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River Cleaning Bot Using IOT

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ABSTRACT: The design and development of River Cleaning and Monitoring Systems (RCMS) are reviewed in detail in this study in order to meet the growing environmental problems related to river pollution. The Study includes developments in autonomous vehicles, remote sensing applications, and sensor technologies that allow for dynamic river health evaluation and real-time data collection. The application of robotics, such as underwater drones and Unmanned Aerial Vehicles (UAVs), is being investigated to automate the removal of pollutants. With the use of renewable energy sources and environmentally friendly products, RCMS places a strong emphasis on environmental sustainability. A promising path for revolutionizing river restoration efforts is provided by the synthesis of cutting-edge technologies and sustainable practices in RCMS design. This approach also provides insightful information for researchers, policymakers, and environmental practitioners involved in reducing the negative effects of human activity on essential water ecosystems

KEYWORDS: RCMS, Sensors, Pollution, River Restoration & Ecosystem.

I. INTRODUCTION

River cleaning systems are an essential technological answer to the growing problems that human pollution in aquatic ecosystems is posing. These systems use a variety of strategies and cutting-edge technologies—like sensor networks, artificial intelligence, and autonomous cars—to actively monitor, evaluate, and lessen the negative effects of pollution on rivers. The principal aim is to maintain and improve the well-being of these marine environments by effectively eliminating physical detritus, impurities, and pollutants. River cleaning systems ensure a more sustainable and methodical approach to maintaining water quality by utilizing a variety of mechanical, robotic, and autonomous devices for targeted interventions. A dedication to environmental sustainability is further emphasized by the incorporation of renewable energy sources and eco-friendly materials. River cleaning systems are essential for protecting the biodiversity and biological balance of rivers in the face of escalating environmental concerns. They also help to solve the pressing demand for comprehensive and creative solutions to water pollution.

1. Classifications of river cleaning system

River cleaning systems (RCS) are categorized according to a range of factors, including the many technologies and techniques used to maintain and repair river environments. One of the main criteria for classification is the technology that these systems use. One type of system is mechanical, which uses physical tools like skimmers, dredgers, and conveyor belts to clear the riverbed and surface of debris and pollutants.

2. Different operational modes for river cleaning system

Unmanned Aerial Vehicles (UAVs), Unmanned Surface Vehicles (USVs), and underwater drones are examples of autonomous vehicles in another category. These self-governing systems are intended to perform automatic duties related to cleaning and monitoring. Furthermore, a few river cleaning systems concentrate on sensor technology, using a range of sensors—including water quality sensors—for ongoing evaluation without the need for direct physical intervention.

The way these system function is another important factor for classification. Cleaning systems are made expressly to remove impurities, pollutants, and physical debris from river environments. In contrast, monitoring systems prioritize the acquisition and examination of data in real-time to evaluate the general health of rivers, their pollution levels, and the quality of the water, all without requiring direct cleaning intervention.

Another consideration for classification is the scope of the business. Large-scale river cleaning, encompassing vast areas and solving pervasive pollution issues are the goals of macro-level systems. Conversely, micro-level systems are designed for targeted cleaning and monitoring in smaller river segments or specific pollution locations.



Fig.1 River cleaning system

The classification of power sources makes a distinction between renewable energy sources and conventional power. Whilesome river cleaning systems prioritize sustainability by integrating eco-friendly power sources like solar, wind, or hydro energy, others rely on conventional power sources like electricity or fossil fuels.

One important classifying factor is operational autonomy. In order to maintain control and make decisions during cleaning and monitoring operations, manual systems need human operators. Autonomous systems, on the other hand, use automation and artificial intelligence to make decisions on their own and carry out tasks independently.

Some river cleaning systems put an emphasis on eco-friendliness by using biodegradable materials, bio inspired designs, and sustainable procedures in order to minimize their negative effects on the environment. On the other hand, conventional systems might make use of conventional tools and materials without giving ecological sustainability any thought.

II. EMBEDDED INTEGRATED RIVER CLEANING SYSTEMS

Technology integration affects classification. Some systems use artificial intelligence (AI) for data analysis and decision-making and the Internet of Things (IoT) for connectivity. Others use robotics to accomplish duties like cleaning and monitoring. These classifications provide a thorough framework for comprehending the wide range of river cleaning systems available, assisting practitioners, policymakers, and researchers in choosing or creating systems that are suited to particular operational needs and environmental challenges.

III. RCMS METHODOLOGY

Cleaning rivers using a chain conveyor with a DC motor for dirt collection, along with a monitoring system using a pH sensor, involves several steps and considerations. Here's a general methodology to guide you through the process:

1. Initial Assessment:
2. Design of Chain Conveyor System:
3. Selection of DC Motor:
4. Integration of Dirt Collection Mechanism:
5. Installation and Testing:
6. pH Monitoring System:
7. Integration of Monitoring System:

8. Operation and Maintenance:
9. Environmental Considerations:
10. Continuous Improvement:

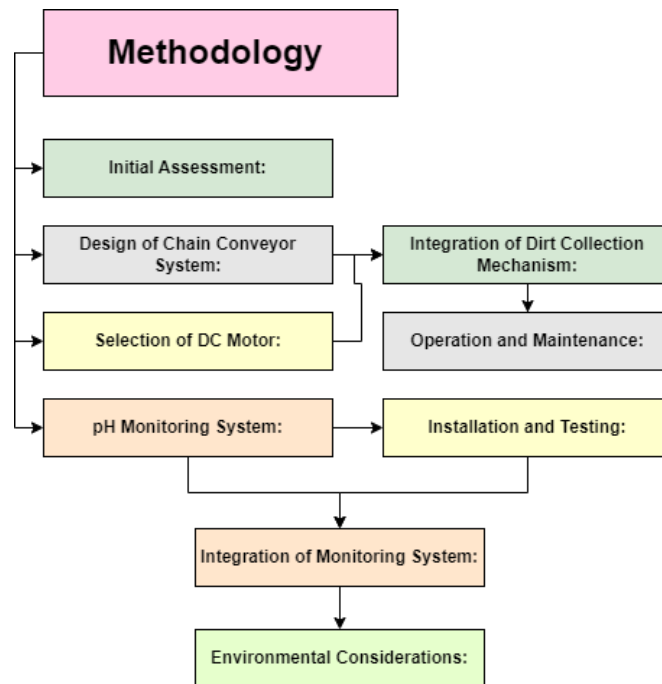


Fig.2 Rcms Methodologies

IV. WORKING

The river cleaning process begins with the deployment of a chain conveyor system equipped with a DC motor along targeted areas of the river. As the conveyor moves along the riverbed, it efficiently collects dirt and debris, pulling them onto the conveyor belt for transportation. Simultaneously, a monitoring system integrated with pH sensors strategically placed along the river continuously monitors the water's pH levels in real-time. This data is relayed to a central control station for analysis, enabling prompt identification of any potential pollution sources or environmental concerns. Operators oversee the cleaning operation, ensuring the conveyor system operates smoothly while also monitoring the pH levels to maintain water quality standards. This integrated approach not only effectively removes pollutants from the river but also enables proactive monitoring and management of water quality, contributing to the preservation and restoration of the ecosystem.

The system will have two types of implementations.

- Modal Development
- Code Development
- Modal development- the modal must float on the water with its frame and other waste + metal collecting mechanisms.
- The modal will run wirelessly using wi-fi or Bluetooth module.
- The system will have motor pulley mechanism with magnet to pull the metal content from underground river surfaces.
- The system will have Ph sensor to measure the Ph Value of the water connected to Arduino. Also metal sensor for metal identification inside the underground surface of river.
- Code development – to make the modal wirelessly we require embedded modules. They are motors and drivers to create motion in waters, sensor reading, and IOT data storing systems etc.

V. RCMS SURVEY

Ahmed Shabbir Khan [1] The majority of Mumbai's industries are found close to lakes, rivers, and oceans. Thousands of industries also surround the Mithi River. residential and business districts. This results in an increase in the Mithi River's water pollution level as well as a number of serious environmental issues and contamination in the river's natural ecosystem. The discharge of untreated water into a river has a detrimental effect on the quality of the water, resulting in a much lower level of water compared to the international standard. Over 20 times the water standard amount of contamination in rivers has been quickly raised by unlawful and untreated industrial and commercial effluents. Almost all rivers are often found to be contaminated by different human activities. One of the most contaminated waterways is the Mithi River, which gets a lot of pollutants and effluents from both legal and illicit industrial activity. 4. The river has several areas that are prone to flooding. The river may flood for a number of causes. The primary cause of the river's floods is tidal variation. Some of the main causes of the river's flooding problems are excessive siltation, unauthorized construction that reduces the river's capacity to hold water, increased runoff water gradients brought on by development and high-covering areas, obstructions to the drainage system caused by solid waste matter—mostly plastic—garbage dumping, shoddy structural design, etc. Flooding is a result of the Mithi River's high siltation process. More than twelve thousand cubic meters of silt and debris from the Mithi River should be excavated, according to a recommendation made by the Mumbai Metropolitan Region Development Authority (MMRDA).[1]

By Osiany [2] The objective of this study is to design and construct the AGATOR (Automatic Garbage Collector), an automated garbage collector that uses a rotor robot concept to effectively and efficiently counteract rubbish buildup in rivers with no flow. Design and construction is the implementation strategy. This approach entails demand analysis, the engineering, development, and testing of hardware and software, as well as the individual component requirements. The IC ATmega16 with a 5 volt voltage and a 1,1 mA current, the IC Driver with a 12 volt voltage and a 1,2 mA current, and the limit switch acting as the controller are the components used in the test results that are obtained using the AGATOR specification. Robot control system, actuator robot, sensor system, and mechanical robot are examples of support equipment for robots. The trash can can only hold a maximum weight of 5 kilograms. When taking out the trash, the robot moves at an average speed of 0.26 m/s.[2]

Mragank Sharma [3] The essential requirement for life on Earth is water. Even though there is 70% water on Earth, most of it is unfit for human consumption. Since clean water is needed for so many things, including drinking, bathing, cleaning, and cooking, there is a large demand for it. Water contaminants have the potential to seriously harm human health and even endanger lives. The primary purpose of the with the aid of claws, the automatic drainage system is designed to gather, move, and dispose of solid waste in the trash bucket. Papers, polythene bags, and empty bottles are among the solid waste materials found in drainage water. Blockages in the drainage system can result from contaminants in the drainage water. To prevent situations like this, it is necessary to periodically remove these pollutants to ensure that drainage water flows continuously. With the aid of the model, which uses a driving system to extract solid waste and dispose of it in a trash bucket, the drain may be continuously cleaned. The goal of this project is to start the system functioning efficiently. Every time an impurity is detected, this project automatically purges the drainage system's water supply. Additionally, to prevent blockages, chain-sprocket-driven claws collect and dispose of solid trash. In addition to lowering the risk to human life, it even lowers the cost of manual labor. [3]

Mr. Abhijeet. M. Ballade [4] Aquatic animals' lives are being hampered and put in risk due to the rise in water pollution caused by waste debris. Similar to this, aquatic creatures occasionally have a tendency to consume surface waste detritus, viewing it as food, which ultimately results in animal deaths. Because of the contaminated Water is where many of humanity's skin diseases are found. In an effort to lessen water pollution, we are developing river cleaning equipment. A "river cleanup machine" is a device that cleans up waste material from the surface of water and disposes of it securely. The river cleanup device in Nashik uses hydropower to remove rubbish, plastics, and other material from the Godavari River. This machine's primary purpose in this project is to remove waste particles from the water's surface and place them in the tray. The conveyor is arranged on a shaft and bearing support; the M.S. angle frame, which is welded to resemble a slope-facing machine part, has a bearing mounted on it and the shaft attached to a pedestal bearing. Waterwheels rotate due to hydropower; belt drives are used to transfer this power to the conveyer system. The conveyer gathers plastics, rubbish, and water debris from water bodies as it moves. [4]

Prof. N.G.Jogi ,Akash [5] The world's holiest river and India's national river, the Ganga River The Ganga River, often known as the Indian soul, is located in India. The current state of our national river, the Ganga, is shocking when we consider that around 29 core liters of sewage, full of toxins and pollutants, are dumped into it.[9] Tones of municipal

solid garbage are also dumped by us. The Indian government is in charge of keeping rivers like Varanasi and Ahmadabad clean. We are all aware of the Ganga Abhiyan. Comparably, due to the large quantity of trash present in the lake water, the villages in every state in India that is connected to both small and large lakes and the majority of villages do not use the lake's water for daily use or for farming. Our first goal is to purify the lake's water, thus we're building an effective pedal-operated boat trash collection. Here, we are collecting trash from the lake using a pedal-operated boat that has a conveyor attached to it.[5]

Ganesh U L, Vinod [6] The idea put out in this research study is to use a mechanical drain cleaner in place of physical labor to clean drains. Even though mechanical drainage is essential to all industrial applications these days, properly disposing of sewage from businesses and industries remains a difficult undertaking. Regretfully, drainage pipes are used for disposal. Human life may occasionally be lost while clearing obstructions in the drainage system. We developed our project to make effective use of this "mechanical semi-automatic drainage water cleaner" in order to control waste disposal and provide regular waste filtration in order to solve this issue and save human life. By encouraging waste management and clearing debris from the drainage system, the drainage system cleaner is a device that helps safeguard the environment against various environmental threats. If these wastes are not removed, they settle in residential areas where they are burned, contributing to climate change; alternatively, they clog drainage systems, resulting in flooding.[6]

Sheikh Md Shahid Md Rafique [7] The design and construction of the river trash cleaning machine are the main focus of this project. The study examined the current state of our country's waterways, which are overflowing with pollutants, hazardous items, garbage, and billions of gallons of sewage. The Indian government has taken on the responsibility of cleaning rivers and has invested a significant amount of money in numerous major and medium-sized projects in different towns, including Ahmadabad, Varanasi, and the "Namami Gange" and "Narmada Bachao" rivers. This was taken into account when designing this equipment, which cleans the surface of river water. In the modern manufacturing world, nearly every step of the process is being streamlined to produce goods more quickly. Mass production relies heavily on automation. We built the remote-operated river cleaning device for this project. The primary goal of the initiative is to clean the river with less manpower and in less time. Using a motor and chain drive setup, we were able to automate the process of cleaning rivers for this project. Below is a list of some automation requirements. In this instance, the cleaning machine is controlled by an RF transmitter and receiver. Automation can be accomplished by several means such as computers, hydraulics, pneumatics, robots, etc. Among these, pneumatics provide an appealing avenue for automation at a low cost. [7]

Viki Sahebrao Bagul [8] The proposed paper represents the devices is place across drain so that only water flow through lower grids, waste like bottle, Etc. Floating in drain are lifted by teeth which is connected to chain. This chain is attached by gear driven by motor .When motor runs the chain starts to circulate making teeth to lift up. The waste materials are lifted by teeth and are stored in waste storage tank. The deplete squander water cleaner machine is planned and made by utilizing gear changing and shaft coupling rule. It comprise fundamentally DC equipped engine, shafts, squander expulsion plates, clean receptacle, course, sprocket and chains. Construction materials are effortlessly available, creates work (development and maintenance), simple to build.[8]

Rajendra Patil [9] Mechanical control techniques, such as harvesting, shredding, mowing, rototilling, rotovating, and chaining, entail the total or partial removal of plants. Hand harvesting, raking, and cut stump control are among the manual harvesting tasks that can be accelerated with mechanical control techniques. utilization of devices powered by motors (Haller 2009; Lembi 2009).

[10] Instead of eradicating the target species locally, these plant management strategies usually lower its abundance to non-nuisance levels. Today, a variety of equipment is used to manage and control aquatic vegetation. This equipment is made for different plant types, such as floating, submerged, and emergent vegetation, and is intended to operate in different aquatic settings, such as wetlands, open water, canals, and shorelines. One sort of barge used for a variety of jobs in rivers, lakes, bays, and harbors is the mechanized aquatic harvester, sometimes known as a "harvester." Harvesters are made to gather and discharge waste and vegetation up to six feet below the water's surface utilizing a conveyor system on a boom that can be adjusted to the proper cutting height. When the barge reaches capacity, chopped material is conveyed to a dumping site and offloaded using the conveyor. Cutter bars gather material and bring it aboard the vessel using the conveyor.[9]

VI. GAP IDENTIFICATION

River cleaning utilizing a chain conveyor with a DC motor for dirt collection, coupled with a monitoring system incorporating pH sensors, represents an innovative approach to tackling water pollution and ecosystem preservation. Through this analysis concludes by highlighting the urgent need for creative and long-lasting solutions in the field of river cleaning systems. The research has examined a wide range of technologies and approaches, including sensor networks, autonomous cars, and mechanical systems. The synopsis of current research emphasizes the benefits and drawbacks of existing methods, highlighting the significance of comprehensive plans that give environmental sustainability a high priority in addition to pollutant removal

VII. CONCLUSION

The conclusions drawn from this assessment highlight the necessity of continuing research and development in the field of river cleaning systems, since pollution caused by humans continues to pose a threat to the health of our rivers. Future systems could revolutionize river restoration efforts and make a significant contribution to the preservation of these important ecosystems by incorporating state-of-the-art technologies, improving operational autonomy, and emphasizing environmentally beneficial techniques. Because river cleaning systems are interdisciplinary, it is necessary for researchers, policymakers, and practitioners to work together to develop practical, scalable, and environmentally responsible solutions that will benefit current and future generations.

VIII. ADVANTAGES OF THE RIVER CLEANING SYSTEMS

Automatic River cleaning and monitoring systems offer a transformative leap forward in river management, surpassing the limitations of manual cleaning methods. Their key advantages lie in operational efficiency, precision, and safety. Automated systems ensure continuous, round-the-clock monitoring, enabling swift response to pollution incidents and early detection of environmental threats. The precision of advanced sensor technologies and artificial intelligence-driven cleaning mechanisms enhances accuracy in pollutant identification and removal, reducing the risk of oversight. Additionally, by eliminating the need for manual labor in potentially hazardous conditions, these systems enhance safety for personnel. The scalability, adaptability, and potential for cost-effectiveness further underscore the advantages of Automatic River cleaning and monitoring systems, making them a sustainable and technologically advanced solution for preserving the health and integrity of our vital waterways.

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