



DESIGN, FABRICATION AND ANALYSIS OF RIVER DEBRIS CLEANER MACHINE

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Abstract: The water bodies gets contaminated by dumping of wastages which affects the environment and marine eco-system and it cause many diseases to human beings which also makes the surrounding unhealthy. This polluted water from the polluted water bodies is being used and consumed by the living organisms and human beings This problem needs a best and cost effective and efficient process to overcome the process. Thus we have come up with an idea i.e., "River Debris Cleaner Machine." This river debris cleaner is a boat which has a storage space and a roller mounted on front side of the boat of the body. The main big objective of this project is to remove river debris and it is achieved by a roller which has plates positioned at a specific angles and from the plates the wastes are transferred into the storage tanks directly. Thus the wastages are collected at a shorter period of time and the water pollution are reduced. This process can be done with low cost and low input power..

IndexTerms – River debris, water pollution, waste management.

1. INTRODUCTION

A stream is a characteristic streaming conduit, generally freshwater, streaming towards a sea, ocean, lake or another waterway. At times a stream streams into the ground and gets dry toward the finish of its course without arriving at another waterway. Little waterways can be alluded to utilizing names, for example, stream, river, creek, creek, and brook. There are no official definitions for the nonexclusive term waterway as applied to geographic highlights, in spite of the fact that in certain nations or networks a stream is characterized by its size. Numerous names for little streams are explicit to geographic area; models are "run" in certain pieces of the United States, "consume" in Scotland and upper east England, and "beck" in northern England. Here and there a stream is characterized as being bigger than a brook, yet not generally: the language is vague. Rivers are essential for the hydrological cycle. Water for the most part gathers in a waterway from precipitation through a seepage bowl from surface overflow and different sources, for example, groundwater energizes, springs, and the arrival of put away water in regular ice and snowpack's (e.g., from glaciers). Rivers and streams are frequently viewed as significant highlights inside a scene, nonetheless, they in reality just spread around 0.1% of the land on Earth. They are made clearer and huge to people by the way that numerous human urban areas and developments are worked around the freshwater provided by waterways and streams. 8.8 million metric huge amounts of plastic waste are unloaded on the planet's seas every year. Asia is the main wellspring of botched plastic waste, with China alone representing 2.4 million metric tons.

Plastic waste has arrived at all the world's seas. This plastic contamination hurts an expected 100,000 ocean turtles and marine vertebrates and 1,000,000 ocean animals each year. Larger plastics called "macro plastics, for example, plastic shopping sacks can obstruct the stomach related lots of bigger creatures when devoured by them and can cause starvation through confining the development of food, or by filling the stomach and fooling the creature into deduction it is full. Micro-plastics then again hurt littler marine life. Water contamination is the tainting of water bodies, ordinarily because of human exercises. Water bodies incorporate for instance lakes, waterways, seas, springs and groundwater. Water contamination results when toxins are brought into the common habitat. For instance, delivering insufficiently treated waste water into normal water bodies can prompt debasement of oceanic environments. Thus, this can prompt general medical issues for individuals living downstream. They may utilize a similar dirtied waterway water for drinking or washing or water system. Water contamination is the main overall reason for death and illness, for example because of water-borne sickness.

2. LITERATURE SURVEY

About 12.7 million tons of plastic squanders are arranged into water bodies which thusly makes an enormous water contamination. This influences the marine environment. Plastic compromises the presence of life submerged from littler fishes to gigantic mammals. Reports say that around 1,000,000 seabirds and 100,000 marine well evolved creatures are executed because of plastic ingestion. Several marine species are nearly elimination because of removal of squanders in water bodies.

Madhavi et al. [1]. has developed a river water cleaning using remote control in 2018. This project is mainly concerned in clean river water surface by operating the machine using mobile application. Arduino Board with a clock speed of 16MHz and a AT

mega 328 microcontroller is used. The DTR of Atmega is connected to Atmega328 via a 100 Nano farad capacitor which let the boot loader to operate at shorter time. 18V-5W Solar panel is used to generate 18V DC supply. A Polyvinyl Conveyor Belt is used to collect wastage and pushes to the storage area. The major limitation is breakage of network signal.

Rajendra et al. [2]. has developed a machine to remove unwanted plant in river in 2016. This project is mainly concerned in partial removal of unwanted plants grown in the upper surface by mechanical ways which include harvesting, shredding, mowing, rototilling and chaining using motor driven machinery. This machine has the capability to remove plants about five feet below the water and in a swath between five and ten feet wide. The harvester cutting head present in the frontline starts in removal when the plants approached the water surface. After removal of plants, the wastages are transferred to the Heavy-duty Stainless-Steel conveyer belt and deposited in the Twin Pontoon Steel storage tank provided. The collected plants are later used as compost or disposed in landfill following proper safety measures. A fire extinguisher, Life jacket and life ring is added for safety measures. There are limitations in removal area.

Saifali et al. [3]. has designed a machine in 2019 which removes the waste from the water surface using floating pipe. The two hollow pipes of 1220mm length were joint together with M-seal which collects the wastages from the water surface and transfers the waste to the 1700mm length conveyor belt and further transferred to the 450mm length collecting tray. Radio Frequency Remote control is used to operate the machine. A 12V, 7.5-amp UPS battery is used as an energy source and 50RPM DC motor is used. The capacity of machine is used for small scale works only.

Pankaj et al. [4]. developed a river cleaner in 2017 using Pelton turbine which is mainly concerned with controlling the river pollution by the energy generated by rotating turbine due to flow of water and through two conveyor belts. Pelton turbine is used to obtain maximum torque and for further rotation with high-speed water pump is used. The vertical conveyor belt with nets in it collects the waste from river and passes to horizontal belt which further passes the waste from the river to land. Then solid waste management process of incineration is carried out. This technique can't able to overcome the coverage of area limitation.

Vinod V Rampur et al. [5]. has designed a debris removal using a mechanical drainer in 2016. The upper surface of water containing the waste is made to flow through the lower basement of the machine. The floating wastes lifted up by the lifters. 12V motor is used to run the chain which revolves with sprocket wheel. After lifting the wastages, they are transferred to the storage bin. The major disadvantage is vibration occurs due to the lifting mechanism.

Ganesh S. Khakare et al. [6]. has planned a waterway squander authority machine which is distantly controlled in 2019. It comprises of a gathering plate which is associated with transport belt. PMDC engine is utilized to turn the chain drive and transport line. Belt gathers the waste and moved to the gathering tray. The absolute electrical gadgets are constrained by RF transmitter and recipient which uses to control the machine remotely. 12V battery is utilized as force source.

Prof. Sandesh M Prabhu et al. [7]. has designed a machine to remove the floating waste using Pelton turbine method in 2019. In this machine the water is made to fall in the blades of turbine. The turbine shaft can be made to drive conveyors through suitable gear drives and chain drives in order to get the desirable slow speed and more torque. The horizontal conveyor is made up of an endless belt made of plastic carried over the rollers. A series of sprockets are mounted on different shafts and the power transmitted by the gears is further transmitted through these sprockets to the conveyors by chain drives. The conveyors can carry the floating wastes away from the water body. Though it doesn't need any external power resource to work, it needs sufficient flow head to operate. This machine is only suitable for flowing water.

3. DESIGN OF RIVER DEBRIS CLEANING MACHINE:

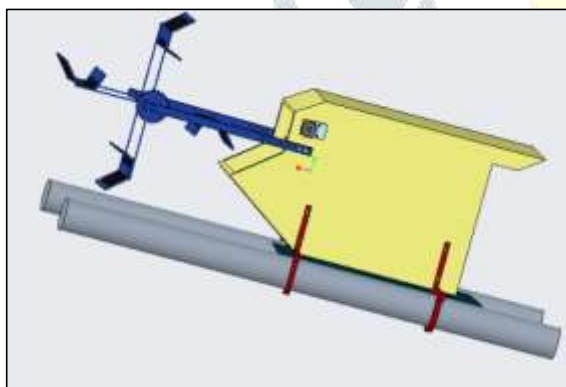


Fig. 1 CAD model of Design of River Debris Cleaner

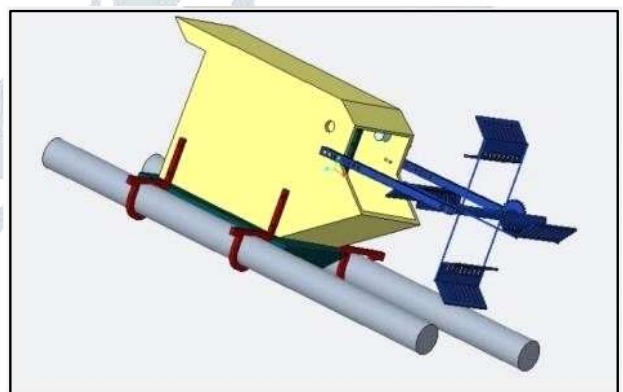


Fig. 2 Side view of the CAD model of River Debris Cleaning Machine

The river debris cleaning machine has been designed as showed in figure 1 and figure 2 considering the importance of the load to which it will be subjected to and also the flexibility for the operation. The design has been made using CAD software PTC Creo 3.0 and the analysis of the river debris machine is done by Ansys-R 19.2. The design of river debris machine includes Base, Frame, PVC, Pipes, waste collecting tank, Dc motor, Roller. The hollow base is made up of galvanized iron sheet of thickness 2mm and is filled with thermocol in order to prevent sinking.

Frame of mild steel bar of a rectangle shape is attached to the base to support the waste collecting tank. PVC pipes are fixed at the bottom of the base to provide floating effect. A 12 V DC motor is used as a powering unit to run the roller through a chain drive which in turn runs the roller blades to collect the debris. A roller is made of a metallic shaft and the roller blades are made up with metallic wire mesh welded to it.

4. ANALYSIS

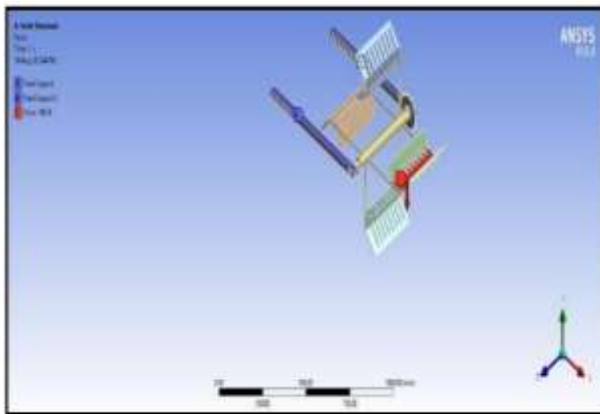


Fig. 3: Load applied in Y-direction

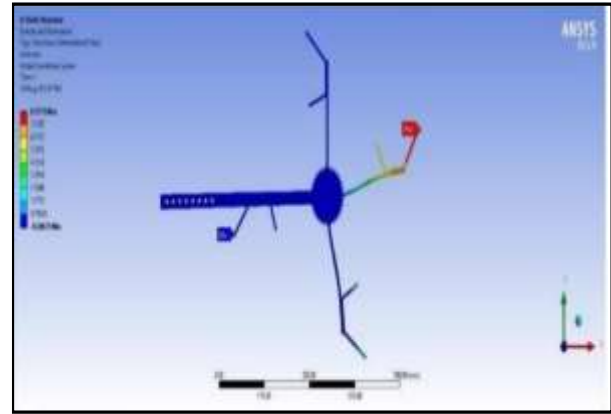


Fig. 4: Load applied in Y-direction

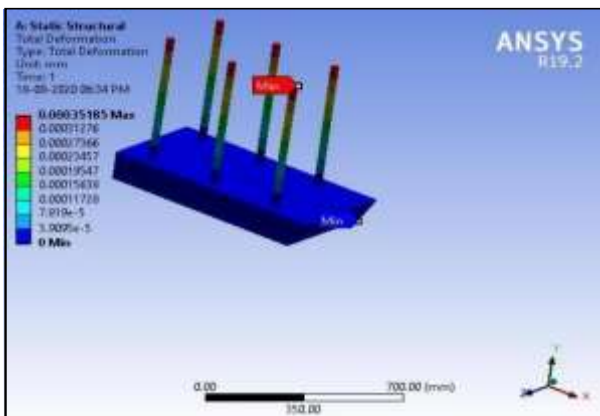


Fig. 5: Load applied to Base in Y-direction



Fig. 6: Photograph of experimental setup of a River Debris Cleaning Machine

The figure 6 shows the complete experimental setup of a River Debris Cleaning Machine. Firstly, the base is fabricated. The base is designed such that it should withstand maximum load and flexible to mechanism. The challenging task is to fabricate hollow base. The base is made up of light weight material. The hollow space is filled with thermocol. Flat rectangular rods are welded at sides using gas welding like pillars. The fabrication of roller is made using circular shaft mounted with four plates placed exactly 90 degrees. Plates are made up of circular rods, and mesh was placed in these plates. The central shaft is inserted to the hollow circular shaft through bearings then it is welded with square rods on either end these squares helped to mounting of the roller on to the base model through nuts and bolts which made the fabrication easier as well added as advantage that it helps in adjusting the height of the roller from the water level.

CONCLUSION

This paper is mainly focused on unique and economical design with lightweight and very useful for the small-scale works. River Debris Cleaner machine can be effective in the waste collecting process. It is self-sufficient and does not require any fuels to operate which makes it as eco- friendly. Solid wastes collected can be disposed by incineration.

The design is assembled and fabricated according to the CAD design and it is tested. The motor is connected to the roller and body and is tested and it worked safely. River Debris Cleaner machine is able to collect about 6-7 kgs of wastages under normal conditions. The loads are applied and the analysis of the design is done. The design is found to be safe. The machine floats in the water without any leakages.

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