

## Design and Development of Unmanned River Water Trash Collector

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### ABSTRACT

Water is the most vital source for sustainability of life. River water quality in rapidly urbanizing Asian cities threatens to damage the resource base on which human health, economic growth and poverty reduction all depend. This project emphasis the design and fabrication of unmanned river water surface trash collecting machine. In this project we have fabricated the remote operated river cleaning machine. The main aim of the project is to reduce the man power, time consumption for surface trash collection the river. An automated the operation of river cleaning with help of a motor and chain drive arrangement is developed.

**Keywords:-** River water; trash collecting machine; water quality; human health.

### I. INTRODUCTION

Rivers carry water and nutrients to areas all around the earth. They play a very important part in the water cycle, acting as drainage channels for surface water. Rivers drain nearly 75% of the earth's land surface. Rivers provide excellent habitat and food for many of the earth's organisms. However, river absorbs more than a billion gallons of waste each day, three-quarters of it raw sewage and domestic waste while the rest industrial effluent, making it one of the ten most polluted rivers in the world. Unquestionably clean, healthy rivers reduce human health risk and improved quality of life. Less trash increase recreational activities along rivers-clean and safe walk and run trails for the community.

Water running through a water drainage system mostly carries along waste materials most which are non-biodegradable which not only cause flooding but also 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 building, etc.

The impurities present in water can cause hazardous and disease. As long as the draining system is

considered the function of the main drainage system is to collect, transport and dispose of the water through an outfall or outlet. Impurities in drainage water can be only like empty bottles, polythene bags, papers, etc. It's an Industrial Working Prototype of Entirely Solar Powered Water Cleaning Mechanism which Can auto collect floating garbage and solid waste from the water surface and collect it into its floating bin. It can be programmed, scaled up to any size and can operate remotely.

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 Water masters you are generally equipped to handle all kinds of environments and projects of all sizes.

## II. ASSEMBLING PROCEDURE

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 angle. 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.

L- Section is welded in base frame which is used to hold the hollow pipe with the help of nut and bolt. Inclined section is welded on base frame to support the bearing and shaft. 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. 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. 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.

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

### III. DESIGN CALCULATIONS

#### (i) Motor calculation

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

Where, Volt= 12V; Amp=7.6 amp;

Power=  $V \times I = 85$  watt

#### (ii) Design of Spur Gear

Design power  $P_d = P_R \times K_i$ , Where  $K_i = 1.25$  for light shocks (8 to 10 hrs a day)

$P_d = 85 \times 1.25 = 106.25$  watt

Total load  $F_t = P_d \div V_p$

Where,  $F_t$  = tooth load and  $V_p$  = pitch line velocity

(iii) **Bending strength** by Lewis equation,  $F_B =$

$$S_o \times C_v \times b \times y \times m$$

Where  $S_o$  = Basic strength Mpa;  $S_o = 245$  Mpa SAE 1045 heat treated ;  $C_v = 0.4$  (assume);  $b$  = Face width = 10m

$F_B = 245 \times 0.4 \times 10 \times m \times 0.3667 \times m = 359.36$  m<sup>2</sup>

Using criteria,  $F_t = F_B$

$2832.31/m = 359.36m^2$

$m = 1.99$ ;  $mm = m = 2$  mm Recommended

$F_B = S_o \times C_v \times b \times y \times m$

$b = 1993.75 / 245 \times 0.4 \times 0.3255 \times 2 = 20$  mm

$F_t = F_B$

$F_t = 2832.31/m = 1416.15$  N

$F_t < F_B$  (Design is safe)

#### (iv) Dynamic load:

$F_d = F_t + (21V_p(C_e b + F_t) / 21V_p + \sqrt{C_e b + F_t})$

$V_p = 0.02827 * m$  ;  $V_p = 0.075$  m/sec

Where,  $C$  = Deformation Factor table XVI-4;  $C = 11800$ -

(20o full depth);  $b = 1$ ;  $e$  = error in profile = 0.05

$F_d = 1595$  N

$d > F_t$

∴ Design is safe

#### LiPo Battery:

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated as LiPo, LIP, Li-poly, lithium-poly and others), is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers form this electrolyte. These batteries provide higher specific energy than other lithium battery types and are used in applications where weight is a critical feature, like tablet computers, cellular telephone handsets, and radio-controlled aircraft

#### bolt/nut :

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten multiple parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together.

#### ESC:

An electronic speed control or ESC is an electronic circuit with the purpose to vary a servo-motors speed, its direction and possibly also to act as a dynamic brake. ESCs are often used on motors essentially providing an electronically-generated three-phase electric power low voltage source of energy for the motor.

#### Propeller:

A propeller is a type of fan that transmits power by converting rotational motion into thrust. A pressure difference is produced between the forward and rear surfaces of the airfoil-shaped blade, and a fluid (such as air or water) is accelerated behind the blade.

Due to lack of circulation, water can become stale and undrinkable. In order to ensure safe and clean drinking water on board, boat freshwater system needs to be sanitized if it hasn't been used for some time, for example before your first use of the system after your boat has been stored for the winter. In order to clean boat water tanks, remove the old water before starting the disinfection procedure. The water cleaning boat project also includes a rotatable wireless camera which can help the controller of the boat to navigate the machine from a long distance away. Water cleaning boat runs with a motor powered propeller that uses air thrust to push the boat forward. A robotic hand with grabbing and turning ability has been affixed to the front of the boat. The hand can collect waste off the surface of the water and put it into the storage basket positioned at the back of the boat. It uses two motors to fold the arm and to work it properly

#### IV. ADVANTAGES

- This cleaning system is easy to operate and flexible.
- This system is Eco-friendly.
- This requires less man power.
- This required more use of renewable energy Sources.
- This system is Cost effective (Initial and Maintenance cost is low).
- This is efficient method.

#### V. APPLICATIONS

- Useful to reduce the water pollution in river
- It is applicable to reduce water debris, impurities, and all types of impurities which are floating on water surface in swimming pool.
- It is useful to remove the environmental marine pollution at Godavari River.
- It is useful in fishery plant to collect dead fishes.

#### VI. DISADVANTAGES

- Waste collecting capacity is limited.
- Only useful to collect waste which is floating on river surface

#### VII. FUTURE SCOPE

Now day by day world facing biggest problem of floating garbage. And it is increasing in tremendous amount so it is very difficult to clean all this floating garbage because of more requirement of manpower. so, in future this remote operated floating river cleaning machine has more scope to remove large capacity of garbage automatically as fast as possible. And by making modifications in this machine, this is used for automatically removing garbage from beaches also.

#### VIII. CONCLUSION

The motive of the project is to automate the sewage cleaning process in drainage, to reduce the spreading of diseases to human. 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 Design Calculation and specification.

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