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Unmanned Multi-Purpose Marine Robot with IoT

Arpitha Shankar S I, DivyaMohan, Divyashree N, Keerthana C, Keerthana H K
Department of Electronics and Communication Engineering, GSSSIETW
Mysuru, Karnataka, India
arpithasi@gsss.edu.in

ABSTRACT

Protecting maritime borders is essential and important since it might be difficult to keep an eye out for potential enemies there. Furthermore, the use of marine resources is essential to understanding global climate and ecosystem changes, which bolsters research projects that collect data for weather tracking and pH sensing, among other uses. The practice of discarding waste into nearby bodies of water in the absence of proper disposal facilities has gained popularity in recent times and has resulted in adverse effects on the ecosystem over an extended period.

The outcome of border patrols by the navy is what determines national security. suitable trash disposal is essential to protect the region's bio diversity, in addition to the study of many other data such as temperature, pressure, pH levels, etc. to take suitable action for the changing environmental circumstances. The design of a versatile, trustworthy, and affordably priced marine robot is described in this paper. In addition, it may be used in aquatic environments to monitor other parameters required for weather prediction, eliminate floating debris, and detect pH levels. It has an efficient continuous power system that draws energy from solar radiation.

Keywords —Arduino Uno, BMP180, Wi-Fi module ESP8266, Ultrasonic Sensor, Bluetooth module

I. INTRODUCTION

The majority of the time, military robots are utilized in integrated systems. These robots can be autonomous machines or remote-controlled devices, and they come in a variety of sizes and designs depending on what they are used for. Some people think that automated weapons systems will be used in modern warfare. Military robots often fall into one of the following categories: ground, airborne, or marine, as well as those focused on group robot use. The majority of military robots are still somewhat simple machines, and humans are involved in almost every facet of operation for the majority of contemporary unmanned systems. military systems, specifically and especially. It is also used to measure the pH of water and remove impurities from it.As a result, its primary concerns are its four modes of operation: cleaning, water monitoring, weather forecasting, and surveillance.

A servo motor and ultrasonic sensor make up the radar system, which tracks the presence of intruders or attackers and transmits the data to a server unit. The wireless camera equipment is designed to record live footage and transmit it to a central station. weather monitoring system to keep an eye on environmental factors like temperature, air pressure, and seismic activity. Every piece of tracked data will be transferred to the cloud for later examination.Water pH sensor to check the pH of the water in a lake or river.used to gather floating waste from rivers in order to clean lakes or rivers. Solar panels will power the entire robot. Central station controls the robot application. To enable robot mobility, robot wings are composed of plastic and DC motors. Through its mechanisms, the machine makes sure that various plastic materials are processed effectively.

II. RELATED WORKS

The literature is primarily scrutinized to identify gaps in the knowledge of the field source. This gap is further explored during research to establish Latest facts or theories that Providevalue to the field. The concept of conducting a scientific and systematic study necessitatesobservation of existing knowledge, thus, facilitating the need for literature review.

Nirmala M. et al.,[1]describes the Solar powered unmanned robot with radar system, The robot can be used in several lateral military robotics achievements, with the primary requirements being the formulation of advanced unmanned system management. By using solar energy, one can become less dependent on conventional energy sources and also save money and protect the environment. Highly dependent on sunshine. Its operational capabilities may be restricted on overcast days or at night.

Water pollution caused by human generated waste. Exposure to harsh marine environments may lead to wear and tear, requiring regular maintenance. This includes detecting & removing man-made contaminants & plastics[2].

Underwater exploration is a challenging task due to the hard environment and limited visibility. Traditional manned underwater vehicles are expensive to operate and put divers at risk. This can operate in extreme conditions, such as deep waters, strong currents and areas with limited visibility, which would be too dangerous for human divers. Hydrodynamic Design and propulsion technology used for analysis, employ computational fluid dynamics (CFC) simulations [3].

The study focuses on Subsea pipeline Inspections can be hazardous for divers due to the extreme environmental conditions and potential risks associated with underwater operations. It eliminates the need for human operators to be present in these hazardous environments, thereby reducing the risk of accidents or injuries. USR (User System Resources) Technology are used for Navigation. [4]

Rashmi Srinivasan et al.,[5]suggests using wireless sensor networks to monitor adversaries at maritime boundaries and to continuously monitor the weather. A cloud-based system provides more capacity for data collecting and enables online data access from a distance. Monitoring the weather across bigger areas is very challenging.

Vanitha Jain et al.,[6]Addresses when rescuers risk their lives to save victims who fall into bodies of water. Technologies known as SAR (Save and Rescue) are employed to find and save human lives. more responsive, precise, and quick than a manual rescue mechanism

Current state of Environmental monitoring faces problem in terms of accuracy, coverage and efficiency. Implementing network of sensor to measure critical environmental parameter including temperature and salinity. Robotic System enable data in hard-to-reach oceanic zone, enhance the scope and accuracy. Maintenance and repair of robot system in deep sea environment can be complex and Costly.[7]

D S Terracciano et al.,[8] This study come across the difficulty in accessing certain underwater areas. The use of AI or ML algorithm enhance the robot's decision-making capabilities for effective Surveillance. Marine robot can operate in Hazardous or hard to reach areas in challenging underwater condition.

III. METHODOLOGY

The RADAR system, which consists of an ultrasonic sensor and servo motor, includes the remotely operated weapon/triggering unit, which will aid in destroying enemies or suspicious objects, and the weather monitoring system, which will monitor atmospheric factors like air pressure, temperature, and Earthquake waves. When adversaries or illegal items are detected, the RADAR system will report this information to the server and wireless camera units. Every tracked piece of information will be transferred to the cloud for further review. We will utilize our water PH sensor to keep an eye on the water PH level in the lake or river. The same robot may be used to clean lakes and rivers.This will gather the river's floating waste. Solar panels will power the entire robot. Central station controls the robot application. Plastic and a DC motor are used to create the robot wings, which aid with movement.

A. Block diagram

The Arduino is interfaced with the three sensors. Ph, Air Pressure, Ultrasonic, Temperature, and Humidity Sensors are the inputs that the Arduino receives. The block diagram in Fig 1 outlines the key components and their interactions in an unmannedmultipurpose marine robot with IoT capabilities, showcasing the integration of sensors, communication system, and user interfaces to achieve versatile and autonomous marineoperations.

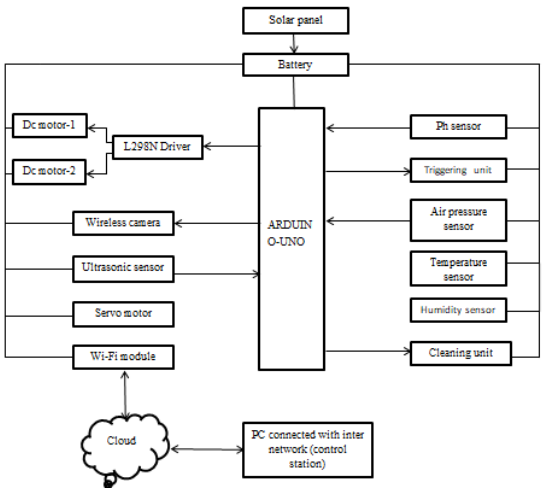

Fig 1: Block Diagram of Unmanned Multi-Purpose MarineRobot with IoT

B. Hardware and Software requirements

Hardware Requirements:

The Unmanned Multipurpose Marine Robot is a fascinating project that brings together a variety of components to create a versatile and smart underwater explorer. At its heart lies the Arduino Uno, orchestrating the robot's actions. With the help of an ultrasonic sensor, it navigates through the depths, avoiding obstacles with ease. The pH sensor ensures it monitors the water quality, contributing to marine research. A DC motor propels it forward, while a servo motor enables precise movements for tasks like sample collection. Motor drivers ensure efficient power management. Equipped with a wireless camera, it captures breathtaking underwater footage, streamed in real-time via the ESP8266 Wi-Fi module. The HC-05 Bluetooth module allows for remote control and data exchange. Additionally, an air pressure sensor aids in depth measurement, enhancing the robot's navigational capabilities. Together, these components form a remarkable IoT-enabled marine robot, revolutionizing underwater exploration

Software Requirements:

The Software Requirements are Arduino Sketch, Embedded C and Flash Magic

C. Flowchart

The implementation of theUnmanned Multi-Purpose Marine Robot with IoT utilizing Arduino Uno yielded promising results.The robot movement is controlled by the Bluetooth controller application, in an user equipment. It moves forward, backward, right, and left as per the directions given by the user equipment. The robot has been designed to incorporate all the sensors and wireless camera.

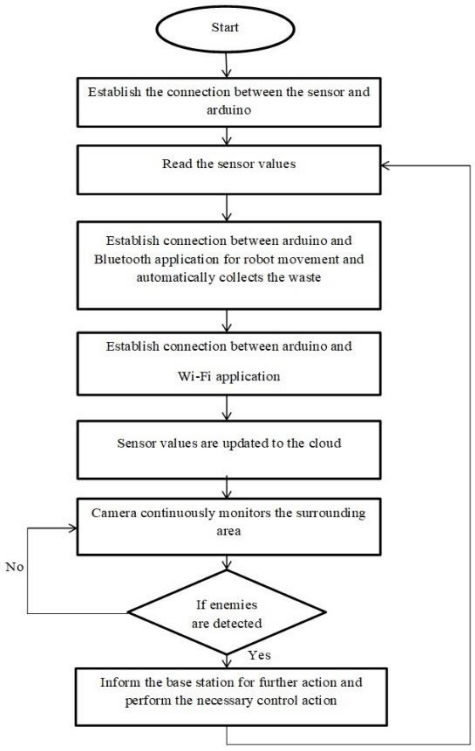

Fig 2: Flowchart of Unmanned Multi-Purpose Marine Robot with IoT

IV. RESULTS

There are four modes of operation for the robot.

When in the Surveillance mode, a wireless camera can be used to check and monitor the surroundings as soon as the ultrasonic sensor detects the presence of any intruders. The live broadcast is recorded to assist the base station in carrying out additional tasks.

When the river purification mode was engaged, the raw materials were easily collected in the bin found in the model's backend.

The air pressure sensor provides the temperature, humidity, and pressure readings used in the weather forecasting mode. The values track variations in the weather.

In order to check the water quality, a pH detector is utilized to gather pH data in the quality of the water monitoring mode.

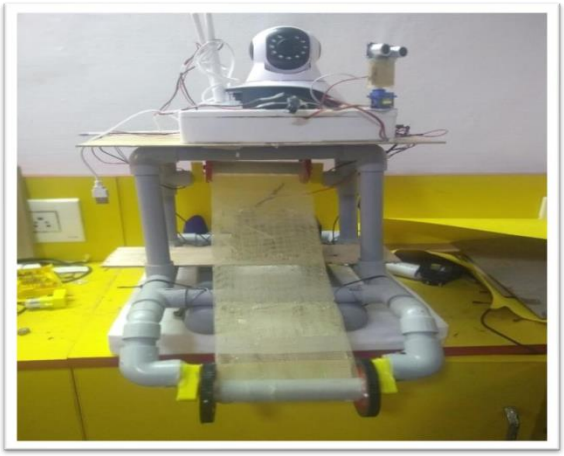

Fig 3: Unmanned Multi-Purpose Marine Robot with IoT

V. CONCLUSION

To sum up, the Arduino Uno-powered Unmanned Multi-Purpose Marine Robot with IoT offers a potential answer. Although there are numerous ways to protect our coastal areas, using an android-based robot to patrol these areas could be more beneficial. It lessens the amount of human activity in the coastal area. By using this technique, the risk to our soldiers' lives is decreased.The ultrasonic sensor and servo motor on this maritime robot work together to function as a radar system. While a radar device helps identify the movement of an illegal person or item, servo motors move the ultrasonic sensor. The base station receives the alert message "object detected," and wireless cameras are used to monitor the area.Livestreams that have been recorded can be used to carry out further tasks like triggering. The more applications added, the more effective the robot will become. The marine robot's other duties include cleaning water and keeping an eye on the weather and water quality.

To forecast environmental problems like global warming, numerous observable variables are plotted, including temperature versus time, pressure versus time, humidity versus time, and pH versus time. The data saved in the cloud can be subjected to further data analysis.

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