Design of Trash Cleaning Machine

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Abstract— **This project emphasis on design and analysis of trash cleaning machine. Mechanical control method involve the complete or partial removal of plants by mechanical means, including: harvesting, shredding, mowing, rototilling, and chaining. Mechanical control methods can also be used to expedite manual harvesting activities, including hand harvesting, raking, and cut stump control, with the use of motor-driven machinery (Haller 2009; Lembi 2009).**
Nowadays almost all manufacturing process is being atomized in order to deliver the product of the faster rate. The main aim of the project is to reduce manpower, time consumption for cleaning the canal. In this project we have automated the operation of canal cleaning with the help of a motor and chain drive arrangement. The device is placed at water bodies so that flow occur through lower grids. Waste like plastic bottles, cans, bio-debris, etc. are lifted up by using conveyor fitted with projecting teeth.

Keywords——**Motor, shaft, chain drive, conveyor, collector.**

I. INTRODUCTION

In developing countries, accumulation of floating waste such as plastic scraps, foam scraps or tree leaves on city canal or ponds block water drainage and cause pollutions. Cleaning water surface is therefore and essential routine task. The canal clean-up machine used in that places where there is waste debris in the water body which are to be removed. This machine consists of conveyor mechanism which collects and removes the wastage, garbage and plastic wastage from water bodies. This is also reduce the difficulties which we face when collection of debris take place. A machine will lift the waste surface debris from the water bodies, this will ultimately result in reduction of water pollution and lastly the aquatic animal death to this problem will be reduced. It consists of chain drive mechanism which lifts the debris from the water. The use of this project will be made in rivers, ponds, lakes and other water bodies for cleaning upper water waste debris.

From this project we hope to clean surface water debris from bodies. Similarly they are lot of problem of water pollution under Godavari river, Nashik which affect the acoustic, human life and beauty of Godavari river. In spite of creating lots of awareness, people use to throw the waste into the canal which in turn decomposes day by day and causes lot of disease. As manual cleaning of such pons involves lot of risk, as the person can get infected. Also there is a huge risk for endangered aquatic species. Inspired by a lake cleaning project in India.

Fig. 1: Garbage on water bodies

II. LITERATURE SURVEY

M. Mohamed Indris, M. Elampatrhi, C. Manoj Kumar, Dr. N. Nithyavathy, Mr. K. Suganeswaran, Mr. S. Arun kumar[1]

The motive of the project is to automate the sewage cleaning process in drainage, to reduce the spending of diseases to human. The black water cleaning process helps to prevent pest infestation by reducing this residue that can attract and support pests. It also improves the shelf life and sensory quality of food products. In proposed system, the machine is operated with remote control to clean the sewage. Hence, this system avoids the impacts from the sewage waste and its harmful gases. This help to prevent the mosquito generation from the wastage. This system has limited human intervention in the process of cleaning and turn reduces spreading of diseases to mankind. Modern services are becoming polarized.

Mr. P. M. Shirsat, Dr. I.A. Khan, Mr. P. V. Jadhav, Mr. P. T. Date [2]

This paper emphasis on design of trash cleaning machine. The work has done looking a current situation of our national water bodies which are dump with crore litres of sewage and loaded with pollutants, toxic materials, debris etc. The government of India has taken a charge to clean rivers and invest huge capital in many water cleaning projects like "Namami Gange", "Narmada Bachao", and many major and medium projects in various cities like Ahmedabad, Varanasi, etc. By taking this into consideration, this machine has designed to clean river water surface. Conventional method used for collection of floating waste are manual basis or by means of boat, thrash skimmers etc. and deposited near the shore of rivers, canals etc. These methods are risky, costly, and time consuming.

Mr. Abhijeet, Mr. Ballade, Mr. Vishal S. Garde, Mr. Akash.S.Lahane and Mr. Pranav V. Boob [3]

India is holy country and during lots of festivals like Ganesh visarjan, navaratri durga puja, and mainly sianhnsth Kumbhmela there is lots of water pollution of Godavari River, Nashik. The water pollution is very important problem in rivers, ponds, and water bodies near Godavari river, Nashik. Due to increase water pollution in the form to waste debris; it is happening the life of aquatic animal and make their life in danger. Similarly sometimes the aquatic animal tends to eats surface waste debris considering it as a food; which ultimately cause the death of animals. Due to polluted water many skin diseases to human kind are observed. So that to reduce the water pollution we are trying to make water bodies clean-up machine. "Trash cleaning machine" is a machine in which involves the removing of waste debris from water surface and safely dispose from the water body. The river clean-up machine workers on hydropower to extract waste water debris, plastics and garbage from Godavari river, Nashik.

Pankaj Singh Sironi, Rahul Dev, Shubham Gautam, Vinay Kumar Singh, Saroj Kumar [4]

Canal water is used for irrigation which in return gives food to the people. They also maintain the ecology of region and bring prosperity. We made this project to clean water bodies. After implementing the project we can control the pollution of river it is very beneficial to our society. Water is the source of life. It covers 70% of the earth. But only a small portion of this previous natural resource is fit for human consumption. Out of the earth's total water 97% is stored in oceans which are not fit for human consumption. The further 3% is stored in various sources like glaciers, rivers, lakes and underground aquifers. Rivers have a special place in the lives of the Indians. Now a days we can see the water pollution is the biggest problem in our country therefore we introduce our society with an advance and movable trash cleaner. We make this project for looking clean water bodies like lake, ponds, rivers, canals etc.

Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Parwitra [5]

Nowadays, the environment problems arise in many towns in Indonesia. These problems come along by developing activities such as construction of houses, offices, and other business areas. The environmental problems occur due to several reasons; they are low budget allocation on environment management and public awareness in protecting the environment. The environment issue which comes up from year to year and still cannot be solved is about garbage and waste from various places dispose into rivers. Those garbage can clog water flow, induce the water become dirty, smelly, and often over flow so then give effect floods. This research aims to design and make the model as the garbage collector to counter accumulation of garbage in water bodies.

Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Parwitra [6]

The most sacred river in the world and national river of India is "Ganga River". Ganga is the soul of India and is Holly River in India. If we look at the current status of our national river it is very shocking we dump 29 crore litres of sewage in Ganga which is loaded with pollutants, toxins. [9] Government of India takes charge to clean rivers in Ahmadabad, Varanasi etc. All of us to know about Ganga Abhiyan. Similarly, the villages in all state of India which joint with small and big lakes and maximum villages

III. OBJECTIVES

1. To reduce the pollution in water bodies
2. To overcome the difficulty of removing waste particulate floating on water surface
3. To maintain the automation during working towards cleaning river
4. To perform fast and reliable operation during cleaning river
5. Improve the water quality of a Godavari stream or river
6. To work for society for clean up a section of stream or river
7. To record the amount of garbage removed from the water ways and give solution to local
8. To make a low cost waste accumulation and disposal concept.

IV. WORKING

In this project the main aim of this machine is to lift the waste debris from the water surface and dispose them in the tray. It consists of the arrangement of the conveyor which is placed on the shaft in bearing support; the shaft is coupled to the pedestal bearing is mounted on the MS angle frame, the frame is welded and resembles the shape of slope facing machine part. Due to hydropower power transmitted to conveyor system by means of chain drive. As the conveyor is move, it collects the water debris, waste garbage and plastic from the water bodies. As the machine is place in the water the waste debris in water will get lifted and it moves in upwards direction. As the waste debris reaches the upper extreme position it will get dropped in the tray. Hence this will result in cleaning of water surface and safe collection of waste debris from water. After collection of all wastage debris the second conveyor is convey it out of the river. The river clean-up machine is utilised long floating barriers which is being at an angle capture the plastic, making mechanical extraction possible.

Fig. 2: Trash cleaning machine

V. METHODOLOGY

Methodology used for whole processing of pump is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

Design consists of application of scientific principle, technical information and imagination for development of mechanism to perform specific function with maximum economy and efficiency. Hence careful design approach has to be adopted. The total design work has been split into to parts.

1. System design
2. Mechanical design

System design:

System design mainly concern various physical constrains and ergonomics, space requirements, arrangement of various components on frame at system, man machine interaction, no. of controls, position of controls, working environment, of maintainance, scope of improvement, weight if machine from ground level total weight of machine and a lot more. In system design we mainly concentrated on the following parameter.

System selection based on constraints our machine is used in small-scale so space is major constraints. The system is to be very compact so that it can be adjusted in small space.

Arrangement of various components:

Keeping into view the space restriction all components should be laid such that there is easy removal or servicing is possible. Every possible space is utilised in component arrangement.

Man machine interaction: friendliness of machine with the operated that is operating is an important criterion of design.

VI. DESIGN CALCULATION

Parts used
1. Chain sprocket
2. Chain
3. Conveyor
4. Dc motor
5. Switches
6. Frame
7. Collecting box

CALCULATION:

Selection of motor

The motor is use to provide the motion for the chair while climbing. The main objective is that to use the mechanism to anywhere not for the fixed area. As we need high torque during climbing we selected the geared DC motor also it reduces the problem of spark generation as compare to the AC motor.

Stair dimensions

Land: 254.0 mm

Rise: 177.8 mm

TOTAL mass acting including setup-15kg=15x9.898N=148.47 N

Normal force acting (F_n) = mgcosθ

=15 X 9.81 X COS (35)

Frictional force F_f = μF_n

=0.2X132.97

=26.594

Opposing force (Fo) = mgsinθ

=15X9.81XSIN (35)

=21.00

Torque required = (F_f + Fo) r_w

= (26.594+21.00) * 0.18

= 8.566 Nm

Shaft

Torque calculation

Power of motor=120 watt

Power transmitted by shaft,

T→Torque transmitted

$$P = \frac{2\pi NT}{60}$$

N=RPM OF MOTOR=30 RPM

T →Torque transmitted

120=2X3.14X30XT/60

T=120X60/2X3.14X30

T=0.37x10^3 Nm

Torque transmitted by sprocket

We know that,

No. of teeth (Gear), N1 = 18

No. of teeth (sprocket), N2 = 18

Ratio = R = 1: 1

Torque on sprocket = 1 × T

=0.37x10^3 Nm

Diameter of Sprocket

Periphery = π × diameter of sprocket

18 × 6.25 = π × D

$$\mathcal{D} = \frac{18 \times 6.25}{\pi}$$

D= 35.52mm

Diameter of shaft

Torque transmitted,

T = Force × radius

F=0.37X1000/18=20KG

Torque transmitted by shaft,

$$T = \frac{\pi}{16} \times \tau \times d^3$$

$$T = \frac{\pi}{16} \times \tau \times d^3$$

τ = 70 N /mm²

0.37X1000= (3.14/16) D^3x70

D=3mm

Taking factor of safety = 1.6

=4.8mm

We select dia. Of shaft = 10 mm. for safety factor

Power source:

Here we used 1*12v rechargeable DC battery to supply required current to drive high torque motor and related accessories

Specification:

1. 4 batteries of 12volts each

2. Cycle use: 14.4V - 15V

3. Standby use: 13.5V – 13.8V

4. Charging time: 6 – 8 hours with standard charger.

Pulley: In this project we used two types of pulleys

A) Driving pulley: Here we have used Aluminium material which have medium strength alloy with good mechanical properties such as corrosion resistance and weldability.

B) Idler pulley: We have plastic polymer which is light and can be easily driven. This pulley are used for giving support only to the belt

Selection of the bearing:

Here pederastic bearing are selected for radial load of transportation along with the self-weight of plate including friction being 10 kg. During 90% of time & 15 kg load during remaining 10%. The shaft rotates maximum at 30 rpm. We have to determine the value of dynamic load rating for5000hrs of operation with not more than 10% of failure

W_1 =10kg

W_2 =15kg

N=30 RPM

Therefore no. of revolution during 90% of time

L_1 =.9X15X60X5000

L_1 =4X10^6

L_2 =.1X10X60X5000

L_2 = 2.7X10^6

Basic dynamic load rating = C = $\dfrac{(L_1 * W_1^3 + L_2 * W_2^3)^{\frac{1}{3}}}{10^6}$

$$C = 2.35 x 10^{-3}$$

Selection of bolt:-

Bolt is to be fastened tightly also it will take load due to rotation. Stress for C25 steel f_t =420 kg/cm². Std. nominal diameter of bolt is 8mm. From table in design data book, diameter corresponding to M8 bolt is 8.160mm

Let us check the strength:-

Initial tension in the bolt when belt is fully tightened.

P =30 kg = 150 N is the value of force applied by hand

$$P = \frac{\pi}{4} d_c^2 x f_t$$

F_t = (300 * 4) / (3.14 * 12 x 0.84)

F_t = 3.76 N/mm²

The calculated f_t is less than the maximum f_t hence our design is safe.

VII. CONCLUSION

It is very helpful to clean canal and other water bodies. An innovative method of minimizing manual stress and thus reliably stabilizing the garbage collect in the collector. No need of any electric power to operate this trash cleaning machine. The advantage which attained from our Idea is of a better useful one and we are happy in having eco-friendly idea. Usual once make it difficult to obtain and feels bulky work, our idea provide to answer to this issue through this project we can be able to understand the difficulties in maintaining the tolerances and also the quality. Also it is very beneficial for our society. Although this system able to collect the garbage from the lake with human intervention. The objective of the project was successfully achieved. [2][3][4]

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