River Debris Cleaning Unmanned Robot

Anita B Dombale, Unnati Vaidya, Rugwed Ushir, Hiteshwari Vasave, Bhoomi Powar , Aarya Velenkar.

Department of Engineering, Sciences and Humanities (DESH)
Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India

Abstract - **In order to address the widespread problem of floating debris, this study presents an innovative, dual-system method for cleaning river water. To effectively collect and remove debris, our approach combines an autonomous cleaning robot with a fixed roadblock. Built from sturdy PVC pipes, the barricade spans the width of the river, effectively catching floating debris and halting its downstream passage. To concentrate trash in a manageable region, it is imperative to complete this initial containment stage. An autonomous cleaning robot is sent to collect and remove rubbish that has accumulated at the barricade. The robot navigates the water using BO motors coupled with an L298N motor driver, which is powered by an Arduino Uno microprocessor. It has a garbage-scooping conveyor belt mechanism that deposits waste into an onboard collection bin. When the robot reaches the end of its intended journey, its directional controls enable it to reverse and return to its starting position. This flexibility to operate in both directions guarantees complete coverage of the garbage pickup region. Our technology is a workable option for extensive river cleanup projects because of its simplicity, economy, and efficiency in design. Tests conducted in controlled circumstances have shown that the prototype can greatly lower the amount of floating garbage. This concept offers a workable and scalable solution to a significant environmental concern by emphasising mechanical simplicity and reliable performance. By using this dual-system strategy, water quality may be greatly enhanced and aquatic habitats could be shielded from the damaging impacts of pollution. Our results indicate that this technology might have significant positive effects on the environment if widely adopted, which is a compelling argument for its continued development and implementation in different river systems across the globe.**

Keywords *— Debris, PVC pipes, Barricade, L298N motor driver, Conveyor belt, Arduino Uno microprocessor*

I. INTRODUCTION

Rivers, the lifeblood of civilization, have supported societies for ages by supplying clean water for industry, agriculture, and drinking as well as acting as thoroughfares and sites of scenic beauty. But today, pollution poses a serious threat to these essential water sources. Conventional river cleaning techniques, which rely on manual labor and traditional boats, frequently fall short of meeting the rising pollution levels. This reliance on labor involves significant financial and time commitments in addition to logistical difficulties. Fortunately, there is some hope in the fight against contamination thanks to developing technologies.

The introduction of remotely operated floating river cleaning equipment, which represent a paradigm shift in river cleaning techniques, is one of the most exciting advances. These cutting-edge machines cruise waterways on their own and collect trash, debris, and plastic pollution without assistance from humans. This technology is attractive not just because it is eco-friendly but also because it is efficient and provides a long-term solution to the urgent problem of river pollution.

The importance of these developments is never greater than in areas like India's holy Ganga River that are severely affected by pollution. Owing to the fact that occasions such as the Kumbh Mela raise pollution levels, immediate action is required to protect the natural integrity of these sacred water bodies. The Government of India has committed significant resources to restoring these lifelines of civilization by launching ambitious river cleaning efforts like "Namami Ganga" and "Narmada Bachao," realizing the seriousness of the problem. Furthermore, towns like Varanasi and Ahmedabad have seen the implementation of creative programs meant to revitalize their regional ponds and rivers.

The creation of remotely operated, autonomous river cleaning machines has become a ray of hope in answer to these demands. These state-of-the-art tools have the potential to completely transform the field of environmental conservation since they are painstakingly made to navigate the complexities of river ecosystems. By utilizing technology, we can reduce the workload for human labor and improve the effectiveness of river cleaning initiatives, providing future generations with a safer and more sustainable future.

Above all, it is important to remember that these advancements are driven by people. A group of devoted scientists, engineers, and policymakers who are committed to preserving our natural heritage are the people behind every machine. Their creativity and tenacity provide witness to the transforming power of teamwork in tackling difficult environmental problems.

In conclusion, let us welcome the potential of remote operation and unmanned devices as we enter a new age in

river cleaning technology. We can free our rivers from the sway of pollution and usher in a cleaner, better future for the earth by combining innovation and stewardship.

II . LITERATURE REVIEW

MS A. Sujata Reddy, T. Gayathri, Ch. Sharanya, O. Hanisha 'River Surface Cleaning Water Boat'. This project gives solution of automated river cleaning with the help of a tread mill arrangement. The cleaning machine, controlled by an RF transmitter and receiver, uses a battery-powered conveyor belt to remove and store debris on the boat. A camera on the boat assists with navigation. The Water-boat Project combines Science, Technology, and Community efforts to foster environmental sustainability.

Kalyani Chandurkar, Dr. Narendra Bawane, Parinay Lavatre. 'An improved River Cleaning System'. This aim behind this project is to design and fabricate an improved system which is used to clean the waste materials which floats in water surface. The system basically detects the garbage and operable automatically, storing it in a bin or basket. A level sensor indicates when the basket is full and need to be unloaded.

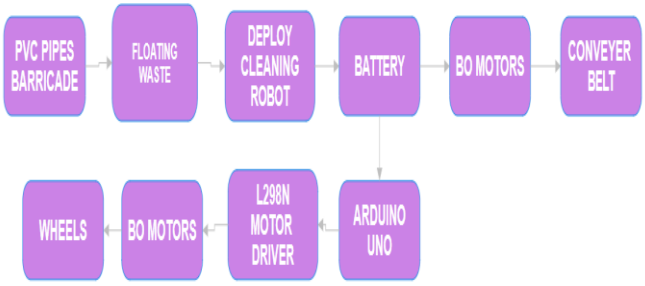
Devdatta Chandane, Ravi Dhanani, Jay Jadhav, Prof. Ekta Ukey. 'Bio-waste Cleaning Boat'. autonomous multi-robot system for lake cleaning and fishery maintenance. The robots, equipped with tactile sensors and wireless communication, autonomously remove impurities, oxygenate water, spray chemicals, distribute food, and measure water quality. Inspired by ants and bees, the "recruitment algorithm" enhances navigation and waste removal. Simulations and real-world tests show the system's efficiency and effectiveness.

Akash Shahu. Remote Controlled Unmanned River Cleaning Bot. This project focuses on using a motor-driven conveyor system to lift waste debris from water surfaces and deposit it into a tray, effectively cleaning the water. Propulsion is provided by a PMDC motor-driven propeller, controlled remotely via an RF transmitter and receiver. A four-bar collecting mechanism assists in real-time garbage collection. A water wheel propeller, driven by a motor and chain drive, aids in movement. Furthermore, a tracking system adjusts the solar array angle for enhanced solar output.

M.F Mukhtar, M.I.F Rosley, A.M.H.S Lubis, N. Tamaldin, M.S.F Hussin, A.A.M. Damanhuri, K.A. Azlan, N.H Hanizat. 'Development of river trash collector system'. The River Trash Collector System (RTCS) aims to remove floating trash, oil, fuel, and detergents from water, addressing pollution threats to Malacca River, a key tourist attraction and habitat. Utilizing Solidworks design and Rapid Prototyping, a functional prototype will be created to clean the river. This system will significantly benefit Malacca River by mitigating pollution issues.

III . Methodology/Experimental

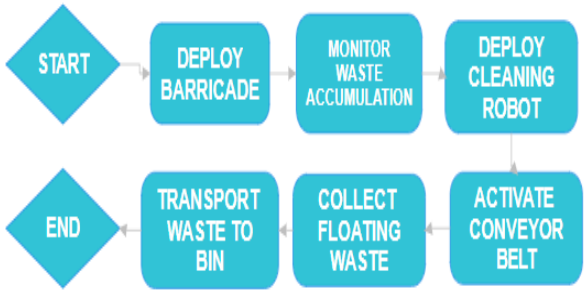
A. Block Diagram



B.Method

The cleaning process is a combination of the usage of the 2 parts of the project. The first part that is the waste blocker is installed in the flowing river. The aim of this part is to block the waste, both floating on the river and submerged under the water. The flotation pipes hold the whole assembly of the waste collector. The connector strings made up of rubber help gain the flotation pipes, some flexibility so as to withstand the flow of water. Under the surface of the water, the net blocks the waste flowing in the direction the flow of the river. From a general perspective the working of this part is same as that of a fishing net. However, this net blocks the waste in a horizontal fashion and doesn't trap it perpendicularly like that of a fishing net. Now all the waste is trapped behind this Waste Blocker.

Now the functionality and use of the garbage collector is put to test. The main aim of this part is to collect the floating waste blocked by the waste blocker.



Flowchart

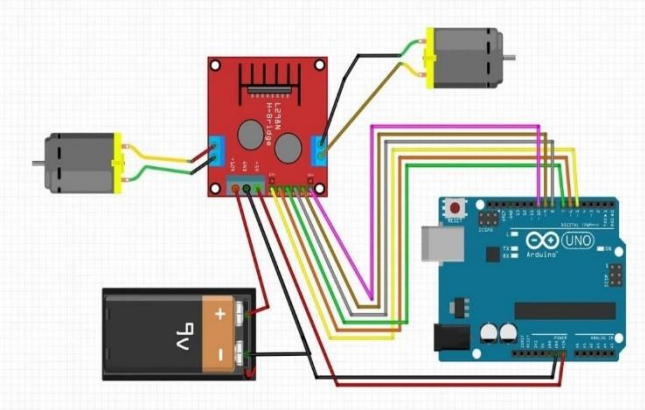


Fig.1 Circuit Diagram

The aim of the conveyor belt is to lift this waste and direct it into the box for collection, The dimensions of the box are one feet by 1 feet. However, one side of the box is cut up at 8 inches. This is where the conveyer belt is mounted and the gap allows the waste to enter the box. The circuit of the conveyor belt is independent from that of the propelling motors. When both the circuits are turned on, the propelling, motors allow the robot to go to and for within a particular distance and collect the waste. On turning on the circuit of the conveyor belts, the BO motors start rotating, which are connected to rollers. These rollers are the part on which the

leather belt is mounted upon. Thus similar to a pulley belt, the leather belt starts rotating.

As the leather belt rotates, the floating waste is transported from the water into the box. The circuit of the propelling motors includes an Arduino Uno MCIB which allows it to move within a particular distance as programmed by us. The panels are easily removable allowing the collection of waste from the box once it is full. The design of the box is simple and waterproof using sealants so as to disallow the water from the river to enter into the box. Some quantities of water that enter with the waste are allowed to exit using a hole at a certain height the panels by using the simple principles of volume and buoyancy

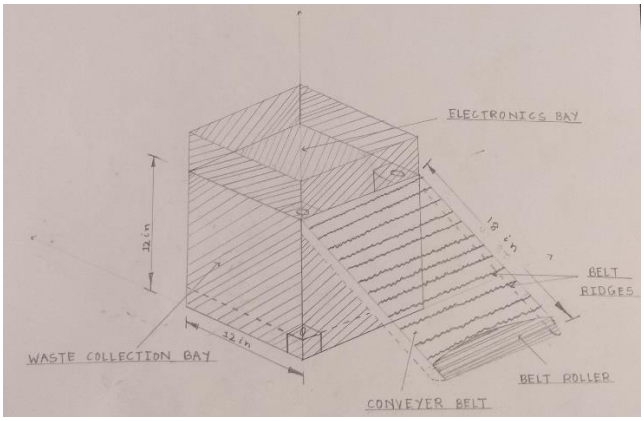


Fig.2. Conveyor Belt Design

C. Assembly

Cur project comprises of 2 parts. First is the Waste Blocker and second is the Garbage Collector. The Waste Blocker Is

the stationary part. While the Garbage Collector is a moving robot. The assembly of the Waste Blocker is as follows It comprises of four main parts namely: The flotation pipes, the connecting threads, the net and the count counterweight The flotation pipes are the part of the waste blocker that floats on the water. The connecting threads connect these pipes to form a chain of flotation pipes. The neck is the main part of this assembly as it is submerged and actually blocks the waste. This net is mounted on to the floor station pipes. To keep maximum part of the net submerged under water and to give it to stability, a counter weight is connected to this net. This assembly isdone with the help of hooks, screws and nut bolts. The assembly of the Garbage Collector isas follows: This garbage collector has 3 main subcomponents, namely the chassis, the box and the conveyer belt. The chasis is comprises of PVC pipes and PVC connectors. The pipes are connected to each other using 3 axes PVC connectors so as to make a cube The box is made up of acrylic sheets of 3 mm thickness. This box forms the body of the chassis. Two 12 V propeller motors are fixed onto the box These motors are torquey and of 150 RPM so as to propel the box forward even with the weight of the garbage. The shafts of the motors are extended using hollow pipes and then connected to the PVC propellors. This is done to maximize the torque, as torque and length from point of rotation are directly proportional (ie greater the distance of propellor from the rotating shaft, greater the torque). One side of the box is partially open so as to mount the conveyor belt on it and allow garbage into the box. The convert belts are a corn bination of leather belts BO motors and rollers. They are of a particular height and at such an angle that the waste directly falls into the box. The main aim of this arrangement is to make the box as light as possible so as to prevent it from submerging into the water. The assembly is done using self-tapping screws, silicon sealant and adhesives

IV. Results and Discussions

The work being done by these floating river cleaners is excellent. They've been put to the test in several locations, and they do a fantastic job of locating and collecting rubbish in the water. These machines are faster, less expensive, and more better for the environment than people cleaning by hand.

These devices have a low environmental impact. They target rubbish while preserving the natural equilibrium of the river by using intelligent sensors and filters. Moreover, they produce less pollution as they don't require humans to operate them.

However, we must monitor the situation to ensure that no plants or animals are inadvertently harmed.

The communities around the river benefit from using these advanced cleaners. More tourism, better fishing, and more enjoyable water sports like boating and swimming are all benefits of cleaner water. Additionally, since fewer people are required to operate these devices, there is an opportunity for people to acquire new skills and pursue various careers.

These devices are quite amazing, but there are still a few glitches to iron out. Fixes are needed for things like battery life and ensuring the sensors are accurate enough. Furthermore, we must ensure that our data is secure and that these devices are compatible with other river management systems.

We all have a responsibility to maintain the cleanliness of our rivers. To maintain the health of our waters, businesses and communities must collaborate. Through fostering teamwork and engagement, we can ensure that these machines are utilized to their full potential.

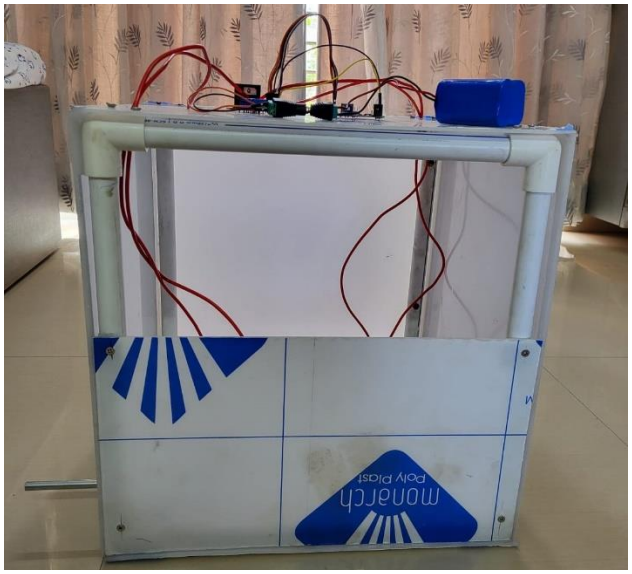


Fig.3. Robot Prototype

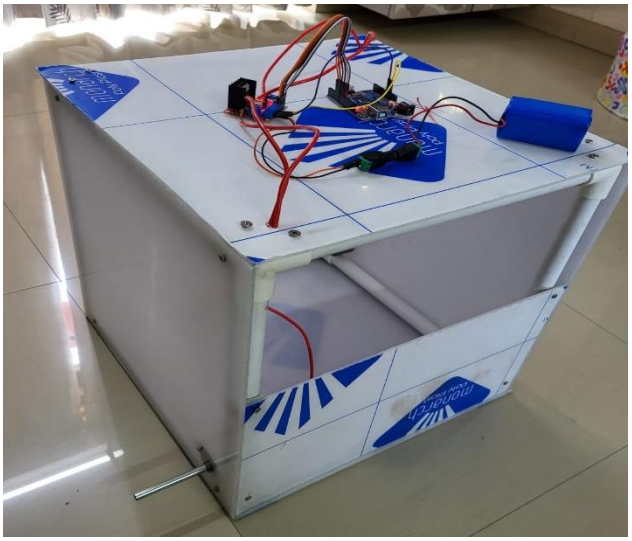


Fig.4.Robot Design

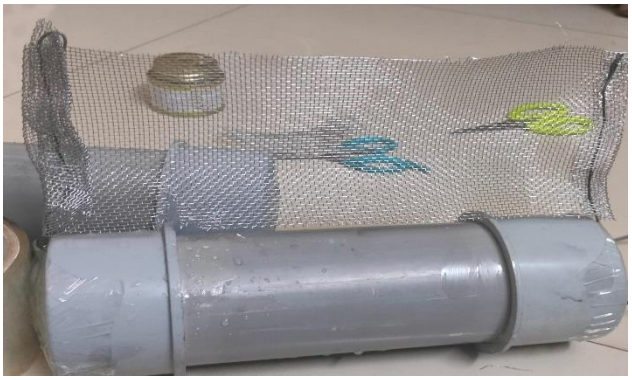


Fig.5.Barricade Prototype

V . Conclusion

Both projects aim to address water pollution, albeit through different methods. The net placed at the edge of a pond serves as a passive barrier to catch floating debris and prevent it from further contaminating the water. Its success would be evaluated based on the amount of garbage it captures and the degree to which it reduces pollution in the pond. This method is relatively simple and cost-effective. On the other hand, the robot designed to collect garbage from floating water takes a more active approach. It autonomously navigates the water surface,

collecting trash and pollutants along its path. The effectiveness of this solution would depend on factors such as the robot's design, speed, and capacity, as well as its ability to operate efficiently in various water conditions. Additionally, considerations regarding energy consumption and environmental impact may also influence its overall viability.

In conclusion, both projects offer promising strategies for water purification, each with its own set of advantages and challenges. The net provides a passive means of trapping debris, while the robot offers an active solution for collecting garbage. Ultimately, the success of these projects would depend on their implementation and their ability to significantly reduce water pollution in practice.

VI . REFERENCES

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