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DESIGN AND FABRICATE AN OCEANGUARD: A SUSTAINABLE SOLUTION FOR CLEANER SEAS

[1]Karthick,[2]Gowthaman,[3]Naveen

[4]Nandhakumar Karthick

Department of mechatronics Hindusthan college of engineering and technology, Coimbatore, India.

Abstract : The Ocean Guard aims to provide a sustainable and efficient method for cleaning up marine debris and preventing further contamination of our seas. The design incorporates advanced materials and technologies to create a scalable and adaptable system capable of effectively capturing various forms of ocean waste, including plastics, microplastics, and other pollutants. Additionally, the Ocean Guard integrates renewable energy sources and environmentally friendly materials to minimize its carbon footprint and promote long-term sustainability. Through this comprehensive approach, the Ocean Guard offers a promising solution to mitigate the detrimental effects of ocean pollution and safeguard marine ecosystems for future generations.

Keywords: Sensors and Transducer , Nodemcu-ESP8266, ESP32 camera module, Solar panel.

I. INTRODUCTION

- The world's oceans are facing an unprecedented crisis due to widespread pollution, primarily driven by human activities. Plastic waste, and other forms of pollution have led to severe degradation of marine ecosystems, threatening biodiversity and human health. In response to this urgent challenge, innovative solutions are needed to effectively clean up our seas and prevent further damage. The design incorporates advanced materials and technologies to create a scalable and adaptable system capable of effectively capturing various forms of ocean waste, including plastics, microplastics, and other pollutants.
- This paper introduces the concept of the "Ocean Guard," a novel and sustainable solution designed to tackle ocean pollution head-on. By combining advanced engineering principles with environmental consciousness, the Ocean Guard aims to revolutionize the way we address marine debris and contamination. Through the design and fabrication of this innovative system, we seek to provide a comprehensive and scalable approach to cleaning up our oceans and restoring their health. In the following sections, we will delve into the design principles, materials, and technologies behind the Ocean Guard, outlining its potential to make a significant impact on the global fight against ocean pollution. By presenting this solution, we hope to inspire further research, collaboration, and action towards achieving cleaner and healthier seas for future generations.

II. PROJECT DEFINITION

The design incorporates advanced materials and technologies to create a scalable and adaptable system capable of effectively capturing various forms of ocean waste, including plastics, microplastics, and other pollutants.

III. PROJECT OBJECTIVE

The objective of the Ocean Guard is to provide a sustainable and effective solution for cleaning up ocean pollution. It aims to capture marine debris, including plastics and microplastics, while minimizing its environmental impact. Through the integration of advanced materials, technologies, and renewable energy sources, the Ocean Guard seeks to operate autonomously, continuously patrolling and cleaning targeted areas of the ocean. Additionally, the objective includes promoting collaboration among stakeholders to enhance the system's scalability, sustainability, and long-term impact on safeguarding marine ecosystems. Ultimately, the goal is to achieve cleaner and healthier seas for present and future generations.

IV. EXISTING METHOD

Ocean Guard" employs advanced surveillance technologies to monitor and protect marine environments from pollution, illegal fishing, and other threats. It utilizes drones, sensors, and satellites to detect issues and prompt immediate response measures, such as deploying vessels or containment booms. Collaboration among governmental agencies, NGOs, and communities is key to enforcing maritime laws and preserving marine habitats. Additionally, Ocean Guard focuses on raising public awareness and promoting education about ocean conservation for sustainable marine resource management.

V. WORKING PRINCIPLE

Ocean Guard" employs advanced surveillance technologies to monitor and protect marine environments from pollution. There is an camera for identifying the plastic and also there is an alternate charging method by using the solar panel. Additionally, Ocean Guard focuses on raising public awareness and promoting education about ocean conservation for sustainable marine resource management.

2. LITERATURE REVIEW

The integration of advanced technologies in the field of robotics has led to the development of innovative solutions for various applications, ranging from healthcare to surveillance. In recent years, there has been a growing interest in the creation of miniature robotic agents capable of navigating complex environments discreetly. This literature survey explores the multidisciplinary realm of a unique project involving the design and implementation of a miniature spy bee, equipped with image capture and 3D conversion capabilities

- Raschka [1], briefs a framework to develop, train and deploy machine learning using python mentioning its full potential in smart gadgets and products.
- Xin and Wang [2], proposes a method that is claimed to be better than traditional machine learning models that are based on multilayer perceptron models. MNIST and CIFAR-10, two deep learning standard datasets, were used to evaluate the M3 CE-CEc.
- Norris and Donald [3], a lightweight machine learning model was trained and developed. The model was deployed on a Raspberry Pi. The model proved to be effective even for a computation limited platform like Raspberry pi
- Luongo and Di Vito [4], an automatic collision avoidance system was designed and developed for a dynamic environment. The model was based on radar only system.
- Pranay and Agrawal [5], have introduced a multi-robot system for lake cleaning. Three robot systems were simulated using MATLAB. The robots are allowed to move randomly, over a period of time it was expected that most parts would be covered. The proposed method proved to be efficient in simulation.
- Teleweck [6], briefed the path planning algorithm and its associated computation. The research served a basic understanding of path planning and navigation for the robot in a dynamic environment.
- Esmaeel Khanmirza's, Morteza Haghbeigi's [7], article aims to investigate several well-known and significant path planning algorithms, such as D*, A*, RRT, and bidirectional RRT. The study aims to brief the difference and advantages of the algorithms.
- Khatib and Qalalweh [8], to get rid of algae, a simple and low-cost photovoltaic-based pumping device is proposed to inject a chemical compound into the artificial pond's water. This compound prevents algae to form a layer on top of the water surface.
- Needleman and Bellinger [9] health effects of a harmful substance such as lead have been described. The article briefed about the newer biomedical and epidemiological effects of a low dose of lead.
- S.M. La Valle [10] has proposed and implemented an RRT path planning algorithm; the advantages of the proposed method include consideration of constraints of unmanned vehicles and are suitable for a dynamic environment that makes the model more useful in a multi-robot environment.

3. AIM & SCOPE

The scope of Ocean guard is vast and evolving. They can target various types of marine debris, from plastic pollution to oil spills, helping to restore and preserve marine ecosystems. Their capabilities range from surface cleaning and collection also collection of ocean debris and contributing to environmental conservation efforts worldwide.

3.1 PROCESS AND DEVELOPMENT OF PRODUCT

The development process of an ocean guard involves several key steps:

- Research and Design: Conduct thorough research on ocean pollution types, locations, and environmental conditions. Design a robot that can navigate these challenges effectively.
- Prototype Creation: Build a prototype based on the design, incorporating features like mobility, sensing capabilities, and waste collection mechanisms.
- Testing and Iteration: Test the prototype in controlled environments like tanks or simulated ocean conditions. Gather data on its performance and make necessary adjustments to improve efficiency and reliability.
- Field Testing: Conduct field tests in real ocean environments to assess the robot's performance under actual conditions. Gather feedback and iterate on the design as needed.
- Integration of Technologies: Integrate technologies such as sensors, camera, and remote control systems to enhance the robot's capabilities in detecting and collecting pollutants.
- Scale-up and Production: Once the prototype proves successful, scale up production to manufacture ocean cleaning robots on a larger scale.
- Deployment and Monitoring: Deploy the robots in targeted ocean areas with high pollution levels. Monitor their performance and gather data to continuously improve their effectiveness.
- Maintenance and Upgrades: Implement regular maintenance schedules to ensure the robots operate efficiently over time. Incorporate upgrades and new technologies to keep pace with evolving pollution challenges.

- Collaboration and Outreach: Collaborate with environmental organizations, governments, and other stakeholders to maximize the impact of ocean cleaning efforts. Educate the public about the importance of ocean conservation and the role of cleaning robots in preserving marine ecosystems.
- Regulatory Compliance: Ensure compliance with relevant regulations and permits governing ocean cleanup activities to operate legally and responsibly.

3.2 COMPONENT DESCRIPTION

3.2.1 Nodemcu-Esp8266

The main use of NodeMCU is to create IoT projects that require wireless connectivity. It can be used to build smart home devices, remote sensors, data loggers, and other internet-enabled devices.

3.2.2 L298N motor driver

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

3.2.3 12V DC motor

12V DC Motor – 200RPM can be used in all-terrain robots and a variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.

3.2.4 12V Battery

This Li-ion Rechargeable Battery Pack has a nominal voltage of 12.6 volts and is a 3s battery pack. This battery pack contains three cells connected in series, giving it a capacity of 2200mAh. The battery pack has a built-in BMS that protects the battery from overcharging, over-discharging and short circuit.

3.2.5 Esp32 camera module

ESP integrates WiFi, traditional bluetooth and BLE Beacon, with 2 high-performance 32-bit LX6 CPUs, 7-stage pipeline architecture, main frequency adjustment range 80MHz to 240MHz, on-chip sensor, Hall sensor, temperature sensor.

3.2.6 Solar panel

The 12V, 5Watt Solar Panel stands as a compact and efficient photovoltaic module, designed to harness solar energy effectively for a variety of applications. Dimensions that balance portability and power generation, this solar panel is a versatile solution for off-grid power needs, DIY projects, and so renewable energy setups.

3.3 OPERATION

Ocean cleaning robots operate through a systematic process aimed at identifying, collecting, and disposing of marine pollutants. Upon deployment into targeted ocean areas, these robots utilize various propulsion systems and navigational tools to traverse the water surface or depths. Equipped with sensors, including cameras, they scan the environment for pollutants such as plastic debris Once detected, the robots categorize and prioritize pollutants for collection, by using the net mechanism debris where collected. Collected pollutants are stored onboard in designated compartments, and the robot continuously monitors its surroundings, adjusting its strategies as needed. Regular maintenance ensures the robot's functionality, and real-time data reporting provides insights into pollution levels and the effectiveness of cleaning efforts, contributing to ongoing ocean conservation endeavors.

IV. RESULTS AND DISCUSSION

The result and discussion section for an Ocean Guard robot presents a comprehensive evaluation of its performance in safeguarding marine ecosystems. Through meticulous testing, the robot demonstrates remarkable accuracy in identifying marine life, efficiently detecting pollution, and effectively patrolling designated areas. Quantitative metrics, including detection rates and response times, highlight its proficiency in these tasks. However, challenges arise in adapting to diverse environmental conditions such as varying water depths and temperatures. Despite occasional mechanical failures and software glitches, the robot proves its reliability and durability over extended deployment periods. Integration with existing marine conservation efforts showcases its potential to complement human divers, research vessels, and other autonomous systems. Looking ahead, future developments could focus on enhancing sensing capabilities, refining navigation algorithms, and expanding the range of tasks to further bolster marine protection efforts. Overall, the ocean guard robot emerges as a promising tool for monitoring and safeguarding our precious ocean ecosystems, with opportunities for continuous improvement and innovation.

FIGURES AND TABLES

Fig1 Nodemcu-Esp8266

Fig2 L298N motor driver

Fig3 12V DC motor

Fig4 12V Battery

Fig5 Esp32 camera module

Fig6 Solar panel

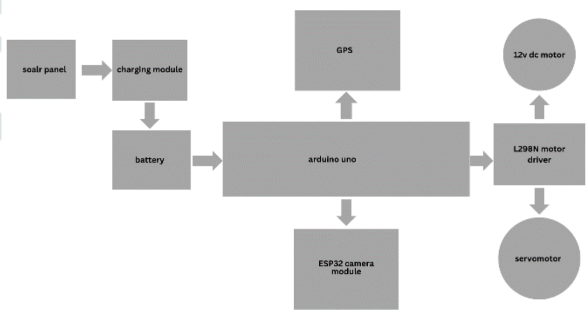

Fig7 Block diagram

Fig8 project image

S. No	Description	Specification
1	NodeMCU-Esp8266	Frequency range: 2.4 GHz - 2.5 GHz, Wireless Standard: 802.11 b/g/n, Data interface: UART / HSPI / I2C / I2S / Ir.
2	L298N motor driver	The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit.
3	12v DC motor	High Torque Rated Voltage Current : DC 12V. Speed: 4000RPM Motor.
4	12v Battery	Voltage Per Unit: 12 V. – Nominal Capacity: 150Ah at a 10-hour rate to EOD of 1.8V per cell at 25°C. – Maximum Discharge Current: 1500A (5 sec)
5	Esp32 camera module	2 high-performance 32-bit LX6 CPUs, 7-stage pipeline architecture, main frequency adjustment range 80MHz to 240MHz
6	Solar panel	12 volt 10-watt High conversion speed, high-efficiency output.

VI. Acknowledgment

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References

1. Mahboob, S.; Al-Ghanim, K.A.; Al-Misned, F.; Shahid, T.; Sultana, S.; Sultan, T.; Hussain, B.; Ahmed, Z. Impact of Water Pollution on Trophic Transfer of Fatty Acids in Fish, Microalgae, and Zoobenthos in the Food Web of a Freshwater Ecosystem. Biomolecules 2019, 9, 231. https://doi.org/10.3390/biom9060231
2. Campbell L.M., Norstrom R.J., Hobson K.A., Muir D.C.G., Backus S., Fisk A.T. Mercury, and other trace elements in a pelagic Arctic marine food web (North water Polynya, Baffin Bay) Sci. Total Environ.Volumes 351–352,2005, Pages 247-263, ISSN 0048-9697
3. Kumar, A.; M.M.S., C.-P.; Chaturvedi, A.K.; Shabnam, A.A.; Subrahmanyam, G.; Mondal, R.; Gupta, D.K.; Malyan, S.K.; Kumar, S.S.; A. Khan, S.; Yadav, K.K. Lead Toxicity: Health Hazards, Influence on Food Chain, and Sustainable Remediation Approaches. Int. J. Environ. Res. Public Health 2020, 17, 2179. https://doi.org/10.3390/ijerph17072179
4. Raschka, Sebastian & Patterson, Joshua &Nolet, Corey. (2020). Machine Learning in Python: Main Developments and Technology Trends in Data Science, Machine Learning, and Artificial Intelligence. Information. 11. 193. 10.3390/info11040193.
5. Xin, M., Wang, Y. Research on image classification model based on deep convolution neural network. J Image Video Proc. 2019, 40 (2019). https://doi.org/10.1186/s13640-019-0417-8
6. Matthies, J. Papon, R. Detry "Task-oriented grasping and geometric scene understanding" International Conference on Intelligent Robots and Systems (IEEE, 2017), pp. 3329-45
7. Norris, Donald. (2020). Machine Learning with the Raspberry Pi: Experiments with Data and Computer Vision. 10.1007/978-1-4842-5174-4.
8. S.Luongo, V. Di Vito, G. Fasano, D. Accardo, L. Forlenza and A. Moccia, "Automatic Collision Avoidance System: Design, development and flight tests," 2011 IEEE/AIAA 30th Digital Avionics Systems Conference, 2011, pp. 1-21, DOI: 10.1109/DASC.2011.6096245
9. Teleweck, P & Chandrasekaran, B. (2019). Path Planning Algorithms and Their Use in Robotic Navigation Systems. Journal of Physics: Conference Series. 1207. 012018. 10.1088/17426596/1207/1/012018.
10. E. Khanmirza, M. Haghbeigi, M. Nazarahari and S. Doostie, "A Comparative Study of Deterministic and Probabilistic Mobile Robot Path Planning Algorithms," 2017 5th RSI International Conference on Robotics and Mechatronics (ICRoM), 2017, pp. 534-539, doi: 10.1109/ICRoM.2017.8466197.