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ROV (Remotely Operated Vehicle) - A Splash in Aquaculture

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Abstract

Aquaculture is a fast-growing, highly complex sector with many farmed species under many production systems in different aquatic environments. This complexity can put a strain on shaping a more sustainable aquaculture system, as many issues may affect environmental and production effectiveness. With the continuous development of science and technology, intelligence and informatization in aquaculture, it is easy to face problems. Today it has become a new trend. Smart aquaculture cannot only realize real-time monitoring, prediction, warning, and risk control of the physical and chemical factors of the aquaculture environment but can also conduct real-time monitoring of the characteristics and behaviors of the fish, which infers with the changing environment

Introduction

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their action, learning, problem-solving, and decision-making capabilities of the human minds. It is a field, which combines computer science and robust datasets, to enable problem-solving. It is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.

ROV - Underwater Robot

It is a remotely operated underwater vehicle, also sometimes known as an underwater drone or underwater robot. They are divided into two types, namely, AUV (Autonomous Underwater Vehicles) and ROV (Remotely Operated Vehicles). AUV is an underwater vehicle capable of moving in the water automatically without a direct human control. Whereas, ROV is an underwater vehicle whose movements are controlled directly by humans from the water surface (Bogue, 2015).

What is ROV?

It is an unmanned, highly maneuverable underwater vehicles used for a variety of underwater tasks, while being operated by a pilot topside or on the shore. These underwater machines are controlled by a person typically on a surface vessel, using a joystick in a similar way that you would play a video game. These camera equipped vehicles allow users to get eyes underwater safely and efficiently.

What are ROV Used for?

- In exploration and science
- In STEM education and academic Research
- In underwater inspection
- In search, rescue and port security

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Operation of ROV

It is equipped with a specific sensors such as camera or video, transponder, compass, odometer, bathy (data depth) and others depending on the purposes and objectives of its usage. It can be operated via IOT (Internet of things), controller, and surveillance under water and outside water with lots of features on it (Aguirre-Castro *et al*., 2019). IoT will help the user to get access to everything from anywhere in the world (Figure 1).

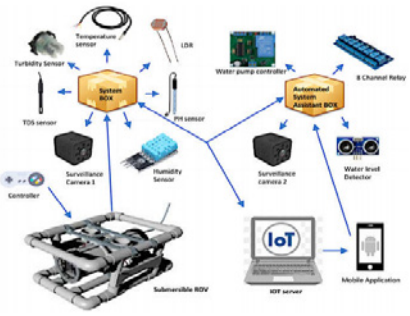

Figure 1: Data measured through ROV and delivered through IoT

Applications of ROV

It gives a unique access to the underwater world, a place that humans can't easily explore alone**.** Currently it is applied in various industries, such as, search and rescue, military, recreation and discovery, aquaculture, marine biology, oil, gas, offshore energy and shipping.

ROV in Marine Fisheries

To study about;

- The impacts of invasive species.
- To assess the marine protected areas.
- To assess the population trends in demersal fishes.
- To map the benthic habitats.
- To examine the diversity in reef.
- To detect the marine litter.
- To assess the spatial and temporal changes in fish and sessile benthos associated with artificial structures.

ROV in Aquaculture

Aquaculture is a key source of food, nutrition, income and livelihoods for millions of people around the globe. With more focus on successful and sustainable fish farming operations, the need to regularly inspect fish health and behaviour, submerged infrastructure and the underwater environment is becoming increasingly important. ROV allows operators to take the control of their fish farms. It is used in the aquaculture for the most efficient performance of net inspections, lighting, feeding, trouble shooting and stock monitoring (Rohit *et al*., 2019). The use of underwater ROVs has proven to be a cost effective way for fish farmers to ensure healthy fish crop, efficient harvest and environmental protection in various ways namely as follows.

1. Net Inspection and Underwater Infrastructure

It is an easily and quickly deployed on any farm to carry out occasional or regular inspections of underwater infrastructure and equipment such as nets and moorings. Using ROV, operators can easily make a net inspection a part of their daily routine. A consistent net inspection allows pilots to monitor the regular wear and tear on lines, nets and mooring, as well as holes from potential pest incursions. By conducting regular inspections, fish farmers can reduce the risk of escapes and also to check nets and farms to ensure that everything is safe and in place. In addition to the inspection of nets, ROVs also provides users with a reliable way to temporarily mend holes until a more permanent repair can be made by net patching tool allows for quick emergency repairs.

2. Feed Monitoring

Farms can make use of their ROV to monitor the feeding of their stock and ensure that they are employing the most efficient feeding practices. "Feed is by far the most expensive component at the fish farm". By using ROV feed intake of their stock can be monitored. It will allows to better gauge the feed that have rationed for the cages, so that underfeeding can be prevented and it will allow us to get the fish up to size efficiently.

3. Sampling/ Monitoring Fish Behaviour

Maintaining fish health at sea these days is a constant battle. Ocean acidification, rising sea temperatures, toxic algal blooms, endemic viral, bacterial and fungal diseases, pollution and sea lice are all growing challenges. Hence, ROV is used to minimize the need for sampling and handling, thereby reducing stress. Sampling is a time consuming process and thereby it raises cortisol levels in fish. At certain times of the year when oxygen levels are lower and water temperatures are higher, farms try to minimize handling to prevent loss. By using ROV or submersible camera technicians can make educated judgments about the current state of health and welfare. Common diseases among fish are the source of billions of dollars in loss annually. Early identification will go a long way in preventing the spread of costly diseases. With early detection, health challenges can be identified before they impact our bottom line. However, sampling is not only time consuming but it can also raise cortisol levels in fish. ROV provides a safe and an efficient alternative for sampling, with an in built temperature, depth and oxygen sensors.

Conclusion

ROV addresses the challenges by providing aquaculture farms with durable, easy to use and affordable underwater inspection and surveillance systems for

daily operation and maintenance. Though great strides in mechanized aquaculture are being made, full automation is still a long way off. We probably won't see fish farms that can manage entirely without the sure hands of humans any time soon. But fully embracing and investing in AI plus automation can significantly produce more seafood to feed the growing world population, while reducing the cost and environmental footprint of aquaculture operation.

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