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International Journal For Research in  
Applied Science and Engineering Technology



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# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

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**Volume: 7      Issue: III      Month of publication: March 2019**

**DOI: <http://doi.org/10.22214/ijraset.2019.3487>**

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# pDesign &Development of Sludge Collection Machine

Mohit Kharapkar<sup>1</sup>, Aditya Peshkar<sup>2</sup>, Mohammad Anas Rahman M Waheed Akhter<sup>3</sup>, Mohammed Shahebaz Abdul Kalam Ansari<sup>4</sup>, Vijahat Khan<sup>5</sup>, Anush Kale<sup>6</sup>, Pranjali Chaudhary<sup>7</sup>, Prof. Satish S. Markad<sup>8</sup>  
<sup>1, 2, 3, 4, 5, 6, 7, 8</sup>Guru Nanak Institute of technology, Nagpur, India

**Abstract:** *This project emphasis on design and analysis of the “Design &Development of Sludge Collection Machine”. The work has done looking at the current situation of our national rivers which are dump with corer litters of sewage and loaded with pollutants, toxic materials, debris etc. The government of our country has taken accuse to clean rivers and invest huge capital in many river cleaning projects like “NamamiGange”, "Narmada Bachao" and many major and medium projects in various cities be like Ahmadabad, Varanasi etc. By taking this into concern, this device has designed to clean river water surface. These days almost all the manufacturing process is being atomized in order to deliver the products at a quicker rate. Automation plays an important role in mass production. In this project we have fabricated the remote controlled river cleaning machine. The main aim of the project is to reduce the man power, time consumption for cleaning the river. In this project we have automated the operation of river cleaning with help of a motor and belt drive arrangement. Some needs of automation are described below. Here using wired remote to control the cleaning machine. Automation can be achieved through computers, robotics, etc., wire electronics and electrical circuit of these sources, an attractive medium for low cost automation.*

## I. INTRODUCTION

The “Design & Development of Sludge Cleaning Machine” used in that places where there is waste in the water body which are to be uninvolved. This machine consists of waterwheel driven conveyer mechanism which collect & remove the wastage, garbage & plastic wastages from water bodies. This also decrease the difficulties which we face when collection of debris take place. A machine will carry the waste surface debris from the water bodies, this will ultimately result in reduction of water pollution and lastly the aquatic animal's death to these problems will be reduced. It consists of Belt drive mechanism which carries the debris from the water. The utilization of this project will be made in rivers, ponds, lakes and other water bodies for to clean the surface water debris from bodies. Similarly they are lots of problems of water pollution under Godavari River, Nasik which affect the acoustic, human life & beauty of Godavari River. Waste water is defined as the flow of used water from homes, business industries, profitable activities and institutions which are subjected to the treatment plants by a carefully designed and engineered network of pipes. The huge impact of cleaning the chemical wastes can cause respiratory diseases and it plays a challenging issue for the municipality officers Water damage is classified as three types of impure water. These clean water, gray water and black water. Cleans water is from a broken water supply line or leaking faucet. If not treated rapidly, this water can turn into black water or gray water, depending on length of time, temperature, and contact with surrounding contaminants. A drainage conduit is a narrow channel that is dug at the side of a road or field to carry away the water. Nowadays, even though automation plays a important role in all industrial applications in the proper disposal of sewages from industries and sewage cleaning is still a severe task. Drainage pipes are used for the disposal of sewage and unfortunately sometimes there may be a loss of human life while cleaning the blockages in the drainage pipes. The municipality labors are only responsible to ensure that the sewage is clean or not. Though they clean the ditches at the side of buildings, they can't clean in very wide sewages. The borough workers need to get down into the sewage sludge to clean the wide sewage. It affects their health inadequately and also causes skin allergy.

## II. LITERATURE SURVEY

A. M. Mohamed Idhris

1) *Design and Fabrication of Remote Controlled Sewage Cleaning Machine:* Recent services are becoing polarized. With the emergence of more and more automatic terminal services, modern services are also gradually being unmanned. Thus this semi automated sewage cleaning system helps in cleaning the sewage automatically and helps in decreasing the spread of diseases due to direct human intervention into the sewage. Since the system operation mainly depends on high level programming, it can be extended as per requirements. This system is time saving, portable, affordable, consumes less power and can be made easily available so that can use this system whenever and wherever. Thus, these kinds of machines operate based on the application of

electronics engineering, mechanical engineering and electrical engineering, which are collectively termed as 'Mechatronics'. Drainage from industries is treated through this project to meet the national emission standards, with stable operation, low cost and good effect. Drainage wastewater control is treated by this method to irrigate plants, clean toilets, etc. This system functions move effectively during heavier rains, which have more volume of garbage running water.

*B. Mr. Abhijeet.*

- 1) *Design & Fabrication of River Cleaning System:* While concluding this report, we feel fulfill lots of practical experience during the manufacturing schedules of the working project model. We are happy that our knowledge has been used for social welfare. Although the design criterions with problems definitions which, however were overcome by using references & teachers guidelines. The choice of raw materials helped us in machining of the various components to very close tolerance and thereby minimizing the level of balancing problem. We will do efforts during machining, fabrication and assembly work of the project model to fulfill the need of project.

*C. Mr. P. M. Sirsat*

- 1) *Design and fabrication of River Waste Cleaning Machine:* This project is fabricated on the basis of literature and research on different journal and paper relevantly available and fabricated in accordance so it can provides flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project "Remote Operated River Cleaning Machine" is designed with the hope that it is very much economical and helpful to river and Pond cleaning. On the basis of it design and estimating cost and availability it is very cheap and very useful for the society. This project is fabricated on the basis of literature and research on different journal and paper relevantly available and fabricated in accordance so it can provides flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project "Remote Operated River Cleaning Machine" is designed with the hope that it is very much economical and helpful to river and Pond cleaning. On the basis of it design and estimating cost and availability it is very cheap and very useful for the society.

*D. Pankaj Singh Sirohi*

- 1) *Review on Advance River Cleaner:* This project design and analysis of river water cleaning machine. is fabricated on the basis of literature and research on different journal and paper relevantly available and fabricated in accordance so it can provide flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project "River water Cleaning Machine" is designed with the hope that it is very much economical and helpful to river and Pond cleaning. On the basis of it design and estimating cost and availability it is very cheap and very useful for the society.

*E. Ndubuisi c. Daniels*

- 1) *Drainage System Cleaner A Solution to Environmental Hazards:* The Drainage system cleaner is a machine which helps to protect the environment from different kinds of environmental hazards through the promotion waste management by the removal of garbage from the drainage system. These wastes when not removed end up settling in residential places where these wastes are burnt thereby causing climate change otherwise these wastes block the drainage systems thereby causing flooding. The machine is designed in such a way that it generates motion for its functions by itself through the action of running water thereby cutting out the dangers of the powering the machine by other sources of power because of the harshness of the rain on these other sources. The drainage system cleaner has three major parts which are the Propeller, the Cleaner and the Pan all make up for its effective functioning. The Drainage system cleaner was tested on three different days in the first day it rained in the months of September, October and November 2012 respectively. Based on the findings made after the test the Drainage system functioned well when there is maximum load. I therefore recommend the use of this system by various individuals, government companies and waste recycling companies for prevention of environmental hazards and also encouraging waste management. Drainage systems are blocked most times by garbage like nylon, plastic bottles, and empty cans which cluster together and find their way into the drainage systems. If these garbage are allowed to flow they will end up flowing down to recreational beaches used for tourism purposes making a scene not pleasurable to the eyes (Larsen et al 2009) else these garbage flow to residential sites where they are burnt in a way of getting rid of them, thereby causing climate change. Overflow of water drainage system occurs when there is a blockage of an end of the drainage system forcing the water to find its way elsewhere apart from the mapped out drainage system, therefore the running water spills over the horizontal height of the

drainage systems spreading to regions alongside the drainage system, thereby causing problems such as pushing down of structures such as fences, water logging of farm lands and residential buildings etc.

*F. Prof. N.G.Jogil*

1) *Efficientlake Garbage Collectorby Using Pedal Operated Boat:* This project can be improved to sort more categories of waste. In this system we can use advance conveyor system and conveyor material for increasing the efficiency of collection of garbage. We can use the solar panel for providing power to the boat instead of pedal operating operation. To modify the size of boat according to its waste collecting capacity is increases. This project make only for small lake by doing some modification in its size and capacity it can used in big lake and river like Ganga .This project can useful in clean Ganga mission. This project focused on modelling, design and wire control boat, with emphasis on lightweight, portable appliances. An innovative method of minimizing manual stress and thus reliably stabilizing the garbage collect in the boat. The project carried out by us made an impressing task in the environmental purpose. It is very useful for the small scale works.This project has been designed to perform the entire requirement task, which has also been provided.

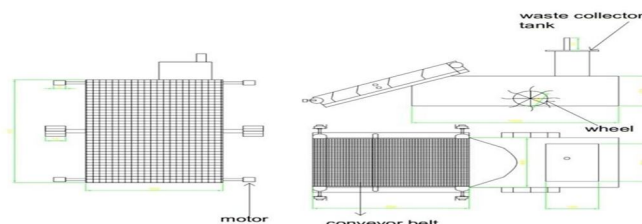
*G. Sheikh Md Shahid Md Rafique.*

1) *Design and fabrication of Sludge Cleaning Machine:* This project is fabricated on the basis of literature and research on different journal and paper relevantly available and fabricated in accordance so it can provides flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project “Remote Operated River Cleaning Machine” is designed with the hope that it is very much economical and helpful to river and Pond cleaning. On the basis of it design and estimating cost and availability it is very cheap and very useful for the society.

**III. WORKING PROCEDURE**

- 1) *STEP 1:* The battery is charged of 8-10 hours. The Design & Development of Sludge Cleaning Machine is placed in the reservoir. This machine is remote controlled. The remote control has 3 buttons and 2 switches. When the first switch is turned on and the circuit is closed
- 2) *STEP 2:* Now the second switch on the either side is turned on, an emf is induced in the circuit the DC motor start rotating in anti-clockwise direction and the conveyor rotates
- 3) *STEP 3:* Initially the button is in neutral position, Further as the first button of left side is pressed in forward direction the left propeller starts rotating in anticlockwise direction.
- 4) *STEP 4:* Similarly as the first button of left side is pressed in backward direction the left propeller starts rotating in clockwise direction.
- 5) *STEP 5:* Also when the third button of right side is pressed in forward direction the right propeller starts rotating in clockwise direction.
- 6) *STEP 6:* Similarly when the third button of right side is pressed in backward direction the right propeller starts rotating in anticlockwise direction.
- 7) *STEP 7:* The middle switch is pressed in forward and backward direction to give the direction to the machine and also to collect and bring the garbage near to the conveyor belt by the help of dc motor at the front of the machine, forward press on button rotates the motor in clockwise direction and anticlockwise in backward press of switch.
- 8) *STEP 8:* The collected waste is then carried forward with the conveyor belt into the waste collector tank.
- 9) *STEP 9:* This collected waste is then disposed manually.

*A. Line Diagram And Original View*



Line diagram of Design & Development of Sludge Cleaning Machine



Side view

Top view

### A. Design Calculations

#### 1) Basic Frame

Length = 1000 mm

Width = 275 mm  $\pm$  0.5 mm

Thickness = 15 mm  $\pm$  02 mm

Height = 175 mm  $\pm$  02 mm

#### 2) Motor Support [12 V DC 300 rpm]

Fix at the height of = 52 mm

Length = 70 mm

Width = 35 mm

#### 3) Main Shaft

Diameter = 25 mm

#### 4) Belt Drive

Belt Length = 1100 mm  $\pm$  02 mm

Belt Weight = 240 mm

#### 5) Wheel

No. of pulley = 2

circumference of pulley = 120 mm =  $\pi D$

$\therefore D = 38.2 \text{ mm} = D_1 = D_2$

Length = 340 mm

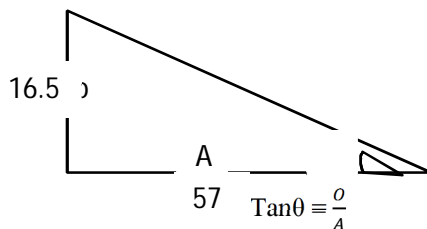
#### 6) Propeller Fan

Inner Diameter = 36 mm

Outer Diameter = 117 mm

#### 7) Conveyer Belt

Conveyer Belt makes an angle of  $18^\circ$  with respect to ground



#### 8) Design of Belt Drive

$P_d$  Design Power =  $P_R * K_L * K_Q$

$P_R \rightarrow$  Rated Power  $K_L =$  overload service factor

$K_Q =$  Capacity coefficient of inclination

$$K_Q = 1$$

$$K_L = 1.1$$

$$P_R = 0.65 \text{ Amp} * 12 \text{ V} = 7.8 \text{ Watt}$$

$$\therefore P_d = 8.58 \text{ w}$$

$$\begin{aligned} \text{Belt velocity } V_p &= \pi D N/60 \\ &= 0.6 \text{ m/sec} \end{aligned}$$

$$\text{Belt Tension } F_1 - F_2 = \frac{P_d}{V_p} = 14.3$$

$$\text{Belt Tension ratio} = \frac{F_1}{F_2} = e^{\mu\theta}$$

$$\text{Angle of loop } \theta = \pi - \frac{D_2 - D_1}{C}$$

$$\theta = 3.14^0$$

$$\therefore \frac{F_1}{F_2} = 3.29$$

$$F_1 = 3.29 F_2$$

$$\therefore F_1 = 20.54 \text{ N}$$

$$F_2 = 6.24 \text{ N}$$

Design Stress

Sd = Allowable Stress \* Efficiency of Joints

Efficiency of Joints = 0.82 ni for wire laced by hand

Allowable Stress = 1.5Mpa

$$\begin{aligned} S_d &= 1.5 * 0.82 \\ &= 1.23 \text{ Mpa} \end{aligned}$$

9) Centrifugal Stress

$$S_{CF} = \rho * V_p^2 * 10^{-6} = 70 * 26.67^2 * 10^{-6} = 4.5 * 10^{-4} \text{ MPa}$$

10) Belt Section

$$b * t = \frac{F_1}{s_d - s_{cf}} = 9.14 \text{ mm}$$

Initial Tension  $F_i$

$$2 * \sqrt{F_i} = \sqrt{F_1} + \sqrt{F_2}$$

$$F_i = 12.35 \text{ N}$$

Stress due to initial tension

$$s_i = 0.9 \text{ Mpa}$$

$$b * t = \frac{F_i}{s_i} = 13.72 \text{ mm}^2$$

selecting higher value therefore  $b * t = 13.72 \text{ mm}$

Now

$$t = 0.02 D_1 = 0.764 \text{ mm}$$

Length of Belt

$$L = \frac{\pi}{2} (D_1 + D_2) + 2C \left( \frac{D_1 - D_2}{4C} \right)^2$$

L = 1180 mm

11) Motor calculation:

12) Motor calculation:

Type: - DC Motor

Power=  $V \times I$

Where, Volt= 12V

Amp=0.65 amp

Power=  $12 \times 0.65$

= 7.8 watt

#### IV. RESULT

Pipeline backlogs are the common cause of sludge in water reservoir and obstruct the flow. Not only can this cause substantial property destruction, but also the growth of disease-causing bacteria due to some waste disposals from factories and biomedical waste, which is hazardous to our health. For these important reasons, it is necessary to have a time to time removal of garbage efficiently by a proper mechanism like Design & Development of Sludge Cleaning Machine. Hence by usage of this machine we can avoid contamination of water, water blockage and damage occurred due to the solid waste.

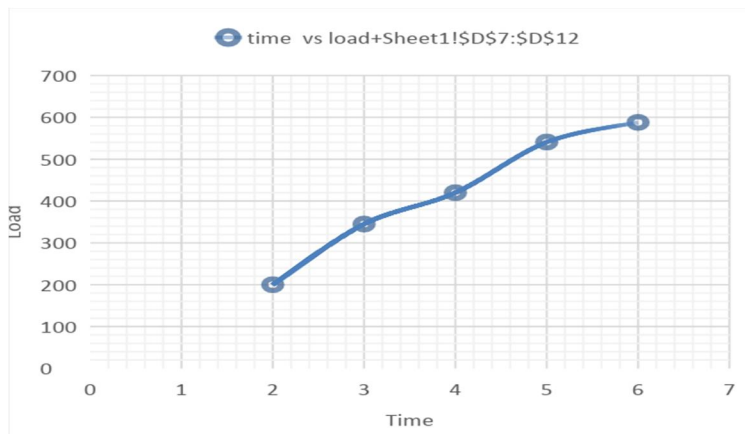
#### V. CONCLUSION

Modern services are becoming modified. With the emergence of more and more automatic terminal services, modern services are also gradually becoming unmanned. Thus this semi-automated cleaning system helps in cleaning the waste and garages automatically and helps in decreasing the spread of diseases due to direct human intervention into the lakes and ponds. This system is time saving, portable, affordable, consumes less power and can be made easily available so that can use this system whenever and wherever. Drainage from industries is treated through this project to meet the national emission values with stable operation, low cost and good effect. The rusting of teeth and gears have been overcome by modification from chain drive to belt drive, the overall weight has been also decreased makes it easy to transport, increase in efficiency and reduction in power consumption. Further described blow in graphs.

#### GRAPHS

#### Paper Waste

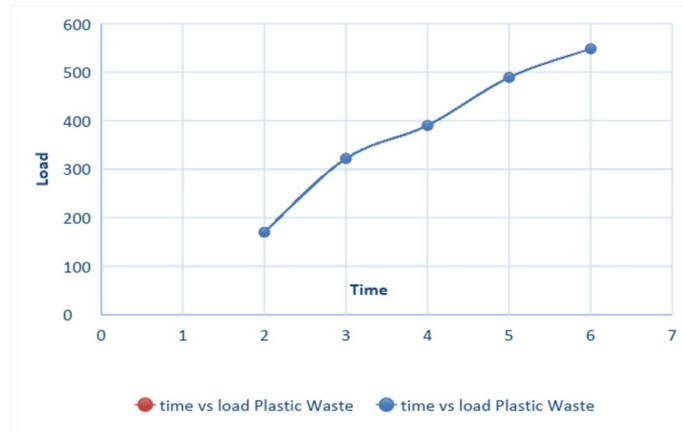
Table No. 1	Sr.no	Time min	Load
	1	2	200
	2	3	345
	3	4	420
	4	5	541
	5	6	588



Plastic Waste

Table NO.2

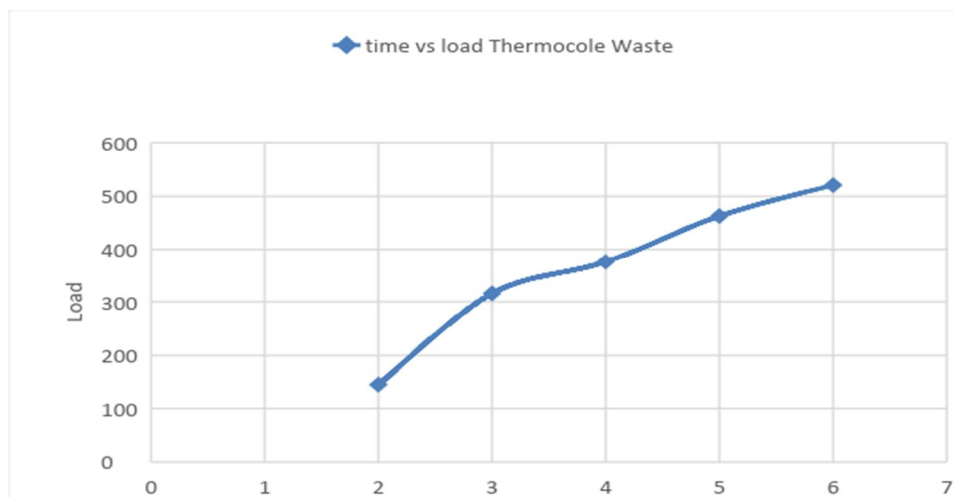
Sr.no	Time min	Load
1	2	170
2	3	322
3	4	390
4	5	489
5	6	548



Thermocol Waste

Table No.3

Sr.no	Time min	Load
1	2	145
2	3	316
3	4	376
4	5	463
5	6	521





Average Graph

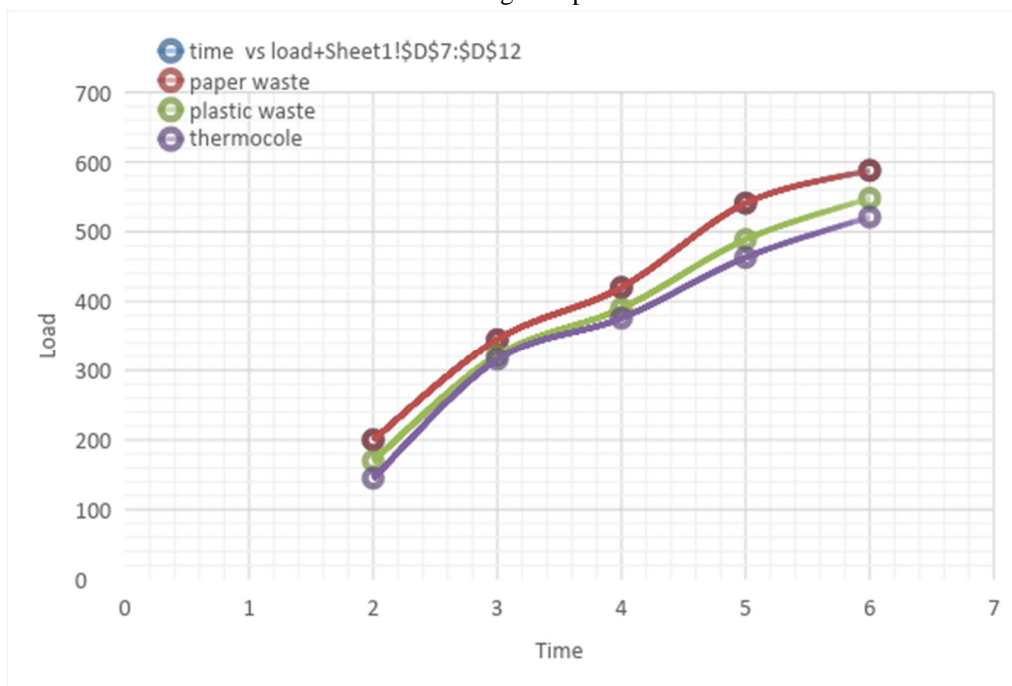


Table No.4

Average

Sr.no	Time min	Load
1	2	171.66
2	3	327.66
3	4	395.33
4	5	497.66
5	6	552.33

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