VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JnanaSangama, Belagavi – 590018

A Project Report
On

"Design And Fabrication Of Lake Cleaning Machine"

Submitted in partial fulfillment of the requirements as a part of the curriculum,

Bachelors of Engineering in Mechanical Engineering

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CERTIFICATE

Certified that the project work entitled "**Design and fabrication of lake cleaning machine"** is a bonafide work carried out by **Mr. Rahul, Mr. Kevin, Mr. Vinod, Mr. Madhusudan,** bonafide students of **CMR Institute of Technology** in partial fulfillment for of the requirements as a part of the curriculum, **Bachelors of Engineering in Mechanical Engineering,** of **Visvesvaraya Technological University, Belagavi** during the year **2019-20**. It is certified that all correction/suggestion indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the bachelor of engineering degree.

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Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**

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Name of the examiners	**Signature with date**
1.	
2.	

DECLARATION

We, students of Eighth Semester, B.E, Mechanical Engineering, CMR Institute of Technology, declare that the project work titled **"Design and fabrication of lake cleaning machine"** has been carried out by us and submitted in partial fulfillment of the course requirements for the award of degree in **Bachelor of Engineering in Mechanical Engineering** of **Visvesvaraya Technological University, Belagavi,** during the academic year 2019-2020.

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Place: Bengaluru

Date:

ABSTRACT

This project emphasizes on design and fabrication of the lake waste cleaning machine. The project has been done looking at the current situation of our national rivers and lakes which are dumped with crores of liters of sewage and loaded with pollutants, toxic materials, debris etc. The government of India has taken charge to clean lakes and invest huge capital in many river cleaning projects, both in north and south India. It is of absolute necessity to reduce the pollution in lakes and rivers as they are the lifeblood of civilization.

Nowadays almost all the manufacturing processes are being atomized in order to deliver the products at a faster rate. Automation plays an important role in mass production. In this project we have fabricated the remote operated lake cleaning machine. The main aim of the project is to reduce the man power, time consumption for cleaning the lake, mainly on the surface level.

In this project we have automated the operation of lake cleaning with help of a motor and chain drive arrangement. Some needs of automation are described below. Here using RF transmitter and receiver ,we can control the cleaning machine. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc.

Of these options, pneumatics form an attractive medium for low cost automation.

ACKNOWLEDGEMENT

This project work marks the end of an unforgettable journey of obtaining my Bachelor's degree. I have not travelled in vacuum on this memorable path, and I am indebted to many people for making it a great and challenging experience.

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It has been an honor to study for 4 years at CMR Institute of Technology, Bangalore, under the guidance of a constant encouraging faculty members. I would like to thank all the faculty and staff of CMR Institute of Technology, Bangalore who helped me throughout the course. Also, I would also like to recognize my fellow graduate students for their constant support and help.

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CHAPTER 1

INTRODUCTION

1.1 MOTIVATION

Lakes and rivers are the lifeblood of civilization. They provide essential water to homes, industries and essential livestock. Without the presence of a large body of fresh water, no civilization has been able to thrive. They directly and indirectly provide habitats to millions of other creatures and organisms. They are also involved in transport between two parts of the country. They are also involved in irrigation.

In our country, the lack of checking or control of the amount of sewage and effluents has resulted in most lakes and rivers being polluted completely, some of them even beyond repair. In Bengaluru alone, we can look at Bellandur lake for example. The lake has turned so toxic that authorities have given up on it. We can ensure that our existing lakes and rivers can be saved from this same fate.

This project emphasizes on design and fabrication of the lake waste cleaning machine. The project has been done looking at the current situation of our national rivers and lakes which are dumped with crores of liters of sewage and loaded with pollutants, toxic materials, debris etc. At least on the surface level, it will aim to reduce pollution by up to 80 percent.

Most common modeling and analysis tools used in today industries are CATIA V5 CAD Modeler. This is what we had used.

1.2 Overview of existing lake cleaning machines

Large-scale shallow water dredging requires large-scale dredging capacity. Traditional big dredgers with limited mobility are poorly suited for inland waters. With a fleet of amphibious multipurpose Watermasters you are equipped to handle all kinds of environments and projects of all sizes.

HOWEVER

These machines are available at a very high cost, with a higher number of mechanical parts, which are more likely to fail. If a single component fails then the whole system will collapse.

Fig 1.1. Watermaster designed in Finland

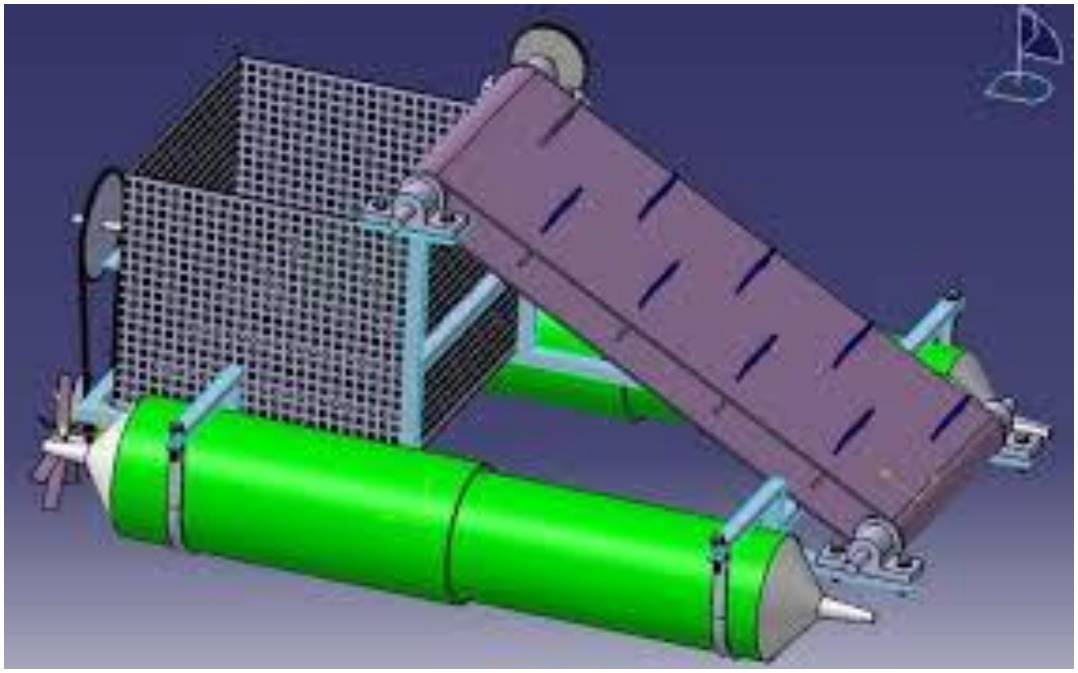

Fig 1.2 Envisioned cleaner

1.3 Problem statement

Most of the available machines are built with high cost, more starting capital. These machines are also purely mechanical, which states that if a failure occurs, it is purely mechanical. Once a component fails, it will cause complete mechanical after effects, due to mechanical damage.

We have already discussed about the importance of cleaning our existing water bodies to ensure betterment.

This project emphasizes on design and fabrication of the lake waste cleaning machine. The project has been done looking at the current

situation of our national rivers and lakes which are dumped with crores and cr crores of liters of sewage and loaded with pollutants, toxic materials, debris etc.

Analysis is of key importance as it helps to reduce cost and reduce the number of mechanical parts, thus reducing maintenance cost.

1.4 Literature review

1). M. Mohamed Idhris, M. Elamparthi, C. Manoj Kumar Dr.N. Nithyavathy, Mr. K. Suganeswaran, Mr. S. Arun kumar, DESIGN AND FABRICATION OF REMOTE CONTROLLED SEWAGE CLEANING MACHINE[1]

The motive of the project is to automate the sewage cleaning process in drainage, to reduce the spreading of diseases to human. The black water cleaning process helps to prevent pest infestations by reducing the residues that can attract and support pests. It also improves the shelf life and sensory quality of food products. In the 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 helps to prevent the mosquito generation from the wastage. The system has a wiper motor that starts running as soon as the set-up is switched on. Two power window motors are connected to the wheel and it is driven with the help of the remote control set-up. The process starts collecting the sewage wastes by using the arm and it throws back the waste into the bin fixed in the machine at the bottom. An arm is used to lift the sewage and in turn a bucket is used to collect them

2). Mr. P. M. Sirsat, Dr. I. A. Khan, Mr. P. V. Jadhav, Mr. P.T. Date Design and fabrication of River Waste Cleaning Machine [2]

This paper emphasis on design and fabrication details of the river waste cleaning machine. Work has done looking at the current situation of our national rivers which are dumped with crores of liters of sewage and loaded with pollutants, toxic materials, debris etc. The government of India has taken charge to clean rivers and invest huge capital in many river cleaning projects like “Namami Gange”, ‘’Narmada Bachao’’ and many major and medium projects in various cities like Ahmadabad, Varanasi etc. By taking this into consideration, this machine has designed to clean river water surface. Conventional methods used for collection of floating waste are manual basis or by means of boat, thrash skimmers etc. and deposited near the shore of rivers. These methods are risky, costly and time consuming. By considering

all the parameters of river surface cleaning systems and eliminating the drawback of the methods used earlier, the remote operated river cleaning machine has designed which helps in river surface cleaning effectively, efficiently and eco-friendly. The "River waste cleaning machine" is used where there is waste debris in the water body which are to be removed. This machine consists of DC motors, RF transmitter and receiver, propeller, PVC pipes and chain drive with the conveyor attached to it for collecting wastage, garbage & plastic wastages from water bodies.

3). Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Pawitra AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model [3]

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 Environment problems occur due to several reasons; they are the 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. This garbage can clog water flow, induce toxins, the water becomes dirty, smelly, and often over flow so then give effect floods. This research aims to design and make AGATOR(Automatic Garbage Collector), a rotor robot model as automatic garbage collector to counter accumulation of garbage in the river which has no flow effectively and efficiently. The method of implementation is design and construction. This method includes the identification of needs, analysis of the components required specifically, hardware and software engineering, developing, and testing. The test results obtain data by specification of AGATOR includes IC ATMega16 with 5 Volt voltage and 1,1 ampere current, IC Driver with 12 Volt voltage and 1,2 Ampere current, and Limit switch as the controller. Support devices of the robot are mechanical robot, robot control system, sensor system, and actuator robot. The maximum load drives the garbage receptacle until 5 kg. The average speed of robot when taking out the garbage is 0.26 m/s.

4). Huang Cheng, Zhang Zhi Identification of the Most Efficient Methods for Improving Water Quality in Rapid Urbanized Area Using the MIKE 11 Modelling System [4]

The Liangtan River basin is shared by Jiulongpo, Shapingba and Beibei district in Chongqing, China. The Liangtan River pilot project comprised identification of key pollution sources leading the Liangtan River basin pollution and the most efficient projects and technology for improving water quality in rapid urbanized area using the MIKE 11 modeling system. Ammonia-N (NH4 -N) and chemical oxygen demand (COD) were found to be most illustrative representing nutrient load from municipal and diffuse rural sources and industrial sources, respectively. The scenario modelling for2015 shows that in terms of improving the water quality, the different sectors should be addressed in the following order: Urban wastewater, industrial pollution load, rural wastewater, livestock pollution load, domestic solid waste and fertilizer pollution load. The largest improvements to water quality by 2015 can be achieved by enhancing municipal wastewater treatment to meet higher wastewater discharge standards for nutrients and by supporting investment in clean technology at the 50 largest industrial enterprise.

1.5 Objectives

In our country, the lack of checking or control of the amount of sewage and effluents has resulted in most lakes and rivers being polluted completely, some of them even beyond repair. In Bengaluru alone, we can look at Bellandur lake for example. The lake has turned so toxic that authorities have given up on it. We can ensure that our existing lakes and rivers can be saved from this same fate.

This project emphasizes on design and fabrication of the lake waste cleaning machine. The project has been done looking at the current situation of our national rivers and lakes which are dumped with crores of liters of sewage and loaded with pollutants, toxic materials, debris etc. At least on the surface level, it will aim to reduce pollution by up to 80 percent.

1.6 Layout of the report

Chapter 1 deals with the motivation, overview of existing cleaning machines, literature review etc.

Chapter 2 deals with the construction aspect.

Chapter 3 deals with specifications and calculations.

Chapter 4 deals with advantages and applications.

Chapter 5 deals with the conclusion.

Chapter 6 deals with the future scope.

Chapter 7 deals with references.

CHAPTER 2

CONSTRUCTION

2.1 Figure

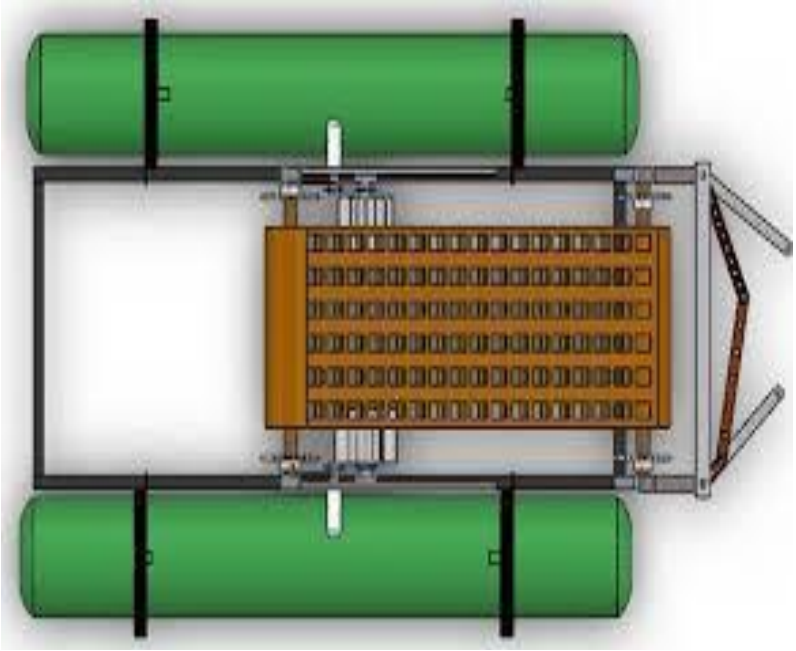

Fig2.1 CAD model of lake cleaning machine

2.2 Construction

The project consists of a motor operated water wheel to run the project. It has four DC Motor of 12V, 7.6 Ampere. The device which is running the project is chain drive coupled and having a collecting plate. The project consists of two main shafts balancing and hoisting the sprocket of chain drive. The

components are rest on frame serve as main body of the project. The steel pipe with pressurize air generates pressure head to run the project on water surface. The fabricated storage tank is used to store the waste fulfilling the purpose of the project.

2.3 Working principle

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. Here we fabricate the remote operated lake cleaning. machine. The collecting plate and chain drives are rotated. continuously by the motor. The collecting plate is coupled between the two chain drives to collect waste from the surface of the lake. The collected wastages are thrown on the collecting tray with the help of conveyer. Our project has a propeller which is used to operate the machine on the lake. The propeller is run with the help of two PMDC motor. The total electrical device is controlled by RF transmitter and receiver which use to control the machine remotely.

2.4 ASSEMBLY OF MACHINE

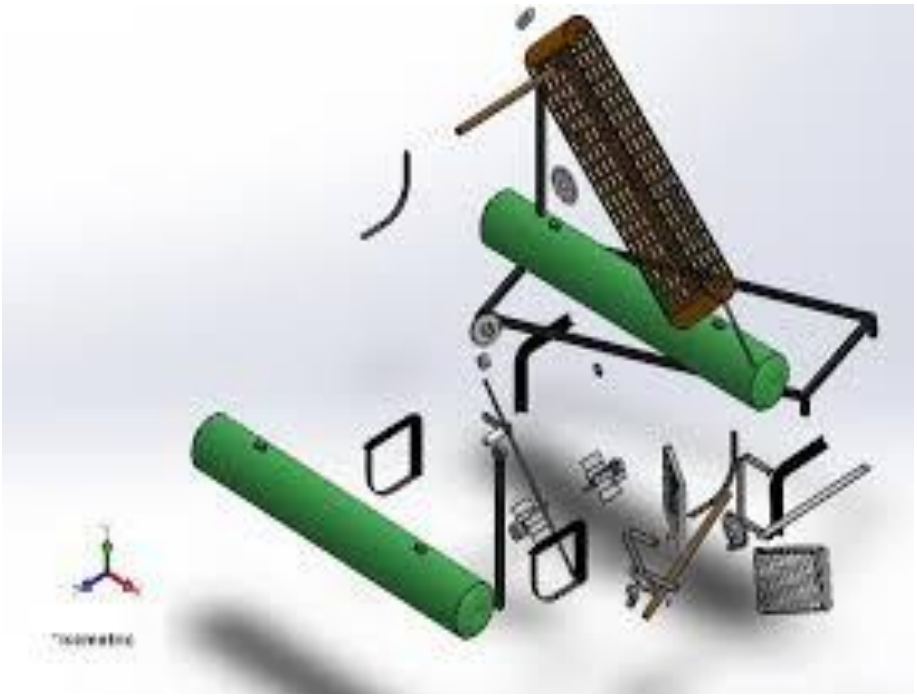

Fig 2.2 Exploded view of the model

Fig 2.3 Assembled view of lake cleaning machine

Base Frame

1. Hollow Pipe 2
2. L- Section 4
3. Inclined Section 2
4. T- section 2
5. Shaft 2
6. Motor 4
7. Gear 2
8. Sprocket
9. Bearing
10. Collecting mechanism
11. Chain
12. Carrying Belt
13. Water Wheel
14. Battery
15. Nut and Bolt
16. U shaped section 2
17. Connecting Link

2.5 Construction Procedure

1). The basic step is to assemble base frame of the project by using hand cutting machine and electric welding machine to withstand the model and its operation. The base frame is made of M.S. or waterproofed wood.

2). Hollow pipe is assembled at the base frame with the help of L- section through nut and bolt. It is made of tin sheet by using rolling and tapping operation. The purpose of this pipe is to float on water, carrying the project weight as compressed air is placed in pipe creating a differential pressure head, causing the machine to float on water.

3). L- Section is welded in base frame which is used to hold the hollow pipe with the help of nut and bolt.

4). Inclined section is welded on base frame to support the bearing and shaft.

5). T- Section is assembled on base frame by welding. It is used to support the larger chain drive with the help of bearing and shaft.

6). Shaft is used to transmit the torque from motor to chain drive. There is two shaft assembled in machine. Shaft 1 is mounted at the front chain drive of machine and shaft 2 is mounted at the rear chain drive with the help of inclined selection and T- section respectively.

7). The drive source of our project is an electric motor having 12V and 7.6 ampere current which is used to drive gear train, water wheel and collecting mechanism. Here we are used 4 motor. 1 motor is mounted on garbage collector, 2 and 3 motor is mounted on left and right water wheel and 4 motor is mounted on carrying belt with the help of gear train and chain drive mechanism.

8). Gear drive is welded on shaft with the help of connecting link and T-section. Gear drive is power transmission drive used to transmit the power from motor to chain drive as required to carry a load as desirable to complete the project objective.

9). There is 8 sprocket used in the project in which 1,2,3,4 are of same dimension is mounted on shaft of carrying belt with the help of chain and Remaining 5,6,7,8 are used to drive the water wheel which is used to float the machine in water.

10). Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and Motorcycles. It is also used in a wide variety of machines besides vehicles. The power is conveyed by a roller chain, known as the drive chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force.

11). Collecting Mechanism is used in our project to overcome real time issue as due to water tension garbage is difficult to collect.

12). By using this four bar mechanism, it rotates at a particular angle intended to collect the garbage for the model. It has two window open and close as user wishes using remote to ON and OFF the mechanism.

13). Water wheel is bolted on shaft which is placed on base frame. The purpose of water wheel is to move the machine forward or backward on water.

Motor is used to rotate the water wheel with the help of chain drive mechanism.

CHAPTER 3

Calculations and specifications

3.1 Specifications

1) Base Frame: Length= 1220mm
Width= 480mm
Square pipe of 20mm
Thickness= 2m

2) L-section*04:
Height= 8inch (203mm)
Width= 7.5inch (190.5mm)
Plates of 1 inch (25.4mm)

Mounted at 230mm from ends

3) Stand:
Height= 520mm
Fixed at 500mm from 1 side.

4) L – support to main end

5) Motor support:
Fixed at the height of 340mm
Length= 10cm
Width= 1cm

6) Dc motor
Rpm= 30
Shaft= 20mm.

7) Main shaft:
Diameter= 25.4mm.

8) Small chain drive Sprocket 2

- Sprocket Radius
- Teeth 27
- Addendum circle 2.88cm
- Base circle 2.74cm
- Pitch circle 2.80cm
- Centre distance 30 cm
- Pitch,Revolution 8mm,30/min

9). Tube:

Length=47.5 inch =1206mm

Diameter = 9cm (90mm)

10). Large chain drive sprocket 2

- Sprocket Radius
- Teeth 24
- Addendum circle 5.5cm
- Base circle 4.8cm
- Pitch circle 5.35cm
- Centre distance 90 cm
- Revolution 10/min

11). Small Chain Drive Sprocket

Sprocket Radius

- Teeth 28
- Addendum circle 3cm
- Base circle 2.5cm
- Pitch circle 2.75cm
- Centre distance 30 cm
- Revolution 23/min

12). Water wheel
Dia of water wheel- 16cm

3.2 Calculations

1). Motor calculation:

Type: - DC Motor

Power= V×I
Where, Volt= 12V

Amp=7.6 amp
Power= 12×7.6
Power= 85 watt

2). DESIGN OF SPUR GEAR

Design power

Pd=PR×Ki

Where Ki=1.25 for light shocks (8 to 10 hrs a day)

Pd=85×1.25

Pd=106.25 watt

3). Total Load:

Total load Ft=Pd÷Vp

Where,

Ft= tooth load

Vp= pitch line velocity

4). Vp= (πDpN)/ (60*1000)

Vp= (πDpN)/ 60

Where,

Dp=m×tp

tp= pinion teeth=24

Vp= (π× m×24×30)/ 60

Vp=0.03769 m

5). Ft=Pd /Vp

Ft=106.75/0.03769m

Ft=2832/m

6). Bending strength by Lewis equation,

FB= So×Cv×b×y×m

Where So=Basic strength Mpa

So=245Mpa SAE 1045 heat treated

Cv=0.4(assume)

b=Face width= 10m

Modified Lewis factor

full depth

Yp=0.485-(2.87/tp) for pinion

Yp= 0.3667

Yg=0.485-(2.87/tg) for gear

Yg= 0.42583

FB= So×Cv×b×y×m

FB= 245×0.4×10×m×0.3667×m

FB= 359.36m2

Using criteria,

Ft= FB

2832.31/m=359.36m2

m=1.99 mm

m=2 mm

Dp=48mm

Dg=96mm

FB= So×Cv×b×y×m

b=1993.75/245×0.4×0.3255×2

b= 20mm

b=10*m=20

Now, checking face width

Ft= FB

Ft= 2832.31/m= 1416.15N

Ft= 1416.15N

FB=359.36m2

FB=1438.75N

Ft< FB

.:Design is safe

7). Dynamic load:

Fd= Ft+(21Vp(Ceb+Ft)/ 21Vp+√Ceb+Ft)

Vp=0.02827*m

Vp=0.075m/sec

Where,

C=Deformation Factor table XVI-4

C=11800-(20o

full depth)

b=1

e= error in profile= 0.05

Fd= 1416.15+ (21×0.075(11800×0.05×20+1416)/

×21*.075+√11800×0.05×20+1416)

Fd=1595 N

Fd>Ft

8). Limiting wear strength

Fw=Dp×b×k×Q

Q = 2tg/tg+tp

= 2×48/48+24

Q =1.33

Fw =48*20*k*1.33

Fw=1276K

Using Criteria,

Fd=Fw

1594=1276K

K=1.24

BHN core=350

For pinion 20o

full depth involute profile

Fw=1276×1.24

Fw=1582 N

Design is safe.

9). Endurance strength

Fen =Seb×b×Yp×m

Where Seb= 596mpa

Yp=0.3667

b=20

m=2

Fen =596×20×0.3667×2

Fen= 8742 N

Fen> Fd

Hence design is safe.

10). Gear ratio:

N1/N2=T2/T1

Where,

N1=rpm of pinion

N2 = rpm of gear

T2=teeth of gear

T1 = teeth of pinion

30/N2=48/24

N2=15RPM

Power= 2πNT/60

Torque T=1416×0.048=67.96 N

Power =2×3.14×15×67.96/60

Power= 106.75Watts

Hence Design is safe.

3.3 Design procedure of chain drive and sprocket

1). Determine the velocity ratio of the chain drive
Velocity ratio = N1/N2
So, N1/N2 = T2/T1, velocity ratio = 1

2). Select the minimum number of teeth on the
smallest sprocket or pinion.
Minimum Number Of Teeth On The Sprocket = 18

3). Determine the design power by using the service

factor, such that

Design power = Rated power x Service factor (Ks)

= 106.25 x Service factor (Ks)

= 106.25 x (Load factorK1) x(Lubrication factor K2)x

Rating factor (K3)

= 106.25 x (1.5 x 1 x 1.25)

Design power = 0.20kW

4). Choose the type of chain, number of strands for the

Design power and RPM of the sprocket

Types of chain = simple roller chain (06B)

Power rating (in kW) = 0.25

Speed of sprocket or pinion (RPM) = 30

5). Note down the parameters of the chain, such as

pitch, roller dia

minimum width of roller.

Pitch (mm) = 9.525

Roller diameter (mm) = 6.535

Minimum width (mm) = 5.72

Braking load (simple type roller chain) in k N = 8.9

6). Determine the load (W) on the chain by using the

following relation,

Pitch line velocity = dN/60

= (3.14 x 0.06 x 30) / 60

Pitch line velocity = 0.0942 m/s

W= Rated power/pitch line velocity

W = 0.25/ pitch line velocity

W= 0.25 / 0.0942

W = 2.65KN

Load on the chain W= 2650N

7). Calculate the factor of safety by dividing the

breaking load (WB) to the load on the chain (W).

This value of factor should be greater than the value.

Factor of safety = (WB/W) = 8.9/2.65

Factor of safety = 3.358

DESIGN OF WATER WHEEL

8). Power of Motor is(P): 85 watt

Diameter of water wheel(d):160 mm

Velocity: πxdxN/60

A calculated RPM is 30

V=0.255 m/se

9). Torque:

Power=2πNT/60

T=85x60/2πx30

T=27.05 Nm

CHAPTER 4

ADVANTAGES AND APPLICATIONS

4.1 ADVANTAGES

1) It is a non-conventional river cleaning system.

2) Its initial & maintenance cost is low.

3) Skill workers are required to drive the system.

4) Environment friendly system.

5) Easy in operation.

6).Makes use of hydropower so easy to maintain

4.2 APPLICATIONS

1). It helps in cleaning surface pollution present.

2). Adjusting the size of the net can also help to clear out sediments.

3). Can be used to clear dead fish and solid waste in fisheries.

CHAPTER 5

CONCLUSION

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 society.

This machine has only a few parts which can be manufactured or bought easily. Flowing water that is used to carry waste itself powers the machine completely. Overall it is environmentally friendly and also reduces the usage of power, from other sources.

CHAPTER 6

FUTURE SCOPE

In the future this project can be improved to sort more categories of waste. In this system we can use advance conveyor system and conveyor material to increase the efficiency of collection of garbage. We can use solar panels for providing power to the boat instead of battery operation. To modify the size of boat according to its waste collecting capacity can be increased. This project is made only for small lake but with modifications to the project, can be amped up to use with bigger lakes.

CHAPTER 7

REFERENCES

[1] M. Mohamed Idhris, M.Elamparthi,C. Manoj Kumar, Dr.N.Nithyavathy, Mr. K. Suganeswaran, Mr. S. Arunkumar, "Design and fabrication of remote controlled sewage cleaning Machine", IJETT – Volume-45 Number2 -March 2017

[2] Mr. P. M. Sirsat, Dr. I. A. Khan, Mr. P. V. Jadhav, Mr. P. T. Date, "Design and fabrication of River Waste Cleaning Machine", IJCMES 2017 Special Issue-1 ISSN: 2455-5304

[3] Huang Cheng, Zhang Zhi*,"Identification of the Most Efficient Methods For Improving Water Quality in Rapid Urbanized Area Using the MIKE 11 Modelling System",2015 Seventh International Conference on Measuring Technology and Mechatronics Automation

[4] Cary, Howard B; Helzer, Scott C.(2005)."Modern Welding Technology Upper Saddle River", New Jersey: Pearson Education

[5] Ndubuisi c. Daniels, "Drainage System Cleaner A Solution to Environmental Hazards", IRJES) ISSN (Online) 2319- 183X, Volume3, Issue 3(March 2014)

[6] Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Pawitra, "AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model" International Journal of Future Computer and Communication, Vol. 3, No. 5, October 2014.

[7] Basant Rai, "Polltution and Conservation of ganga river in modern India", International Journal of Scientific and Research Publications, Volume 3, Issue 4, April 2013 1 ISSN 2250-315.

[8]Dr. K Lingaiah.
DME II handbook.