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Solar Powered Water Trash Collector

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A B S T R A C T

The solar powered water trash collector is an eco-friendly, autonomous device designed to clean water bodies by collecting floating waste. It operates entirely on renewable solar energy, reducing pollution and lowering operational costs. Its large debris bin ensures continuous cleaning with minimal human intervention, while real-time data tracking monitors performance and environmental conditions. The system is designed to handle various types of waste, including plastics, leaves, and other debris, helping to prevent water contamination. It supports marine ecosystems by reducing hazards to aquatic life and promoting cleaner, healthier water environments. This sustainable solution offers an effective way to tackle water pollution in lakes, rivers, and coastal regions, contributing to long-term environmental preservation. Additionally, its durable, weather-resistant build ensures reliable performance in various environmental conditions, while its modular design allows easy maintenance and upgrades. The system's scalability makes it suitable for both small and large water bodies, offering a versatile approach to combat global water pollution challenges.

Keywords: Introduction to the Project, Working, Block Diagram, Circuit Diagram, Flowchart of Code, Conclusion

1. Introduction

Most people have a swimming pool in their house or apartment. Pools often get dirty due to falling dead leaves or other small trash, and cleaning them manually takes time. To save time, I created a boat that collects the trash floating on the water's surface in pools using Arduino technology. This device, known as a "Skimmer Boat," offers an efficient alternative to traditional, labor-intensive cleaning methods that are costly, risky, and time-consuming. The Solar Powered Water Trash Collector is designed to work automatically, making it a budget-friendly, one-time investment for pool owners. It saves on energy and requires minimal maintenance. Most automated cleaners on the market have a built-in function that shuts off after finishing the job, ensuring convenience and efficiency. To further improve the system, solar power technology is integrated into the design. Equipped with solar panels, the skimmer boat becomes a self-sustaining, eco-friendly solution, eliminating the need for external power sources. This reduces electricity costs while ensuring uninterrupted operation during daylight hours, making pool cleaning easier, faster, and more sustainable. The goal of this project is to decrease the consumption of time and manpower while ensuring cleaner water bodies. It aims to provide an efficient solution to remove pollutants from the surface of lakes, rivers, and other water bodies. The system is designed to deliver fast, reliable performance during river cleaning operations, making the process less labor-intensive and more effective. The core of this project is a robotic water surface cleaner built using Arduino Uno, controlled via Bluetooth from a distance. This not only simplifies the cleaning process but also cuts down on work effort and reduces water pollution caused by floating trash. To enhance efficiency and sustainability, the system is powered by solar energy, ensuring minimal power consumption and continuous, eco-friendly operation. The combination of Arduino technology and solar power makes it a reliable, high-performance, and environmentally conscious solution for keeping water bodies clean.

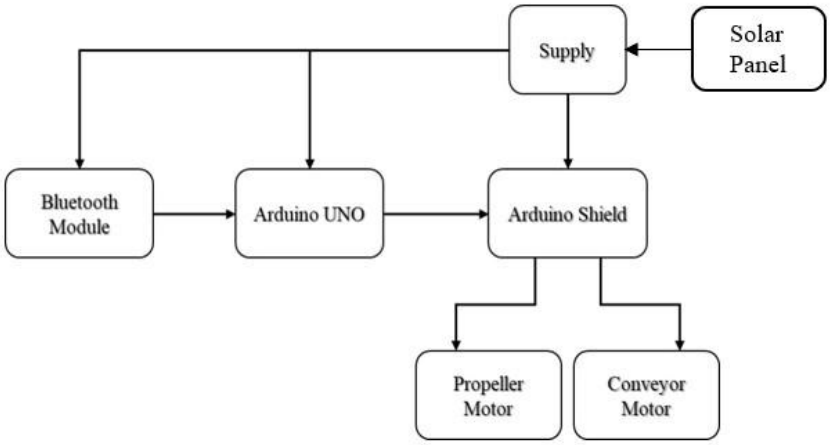

Fig 2.1 Block Diagram

2. Literature Survey

This project is developed to clean trash from the surface of water in a swimming pool using Arduino Uno. Trash like plastic, thermocol, and dead leaves that fall from trees will be collected and stored in the boat's trash compartment. In the swimming pool area, debris like plastic and leaves can be efficiently gathered by this boat, eliminating the need for manual cleaning. The boat features a rotating roller at the front that pulls in trash and deposits it into the trash storage box. The roller, made of plastic with added grip, ensures the trash doesn't slip back into the water. To make this system even more efficient and eco-friendly, solar panels are integrated to power the boat, reducing reliance on traditional electricity sources and enabling sustainable, long-lasting operation. The boat operates through Arduino, controlled by an app on your phone. A motor driver allows precise control of the boat via programmed commands. This setup replaces manual pool cleaning with an automated, user-friendly alternative that saves time and effort. The main advantage of this project is its energy efficiency, ease of use, and faster, more effective cleaning compared to manual methods. With the addition of solar power, the boat becomes even more practical, running independently without electrical recharging. Furthermore, the design can be upgraded with additional features like sensors for better navigation and automated cleaning cycles, making the system smarter and more efficient.

3. Hardware aspects and working

a) **Bluetooth Module (HC-05):** These are small electronic modules that enable wireless communication between devices over short distances using Bluetooth technology. In the context of the described system, the Bluetooth module is connected to the Arduino, allowing the robot to communicate wirelessly with external devices such as smartphones or tablets for remote control or data monitoring.

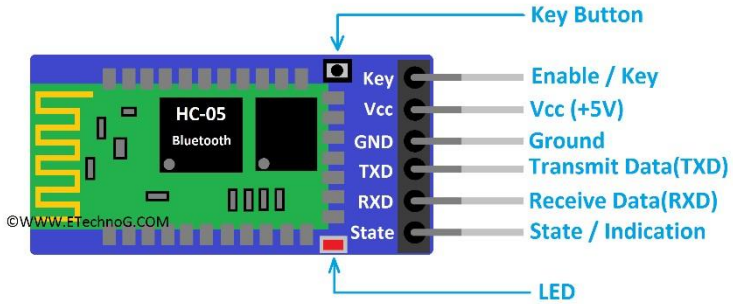

Fig 3.1 Bluetooth Module (HC-05)

b) **Arduino:** The Arduino serves as the central control unit of the robot. It is a microcontroller platform that processes sensor data, executes programmed instructions, and manages the overall operation of the robot. With the help of the Bluetooth module, the Arduino can receive commands or send data wirelessly, making it a versatile control system for the robot.

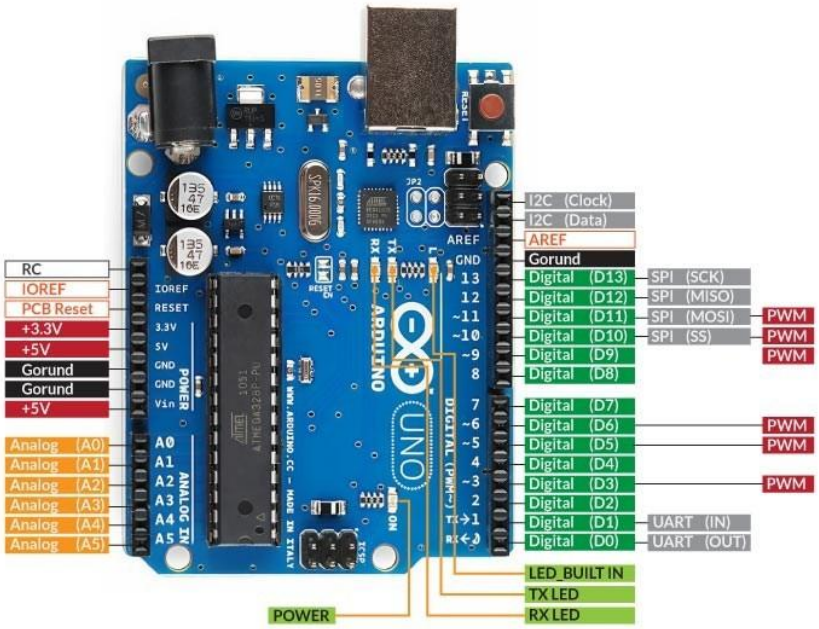

Fig 3.2 Arduino Uno

c) **Motor Driver:** This electronic component is used to control the speed and direction of the motors. It interprets signals from the Arduino and adjusts the power supplied to the motors accordingly, allowing precise control over the robot's movement. Motor drivers are essential for driving motors efficiently and protecting them from damage due to over current or voltage spikes.

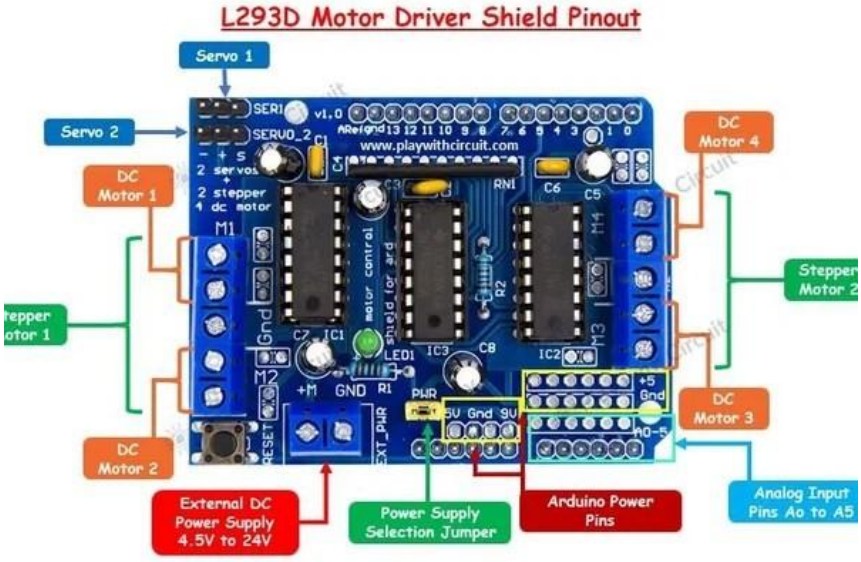

Fig 3.3 Arduino Motor Shield

d) **Dual Shaft BO-Motor:** These components provide propulsion for the robot, allowing it to move around the pool. The motors convert electrical energy from the battery into rotational motion, which is then transferred to propellers or other propulsion mechanisms to generate thrust. Depending on the design of the robot, different types of motors and propellers may be used to achieve the desired performance and maneuverability in water.

Fig 3.4 Dual Shaft BO-Motor

e) **Gear Motor:** A conveyor motor uses Gear Motor. A gear motor is a motor designed with an integrated gearbox. Gear motors function as torque multipliers and speed reducers thus requiring less power to move a given load. The gear motor is used to operate a conveyor belt mechanism designed to remove debris from the pool surfaces. The Arduino can send commands to the motor driver to control the speed and of the conveyor belt, facilitating efficient cleaning of the pool.

Fig 3.5 Gear Motor

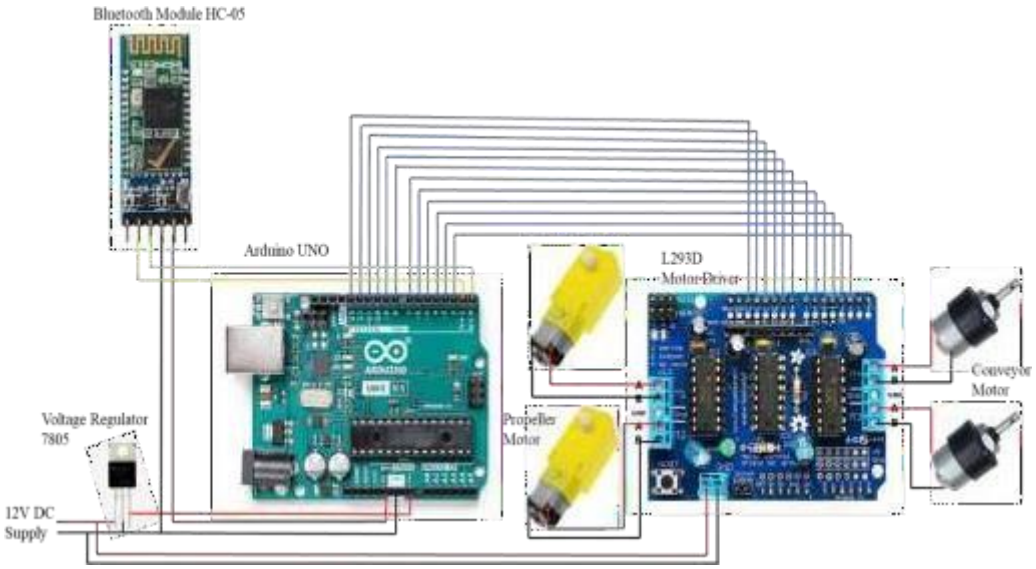

Fig 3.6 Interfacing diagram

The Arduino microcontroller processes commands from the Bluetooth module and adjusts the speed and direction of the motors and propellers accordingly. It can vary motor speeds to control forward, backward, left, and right movements of the boat through the water. By adjusting the power supplied to the motors, the Arduino can navigate the boat smoothly and precisely in different directions. The Arduino also controls the activation of the

cleaning mechanism, which consists of a conveyor belt driven by a stepper motor. When initiated through the mobile app or software interface, the Arduino sends signals to the stepper motor to start the conveyor belt's motion. As the boat moves along the pool surface, the cleaning mechanism collects debris, dirt, and algae, improving the cleanliness of the pool. A Bluetooth module integrated with the Arduino enables wireless communication with a paired device, such as a smartphone or computer. This allows users to remotely control the boat's movement, initiate or stop the cleaning process, and monitor its status through a dedicated mobile app or computer software. The mobile app or computer software provides a user-friendly interface for interacting with the boat. Users can easily control the boat's movement, start or stop the cleaning process, and receive real-time status updates and alerts. The interface may include intuitive controls, visual feedback, and notifications to enhance the user experience and facilitate efficient operation of the robotic boat for pool cleaning purposes.

Fig 3.7 Actual model

APPLICATION

1. Used to collect trash like leaves, plastic etc. From swimming pools.
2. If the size of the boat increases, then it can be used for cleaning the rivers and drains.
3. We can use it for small lakes and rivers.

ADVANTAGES

1. It is time saving.
2. It reduces the manpower.
3. It is energy efficient.
4. It can be used very easily.
5. User interface is easy.

DISADVANTAGES

1. It cannot used for long scale application like river cleaning, sea cleaning etc.
2. The trash which collected in the boat so we have to remove it manually so it is time consuming.
3. It connected through Bluetooth so it has only 10 Meters range.

FUTURE SCOPE

In the future, this can be expanded with advanced features like Autonomous Navigation, Water Filtration, Increased Durability, and Environmental Compatibility. It can be scaled up for large water bodies like seas, rivers, and lakes, with a larger trash collection capacity and added functions like a GSM module with a camera for better navigation and monitoring. Powered by renewable solar energy, this upgrade would reduce the need for manual labor, help clean water bodies more efficiently, and protect aquatic life by preventing trash from harming the ecosystem.

4. Conclusion

We're trying to make the Solar Powered Water Trash Collector even cooler by adding features like controlling it with your phone. Imagine using a special app to check and steer the boat from anywhere. To boost efficiency and make it eco-friendly, the boat will run on solar power, reducing electricity use and allowing longer, uninterrupted cleaning sessions. We're also making a solid plan to figure out who will like it the most and finding the best ways to sell it. Our goal is to make sure lots of people know about it, see its benefits, and find it super handy all while supporting a cleaner, greener future.

Our solar powered water trash collector isn't just about cleaning it's about changing how pool maintenance works. We're combining smart technology with eco-friendly solar energy to create a reliable, cost-effective solution that's easy to use and built to last. By carefully designing, pricing, and adapting it for global markets, we aim to make sure it stands out for its performance, innovation, and ability to make pool care effortless and sustainable for everyone.

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