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IoT-ENHANCED SOLAR MARINE DEBRIS COLLECTOR

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Abstract - *Eco-Friendly Solar Powered Waterborne Debris Collector represents an innovative solution to address the growing issue of marine pollution. This vessel harnesses the power of the sun through integrated photovoltaic panels, ensuring sustainable and eco-friendly operation. Equipped with advanced sensors and navigation systems, the boat detects and collects floating debris, plastics, and other pollutants from the water's surface. The collected waste is then appropriately segregated and stored onboard, minimizing its impact on aquatic ecosystems. With its solar energy source, this boat operates silently and emits zero greenhouse gases, contributing to cleaner and healthier oceans. Its autonomous navigation capabilities, controlled by artificial intelligence, allow it to cover vast areas and reach remote regions with ease. As a sustainable and eco-conscious solution, the solar-powered sea waste collector boat exemplifies the potential for technology to allay the global problem of marine pollution. while simultaneously reducing our reliance on fossil fuels and protecting marine life. This innovation paves the way for a brighter and cleaner future for our oceans and the planet.*

Key Words: **IoT, ESP 32, Solar Panel, Camara Module, DC Motors, Batteries, Solar Powered System**

1. INTRODUCTION

Marine pollution, particularly plastic waste, is a major concern for our oceans. The IoT-Enhanced Solar Marine Debris Collector tackles this problem by merging solar energy and IoT technology to enhance debris collection. Users can control and supervise the collector from a distance through the Blink app, enabling adaptable and efficient cleaning operations. This new approach utilizes sustainable energy and offers instant data and control, making it suitable for different marine settings. This paper focuses on creating a complete system that combines IoT features to remotely control and monitor a solar-powered marine debris collector. It involves developing the hardware elements like the collection mechanism and storage unit, as well as the software aspects, specifically linking with the Blink app for IoT management. It tackles issues related to efficient debris collection, ensuring live monitoring and control, and supporting sustainability with solar power.

2. SYSTEM ARCHITECTURE

2.1 Proposed System

The Proposed system incorporates solar panels for sustainable energy and reduces the need for external power. It uses smart sensors for obstacle detection, debris monitoring, and water quality assessment, providing valuable data for decision-making. The camera module captures visual data to notify operators of important events, and a user-friendly interface allows remote interaction. The system is designed to be scalable and adaptable, working effectively in various marine environments. It aids ocean conservation by offering real-time data for remote control and monitoring of the debris collector. Overall, the system improves efficiency and reduces the necessity for continuous human involvement, providing a comprehensive solution for marine pollution challenges.

2.2 System Operation

The IoT-Enhanced Solar Marine Debris Collector is built with a comprehensive structure that prioritizes sustainability, efficiency, and user control. Its main components include high-efficiency solar panels that capture and convert sunlight into electrical energy to power the collector and store excess energy in batteries for continuous operation in low-light conditions. The debris collection mechanism consists of a mechanical arm with a conveyor belt or net to capture floating debris, transferring it to an onboard storage compartment for disposal later.

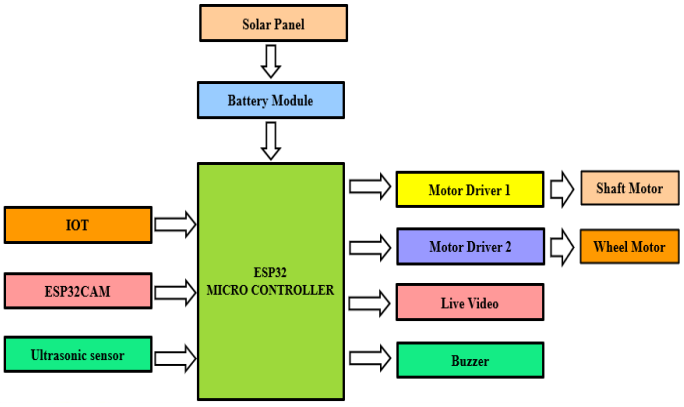


Fig -1: Block Diagram of IoT Enhanced Solar Marine Debris Collector

Key to the system is the ESP32 module, which oversees operations and communication between components. The ESP32 camera module enhances monitoring capabilities by providing visual data. Ultrasonic sensors at the back of the device detect objects and obstacles, ensuring smooth navigation and operation.

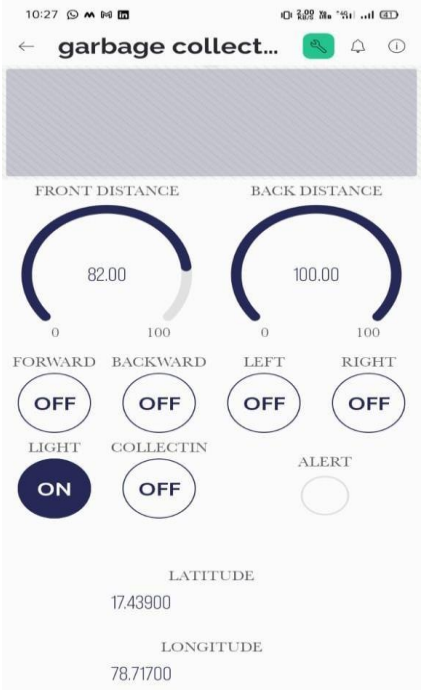


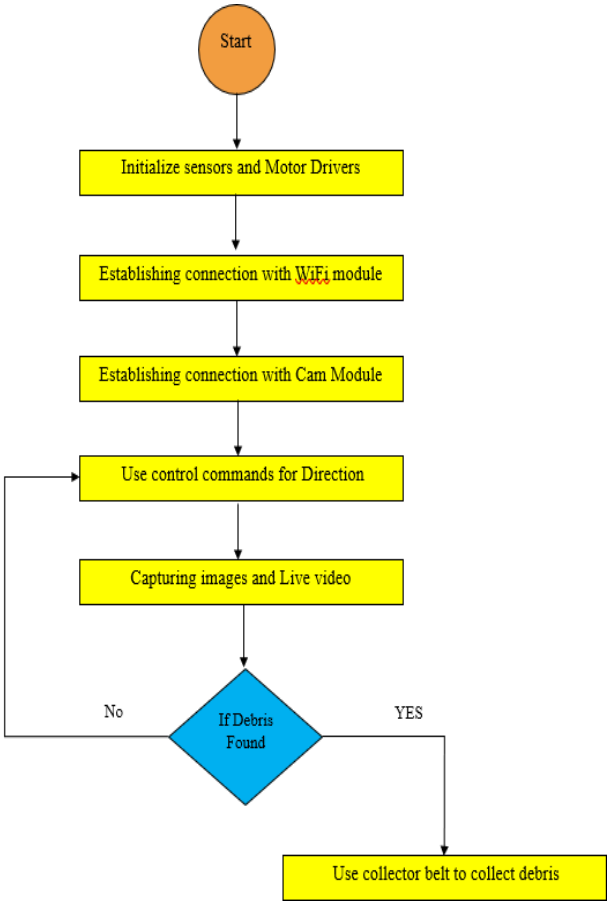
Fig -2: Overview of Blynk IoT Template

The Wi-Fi connectivity enables the ESP32 module to connect with the Blink app for remote control and monitoring. Through the app, users can initiate, cease, and steer the collector, as well as track its status and performance through a user-friendly interface. Real- time data on debris types and quantities are collected and sent to a cloud server for storage, analysis, and reporting. An analytics dashboard within the Blink app offers detailed insights into the collector's efficiency and environmental impact. This design guarantees that the IoT-Enhanced Solar Marine Debris Collector is sustainable, efficient, adaptable, and user-friendly. It harnesses solar power and advanced IoT technology to provide a robust solution for managing marine debris and advocating for cleaner oceans.

3. SOFTWARE ALGORITHM

Step 1: Start
Step 2: Initialize sensors and Motor Drivers
Step 3: Establish connection to WiFi module
Step 4: Continuously monitor water for debris
Step 5: Capture images or videos of detected debris using live camera module
Step 6: Use control commands via WiFi module for direction (front, back, left, right)
Step 7: Adjust collector's movement direction based on commands
Step 8: Repeat steps 3-6 continuously for ongoing debris detection, camera operation, and movement adjustment.

4. FLOW CHART



5. RESULT AND DISCUSSION

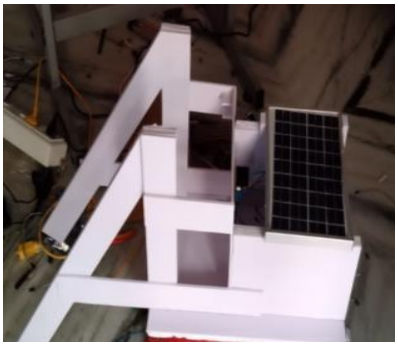


Fig -3: Design of Debris Collector Chassis

As shown in figure 3, the first step in developing an IoT-Enhanced Solar Marine Debris Collector is the Design of the Debris Collector Chassis.

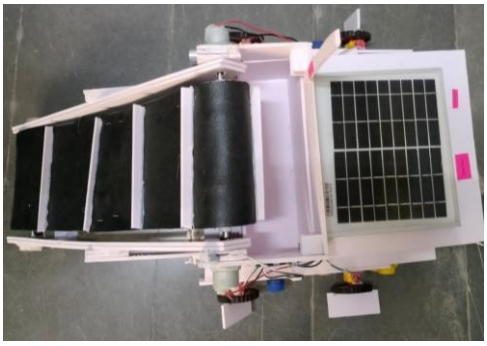


Fig -4: Employed with Solar Panel

Fig -5: Debris Collector

As shown in figure 4 and 5, the IoT enhanced solar marine debris collector is utilized with a solar panel in order to capture solar energy from the sun and collector belt to collect debris from water bodies. The Wheels helps in controlling the movement of the debris collector with the help of Blynk Application.

Fig -6: Integrated with Ultrasonic Sensor

In figure 6, we can see that the debris collector is integrated with an ultrasonic sensor at the back, so if an object approaches the collector from behind, we will receive an alert through an audible buzzer. So that we can take necessary precautions by stoping the movement of the debris collector.

Fig -7: Debris Collector collecting Debris

Figure 7, illustrates how the IoT Enhanced Solar Marine Debris Collector collects debris present in the water bodies using a belt collector. Rotating of the collector belt can be started and stopped by using Blynk app. Collector Belt Starts rotating inorder to collect the debris from the waterbodies and then stores the debris storage tank.

6. CONCLUSION

In conclusion, the proposed system marks a big advancement in decreasing marine pollution. It has the potential to expand cleanup efforts to far-off areas, connect with marine conservation and blue economy initiatives, and collaborate with industries to encourage sustainable practices. Through technology, these devices offer flexible solutions for emergency response, smart city growth, and educational programs, fostering community participation and environmental conservation. Going forward, their role in safeguarding marine environments and promoting ocean sustainability is vital for a cleaner, healthier future.

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BIOGRAPHIES

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