

Design and Fabrication of River Water Cleaning System

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Abstract: *The objective of this project is to design and fabricate a river waste cleaning machine, "River cleaning machine", which removes waste from water surfaces and disposes them safely from the water bodies. As a result of the increase in pollution in the form of waste debris, it is hampering the life of aquatic animals and making their life at risk. This work has examined our national rivers that are dumping crores of litres of sewage and are loaded with toxic material, pollutants, and debris. This project will employ a machine to lift debris from the surface of water bodies, which will reduce water pollution and, ultimately, aquatic animal mortality from these problems will be decreased. The main aim of the project is to reduce manpower and time consumed in cleaning the river. Using a motor and chain drive arrangement, this project uses a battery to store energy for river cleaning. We are designing and developing a river cleaning machine as part of our project. After the 3D model is drawn, all the parts are manufactured, assembled, and then tested.*

Keywords: River Waste, Water Bodies, Motor and Chain Drive.

I. INTRODUCTION

There is a "River cleaning machine" which is used in the removal of waste debris from water bodies. It is a waterwheel driven mechanism that is used to collect and remove waste, garbage and plastic wastes from water bodies. The collection of debris will also be easier, as a machine will lift the waste materials from the surface of the water. This will reduce water pollution, as well as reducing aquatic animal deaths. The project consists of belt drive mechanisms which lift debris from the water. This will be used to remove surface water debris from rivers, ponds, lakes, and other water bodies.

The term "waste water" refers to the flow of used water that comes from homes, commercial activities, businesses, and institutions into a treatment plant through a carefully constructed network of pipes. The biggest impact is the respiratory diseases that can result from the chemical wastes that are cleaned, so it is a challenging issue for township officials. The proper disposal of industrial sewages from industries and sewage cleaning is still a challenging task in today's world, even though automation plays an important role. Drainage pipes are used for this purpose and unfortunately sometimes human life may be lost when cleaning blockages in drainage pipes. This type of problem is solved with the river cleaning machine. In the lower basement, the device is placed across a river and sea so that only river sand can pass through. Any floating waste, such as bottles, plastic cans, covers, etc., is lifted by lifters attached to the chain. The chain moves through the sprocket wheel that is driven by the motor. The energy supplied to the motor is electrical energy. As the motor runs, the chain starts to circle making the lifter lift up. The waste material is lifted by lifter teeth and deposited in the collecting box. Upon filling the collecting box, the waste materials are removed. The bottom of the box has a 45-degree bend plate, which is used to level the riverbed. The material we are going to use is M/S Mid-Grade, which is easily available in the market at a lower price than other materials. As the rollers are allowed to move inside the drainage, the buckets will move inside the drainage and settle on the material inside the drainage block. This is because the rollers rotate. The two rollers are connected to each other through belt drive, on which perforated buckets are mounted. The bucket will pick up waste material and floating material from the drain block. The bucket will allow water to flow out as it is perforated, and only waste material will be collected into the belt-driven storage container.

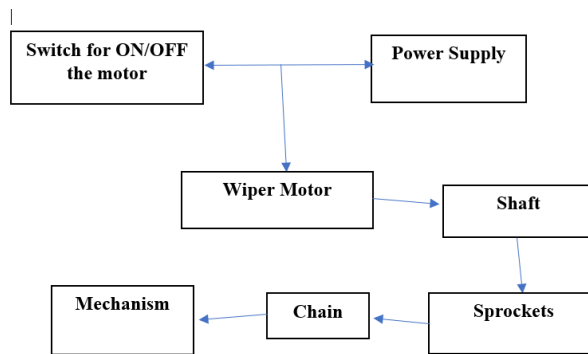


Figure 1: Working Mechanism of river cleaning system [1].

II. OBJECTIVE

- The major purpose of the project is to reduce the amount of manpower and time needed to clean the river.
- Water bodies can be cleaned by reducing pollution.
- To maintain automation while working toward cleaning River.
- To perform fast and reliable operations when cleaning the river.
- A water body's water quality can be improved. Dedicated to cleaning up a section of the river for the benefit of society.

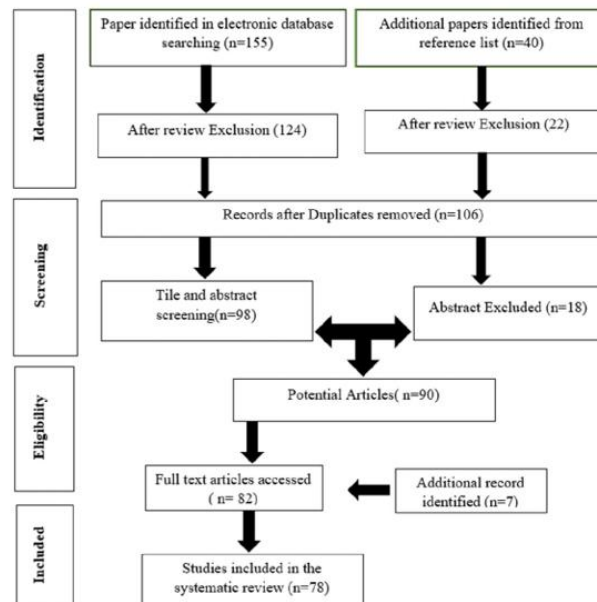


Figure 2: Flow chart for research paper identification and selection strategy

The search engines Google Scholar, Scopus, and Science Direct were used to identify the most important articles relevant to this review. The combination of keywords “River cleaning”, “Automatic robot”, “water bodies”, “motors” and “chain drive” were used. The last search took place on May 10, 2022. Figure 2, illustrates the process of identifying and selecting relevant research articles.

The first stage involves searching for articles according to their titles and abstracts. Afterward, existing articles are sorted in order to select the appropriate ones that meet the following three basic criteria, namely: a) the subject should be related to river cleaning mechanism, b) the working of river cleaning system, and c) the subject should be related to automation. References in the list also led to the identification of additional papers. The final number of papers left in the database is 106 after exclusion from the database. In the second stage, abstracts from these papers are screened,

which resulted in 90 potential articles being shortlisted. Then, the articles are read through to determine if they are relevant or not. 78 articles were deemed relevant at the end of the process.

III. LITERATURE REVIEW

A. "Design and Fabrication of River Waste Cleaning Machine" by *Sirsat, P. M., Khan, I. A., Jadhav, P. V., & Date, M. P. (2017). Design and fabrication of river waste cleaning machine. IJCMES, (1).*

As discussed in this paper, the focus is on the design and fabrication details of a river waste cleaning machine. The work has been done based on our current situation, in which our national rivers are contaminated with millions of gallons of sewage and loaded with pollutants, toxic materials, debris, and other toxins. With a view to cleaning rivers in India, the Government has invested vast amounts of capital into a number of river cleaning initiatives like "Namami Gange", "Narmada Bachao", and various major and medium projects in cities like Ahmadabad, Varanasi, etc. This machine is designed to clean river water surfaces by taking this into consideration. Conventional methods of collecting floating waste include hand-picking or using boats, thrash skimmers, etc., and depositing them near the shores of rivers. We have designed the remote-controlled river cleaning machine that eliminates the drawback of the methods used previously and is efficient, effective, and eco-friendly, by considering all the parameters of river surface cleaning systems and eliminating the drawbacks of the methods used earlier.

With the help of a PMDC motor, the machine is driven by a propeller to drive the machine on the river. The machine consists of a collecting plate together with conveyor belt and chain drives that rotate. The "River waste cleaning machine" is used to clean debris from a water body when there are wastes in it that need to be removed by a RF transmitter and receiver. DC motors, RF transmitters, PVC pipes, chain drive & conveyors will be used to collect wastes, garbage & plastic wastes from water bodies. The "River Waste Cleaning Machine" will be cost-effective, easy to operate, helpful for water cleaning and can be modified to increase the cleaning capacity and efficiency.

B. "Design and fabrication of beach cleaning machine" by *Dhole, V., Doke, O., Kakade, A., Teradale, S., & Patil, R. (2013). Design and fabrication of beach cleaning Machine. International research journal of engineering and technology.*

Keeping the beach clean manually is a difficult process, which is why we have come up with equipment that collects (sticks, on degradable waste) and separates, allowing easy disposal. The entire process is primarily driven by an engine that is fueled by fossil fuels. Separation of waste material takes place through the principle of density difference, where the different types of waste are collected in two hoppers, which makes it easy for the waste to be disposed of. Tourism is concentrated in coastal areas, so it is necessary to keep those beaches clean for attracting tourists. We have manufactured a beach cleaning machine to help keep beaches clean so that tourists will be attracted to those areas. As the era is moving towards being digitalized and automated with a great speed, the youth want everything very easily and smartly. The motor drives the conveyor, the strainer attached to the conveyor collects waste from the surroundings, and the waste is transferred to the bucket through the conveying belt.

There is a fact that people of all generation find it very easy to be smart effort and more and more being healthy, and are becoming eager to join the latest technology of being "smart work"; nobody likes to wait for long hours only to receive good surroundings, so we have created an application called "Smart cleaning system" to help us manage waste more efficiently. To accomplish this, Beach Cleaning System proposes a system that allows beach cleaners to effectively communicate through an application and do their work intelligently. As industries continue to expand, the problem of sewage water must be urgently resolved due to the increasing sewage problems caused by industries in the surrounding areas. The wastes produced by these industries are of great harm to human health and to the environment. The second important issue is a waste management system by which workers can ensure health and work efficiency through application that eliminates the need for waiting for worker to get to drainage.

C. "Drainage Water Cleaner Machine" by *Patil, G. S., Pawar, R. A., Borole, M. D., Ahire, S. G., Krishnani, A. L., & Karwande, A. H. (2018). Drainage Water Cleaner Machine.*

Life on earth cannot exist without water. Although there is 70% water on the planet, most of this is not suitable for drinking purposes. Humans require clean water for a variety of reasons, including drinking, bathing, cleaning, cooking, etc. Impurities present in water can cause health issues that can lead to long-term health consequences. A water treatment plant

treats wastewater collected from homes, organizations, business activities, and foundations through a well-planned and constructed system of pipes. The amount of wastewater handled by a plant fluctuates according to the season and with the seasons. This paper examines both processes that remove toxins from wastewater and those that discard them. Using a wastewater treatment innovation that eliminates, instead of destroying, a contaminant, will produce better treated wastewater. Typical wastewater is characterized by its source, regularly 200 to 500 liters of wastewater are generated for each user of the system each day. During wastewater treatment, this stream is treated before it is released back into the earth, there are no occasions when wastewater is treated, and most plants are working 24 hours a day, all week. Waste water treatment plants are instrumental in the water cycle, helping nature shield water from excessive contamination. Most plants have essential treatment as well as auxiliary treatment. By gathering, dismantling, cutting, rotating, and binding plastic containers and undissolved solids, our proposed system cleans and controls drainage levels using an auto mechanism technique. On a mechanical level, it involves gathering, dismantling, cutting, rotating, and binding plastic containers and undissolved solids by mechanical means. Recent research on management of waste water has been carried out in many categories. Our project stands among them with its ideology and new technologies Many specific empirical studies have been carried out and categories such as drainage cleaning system and its automation have been studied in great detail.

D. “Study of River Harvesting & Trash Cleaning Machine” by Patil, R., Itnare, R., Ahirrao, S., Jadhav, A., & Dhumal, A. (2016). *Study of river harvesting & trash cleaning machine. International journal of innovative research in science & Engineering, 2, 422-431.*

By using mechanical means, plants can be removed completely or partially, including harvesting, shredding, mowing, rototilling, rotovating, and chaining. Using motor-driven machinery, mechanical control methods can be used to facilitate manual harvesting, including hand harvesting, raking, and stump removal. As a result of these management techniques, plant species are rarely eradicated locally, but they are reduced to non-nuisance levels by reducing their abundance. There are many types of aquatic vegetation management and control machines available today, each suited to particular plant types and aquatic habitats. The mechanical aquatic harvester is a barge used to manage aquatic plants in rivers, lakes, bays, and harbors, as well as to remove trash. Using a conveyor system mounted on a boom, harvesters collect and unload vegetation and debris up to six feet below the surface of the water using the appropriate cutting height. A conveyor carries material from the cutter bars to the barge; after the barge has been filled to maximum capacity, cut material is delivered to a disposal site and offloaded. This invention relates to skimmer boats, that is, boats used to collect and dispose of floating solid waste materials in harbors and waterways. A highly maneuverable vessel is the focus of this invention. It includes means for picking up floating debris, storing the debris on the vessel, and discharging the debris to a storage area, such as a shore or another vessel, such as a barge, which is a highly maneuverable vessel. As a result of the proposed collection of floating solid waste and other debris, many boats and vessels have been proposed. Catamaran-type hulls, with pontoons or sponsors, and monohulls with paddle wheels or screw drivers have been proposed. A trash skimmer is typically designed with hydraulically powered open mesh conveyors that are positioned between the pontoons of a twin-hull catamaran. To propel and maneuvers the vessel, twin over-the-rear propellers are used, and they can be tipped up to clean weeds and debris. The main pickup conveyor reaches from the front end, and extends into the water to catch the floating material. It picks it up and carries it back to the main storage conveyor.

E. “Design and Analysis of River Water Cleaning Machine” by Wagh, M. N., & Munde, K. (2018). *Design and Analysis of River Water Cleaning Machine. IJSDR1807049 International Journal of Scientific Development and Research (IJSDR) July.*

As part of the project, we designed and analyzed a river water cleaning machine. The analysis was based on the current state of our national rivers, packed with sewage, polluting materials, debris, etc. In order to clean rivers, the Indian government has invested huge capital in various river cleaning projects, including Namami Gange, Narmada Bachao, and many major and medium projects in Ahmadabad, Varanasi, etc. By taking this into account, this machine has been designed for cleaning river water surfaces. In order to deliver products more quickly, almost all manufacturing processes are being atomized nowadays. As automation plays a crucial role in mass production, we have fabricated a remote-controlled river cleaning machine for this project. In order to reduce the amount of time and manpower required to clean the river, our project uses a motor and chain drive arrangement to automate river cleaning operations. Here we describe some of the

automation requirements, and the cleaning machine is controlled using a RF transmitter and receiver. There are many ways to automate, including computers, hydraulics, pneumatics, robotics, etc. Of all these sources, pneumatics is an attractive option for low-cost automation. More than two thirds of the planet's surface is covered by water; less than a third is occupied by land. Due to the growing population of the planet, water resources are being put under increasing pressure. Human activities are reducing the quality of our oceans, rivers, and other inland waters by "squeezing" them. It is known that poorer water quality leads to water pollution. This invention relates to skimmer boats, i.e., boats used to collect and dispose of floating solid waste material in harbors and waterways. In accordance with relevant research findings, a river water cleaning machine has been designed and analyzed based on literature and research findings found in various journals and papers, and manufactured so that it can be operated at any time. Despite being easy and inexpensive, this innovation has a lot of potential to become more economical in the future. According to its design and estimating of cost and availability, this project "River Water Cleaning Machine" can be very cheap and useful for river and pond cleaning.

Vegetation management and control machines available today, each suited to particular plant types and aquatic habitats. The mechanical aquatic harvester is a barge used to manage aquatic plants in rivers, lakes, bays, and harbors, as well as to remove trash. Using a conveyor system mounted on a boom, harvesters collect and unload vegetation and debris up to six feet below the surface of the water using the appropriate cutting height. A conveyor carries material from the cutter bars to the barge; after the barge has been filled to maximum capacity, cut material is delivered to a disposal site and offloaded. This invention relates to skimmer boats, that is, boats used to collect and dispose of floating solid waste materials in harbors and waterways. A highly maneuverable vessel is the focus of this invention. It includes means for picking up floating debris, storing the debris on the vessel, and discharging the debris to a storage area, such as a shore or another vessel, such as a barge, which is a highly maneuverable vessel. As a result of the proposed collection of floating solid waste and other debris, many boats and vessels have been proposed. Catamaran-type hulls, with pontoons or sponsors, and monohulls with paddle wheels or screw drivers have been proposed. A trash skimmer is typically designed with hydraulically powered open mesh conveyors that are positioned between the pontoons of a twin-hull catamaran. To propel and maneuvers the vessel, twin over-the-rear propellers are used, and they can be tipped up to clean weeds and debris. The main pickup conveyor reaches from the front end, and extends into the water to catch the floating material. It picks it up and carries it back to the main storage conveyor.

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Bucket elevators, also known as grain legs, are used to transport flowable bulk materials (usually grain or fertilizer) vertically. There are several parts to this elevator: 1. Buckets to contain the material; 2. A chain to pull the buckets; 3. Ways to drive the chain; 4. Accessories to load the buckets or pick up the material, to receive the discharged material, to maintain the chain tension and to enclose and protect the elevator. Bulk materials can be elevated using bucket elevators in a variety of ways, 5 including in horizontal, inclined, and vertical motions. Bucket conveyors consist of endless chains or belts to which buckets are connected to convey bulk materials. Various discharging mechanisms are available, but the buckets remain in the carrying position until they are tipped.

IV. COLLECTING TANK

Collecting tanks (or collecting boxes) are water tanks designed to collect and store waste, generally collected from sewage. A collecting box collects wastes from drainage (or) sewage. Cycling chains are roller chains that transfer power from the upper shaft to the lower shaft by running the wiper motor. Conveyors that are connected to chains by welding, most chains are made from carbon or alloy steel, some are nickel-plated for aesthetic or corrosion resistance reasons.

4.1 Sprockets



Figure 5: Sprockets.

The sprocket wheel engages a chain and runs over it, while a sprocket is a profiled wheel with teeth, cogs, or even sprockets. In contrast to gears that mesh directly, sprockets have teeth and pulleys are smooth; they are also used for power transmission from one shaft to another where slippage is prohibited. Instead of belts or ropes, sprocket chains are used and sprocket wheels take the place of pulleys. Some chains can run at high speeds and are constructed to be noiseless even while running at high speeds.

4.2 Bearing



Figure 6: Bearing.

Bearings reduce friction between moving parts by restricting relative motion to only the desired motion. The bearing may, for example, be designed to allow lines to pass freely over a fixed axis, or to permit rotation around a fixed axis; or it may be designed to prevent movements by controlling the normal forces acting on the moving parts. A bearing is a device that minimizes friction in order to facilitate desired motion. Bearings are broadly classified according to what they do.

4.3 Conveyor System

Using a conveyor system can move materials from one section to another without requiring strenuous or expensive labour. Conveyors can be installed almost anywhere and are safer than using a forklift or other machine to move materials. The conveying system can move a variety of loads of any shape, size, or weight. Many have advanced safety features that prevent accidents. Available options include hydraulic, mechanical, and fully automated systems. In many industries, conveyor systems are commonly used, such as automotive, agricultural, aerospace, chemical manufacturing, canning, bottling, and printing.

V. CONCLUSION

The project " River Waste Cleaning Machine " has been designed to be very inexpensive, easy to operate, and helpful for water cleaning, as well as being able to be modified to improve cleaning power and efficiency. After calculation and experimentation, the result is very satisfying, Since this is an innovative way of minimizing manual stress, we can conclude that it is a very reliable method of stabilizing the in the river. As a result of the work conducted by us, we have been able to make an impressive contribution to the environment and it has a lot of uses in small-scale works, even though this system could be used to collect garbage from the lake without human assistance, the project's goal has been accomplished. The robot is designed for collecting floating wastes such as plastic bottles and other debris from the surface of the water. Its design, analysis, and hydrodynamic modelling will be explained. In addition, it can be used for tasks such as inspection, picking up waste from the bottom, etc. Hydrodynamic modelling and CFD analysis are performed assuming that the hydrodynamic parameters are greatly influenced by the hull. This design is a small, simple, lightweight and compact solution for tackling the problem of waste collection on water bodies by ignoring the frame and arm parts. In this paper, a novel river cleaning robot is developed which functions both underwater and on the surface. The vision-based waste detection system, sensors, artificial intelligence, Internet of things, etc., are planned for future inclusion to make the robot completely autonomous.

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