Design AND Fabrication OF River Water Garbage Collector WITH Power Generation AND Purification

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Abstract- *The Design and Fabrication of River water garbage collector with power generation and purification is been done to clean the river water by collecting the floating garbage waste using machine instead of collecting it manually. And this process helps in purification of river water which is infected by other wastes, suspended particles and chemicals and this process also helps in power generation. In order to replace the traditional manual cleaning rivers and lakes water garbage and so on, and then improve the clean-up efficiency, while addressing the labor force of large salvage, low security issues this process is adopted. This mechanism is eco-friendly and low initial investment and low maintenance*

Keywords- garbage collector, power, purification,river.

I. INTRODUCTION

The "River water garbage collector with power generator and purifier" used in that places where there is waste debris in the water body which are to be removed. This machine is consisting of waterwheel driven conveyer mechanism which collect & remove the wastage, garbage & plastic wastages from water bodies. This 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.

Hydroelectric power is basically electrical energy that has been generated using natural force such as flowing water. In this machine, the turbine is designed in such a way that when the turbine rotates by means of water, the propeller in turns rotates a shaft which is connected to mini power generator.

Water as the important source, the rivers played the very important role in human society's development, in particular urban river, but in order to meet the need of human itself, People regardless of river ecological balance and health development, the massive below standards and without treatment sewage has entered the river course, in particular serious pollution which produces to the city river course. By using mesh and semi-permeable membrane purification can be done.

This will ultimately result in reduction of water pollution and the aquatic animal's death to these problems will be reduced.

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 the surface water debris from bodies. Similarly, they are lots of problems of water pollution.

II. LITERATURE REVIEW

1. Amphibious clean - up robot

Nan Pan, Lifeng Kan, Yajun Sun, Jinlun Dai Kunming University of Science & Technology.

In order to replace the traditional manual cleaning rivers and lakes water hyacinth, garbage and so on, and then improve the clean-up efficiency, while addressing the labor force of large salvage, low security issues, a new amphibious cleaning robot is developed. The robot is mainly composed of solar automatic tracking system, amphibious system, rotary gather system, rotary collection system and so on. Its structure is simple, safe and reliable, and it takes solar energy as the main source of energy.

2. Experimental research on purification of different aquatic plants in the urban river's

Wang Ying, Shao Xiazhen, Yu Yangming Key Laboratory of Northwest Water Resources and environmental Ecology of Education Ministry Xi'an University of Technology.

Using the water hyacinth、Hydrilla verticillata and Hydrilla verticillate water hyacinth combination to conduct the purification research, which simulates the urban river water, the experimental study discovery, under the move water condition which the velocity of flow is 1.74cm/s, the water hyacinth group has obvious superiority to TN, TP, COD and Turbidity purifies, the average elimination rate of TN, TP and COD achieves74.92%, 87.8%, and 78.19% respectively. With NH3-N elimination and DO density maintain the Hydrilla verticillata group has good effect, the average elimination rate of NH3-N achieves 87.79.

3. Designing a Small Hydro Power Plant Capable Of Producing 10 MW of Electricity at

Webeye along River Nzoia, *CholDhieuGabriel, University of Nairobi.*

The objective of this project is to come up with the design of small hydropower plant capable of generating 10 MW at river Nzoia passing through Webuye East constituency. The entire Bungoma County is suffering from power shortage. This is because the power from the national grid is not sufficient to cater for the demand of the area. In addition to this, the additional power from the hydropower plant will attract investors to the area.

4. AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model

***OsianyNurlansa, DewiAnisaIstiqomah, and MahendraAstuSangghaPawitra, Member, IACSIT*.**

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**.**

5. Ceramic Membrane Filtration

James E. Amburgey, Ph.D. University of North Carolina at Charlotte,TanjuKaranfil, Ph.D. Clemson University.

To meet the growing water demands as well as higher water quality standards, membranes have been successfully tested and recognized as an alternative to conventional water treatment methods. Typical conventional water treatment processes include coagulation, flocculation, sedimentation, filtration, and disinfection.

6. Small-scale Water Current Turbines for River Applications

***Kari Sornes,Zero Emission Resource Organization*.**

Water current turbines, or hydrokinetic turbines, produce electricity directly from the flowing water in a river or a stream. No dam or artificial head is needed to produce the small-scale power output. Several of the devices mentioned in the report may have application in tidal waters, ocean currents and manmade channels, but the scope of this report is limited to applications in free-flowing rivers.

7. Surface Water Treatment Technologies

St. Johns River Water Supply Project.

Selecting treatment technologies for any water treatment system is driven primarily by drinking water regulations and the meeting of consumer expectations. For surface water treatment, the primary regulations are the Enhanced Surface Water Treatment Rules (ESWTR) and the Disinfectant/Disinfectant Byproduct (D/DBP) Rules.

8. Ocean Current Turbine

Noor Rahman, Saeed Badshah, AbdurRafai, MujahidBadshah.

Humanity is facing energy crises and researchers are working to solve these energy crises. They are exploring the new energy resources which will be less harmful and less environment damaging. The ocean has covered about 70% of our planet earth and it composed of a huge potential energy in different forms.

9. Efficient Lake Garbage Collector by using Pedal Operated Boat

Prof. N.G.Jogi1, AkashDambhare, KundanGolekar, Akshay Giri, Shubham Take.

The most sacred river in the world and the national river of India “Ganga River.” Ganga is the soul of India and is Holly River in India. If we look at current status of our national river it is very shocking we dump about 29 crore liters of sewage in Ganga which is loaded with pollutants, toxins. We also dump tones of municipal solid waste. The government Of India takes charge to clean rivers Ahmadabad, Varanasi, etc.

10. Design And Fabrication Of River Cleaning Machine

Sheikh MdShahidMdRafique, Dr. AkashLangde, Dept. of Mechanical Engineering, Anjuman college of Engineering and Technology Nagpur, Maharashtra, India.

This project emphasis on design and fabrication of the river waste cleaning machine. The work has done looking at the current situation of our national rivers which are dump with crore 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 “NamamiGange”, ‘’Narmada Bachao’’ and many major and medium projects in various cities like Ahmadabad, Varanasi etc.

11. Automatic Rubbish Collector

MohdYazri Bin Ismail, Faculty of Electronic and Computer Engineering University Teknikal Malaysia Melak.

This project is to construct one automatic rubbish collector especially for river and drain and all of this process will be control by automatic system. This project will be install at a river, drain or water course. Automatic rubbish collector is not only to gather the rubbish but for the process to collect also will do by this system.

12. Development OF Hydrokinetic Power Generation System

Anurag Kumar, Dr. R. P. Saini, Student, M.Tech. Alternate Hydro Energy Centre, Indian Institute of Technology Roorkee, Uttarakhand, India.

Small scale hydropower is one of the renewable energy source of energy which has vast potential. Hydrokinetic turbines are suitable to tap this potential and the technology is recent which produces electricity from flowing water. Hydrokinetic turbines are more suitable to convert kinetic energy in the river and marine current. An extensive literature review has been carried out and presented in this paper. This paper basically summarizes existing hydrokinetic turbines and projects implemented so far.

13. Development of Electricity-Generating Technologies

Manfred Lenzen, ISA, School of Physics, The University of Sydney, Sydney, NSW 2006, Australia.

Electricity is perhaps the most versatile energy carrier in modern economies, and it is therefore fundamentally linked to human and economic development. Electricity growth has outpaced that of any other fuel, leading to ever-increasing shares in the overall mix. This trend is expected to continue throughout the following decades, as large especially rural segments of the world population in developing countries start to climb the “energy ladder” and become connected to power grids.

14. Harnessing Hydropower

D. Lumbroso, A. Hurford, J. Winpenny and S. Wade, University of Manchester.

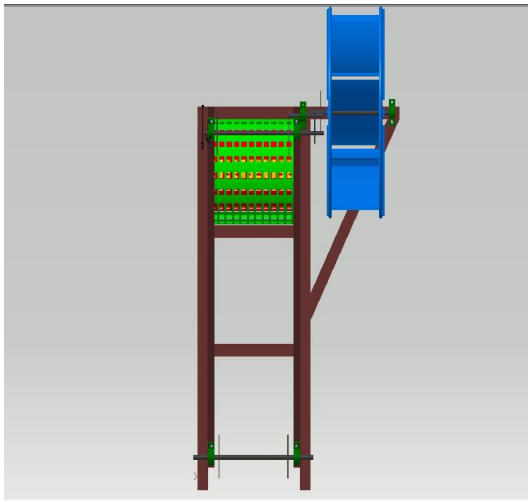
The Harnessing Hydropower study aims to provide an analysis of the historical performance of hydropower in selected countries and an assessment of the risks and opportunities related to future climate change in the context of water, energy and food security. The target audience for this work is Department for International Development (DFID) staff together with other development professionals, and government officials who are interested in the performance and development of the hydropower sector in low income countries and the trade-offs between water, energy and food security in the context of climate change.

III. OBJECTIVES

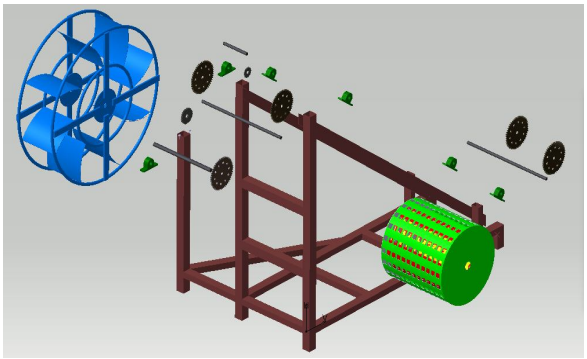
1) To reduce the pollution in water bodies.
2) To overcome the difficulty of removing waste particulate floating on water surface.
3) To maintain the automation during working towards cleaning River.
4) To perform the fast & reliable operation during cleaning River.
5) Improve the water quality of a stream or river.
6) To work for society for clean up a section of a stream or river.
7) To record the amount of garbage removed from the waterway & give solutions to local.
8) To treat the surface water for domestic purposes, by using meshes and semi-permeable membrane
9) To generate the electrical energy from water by means of turbine which in turn rotates the generator.

IV. CONSTRUCTION

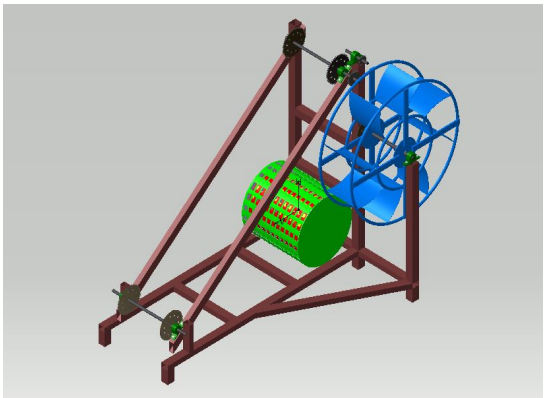
i. Model of river water garbage collector:



ii. Exploded view of the model:



iii. Assembled view of the model:



V. METHODOLOGY

River water garbage collector with power generation and purification works with the help of kinetic flow of river water. When the river water hits the turbine blades it tends to rotate ant this turbine is inturn connected to the conveyor system. By the use of turbine rotary motion the power can be generated with the help of dynamo, which is coupled with spur gear mechanism. The turbine and the conveyor is been made to rotate in opposite direction by connecting the chain drive. The bucket shaped carriers are fixed to the conveyor to carry the floating garbage wastes and they are dumped to a container at the other end of the conveyor. To convey the garbage from the floating water, the conveyor is designed and fabricated which rotates the system using the mechanical chain drive mechanism the power from the turbine is used to drive the conveyor system.

The dynamo is coupled with turbine shaft and when the turbine rotates due to the flow of river water, it inturn rotates the shaft and hence the dynamo generates power. To check the power output directly from the dynamo we have installed he LED bulbs to show the power production from the mechanism.

The water is then sent for purification process, which further helps to purify the water by removing unwanted particles and chemicals mixed with it. In this purification process there are three meshes in which the first mesh holds larger particles from going further, in second and third mesh filters small particles which pass through the first mesh and at last the semi–permeable membrane filters out soil and sand particles.

VI. COMPONENTS AND SPECIFICATIONS

1. Frame
   - Material = MS-15277
   - Length, l = 1815mm
   - Height, h = 1500mm
   - Width, w: -
   - a) At conveyor end 550mm
   - b) At turbine end 650mm
   - Rectangular hallow section: -
     - Width, w = 40mm
     - Height, h = 60mm
     - Thickness, t = 1.5mm

2. Turbine
   - a) Turbine rings: -
     - Material = MS-EN8
     - Diameter, d = 20mm
     - Inner ring diameter, d_1 = 500mm
     - Perimeter, $p_1 = \pi * d_1$
     - $p_1 = \pi * 500$
     - Outer ring diameter, d_2 = 1000mm
     - Perimeter, $p_2 = \pi * d2$
     - $p_2 = \pi * 1000$
     - Quantity = 4
   - b) Turbine Blades: -
     - Material = MS - IS277
     - Thickness, t = 2mm
     - Quantity = 8
   - c) Disc: -
     - Material = MS-IS277
     - Thickness, t = 5mm
     - Diameter, d = 210mm
     - Quantity = 2
   - d) L-section: -
     - Material = MS-IS277
     - Thickness, t= 3mm
     - Width, w = 25mm
     - Height, h = 25mm

3. Shaft
   - a) Turbine Shaft:
     - Diameter, d = 25mm
     - Hollow rod
     - Quantity = 1
   - b) Conveyor Shaft:
     - Diameter, d = 20mm

4. Bearing
   - a) PILAR BEARING:
     - Part no: - UCP204
     - Bearing no: -UC204
     - Total width = 38mm
     - Internal diameter = 20mm
     - Static load rating = 6650N
     - Dynamic load rating = 2800N
     - Weight = 0.7kg
     - Quantity = 4

b) Turbine Bearings:

Part no: UCP205
Internal diameter = 25mm
Total width = 38mm
Static load rating = 7850N
Dynamic load rating = 14000W
Weight = 0.8kg

Quantity = 2

5. Sprocket and Chain drive

a) Chain:

Pitch = 12mm
Material = high carbon steel
Quantity = 3

b) Large Sprocket:

Material = high carbon steel
Pitch = 12mm
Teeth (z) = 50
Quantity = 5

c) Small Sprocket

Material = high carbon steel
Pitch = 12mm
Teeth (z) = 33
Quantity = 1

6. Spur gear

a) Drive Gear:

Number of teeth $z_1 = 48$

Diameter $d_1 = 100$mm

b) Driven Gear:

Number of teeth $z_2 = 36$

Diameter $d_1 = 75$mm

c) Transmission Ratio:

$I = z_2/z_1 = d_2/d_1 = n_1/n_2$
$I = z_2/z_1 = 36/48$
$I = 0.75$

7. Bolt hexagonal and nut

Diameter = 8mm
Quantity = 12

8. DC Motor

Voltage = 12volt
Current = 0.35amps
Speed = 100rpm
Power = V * I = 4.2watts

9. Lithium Ion Battery

Voltage = 12volt
Current = 7.2amps
Type = Rechargeable

10. Purification Chamber

Number of meshes = 3

Mesh 1:

Material = MSIS277
Diameter = 500 mm

Mesh 2:

Material = Galvanised iron
Diameter = 400mm

Mesh 3:

Material = MSEN8
Diameter = 340 mm

Suction pipe

Material = MSIS277
Diameter = 25 mm

Semi-permeable RO membrane

Material= cotton

VII. CALCULATIONS

POWER GENERATION:

1) Torque = force × radius

$T = F \times r$

F = load of sprockets, Load of chain, Load of gear drives

r = radius of the driven gear of dynamo

Total load = 10.2 kg

$F = 10.2 \times 9.81$ N

F = 100.062 N

r = 0.0275m

$T = 100.062 \times 0.0275$

T = 2.7517 Nm

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

Case 1. N = 20 rpm

$P = \frac{2\pi \times 20 \times 2.7517}{60}$

P = 5.76 watt

Case 2. N = 30 rpm

$P = \frac{2\pi \times 30 \times 2.7517}{60}$

P = 8.644 watt

Case 3. N = 40 rpm

$P = \frac{2\pi \times 40 \times 2.7517}{60}$

P = 11.52 watt

Case 4. N = 50 rpm

$P = \frac{2\pi \times 50 \times 2.7517}{60}$

P = 14.407 watt

DC MOTOR CALCULATIONS:

Power = V × I
Rpm = 100rpm
Where, volt = 12
Current = 0.35 A
Power = 12 × 0.35
Power = 4.2 watts
PUMP CALCULATIONS:
Flow = 4.5 lpm
Flow for atleast 8 hrs. = 4.5 × 60 × 8 = 2160 l
AMOUNT OF GARBAGE COLLECTION:
Diameter of pipe d =110 mm
Length of cross-section of pipe l = 350 mm
Volume of half cylinder $v = \pi/8 \times d^2 \times l$
$V= \pi/8 \times (.110^2 \times .350)$
$V= 1.66 \times 10^{-3}\ m^3$
Number of conveyor buckets = 5
$V = 5 \times 1.663 \times 10^{-3}$
$V = 8.315 \times 10^{-3}\ m^3$

VIII. ADVANTAGES

1. Machine uses the Kinetic energy of flowing water so no power outsource is required.
2. Very eco -friendly machine.
3. Power can be generated within the same mechanism.
4. Design aspects are very simple and easy to manufacture.
5. Low maintenance.
6. Cost effective.
7. Purification of water can be done in the same system.
8. It is a non-conventional river cleaning system.

IX. APPLICATIONS

1. It is applicable to reduce water pollution in rivers & ponds.
2. It is useful to remove the sediments present in swimming pool to keep it clean.
3. It is useful to purify the water and make it reuse for the domestic purposes and other agricultural purposes.

X .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 provide flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project “river water garbage collector, with power generation and purification”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.

On Calculating and Experimenting the result are very satisfactory. The maximum river velocity is about 3.1m/s recorded as per the survey. We are able to get maximum turbine speed about 60rpm. Up to 18watt power we are able to generate with the maximum speed of 60 rpm and also about 4.5lpm of water can be purified from this system.

On the basis of these result we can conclude that it is an innovative method of minimizing manual stress and thus very much reliably stabilizing the in the pond. The project carried out by us made an impressing task in the environmental purpose and it is very useful for the small-scale works. Although this system able to collect the garbage from the lake with human intervention. The objective of the project was successfully achieved.

XI. FUTURE SCOPE

In future, 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 instead of battery operation for the purification of water. To modify the size of machine according to its waste collecting capacity is increases. This project makes only for small lake by doing some modification in its size and capacity it can use in big lake and river like Ganga.

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