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Design of Optimized and Innovative Remotely Operated Machine for Water Surface Garbage Assortment

Ganesh S. Khekare[1*], Urvashi T. Dhanre[2], Gaurav T. Dhanre[3], Sarika S. Yede[4]

[1]Department of Information Technology, G. H. Raisoni College of Engineering, Nagpur, India
[2]Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, India
[3] Operation & Maintenance Division, Thermax Limited, Kolhapur, India
[4]Department of Mechanical Engineering, Agnihotri College of Engineering, Wardha, India

Corresponding Author: khekare.123@gmail.com,   Tel.: 9960460161

Abstract— India is one of the largest countries in the world and holly also. In India many festivals are celebrated with brotherhood. So in the festivals like ganpati utsav, durga puja the garbage is discharge to the lakes or rivers in large amount. As the garbage is present in the river and lake, the water of river and lake gets contaminated. This polluted water affects the human lives if that contaminated water is used for drinking, the resident suffer from epidermal, gastrointestinal, neurological disorders and cardiac ailments. It also affects the species resides in the water. There is no small and fuel efficient device for collecting the garbage from river and lakes. The conventional machineries available in the market have very high cost as well as are not efficient. The conventional machineries are pedal operated and human efforts are required for the operation of machine. Some machineries use petrol or diesel for the operation. It is possible to clean the surface of water reservoirs by using remote operated river surface cleaning machine. By taking this into consideration our main motive is to clean water. For that purpose the remote operated river surface cleaning machine is useful. This water garbage collector machine is made up of DC motors, RF transmitter and receiver, propeller, PVC pipes and chain drive with the conveyor attached to it for collecting garbage from the lake.

Keywords—DC motors, RF transmitter and receiver, Propeller, PVC pipes, Water Garbage Collector Machine

I. INTRODUCTION

The various machines are used in that places where removal of waste debris in the water body is require. Pollution of water is increasing throughout the world. A 2007 study found that discharge of unprocessed waste is that the single most vital supply of pollution of surface and well water in Republic of India. There is an outsized gap between generation and treatment of domestic waste water in Republic of India. The problem isn't solely that Republic of India lacks enough treatment capability however additionally that the waste treatment plants that exist don't work and don't seems to be maintained.

The various government-owned garbage treatment plants remains closed most of the time thanks to improper style or poor maintenance or lack of reliable electricity offer to control the plants, together with absentee employees and poor management. The waste water generated in these areas commonly mixes into the soil or evaporates. The uncollected waste accumulates within the urban areas causes unsanitary conditions and cathartic pollutants that leach into surface and groundwater. More than 500 million people live along the Ganges River [1]. An estimated 2,000,000 persons ritually bathe daily in the river, which is considered holy by Hindus. Ganges river pollution is a major health risk [2]. Minister of Environment, B. Kambuaya, and discovered waste production of thirty-three cities across state by the Central Bureau of Statistics records in 2007 reached 132,192 cubic meters per day. Not all the waste disposed and transported in landfill, such as a lot of garbage that have not been handled properly such as burned and thronged in the river. This phenomenon that causes environment problems. Rivers turn into domestic landfill. Kambuaya states 80 percent of river polluted by local waste. River scheme that gets besieged of high pollution load than different rivers in Java is Ciliwung watercourse.

This watercourse is found in Jakarta that passes through several villages that have poor hygienically conditions generally. During the time of year this watercourse usually overflows and causes floods. Jakarta government makes efforts to beat waste pollution within the rivers. One of them is to launch issue regulation in Jakarta that prohibits selling

into rivers. Some different of wasting management are area unit given among others through the trash bank or call up bank and reuse them into hand sewn things which will create profits. In addition, the government of Indonesian also makes effort by the issue of the law No.18 of 2008 on Waste Management at the side of Government Regulation No.81 of 2012, mandates the need for a fundamental paradigm shift in the management paradigm that is gathering waste transporting, processing waste into a convergent on wasting reduction and waste management. They recycle and recycle garbage that is thought as cut back, Reuse, and Recycle (3R) through intelligent efforts, efficient, and program. Government's efforts are not enough. There are many garbage's found and clog the stream flows in the river, dumps into the branch of the river, piles up at the doors of water, in ditches, small streams and cause shelter black waste, which might harm the encompassing atmosphere. Wasting reduction activities means all levels of society include government, business and society conducting restriction of madden.

Section II has the Literature review, section III has the methodology, section IV has results and discussion, section V has conclusion and future scope and section VI has references.

II. RELATED WORK

According to Prof. Ketan V. Dhande invented a River Cleanup Machine which is used in those places where there is waste debris in the water body [3]. In this machine waterwheel driven conveyer mechanism and belt drive mechanism which lifts the debris from the water. According to the article from "The Times of India" newspaper entitled with "Nagpur Municipal Corporation begins Nag- Pilli rivers campaign", The Nagpur Municipal Corporation has set the project for cleaning the Nag and Pilli River in West Nagpur. The aim of the project is to rejuvenate and beautify the river. The machineries are used for the collection of floating weeds and debris. As the world moving towards creation of smart cities due to enormous growth in the population and advancement the technology it becomes most important to control water cleaning through efficient method [4]. As the world is moving towards smart cities still the way celebrating festivals remains the same. Automation is required is order to manage the things [5].

Prof. Ajay Dhumal proposed a mechanical aquatic harvester which is used to perform different of tasks, including aquatic plant handling and garbage removal from rivers, lakes, bays, and harbors [6]. It is nothing but a type of barge. This harvesters debris using a conveyor system on a boom and are designed to collect and unload vegetation, cutting height is also adjustable with respect to requirement, can be used up to 6 feet below the water surface.

Cutter bars collect material and bring it aboard the vessel using the conveyor; when the barge has reached capacity, cut material is transported to a disposal site and offloaded using the conveyor. Prof. N. G. Jogi stated cleaning the lake water is the main aim as the villages of India which consist of various small & big lakes and maximum villages does not use the water of lake for farming as well as drinking and for daily uses due to the maximum amount of garbage present in the lake water [7]. For that purpose the efficient lake garbage collector by using pedal operated boat is fabricated. In this, conveyor attached to pedal and use shaft to drive a propeller. A pedal boat consist of two pedals, two propellers attached to the shaft again it comprises a control assembly. In this boat they have attached conveyor system also which i8s operated by the same pedal for cleaning the garbage in the lake. For or underwater inspection a system has been proposed which requires more fuel consumption and cameras not work that much efficiently under water [8]. The information generation system implemented for Kanhan River near Nagpur for river modelling. Excess exploitation of natural resources may cause big trouble to the environment, so happening with the kanhan River. This research work helps to drag awareness in maintenance of natural resources. Generally, R&D activities take adequate time to benefit public domain, whereas public portal of this information system immediately shares approved river water quality data on its portal which is public. The various auto data generation techniques like: data generation through public partnership, data extraction, data estimation and data generation using Geographic information system based utility software is explained in this paper [9].

The main objective of doing this project is to clean the garbage present in small and big lake. To reduce the cost of river cleaning by use of river surface cleaning machine. To tackle the problems about wastage, food material, plastics present in the lake. To clean the polluted water reservoirs to save the life of aquatic animals. To reduce the human efforts by automation in machine. To make ecofriendly and cost efficient machine without use of liquors like petrol or diesel.

III. METHODOLOGY

A. Data Analysis

While conducting study the issues arises i.e. cost of machinery is too high. There are so many methods used for the collection of waste floating on river or lacks manually, by using boat, thrash skimmers etc. and that deposited to the shore of rivers. These methods are risky, costly and time consuming. By considering all the parameters of river surface cleaning and eliminating the drawback of the methods used earlier, the design of the remote operated river cleaning machine which will help in river surface cleaning effectively, efficiently and eco-friendly is proposed.

Several companies offer equipment to clean river, lakes and harbors. The remote operated river surface cleaning machine

can work in river or lake. It can collect the floating garbage by conveyor belt system and stores in a storage tank provided on the machine. This is really a good solution for the aquatic solid waste management. This machine is remotely operated and clean the waste present in the water bodies. In this machine, the conveyor collect the waste present in lake and then collect it in box like structure called storage tank present in back side of the machine. It collects the waste like polythene, food material, and the waste occurs due to religious festivals.

B. Proposed Solution

Hence the designing and fabrication of the remote operated river cleaning machine is proposed. The machine is consist of the collecting plate which is coupled with conveyor belt and chain drives are rotating continuously by the motor. The collecting plate is coupled between the two chain drives to collect the waste materials from river. Then the collected waste is thrown on the collecting tray. The propeller is use to give motion to the machine hence drive the machine on the river. The propeller run with help of PMDC motor. The total electrical devices are controlled by RF transmitter and receiver which use to control the machine remotely.

C. Selection of Components

1. D. C. Motor: The operation of electric motor is based on simple electromagnetism. In this a magnetic field is generated by current-carrying conductor; it will experience a force proportional to the current in the conductor and to the strength of the external magnetic field when it is placed in an external magnetic field.

2. Chain Drive: The work of chain drive is used to transmit mechanical power from one place to another. It is generally used to convey power to the wheels of a vehicle like bicycles, motorcycles etc. In this the power is conveyed by a roller chain called the drive chain by passing it over a sprocket gear. The sprocket gear teeth are meshed with the holes in the links of the chain. The chain is pulled by putting mechanical force as the gear is turned.

3. Propeller: In propeller the power is transmitted by converting rotational motion into thrust. The blades are of airfoil-shaped. A fluid may be air or water is accelerated behind the blade by producing a pressure difference between the forward and rear surfaces of the blade.

4. Conveyor belt: According to Mechanical Engineering conveyor belts are flexible endless strip of fabric or linked plates driven by rollers and used to transport objects. Belt conveyor is one of the basic tools in material handling industry. It is most commonly used in transportation of bulk materials such as grain, salt, coal, ore, sand, etc.

5. Spur Gear: Spur gear is the most common type of gear used. For transmitting power between two parallel shafts spur gears are used. Here the teeth cut on the cylindrical face are parallel to the axis of the gear. Cutting teeth can be done though several types of profiles on a spur gear, we commonly use involute teeth profile. For transmitting rotational motion between parallel shafts a spur gear drive is used. A combination of two spur gears properly meshed with each other is nothing but a spur gear drive.

6. RF Transmitter and Receiver: The RF receiver is used to receive the encoded data which is transmitted by the RF transmitter. A transistor is used which acts as amplifier. From RF receiver the received data is given to transistor. Then the amplified signal is given to carrier demodulator section in which transistor is turn on and turn off and it is depends on the signal. Because of this the capacitor is get charge and discharge so the carrier signal is removed and saw tooth signal is appeared across the capacitor. Then this saw tooth signal is given to comparator, its circuit is constructed by LM558. Now the comparator is used to convert the saw tooth signal to exact square pulse, then for getting the decoded original signal the encoded signal is given to decoder.

7. Control Unit: Since its emergence in the early 1980's the microcontroller has been recognized as a general purpose building block for intelligent digital systems. As it has generated a great deal of interest and enthusiasm among students, teachers and practicing engineers, it is needed to create an acute education for imparting the knowledge of microcontroller based system design and development.

8. Microcontroller is a general purpose device. In microcontroller, a number of the components of a microprocessor system are integrated on to a single chip. For making microcontroller as a mini computer it has inbuilt CPU, memory and peripherals. A microcontroller combines on to the same microchip: The CPU core Memory (both ROM and RAM). As compared to microprocessor microcontroller is better. It has extra peripherals devices connected to enhance the connectivity. It can hold the instruction. It has input and output devices connectivity. Instruction handling capacity of microcontroller is much better. Instructions written in microcontroller is long lasting i.e. never corrupts.

D. Dimensions of the Components:
1. Shaft

Table 1. Dimensions of Shaft

Sr. No.	Mechanical Description	Dimensions
1.	Shaft length	44cm
2.	Outer diameter	2.54cm

2. Battery

Table 2. Battery Specifications

Sr. No.	Mechanical Description	Dimensions

1.	Length	15cm
2.	Width	6.4cm
3	Voltage	12 V
4	Current	7 Ampere

3. Spur Gear

Table 3. Dimensions for Spur Gear

Sr. No.	Mechanical Description	Dimensions
1.	Pitch diameter of pinion	36 mm
2.	Teeth of the Gear	
	Pinion	24
	Gear	48
3.	Module	3 mm

4. Chain

Table 4. Dimensions for chain

Sr. No.	Mechanical Description	Dimensions
1	Chain No.	50
2	Pitch Circle diameter of sprocket	84mm
3	Length of the chain	90.23mm
4	Chain No.	50
5	Pitch circle diameter of sprocket	106mm
6	Length of the chain	213.19mm

IV. RESULTS AND DISCUSSION

While conducting study from newspaper articles, news reports, observations and literature review of existing projects, the problems faced during tackling the issues of cleaning surface of water from water reservoirs. The problems were identified and studied with the help of data collected during the study and applying the basic knowledge of mechanical engineering for overcoming the problem. Finally it can came up with a machine with organized simple mechanism and the final product is shown in fig. It overcomes the water pollution. It is non-conventional river cleaning system. Less maintenance, there is no such system where regular maintenance is required. It is very beneficial for small as well as big lake, where garbage is present in large amount, it can collect this garbage as clean the lake. Its initial cost is less. No consumption of fuels, as fuels like petrol and diesel can be saved because of battery operated

system. Skill worker not required to drive the system self-propel.

Figure 1. Remote Operated Floating Trash Collector

V. CONCLUSION AND FUTURE SCOPE

In this paper various machines of river cleaning has been discussed. Implemented machine is found to be very useful based various parameters like proposed design is efficient, less risk of life as machine is driverless, easy replacement and installation of various parts. Effectiveness of proposed machine time wise and cost wise. Easy to handle, operate and understand the working fundamentals of the machine. Project is made with planning that it provides flexibility in operation. It does not requires fuels like petrol or diesel to operation, pollution factor is also reduced. The project is designed with the view that it must be very much economical, efficient and helpful to river and pond cleaning.

REFERENCES

[1] Emily Wax, *"A Sacred River Endangered by Global Warming"*, Washington post, June 2007.
[2] Hyde, Natalie, *"Population patterns : what factors determine the location and growth of human settlements?".* New York: Crabtree Pub. p. 15. ISBN 978-0-7787-5182-3, 2010.
[3] Ketan V. Dhande, "*Design and Fabrication of River Cleaning System*",International Journal of Modern trends in Engineering and Research'Volume 4, Issue 2 , ISSN (Print) : 2393-8161, February-2017.
[4] Ganesh S. Khekare, "*Design of emergency system for intelligent traffic system using VANET*", IEEE International conference on Information Communication and Embedded Systems (ICICES2014), pp. 1-7, 2014.
[5] Ganesh S. Khekare, Apeksha V. Sakhare "*A smart city framework for intelligent traffic system using VANET*", IEEE International conference on Automation, Computing, Communication, Control and Compressed Sensing (iMac4s2013), pp. 302-305, 2013.

[6] Ajay Dhumal, "*Study of River Harvesting and Trash Cleaning Machine*", International Joiurnal of Innovative reasearch in Science and Engineering, Vol. 2, Issue 3 ISSN: 2454-9665, March-2016.

[7] N.G.Jogi, "*Efficient Lake Garbage Coleector By Using Pedal Operated Boat*" 'International Journal of Modern trends in Engineering and Research' Volume 02, Issue 04 ISSN: 2455-1457, April-2016.

[8] Girish Gaude, Samarth Borkar, "*Comprehensive survey on underwater object detection and tracking*", International journal of computer science and engineering, Vol.6, Issue.11, pp.304-313, E-ISSN: 2347-2693, Nov 2018.

[9] Dinesh Lingote, Girish Katkar, Ritesh Vijay, R. B. Biniwale, "*Responsive Information generation system for Kanhan River, an effective information system for river modeling",* International journal of computer science and engineering, Vol.6, Issue.12, pp.213-221, E-ISSN: 2347-2693, Dec 2018.

Authors Profile

Mr Ganesh S. Khekare pursed Bachelor of Engineering from Priyadarshini College of Engineering, Nagpur in 2010 and Master of Engineering from G. H. Raisoni College of Engineering, Nagpur in year 2013. Currently working as Assistant Professor in Department of Information Technology, G. H. Raisoni College of Engineering, Nagpur since 2012. He is a member of ACM since 2014, a life member of the ISTE as well as IAENG since 2018. He has published more than 8 research papers in reputed international journals including Thomson Reuters (Scopus & Web of Science) and conferences including IEEE and it's also available online. His main research work focuses on Embedded Systems, VANET, Image Processing and Internet of Things, Smart Cities, Data Analytics, etc. He has more than 8 years of teaching experience and 2 years of research experince.

Ms Urvashi T. Dhanre pursed Bachelor of Engineering and Master of Technology from Kavikulguru Institute Of Technology And Science, Ramtek in year 2015. She is currently working as Assistant Professor in Department Mechanical Engineering, Priyadarshini College of Engineering, Nagpur since 2015. She is a member of IAENG since 2018. He has published more than 04 research papers in reputed international journals including Thomson Reuters (SCI & Web of Science) and conferences including IEEE and it's also available online. Her main research work focuses on gas turbine combuster, boiler, thermal engineering, fabrication. She has 4 years of teaching experience and 2 years of research experience.

Mr Gaurav T. Dhanre pursed Bachelor of Engineering and Master of Technology from Kavikulguru Institute Of Technology And Science, Ramtek in year 2015. He is currently working as Operational and Maintance Head in Thermax Limited, Kolhapur since 2016. He is a member of IAENG since 2018. He has published more than 03 research papers in reputed international journals including Thomson Reuters (SCI & Web of Science) and conferences including IEEE and it's also available online. His main research work focuses on gas turbine combuster, boiler, thermal engineering, fabrication. He has more than 6 years of industry experience and 2 years of research experience.

Ms Sarika Yede pursed Bachelor of Engineering and Master of Technology from Bapurav Deshmukh College of Engineering, Wardha in year 2014. She is currently working as Assistant Professor in Department Mechanical Engineering, Shri Shankar Prasad Agnihotri College of Engineering, Nagpur since 2014. She is a member of IAENG since 2018. He has published more than 04 research papers in reputed international journals including Thomson Reuters (SCI & Web of Science) and conferences including IEEE and it's also available online. Her main research work focuses on gas turbine combuster, boiler, thermal engineering, fabrication. She has 4 years of teaching experience and 2 years of research experience.