AquaTech: Fight against Water Pollution

Pradnya Kale
Electrical & Electronics Department
190101381001

Saloni Jangale
Electrical & Electronics Department
190101381007

Aakanksha Songire
Electrical & Department
200101082005

Abstract

This abstract describes a Solar-powered water garbage collector that uses clean energy to remove trash from bodies of water. The prototype "AquaTech" has a number of benefits, including the protection of the environment, affordability, use of renewable energy, adaptability, public health and safety, and the encouragement of awareness and education. The prototype functions independently, effectively, and with no need for maintenance thanks to the use of Solar Energy. By reducing water pollution and safeguarding aquatic life, it contributes to the preservation of aquatic ecosystems. The device may be deployed in many aquatic conditions thanks to its versatility, which helps with waste management in rivers, lakes, ponds, and coastal areas. It reduces health concerns and enhances water quality for recreational activities by eliminating rubbish from water bodies. Additionally, the presence of Solar-powered water garbage collectors promotes responsible waste management by raising awareness of "Plastic Management". The goal of the initiative is to use less labour and time to clean the river. We created the automated river cleaning system "AquaTech" for that reason. The results of system performance showed that the conveyor belt can gather trash from the river, such as glass bottles, plastic waste, and other items at the river's surface. The design and analysis of the floating garbage collector machine is the focus of this work.

Keywords: *Aquatic ecosystems, Solar energy, Waste management,Garbage collector, Aquatech*

INTRODUCTION:

Since last two decades at least 14 million tons of plastic end up in the ocean every year. Plastic debris is currently the most abundant type of litter in the ocean. Almost all urban water bodies in India are suffering because of pollution and they are used for disposing untreated local sewages and solid wastes. To overcome allthe problem regarding the water contamination the government of India has taken initiatives and implemented many schemes. The main aim of this project is to reduce man power and time consumption for cleaning the river. According to the university of Plymouth report, half of the total species of aquatic animals are threatened with extinction as a result of plastic waste. This project is usually for small lakes and by way of performing some amendment in its size and ability it can be used in large lakes and river Godavari. Solar power water trash collector is designed to remove trash and debris from water bodies using renewable energy sources.

This document will provide an overview that how solar power water trash collector "AquaTech" works and the benefits they can provide.it typically consist of floating platform wit series of barriers or booms that captures water floating debris over the water. The system uses sensors to monitor trash floating on the surface of waterbodies, allowing operators to control the collector remotely. The solar energy gathered will be used to run the complete function of the boat to remove the trash from water. The prototype is also user friendly, portable and environmentally friendly. Objective of this study is to designand develop a prototype of a portable trash collector boat for small and narrow space application. This design is being conducted using engineering design method and system analysis to determine the most suitable design. The performance of the prototype was tested and evaluated to determine theeffectiveness of developed design in collecting floating solids from surface water.

Benefits:

The benefits of a "AquaTech" solar-powered water trash collector (presumably a device designed to collect floatingdebris from bodies of water using solar energy) include:

- Environmental Preservation: It helps maintain the cleanliness and health of aquatic ecosystems by removing debris such as plastics, paper, and other waste materials from the water. This prevents the pollution of water bodies, protects marine life, and preserves the overall ecological balance.
- Renewable Energy Usage: By utilizing solar power, the water trash collector contributes to reducing dependence on fossil fuels and promotes the use of clean, renewable energy. This aligns with sustainable practices and helps combat climate change.
- Versatility and Adaptability: Solar-powered water trash collectors can be deployed in various water environments, such as rivers, lakes, ponds, and coastal areas. They can adapt to different water conditions, making them versatile tools for addressing pollution invarious aquatic settings.

Overall, a solar-powered water trash collector offers an environmentally friendly solution to combat water pollution, provides operational efficiency, promotes renewable energy usage, and contributes to public health and awareness.

Literature Review:

- Design and prototype development of portable trash collector Author Abdullah, MohdAzizudin and Endut tried to accommodate the significant waste loading for surface water cleaning purposes, trash collector boats are frequently manufactured in enormous sizes. The hand cleaning technique is frequently used fordrainage and tiny streams.
- Theory of solar energy conversion materials Martsinovich put into practice this remedy for these solar energy conversion materials. One such renewable resource is solar energy; which nature uses during the process of photosynthesis. The initiative uses renewable energy to make the sun a more effective source of energy while cleansing the environment, particularly swimming pools.
- System for Automatic Trash Removal in Water Bodies, a disposal of Parakash and Markose's household garbage in lakes or rivers can cause a drop in water quality and ultimately have a big effect on water pollution.

Methodology:

"AquaTech" solar-powered water trash collector is a device that uses solar energy to collect and remove trash from bodies of water, such as rivers, lakes, or oceans. It typically consists of floating platforms equipped with a combination of technologies, including solar panels, sensors, and a collection system. The solar panels capture sunlight and convert it into

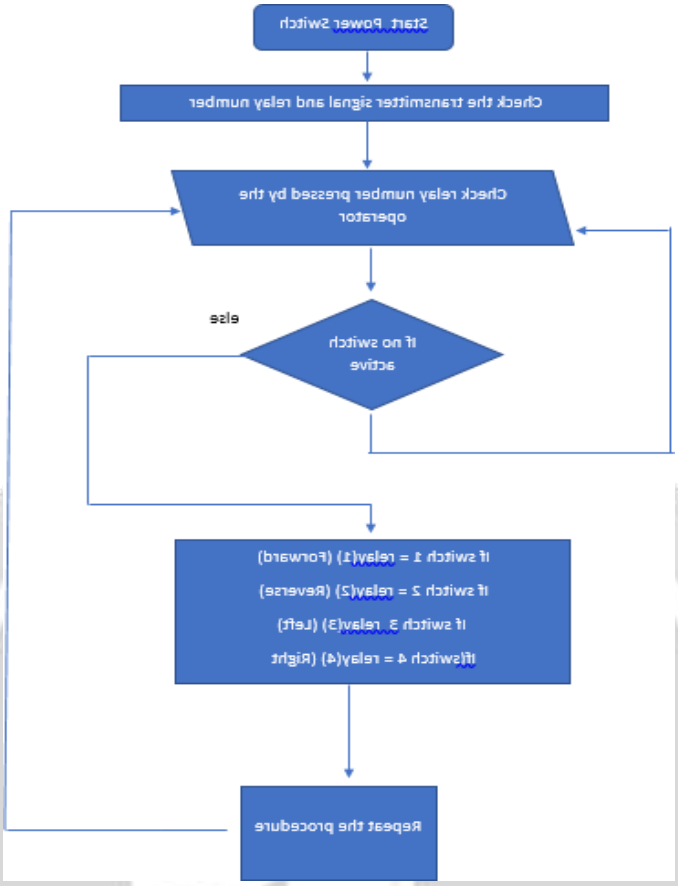
electrical energy, which powers the operation of the device. The sensors help detect and locate trash in the water, while the collection system is responsible for gathering and storing the collected debris. The device can be designed to work autonomously or remotely controlled. It moves through the water, guided by the sensors, and collects floating trash using various mechanisms like nets, conveyors, or suction. The collected waste is then stored onboard or transferred to a separate container for later disposal or recycling. By utilizing solar power, the device operates without relying on external energy sources and contributes to reducing the environmental impact of waste in water bodies. It offers a sustainable solution for addressing water pollution and protecting river waterbodies.

Process of Working:

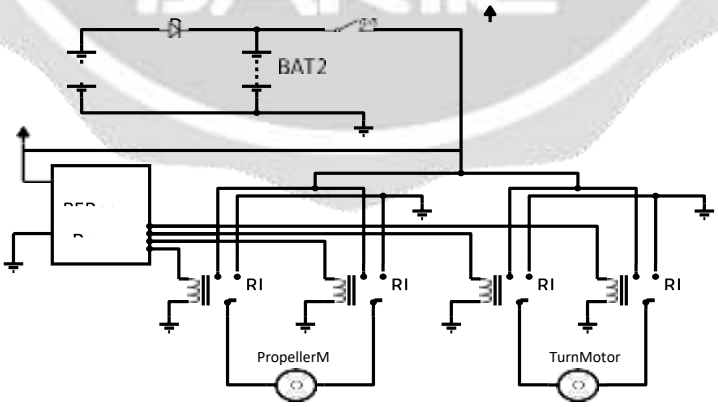
1) Power on the bot
2) Check input transmitter signal and number ofrelays
3) Turn the respective relay on this will operate the specific motor in specific forward reverse direction.
4) The main aim of this floating waste collector "AquaTech" project is to clean the waste that gets accumulated on the surface of water bodies thus keeping the water clean hence decreasing pollution. This project being remote-operated is controlled by an RC remote using which it can be maneuvered accordingly, we use DC pumps to provide the direction control and servo motor arrangement for the steering. To make the boat self-sustainable we have implemented two Solar panels which would charge the battery. Wire gauge net is used for garbage collection.
5) Water is essential to life, yet water pollution is one of the most serious environmental threats that we face today. Our lakes and river are increasingly getting polluted. Reversing the effect of water pollution is very difficult and can take years to remove all the harmful substances from the water. Also, huge manpower and budget would be required for the same. The innovative system that we propose offers a unique and automated way to tackle water pollution by eliminating manual labour thus increasing efficiency and decreasing the cost and time needed.

AquaTech: Solar water trash collector

Flowchart:



Working:



Circuit Diagram

Result:

The proposed approach to water care "AquaTech" consists of two components: proactive and reactive. The entire prototype includes a bot deployed on the water, and mobile devices used by local authorities, providing an end-to-end ecosystem for water care. The virtual fence is a novel concept, which detects human movement through wireless video surveillance withhigh accuracy.

Prototype model gives following result:

1. Pollutant level in water bodies is reduced.

2. Decrease the risk for aquatic life from the pollution.

3. Can also be helpful to collect organic waste from waterbodies' impurities like dead aquaticanimals etc.

4. The work of cleaning swimming pool or fountains reducedas it can be done through remote control now.

Conclusion:

The prototype "AquaTech" has been designed in such a manner which makes is very much economical, easy to operate and helpful for water cleaning and it can be modified with more cleaning capacity and efficiency. Although the design criterions with problems definitions which, however were overcome by using references and teacher's guidelines. The choice of raw materials helped us in machining of the various components to very close tolerance and thereby minimizing the level of balancing problem. It is very useful for society. Cleaning of water bodies is always been a huge problem. Due to which the aquatic life of animals is destroying. So, to maintain a good balance between the aquatic life, this automatic water cleaning machine is introduced. This machine is easy in operations and its manufacturing cost is also low. Hence this water cleaning machine is very useful. Water cleaning machine is designed to make system very much economical and helpful to remove water impurities like plastic, trashes and other day to day waste which is floating on the surface.

This project design and analysis of river water treatment plant was based on research in literature and various journals and papers and was fabricated accordingly, so it will provide flexibility in operation. This invention is easy and has a lot of space to grow at low cost and high economy. The project is a "solar powered floating water garbage collector" designed in the hope that it will be more economical and help clean the river and pond. It is very cheap and very useful to the society in termsof designing it and estimating cost and availability

Future scopes of solar water trash collector:

The future scopes of solar water trash collectors offer several exciting possibilities for further development and application. Here are some potential avenues for future advancement:

- Enhanced Efficiency and Effectiveness:

Improving the design and engineering of solar water trash collectors to enhance their overall efficiency and effectivenessin collecting and removing trash from water bodies.

Optimizing the integration of solar panels to maximize energy generation and minimize power consumption.

Advancing sensor technologies to improve trash detection and enable real-time monitoring and data analysis for better decision-making.

- Autonomous and Intelligent Operation:

Developing advanced algorithms and artificial intelligence (AI) capabilities to enable autonomous navigation and operation of solar water trash collectors.

Implementing machine learning techniques to enhance the device's ability to distinguish between trash and non-trash objects, reducing false positives and optimizing collection efficiency.

- Scalability and Adaptability:

Designing solar water trash collectors that can be easily scaled up or down to accommodate different water

body sizes and conditions.

Exploring modular designs that allow for the seamless integration of multiple devices to cover larger areas or target specific pollution hotspots.

- Integration with Existing Infrastructure:

Investigating opportunities for integrating solar water trash collectors with existing infrastructure, such as water treatment plants or wastewater management systems, to intercept trash before it enters the water bodies.

Exploring partnerships and collaborations with local municipalities, waste management agencies, and environmentalorganizations to streamline the adoption and deployment of solar water trash collectors.

- Data Analysis and Decision Support:

Utilizing the collected data from solar water trash collectors to generate insights into the patterns and sources of marine debris.

Developing decision support systems that can aid in waste management planning, policy-making, and targeted intervention strategies.

- Public Awareness and Education:

Promoting public awareness campaigns and educational initiatives to highlight the importance of responsible wastedisposal and the role of solar water trash collectors in mitigatingwater pollution.

Encouraging community involvement and participation in waste reduction and cleanup efforts.

- Collaborative Research and Innovation:

Encouraging interdisciplinary research collaborations between engineers, environmental scientists, policymakers, and industry stakeholders to address the complex challenges of water pollution and waste management.

By exploring these future scopes, solar water trash collectors can continue to evolve and play a vital role in combating water pollution, preserving aquatic ecosystems, and promoting sustainable waste management practices.

Future Directions and Research Gaps of solar water trash collector:

Future directions and research gaps in the field of solar water trash collectors provide opportunities for further advancement and innovation. Here are some potential areas of focus:

- Advanced Collection Mechanisms:

Researching and developing improved trash collection mechanisms that can efficiently capture a wide range of debrissizes and types.

Exploring innovative approaches, such as robotics or biomimetic designs, to enhance the collection efficiency and adaptability of the devices.

- Waste Sorting and Recycling:

Investigating methods to automate or optimize the sorting of collected waste to facilitate recycling or proper disposal.

Exploring technologies that can extract valuable materials fromthe collected trash for recycling purposes.

- Real-time Monitoring and Data Analysis:

Advancing sensor technologies and data analysis techniques to enable real-time monitoring and analysis of water quality parameters and trash accumulation patterns.

Developing algorithms and models that can predict and identifypollution hotspots for targeted intervention.

- Environmental Impact Assessment:

Conducting comprehensive environmental impact assessments to evaluate the effectiveness of solar water trash collectors in reducing water pollution and their potential ecological consequences.

Assessing the potential release of microplastics or other pollutants during the operation of the devices and exploring mitigation strategies.

- Integration with Existing Infrastructure:

Exploring opportunities for integrating solar water trash collectors with existing water treatment systems, stormwater management infrastructure, or other relevant facilities to intercept trash at its source.

Studying the potential synergies and challenges associated with such integration and developing guidelines for effective implementation.

- Long-Term Durability and Maintenance:

Conducting research on the long-term durability and maintenance requirements of solar water trash collectors, especially in harsh environmental conditions.

Exploring strategies to optimize the lifespan and reliability of the devices while minimizing maintenance and repair needs.

- Socioeconomic and Policy Considerations:

Examining the socioeconomic and policy implications of implementing solar water trash collectors, including cost- effectiveness, regulatory frameworks, and public acceptance.

Assessing the potential economic and social benefits associated with the deployment of these devices, such as job creation or tourism opportunities.

- Collaboration and Knowledge Sharing:

Promoting collaboration and knowledge sharing among researchers, industry stakeholders, policymakers, and communities to facilitate the development and implementationof solar water trash collectors.

Addressing these research gaps and pursuing these future directions can contribute to the continued improvement and effectiveness of solar water trash collectors, ultimately helping to combat water pollution and protect aquatic ecosystems moreefficiently.

Reference links:

1. https://www.ijirt.org/master/publishedpaper/IJIRT15 3663_PAPER.pdf
2. National Mission for Clean Ganga (NMCG), G., 2021. [online] National Mission for Clean Ganga(NMCG), Ministry of Jal Shakti, Department of Water Resources, River Development & Ganga Rejuvenation, Government of India. Available at:https://nmcg.nic.in/NamamiGanga.aspx
3. A. Sinha, P. Bhardwaj, B. Vaibhav, and N.Mohammad, "Research and development ofRo-boat: an autonomous river cleaning robot,"NASA/ADS.[Online]. Available:https://ui.adsabs.harvard.edu/abs/2013SPIE .9025 E..0QS/abstract
4. Bhatkhande, Ankita. "Mumbai Students Build Robotto Help Clean Surface Water." DNA India,23 Mar. 2017, https://www.dnaindia.com/india/report- mumbai-students-build-robot-to-help-clean-surface- water-2364246.
5. Wang M 2008 Rural industries and water pollutionin China J. of Environmental Management 86
6. Rahul P K V, Maneesh K P, Manohar N, Sridharan P,Cyriac J 2017 Automatic Trash Removal System in Water Bodies. Research Article 7(4).
7. Green A 2016 Drones Are Now Cleaning Up OceanTrash. 2018 Co, L.W.W.M.a.E. Buddy Multi-PurposeWorkboat. Available from: https://waterwitch.com/en/products/buddy/.
8. Sinha A 2013 Ro-boat: River Cleaning Robot inaction in Yamuna River.