River Bin for Surface Water Using Low-Cost Materials

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Abstract — "TRASH COLLECTOR BIN" is a floating bin with a number of useful characteristics. This effort's main objective is to rid all of the nation's waterbodies of floating trash and turn to the litter free zones. Steel pipes, a catch bag composed of jute martials, and pimping unit are the three main parts are utilized to clean the surface water. It can be placed in the surface water source, downstream, upstream, tributary, watershed boundary, and wetlands, and any other body of water where floating garbage is visible. This helps to prevent pollutants and debris from entering the ocean. Given that trash collector bin operates on vey on a very basic principle that is, it's function as a water filter. The Design of a trash collector bin for gathering trash that floats on the water's surface is described in this study. Durability and Affordability are two key considerations in the design of trash collector bin. Owing to the nature of the cleaning operations, we created a trash collector bin structure with excellent ability, high stability, and ease of collection for any trash that flows into the water. In this instance, the plastic pipe container works well and satisfies all requirements for structural stability. Waste is collected using a motor – Driven device. This design fits a lot of rubbish in a little amount of area and offers easy and efficient waste evacuation. The entire weight of the waste collected, the conveyor, and the hardware components are supported by this study and lightweight structure. In order to protect the motors from water, an electric circuit and a differential drive mechanism have been built for trash collector bin system. The motors are located on the platform. The trash collector bin Prototype's efficiency in gathering rubbish and returning to the waypoint was demonstrated during testing. A trash collector bin can hold up to 1 kg of waste at most. The project's primary goal is to maximize process speed, energy, and time. The trash collector bin collects any floating rubbish by following the tide. Water is pulled via the trash collector bin's catch bag from the surface. The water is then pumped back into the surface water after that.

Keywords: Floating Trash Collector, Water Pollution Control, Surface Water Cleaning, Solid Waste Management, Sustainable Environmental Engineering, Automated Waste Collection System

I. Introduction

A. General:

Across the world, waste management is a major problem for cities. The amount of garbage Produced is rising along with the rise of city or growth in population, creating serious societal, ecological, and economic problems. In the face of this growing challenge, conventional waste administration methods, which depend on combustion and garbage dumps, are proving to be insufficient and unaffordable. Novel techniques are being investigated as a reaction to the rising need for efficient trash disposal solutions.

One among the global issues that keeps coming up every year and cannot be resolved is waste. It was common practice to dump trash from various areas into lakes, streams, and other bodies of water. Every river, channel, sea etc., in the planet is contaminated with plastic trash. Birds and aquatic organisms frequently consume it, which concentrates harmful substances in their organs and fills their digestive systems to the point of starvation. Waste plastic in the water is an emergency that goes well beyond aesthetics.

Whilst hooks and nets can become tangled in cylinder openings and wrap around propellers that spin vessels may crash with large items, shattering their hulls and propellers. To solve this issue, various governments worldwide are working on various initiatives. Most of these projects use energy and engine systems, which require continuous effort from people.

The vast majority of these projects have been conducted in open ocean or deep seas, with little focus on coastal waterways. Trash may block water flow, making it foul-smelling and dirty, which raises the risk of excess and the ensuing emergencies such as floods. Large supplies, such tractors and cleaning staff, are required for eliminating of waste out of water zones. environments like a watershed's edge. Because it is shielded from powerful flow and Atlantic gales, it can lessen hazardous waste in areas that are obviously highly populated.

The Trash collector bin Concept is one such creative idea that is gaining popularity. It is a comprehensive strategy that rethinks trash management techniques in metropolitan environments. In order to develop a sustainable and effective waste management model, this idea incorporates a number of different factors, such as garbage pickup, reuse and recycling, producing electricity, and community participation. This essay will explore the concept of the Trash collector bin Concept, looking at its tenets, elements, advantages, and obstacles as well as the chance to completely transform methods for handling waste everywhere. The trash collector bin is a device that resembles a bin as well as is equipped with an electrically driven water pump. It is fixed to a watershed border. The fluid's movement of the pump attracts all floating debris and waste into the system, forming an organic container. The fluid is then replenished in the water source. Rarely, depending on the quality. The water movement of the impeller attracts all floating waste and trash into the circulatory system, generating an organic container. The water is then replenished in the form of a water stream. Depending on the caliber of the catch bag, Trash collector bin may occasionally be able to separate oil from water as well.

B. Principles Of the Trash Collector Bin Concept

The concept of the Trash collector bin Idea is based on a number of fundamental ideas that are meant to change the manner we see and handle debris: Circular Economy: The Trash collector bin Concept is based on the ideas of a sustainable economy, which minimizes waste and maximizes value by reusing, recycling, and regenerating resources. The

idea is to develop a closed-loop methodology that avoids the impact on the environment and decreases the exploitation of fresh resources by using a looping method.

- Public Participation: A key component of the Trash collector bin Concept is the active participation of local communities in garbage disposal procedures. The idea creates a sense of ownership over and accountability in inhabitants by including them in the sorting, recycling, and disposal of garbage, which increases collaboration and involvement.
- Progress as well as Technological advancements: Applying cutting-edge developments is an integral component of the Trash collector bin Concept. From smart containers that include devices to highly sophisticated recycling yards, technological advances play an important part in optimum disposal, classification, and thinking about, therefore improving productivity and efficiency.
- Commodity Healing: The Trash collector bin Concept views garbage as a valuable asset that can be salvaged and put to new uses, as opposed to seeing it as an issue that has to be disposed of. The idea aims to maximize value extraction from generated waste while reducing the adverse environmental impact using waste into energy technologies and sophisticated regeneration procedures.

C. *Components Of the Trash Collector Bin Concept*

- Modern sorting and recycling facilities: that can handle a variety of waste materials, among them as plastics, paper, glass, and organic matter, are a key component of the Trash collector bin Concept. These processing plants efficiently separate materials that are recyclable using cutting- edge sorting technology including separation magnets and visual scanner
- Trash-to-Energy facilities: The Trash collector bin Concept includes waste-to-energy facilities, which turn non-recyclable garbage into heat or power, in addition to recycled material. These facilities produce clean energy and reduce the amount of garbage going to landfills by using techniques like anaerobic degradation and pyrolysis.
- Community Outreach and Education: Comprehensive initiatives for public outreach as well as instruction are necessary to guarantee the concept's effectiveness. These programs seek to encourage behavioral change, increase public knowledge of the waste disposal procedures, and provide citizens with the tools they need to actively participate in lowering trash production and boosting the number of recyclables produced.

D. *Benefits Of the Trash Collector Bin Concept*

When contrasted to conventional trash disposal techniques, the Trash collector bin Concept has several advantages.

- Environmental sustainability: The Trash collector bin Concept helps lessen the negative effects of trash disposal on the natural environment, such as release of greenhouse gases, smog, and resource depletion, by encouraging recycling, resource recovery, and the production of energy from renewable resources.
- Resource Efficiency: The idea optimizes the worth of substances by retaining them in circulate for as long as feasible through the implementation of a circular economy approach. This lessens the requirement for additional raw materials while also conserving earth's resources.
- Resource Efficiency: The idea optimizes the worth of substances by retaining them in circulate for as long as feasible through the implementation of a circular economy approach.
- Cost Savings: The Trash collector bin Concept is a financially feasible option for towns and municipalities, even if the initial purchase expenditures may be greater. Over time, benefits linked to less dumping and producing power may exceed the expense of the project.
- Local Development: The idea promotes a feeling of pride, accountability, and leadership in the area by integrating locals in the handling of waste. More collaboration, involvement, and widespread fulfilment with trash administration services result from this.

E. *Objectives*

The main objective of this proposed project work is to remove the floating waste debris from surface water.

1) It reduces the amount of effort required by humans to collect trash from the water bodies around us.
2) Doesn't require any additional help or attention while working.
3) Use of energy to the bare minimum.
4) Removes garbage and other floating and suspended debris from water bodies.
5) Cost-effective and easy to construct.
6) We can locate the river bin in the ideal location.
7) As the project is mainly designed to make combined benefits to the health of human beings, health of aquatic lifeforms, society, and for nation's cleanliness.
8) It will remove the floating water waste safely and quickly making work easier and more Sustainable.

II. LITERATURE REVIEW

A. *Literature Review:*

1) *Arjun Yadav et.al,*

"SEABIN" is a floating bin with several clever features, as the name suggests. The major goal of this effort is to remove floating garbage from all of the country's waterbodies and make them litter-free. The Seabin is a trash can that floats on the water and can be found at marinas, docks, yacht clubs, and commercial ports. The following three key components are used to clean the ocean: a pumping unit, a catch bag made of jute material, and steel pipes. The Seabin follows the flow of the tide, gathering any floating trash. Water is drawn in from the surface and passes through the Seabin's catch bag. After that, the water is pumped back into the marine.

2) *Nitin Agarwala* et.al,*

The marine environment has deteriorated to the extent that it has begun to impact human health and the planet itself. The primary causes of this deterioration are an increasing population, the Industrial Revolution, and the increased use of fossil fuels. While the damage done to the environment cannot be undone, the impact can be lessened with a better understanding of the ocean and with monitoring future pollution using technology. Such an effort will help achieve

sustainability, as laid out by the Sustainable Development Goals 2030 of the United Nations. Though efforts have been made to monitor the ocean for pollutants, both physically and remotely, interpreting the data collected is a humungous task due to the high volume of data. In reply, technology again provides a solution. One such technology, namely 'Artificial Intelligence' ('AI'), can be used to understand and monitor marine pollution, and is the topic of discussion in this article. In doing so, the article will discuss the emerging opportunities and risks associated with the use of AI in managing marine environmental pollution through sustainability. To strengthen the argument, use-cases of AI in the marine environment and their scalability are discussed. However, these cases are considered merely a stimulus for a better and a larger variety of solutions to follow in the ever-evolving domain of AI.

3) Shrikant Somal et al.,

This paper describes the design of a robot for collecting waste floating on the water surface. Three important issues for designing the aquatic robots are a cost-effective solution along with robustness and durability. Due to the nature of the cleaning work, we designed the robot structure with car like mechanism that can provide high stability, good ability in maneuver and can easily collect all the waste flowing on the water. The plastic pipe container works best for this case and fulfils all structural stability criteria. For collection of waste, a motor-driven conveyor belt has been designed for collecting the wastes and deploy it into a plastic box connected to the platform. This design provides simple and effective waste removal and accommodates large amounts of waste within a little space. This light-weight and tough structure support the total weight of the collected waste, conveyor as well as the hardware components used. The rotating arms system based a differential drive mechanism has been designed, which allows the robots to require a 360 turn on the spot and provides high thrust. Electronic circuit and motors have been placed on the platform, in order to protect them from water. The robot is automatically controlled by Arduino, sensors, motor driver, GPS and GSM modules. The testing of the robot prototype proved to be effective in waste collecting and getting back to the way-point. The maximum trash loads that robot can bear is up 5 kg. The main aim of the project is to optimize time, energy and overall process speed.

*4) Krishna Kulkarni *el at.,*

One of the largest problems in our world today is the extreme pollution of our oceans and waterways. Each day, thousands of tons of trash and plastic debris are dumped into our oceans. Since plastic is an non-biodegradable substance, like most natural substances, it is left floating in our waters. Unfortunately, these floating debris sometimes consumed by many of the aquatic lifeforms in our oceans. As we know that plastic is an toxic substance it gets accumulated in the tissue of animals and ultimately leads to the death of animals. This problem of pollution in oceans can be solved with the help of seabins, Which helps in extraction and elimination of the waste material floating on the surface of water The Seabin is a water cleaning device which is installed near to the ports, docks, harbors and in every other waterbodies where we can see the floating debris such that it helps in avoiding the entering of this pollutants or debris into the ocean .As the principle of working of Seabin is very simple i, e it acts as an water filtration system . In simple words the floating debris is attracted towards the floating bin and waste material gets collected in the mesh and the water again enters into the ocean.

5) Dr. Umadevi H, et al.,

In developing countries, cleaning water surface is a routine task collecting a huge number of floating dry waste, such as plastic bottles, encounters tension on the water surface, and the garbage floats away due to the little drag force. The goal of this study is to create a robot that can perform floating trash scooping in place of humans, as well as to evaluate the effectiveness of the planned waste scoopers installed on the floating waste scooper robot. The design of the robot mechanism, waste scoopers, and control are all discussed. On a calm sea surface, the robot was successfully tested. Experiments were carried out on a pond, and the results reveal that changing the robot driving speed and the conveyor belt speed has an impact on garbage scooping. The capability of various scooper designs is assessed, and the weight of plastic bottles gathered by humans using scoop nets is compared to the weight collected

B. Concluding Remarks

The purpose of the Seabin float bin is to eliminate floating debris from rivers and lakes and provide areas free of litter. It is made up of a pumps gear, steel pipes, and a catch bag that holds jute. As it rolls with the tide, the Seabin gathers trash and returns water to the maritime ecosystem.

Sustainability may be enhanced by using artificial intelligence (AI) to detect and monitor marine pollution. However, assessing the results is challenging due to the amount of data gathered. In order to tackle this problem, scientists have created sturdy, affordable, and long- lasting aquatic robots. These robots gather trash using a conveyor belt driven by a motor and a plastic pipe container for stability. To enable autonomous operation, the robots are outfitted with sensors, motor drivers, GPS, GSM modules, and Arduino boards.

When floating debris is visible, the Seabin collects and removes trash to act as a water filtration device. It functions as a water filter by sucking floating debris into the container, collecting waste in the mesh, and releasing water back into the ocean.

To deal with floating dry rubbish, such as plastic bottles, which feel tension on the water's surface and float away due to negligible drag force, Dr. Umadevi H et al. designed a floating garbage scooping robot. It was a peaceful beach where the robot was tested and passed its test. A rectangular hanging sea bin with non-return flaps was designed by Mategaonkar Meenal to manage plastic garbage in the rivers of Mumbai. Aluminium was selected for the bin because of its strength, lightweight nature, and resistance to corrosion. The weight, centre of gravity, and metacentric height of the object were all examined.

Sagar Gavade used embedded, electrical, mechanical, and Internet of Things cloud concepts to create an autonomous ocean garbage collector robot that gathers plastic from floating water. The primary objective is to offer a dependable and reasonably priced remedy for ocean pollution.

Thus, we can also talk about the sea bin concept with the trash collector bin by employing fairly cost materials.

III. MATERIALS AND METHODOLOGY

A. Materials

1) Collection bin

Collection bin is manually designed using a plastic bucket with the following dimension of height – 38cm, Top dia – 30cm, Bottom dia of 26cm. Collection bin acts as the protection for the catch bag, which is built quality of the materials that are durable and strong enough to hold the catch bag firmly, it is the fundamental component of the trash collector bin design. Collection is as shown in figure 3.1.

Fig. 3.1: Collection bin

2) Jute and Sponge

Fig. 3.2: Jute Bag Fig 3.3: Sponge

Jute shown in figure 3.2 is primarily an environment friendly and biodegradable material, the primary objective of providing jute bag as a covering material to the catch bag, which will act as a filter media which aids in capturing the tiny plastic particles present in river water.

The sponge as shown in figure 3.3, is inserted in between the catch bag and the jute bag Catch bag.

The catch bag is designed with a steel mesh. The dimension catch bag is of length – 28cm, cross sectional dia – 20cm, outward projection – 8cm. Catch bag is used to collect/trap the waste debris in river water. Catch bag is introduced into the main body portion, covered by sponge materials that aid in removing or absorbing oil content that runs into the water's surface. Additional jute materials are then wrapped over the net mesh to prevent the entry of microplastic materials. Fig 3.4 shows the catch bag used the experiment.

Fig. 3.4: Catch Bag

3) Steel Square Plate Bolt and zinc plated MS plate round washer:

The steel square pipe is used to hold the main body part of trash collector bin firmly which as the dimension of 40X40 mm and 30X30 mm welded in fillet type. The main purpose of this is to hold the catch bag firmly. With the help of bolts and Zinc plated MS plate round washer of dia – 10mm, it connects the steel square pipe. Fig 3.5 and 3.6 shows the process making the holding device and apparatus used in the process.

Fig. 3.5: Steel Square Pipe

Fig. 3.6: Bolts and zinc plated MS plate round washer

4) Motors

The motor is important apparatus which helps in suction of waste particles that have collected in the water sources tanks. One horsepower is the motor capacity is used in the experimental process.

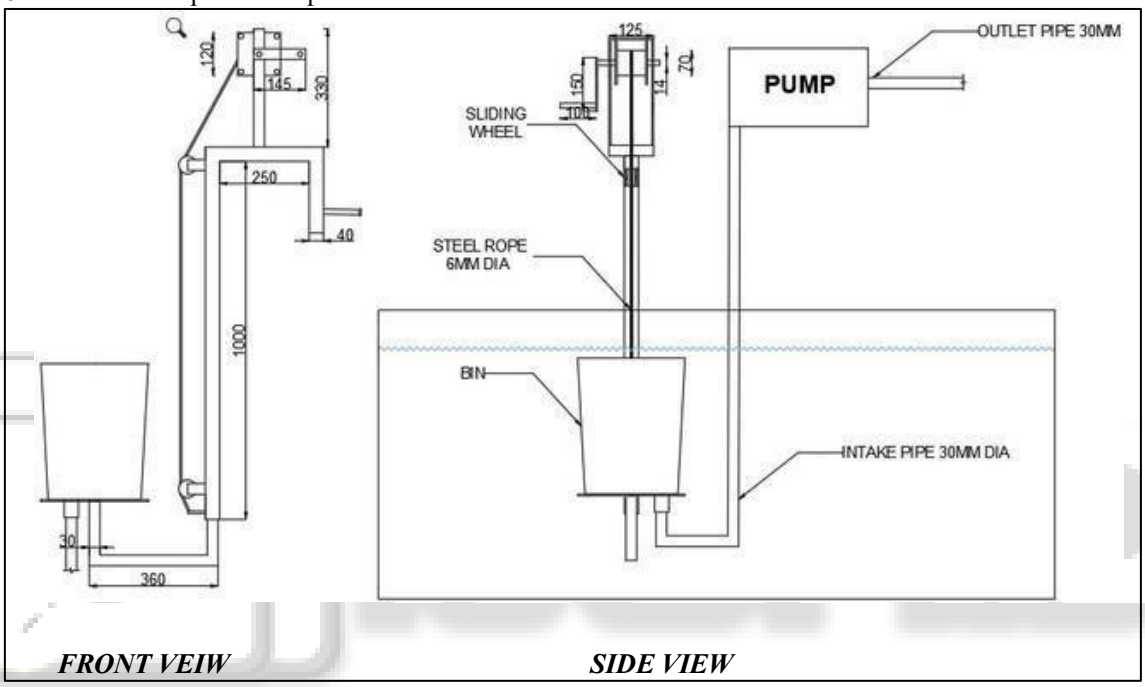

Fig. 3.7: Longitudinal section of experimental setup

Fig 3.8 shows the catch bin front and topview, the catch bin is installed in the sump.

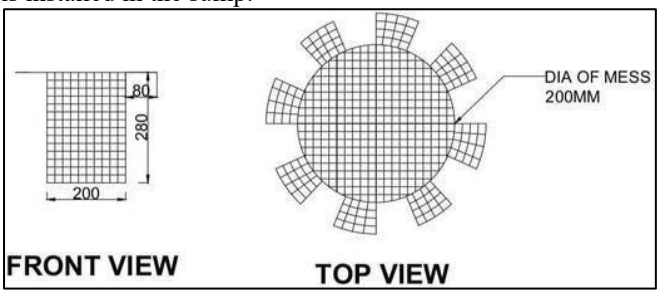

Fig. 3.8: Front and Top view of Catch Bag

B. Methodology

1) Water will be filled in the sump which is recirculated to conduct the experiment.
2) Simulated waste debris is created inside the sump.
3) Catch bin with the help of the frame and slider connected with rope is inserted to the sump.
4) Motor is turned on to collect the debris inside the catch bag.
5) Filtered water will be reverted back to the sump through outlet of the catch bag.
6) Collected debris in the catch bag is manually removed and disposed safely at the disposal site.

IV. ADVANCED METHODOLOGY

1) The Riverbin moves floating in the surface and the water is sucked inside it thanks to a water pump capable of displacing pump.
2) The water is then pumped back into the marina leaving litter and debris trapped in the mesh placed inside the main body which is later disposed away properly.
3) Each Riverbin filters water each year. Within the Riverbin there is a meshlike structure placed which is made up of recycled plastic which will collect all the floating debris and waste around it.
4) The mesh can withstand or can hold debris and when it is full, the helper will take the catch bag cleans it and again places it to its original position.
5) The Riverbin had been designed in such a way that it can be controlled by a single person. The Riverbin floating rubbish bin can be installed in an unused corner of river side.
6) The strategic positioning is Set in places that are known to Become clogged with trash and debris, enabling the

wind and the Currents to push the debris directly to the riverbin. According to the data Seabin can and Floating debris per day (depending on the climate and Pollutants volumes).

7) The mesh of the Seabin has been made so fine that it can trap even micro plastic and other foreign particles of different size is in ranges.
8) According with the company's Website, each Riverbin capability to catch in a plastic bag, disposable Cup, plastic bottles, plastic utensils. The Riverbin is attached to a pump on the side of the river and this pump sucks water Down maximum amount as possible before it returns to the river, and when the catch bag is Full the worker checks it take out the bag cleans it and again places it in main body.
9) And the riverbin is ready to run again. The bin is placed just below the surface of the water, Riverbins use a small submersible pump to Draw water and any nearby debris into its removable bag, which is Made of recycled plastic Mesh, and the water is then passed through a filter which removes oil content or it is directly released into the river.
10) An individual Riverbin is estimated to Be able to catch of floating waste or pollutants per Day. That equates to over half plenty of rubbish per annum –Around a truck load. The pumps are low-cost, and Riverbin Project also are Looking into Recycling the plastic which they collect in their mesh Bags to make more – creating A closed loop cycle which Would further benefit the environment.

A. Evaluation Of Material and Weight

Table 3.1 shows the materials used for the experiment work and their specification.

Sino.	*Item*	*Material*	*Woi*
1	collector bin	Plastic	1kg
2	Catch bag	Steel	0.5kg
3	Framework	Steel Square pipe	12kg
4	Bolts And Zinc Plated MS plate Round Washer	Steel	0.25kg
5	Motor	-	15kg
		Total	*28.75kg*

Table 3.1: Materials and Specifications

V. EXPECTED OUTCOME AND COST ESTIMATION

A. Expected Outcomes:

The idea of using trash collector bins to gather trash should be executed well in a protype model. The floating waste debris are collected in the catch bag of with the duration of the same can be implemented in any type of surface water with a sophisticated setup.

1) Relevance to Social Benefit

The waste collecting trash collector bin are a great step forward in combat-ting pollution, the major cause of water scarcity. However, it could also be a method of improving the lives of individual sin developing countries like India. The most direct effect of decreased pollution is improved health as a result of increased availability of clean water, but the proliferation of trash collector bins could lead to economic opportunities as well. In order to deploy waste collecting trash collector bin across the planet, people are going to be needed to take care of them and take away the waste they collect.

B. Cost Analysis

A detailed cost analysis for a prototype trash collector bin is as shown in table 4.1.

Materials	*Cost*
Steel Frame	3500 Rs
Labor	1500 Rs
Pump	3500 Rs
Catch bag	300 Rs
Bolts connection	100 Rs
Steel Rope	600 Rs
Transportation	500 Rs
Total cost	*10000 Rs*

Table 4.1: Cost Analysis of Prototype Trash collector bin

VI. CONCLUSION

- The following conclusions are drawn from the research work A prototype trash collector bin is developed which actually traps the debris, which is constructed of jute and is one of the key components. This isn't an issue because jute is completely biodegradable, recyclable, and compostable.
- When a catch bag is about to break or at the end of its life cycle, just clean it well to get rid of any plastics or contaminants, then compost it to grow your own veggies.
- Introducing trash collector bin, reduces the effort needed on the part of people to remove debris from the water bodies and doesn't need any extra assistance or supervision to function.
- An Economical and simple to build technology has been designed and developed to Clears out floating and suspended debris, from water bodies.
- The trash collector bin project is a smaller-scale method, but it still has great goals. This eco -friendly Garbage container can be installed in smaller scale water bodies such Irrigation channels, Recreational ponds etc. for sucking up waste and even removing oil from the water bodies.

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