of size 18.41 * 29.50 * 33.50 cm and weight of 15.64 kg to capture 800 * 640 pixels of images. The main aim of the paper was to get underwater video access by remote control communication in remote time via ethernet protocol. They used six motors governed through proportional, integrated, and derivative controllers. Motion control, 3D positioning, temperature capture and video capture are performed at the same time for Raspberry Pi 3 using a threading library for parallel computing. The interface was developed in Python. The device can be used up to 100 m in water. It can be used for surveillance, operations, maintenance, and measurements.

C. Divya SN, in her paper, developed an Alive Human body Detection system using BeagleBone Black. Its main aim is to detect burglars and intruders using various types of sensors. Here she has used a PIR sensor coupled with an ultrasonic and an IR sensor. It also has a temperature sensor for better detection capabilities. All the data from the sensors is collected and processed in the BeagleBone Black. It is also Wi-Fi enabled, so it can be accessed from anywhere. This

solution targets home security, commercial shops, and natural calamities. We aim to pick up the concept of using Ultrasonic sensors from this paper.

D. In a thesis by Maowei Zheng and Wenjie Zhan, they have creatively explained the use of Deep Learning for finding human body parts in an underwater scene. It focuses on using different types of neural networks such as CNN, R-CNN, SSD and YOLO. In their thesis, they have compared the works of all three algorithms and even a combination of all. For the dataset, they have used web scraping and have manually labelled all of it. A total of 1960 images were fed to the neural network and the results were amazing. We aim to apply the same approach by using neural networks that are trained on our data for the project.

E. Underwater Human body detection by Ms Shyma Zaidi and her team talks more about how and what we are doing. They have tried to combine the technology of image processing, cloud computing and IoT. They are using IR to detect objects in the scene and then take a picture of the IR line that is broken. The snap is then sent to the cloud for processing and detecting if the body is human or not. Cloud processing is a part of MLops development and could be beneficial for our project so we will try and implement it.

F. In a paper from RIMLab and the team we found a novel algorithm for object detection in an underwater environment exploiting the multiscale graph-based segmentation. In this approach, it is independent of distortion, colour alteration and other peculiar effects that come with light and its propagation in water. Lighting underwater is a tough image to process as the light gets lesser and lesser the deeper, we go. This method has achieved precise and accurate detection. We too like their plan to implement this method and compare the results with the other methods we are using.

III. CONTENTS

A. MACHINE LEARNING MODEL

Machine learning is the branch of science that allows computers to learn without explicit programming. Machine learning is one of the most exciting technologies ever created. A mathematical representation of the results of the training process is known as a machine learning model. The study of various algorithms that may develop a model automatically through practice and historical data is known as machine learning. A machine learning model is like computer software that uses data or prior experience to identify patterns or behaviours. Our self-taught model will be a convolutional neural network (CNN) or recurrent neural network (Expected – We will opt for the one with higher efficiency).

B. BLENDER

A set of 3D computer graphics tools called Blender is available for free and is used to make

animated movies, visual effects, artwork, 3D-printed models, motion graphics, interactive 3D

applications, virtual reality, and, in the past, video games. 3D modelling, UV mapping, texturing, digital drawing, raster graphics editing, animation, match moving, rendering, and other features are available in Blender. We used this software to prototype and refactor our design until a streamlined design was approached. We are still open to altering the designs if something better is found.

Our prototype will look like this:

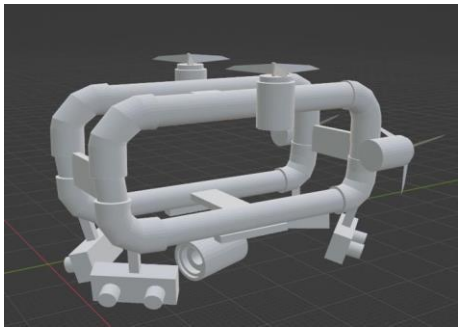

Figure 1 Model

C. MICROCONTROLLERS

An open-source development board called the Arduino Mega 2560 is built around the Atmega2560 AVR microcontroller. An 8-bit microcontroller, such as this one. It makes use of microchip technology ATmega16U2.

Programming for this board is possible using the wiring/processing language. The camera and the thruster are controlled by the Arduino on the ROV. The headlights may be turned on or off, and the camera modes can be changed via digital controls. It contains:

- 14 of the 54 digital input/output pins can be used as PWM outputs, while 16 of the pins are analogue.
- 4 UARTs (hardware serial ports)
- A 16Mhz crystal oscillator and a USB connection.
- A Reset Switch.

Figure 2 Microcontrollers

D. CAMERA

The ROV operator's primary source of visual information is the camera. These cameras are typically chosen because they are High Definition and work exceptionally well in low light. They are the main forward-facing camera utilised for driving the vehicle. The camera will capture all the information on the seabed and will show the detected object image to the user interface for verification of whether the detected object is a human body or not.

• TP-LINK 360° 3MP (2304 1296) will be used. Wi-Fi security camera with ultra-high definition and night vision.

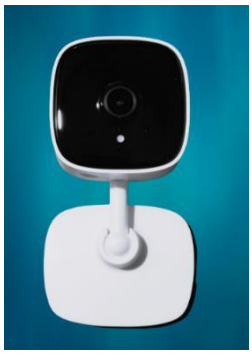

Figure 4 Camera

E. Lights

High-intensity LED strip lights will be used. Since water absorbs light, and while going deeper the water starts getting darker, it is important to use high-intensity gets in all directions to navigate our device wherever it is going in the right direction.

Figure 5 LED Lights

F. Pipes

PVC is a well-known and versatile thermoplastic that has long been used in plumbing applications for both residential and commercial structures as fittings and pipelines. Chlorinated polyvinyl chloride is a thermoplastic that belongs to the same family as PVC (CPVC). The skeletal structure of our prototype will be made from PVC pipes. We plan to use clear pipes to install lights for navigation.

Figure 6 Pipes

G. CAT-5 Cable

Category 5 cable is the name given to twisted pair cables used in computer networks (Cat 5). The cable standard supports most types of Ethernets over twisted pairs up to 2.5GBASE-T but is typically used for 1000BASE-T speeds. It offers the performance of up to 100 MHz, Through CAT-5, additional signals like phone and video are also delivered. Punch-down and modular connections are typically used to connect this cable. Thrusters will be controlled by these cables as they are strong enough and can control all the thrusters with a single wire.

Figure 7 CAT-5 Cable

H. Water Pump

An electromechanical device known as a water pump increases water pressure so that it can be moved from one location to another. Modern water pumps are used worldwide to supply water for domestic, agricultural, industrial, and municipal applications. Here water pump will be modified into the thrusters that are required for our prototype. Their waterproof nature will be of great help to us.

Figure 8 Pump

IV. METHODOLOGY

The working process of ROV is:

An underwater human body detection system allows the user to identify the human body or any other object in the water. It involves the technology of Image processing and Object Detection. This will be done by making an underwater drone. The drone will be made of PVC pipes and connected through silicon glue for waterproofing. The role of PVC pipe in ROV is that it can handle water very well and is corrosion resistant. Cameras, microcontrollers and LEDs are attached to drones for object or human-body detection. The drone will be dropped into the water. The Arduino on the ROV is used to operate the camera and thruster. Digital controls can be used to switch the camera modes and turn on or off the lights. The camera will capture all the information on the seabed and be able to detect if a human is found or not. As soon as a human is found it will notify the user about the same so that further action can be taken. CAT-5 cable wire is waterproof,

it is utilised for wiring. There will be high-intensity LED strip lighting applied. Since light is absorbed by water and the water becomes darker as one descends, it is crucial to utilise high-intensity lighting.

V. CONCLUSION

In this research, CNN and RNN algorithms are identified as suitable deep learning algorithms and they are trained with a dataset containing humans in various underwater scenarios, aiming to detect and track human bodies in an underwater environment which can save a lot of time while searching dead bodies. On the other hand, metrics like training time, and detection speed are necessary if other researchers are reproducing similar work, as these will help them to gain knowledge about the time required to train the algorithms as well as the speed of detecting required entities or objects. CNN algorithm can be given preference over RNN if the speed of detection is more important. But because this aims to solve a real-world problem, it can be concluded that RCNN is the algorithm of choice to effectively detect and track humans underwater.

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