

DESIGN AND DEVELOPMENT OF SOLID WASTE COLLECTING SYSTEM

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Abstract:

Generally available waste collector boats are large in size for commercial purpose to collect high waste loading for surface water cleaning purpose. On the other side, for small streams, the manual cleaning method is quite common in our country. This method is not appropriate for health purpose due to impurities present in water. Now to overcome this situation, this paper highlights a design of waste collecting advance method for cleaning purpose in small area applications like narrow rivers and canals to avoid direct contact with polluted water. The waste collector system is designed to collect floating solid wastes off the water surface to a proper storing bins. The waste then transfer to dumping yards and for recycling. The design methodology of solid waste collector boat using (Blender 2.93) for 3D representation of advance solid waste collecting system to visualize all the details of the method. The designing will conducted using most appropriate method to assure the efficiency of solid waste collecting method.

1. INTRODUCTION

Water resources like lake and river plays very important role in our ecosystem. Water is not only important for humankind but also serve ecosystem for varieties of flora and fauna. With increase in population and expansion of industries water bodies like rivers, lakes, oceans, are now getting polluted every day. Solid wastes like plastic bottles, beverages can, straws, polythene bags, etc. these solid wastes are not properly managed that is why the end up in water bodies and create adverse effects in our ecosystem. This types of wastes also create environmental problems like flash floods, logging, various diseases like malaria, cholera, typhoid fever. Solid waste collectors are those machines which are used to collect various types of solid waste from the environment. In 1965, there was first act which is passed by the group of leaders in united-states of America which is known as solid waste disposal act which comes as a revolutionary step in the field of solid waste collection. Improper disposal of municipal waste involves a serious and dangerous effect on a large part of the areas. Garbage dumped within the road or in open areas poses a public hazard, while contaminating wastewater near canals, rivers, lakes. Solid wastes are one of the major wastes in damaging the environment. To overcome this situation a solid waste collector method developed for small stream

applications like from narrow rivers, canals. The solid waste collector system was designed with conveyor belt system to collect the solid wastes from the surface of water. The design is efficient, and environmental friendly. The design was conducted using engineering method analysis to determine the most suitable design. In addition, a 3D model of solid waste collector system was formed to obtain a proper overview of the design. The performance of system was examined and evaluated to determine the effectiveness of design in collecting solid wastes from water.

1.1 : UNDERSTANDING PROBLEM

We believe that, to develop the most appropriate cleaning technologies, it is essential that we truly understand the problem. Now a days, we see lots of solid wastes in the oceans, rivers but we have to think what is the real problem behind it.

Q1. From where all these wastes are coming?

Q2. To understand the flow structure of wastes?

These two questions tells clear picture of flip side which we generally forget to discuss. 80% of ocean pollution comes from rivers and in rivers the main reason for pollution are canals and untreated sewage. In India, according to study 2007, found that discharge of untreated sewage, canals are the most important sources of surface and ground water pollution.

FLOW STRUCRUE OF SOLID WASTES

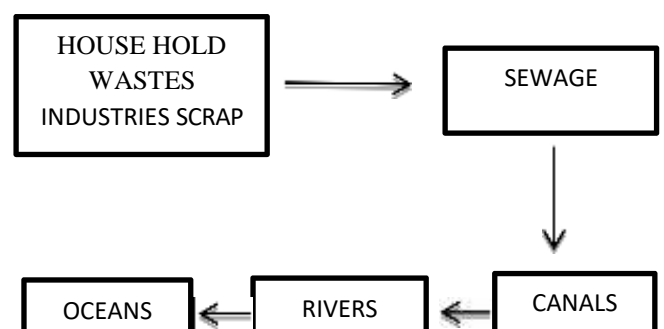


Fig. 1. Flow structure of solid wastes.

1.2 : DESIGN METHODOLOGY

The methodology for designing solid waste collector is based on engineering design and system analysis. Our aim is to design a advance solid waste collector system which stops the solids at the beginning of the flow process with a proper waste management. We focus on a method to collect the solid wastes from canals to stops the spread of solid wastes into the river and further. Special attention is given to the available design waste collector system since it is the basic reference to the development concurrent design.

2. WORKING

2.1: FUNCTION ANALYSIS METHOD

The aim of this analysis method is function required by waste collector to perform the desired work which is to collect floating solids from water. Fig. 2 shows how the solid waste collector should perform in a desired manner. It begins with the collection of floating solids off the surface of water to a proper waste management.

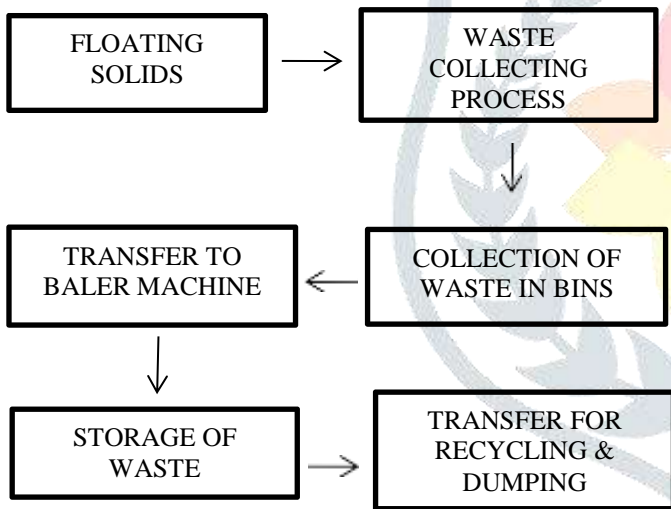


Fig 1.2 Flow chart of working principle

4. WORKING COMPONENTS

4.1: HYDRAULIC PILLARS

Hydraulic pillars are the pillars around which the meshed tooth conveyor belt is mounted across the canal. Pillars are fixed on both sides of the bank of canal but they are not mounted perpendicularly to canal, they are at some angle, if belt will mounted exactly perpendicular to the flow of water then it may oppose the flow due to which there is the chances of accumulation of waste in the middle of belt some where. Which require more power to rotate the belt. That is why there is angle given so any vector component of flow will support the flow of solid waste towards the second conveyor.

WHY HYDRAULIC PILLARS?

We use hydraulic pillars because, if there is any kind of emergency happens like, (flash flood, to let any passing of boat) then we can lift the pillars to let it pass through the canals easily without any further consideration.

4.1: CONVEYOR BELT WITH MESHED TEETH

The function of conveyor belt is to catch the floating wastes from the surface of water with help of number of teeth attached with it, and that deposit the waste at one end of bank of the canal. Conveyor belt is made up of Square hollow mild stainless steel to let the water pass easily and do not oppose the flow of the canal.

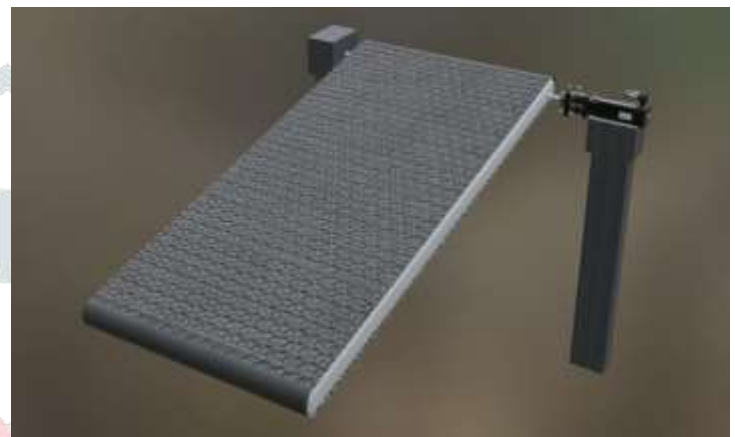


Fig 4.2 Conveyor Belt

4.2: SETS OF CONVEYOR BELT

Number of conveyor belts that will be arranged to collect waste from water to collecting bins. One of the conveyor belt will be fixed parallel to the flow of water but at some angle with ground which will pass the waste to the second conveyor which direct the wastes towards bins.

4.4 : DC MOTOR

Generally the electrical system in a running automobiles usually puts out between 13V and 13.5V, so it is safe to say that the motor can handle up to 13.5V without any problem. The minimum requirement of current for the motor is 1.6 amperes at 70 rpm, 0.9 amperes at 41 rpm (and 4 amperes if you want to run it at 106 rpm). The DC motor transforms electrical energy into mechanical energy. They used to drive devices like hoists, fans, pumps, punch-presses, and cars, pulleys. They have a definite torque-speed characteristic or a highly variable. The requirement here is that torque-speed characteristics of the motor must be adaptive to the type of the load it has to drive. This is the reason that the torque-speed characteristics of DC motors can be varied over a wide range while retaining high efficiency.



4.2: GEARS

There will be a set up of gear, shaft and chain system to transmit the power of DC motor to the conveyor belt and a set of gears to maintain the high torque and low rpm.

4.3: COLLECTING BINS

Collecting bins are bins to collect solid wastes from conveyor to transfer it to baler machine for further operation.

4.4: Baler Machine

The function of baler machine is to compress the waste material at the high pressure to reduce the volume of it. This machine compress the waste to a dense block. With baler machine we can store more waste in a small storage area, this will help to manage proper waste management.



4.4: SOLAR PANELS

Panels with High Concentrated Photovoltaic (CPV) cells are used to generate electricity from sunlight which helps to charge the battery with good efficiency. It is not possible to generate enough energy to run conveyors with single panel. We require a lot of amount of solar panels on the both sides of bank of canal to maximize the capture of sunlight to generate more power.



5. WORKING PROCESS

The design is created to collect the solid wastes such as water plants, cans and plastic bottles, toys, industries scraps, other textile wastes. The system is assumed to have a meshed tooth conveyor belt moving around hydraulic pillars across the canal which is half dipped into water surface to collect floating solids off the surface water. Now, pair of conveyors came into picture in which first one is made up of wire mesh and roller assembly and the other one with synthetic rubber. Wire mesh conveyor is moved with the help of roller assembly which is powered by the DC motor which is driven at high torque, low rpm with DC motor. Metallic teeth (bolted to mesh assembly) conveyor helps to hold and move heavy objects easily. The waste collected by the meshed conveyor with bolted teeth is then directed to the second conveyor. Second conveyor is rotated with the help of rollers assembly & these rollers are operated with the help of another DC motor. Both conveyors are operated by different DC motors and will operate simultaneously. The second conveyor direct waste towards the collecting bins from where the bins transfers waste to the baler machine. Where, the baler compresses the waste to make it compact, to reduce the volume of waste. This result in the ease of transportation of waste and now we can store a huge amount wastes into a very small area. This system is designed to use renewable source of energy that is why we use solar panels..

After that wastes cubes transfers to the storage area, from where the cubes then transfer to waste collection truck by SWM (Solid Waste Management) for further useful operations. It is assumed from many research that we can collect 50,000Kg of waste in a single day.

6. 3D MODEL REPRESENTATION

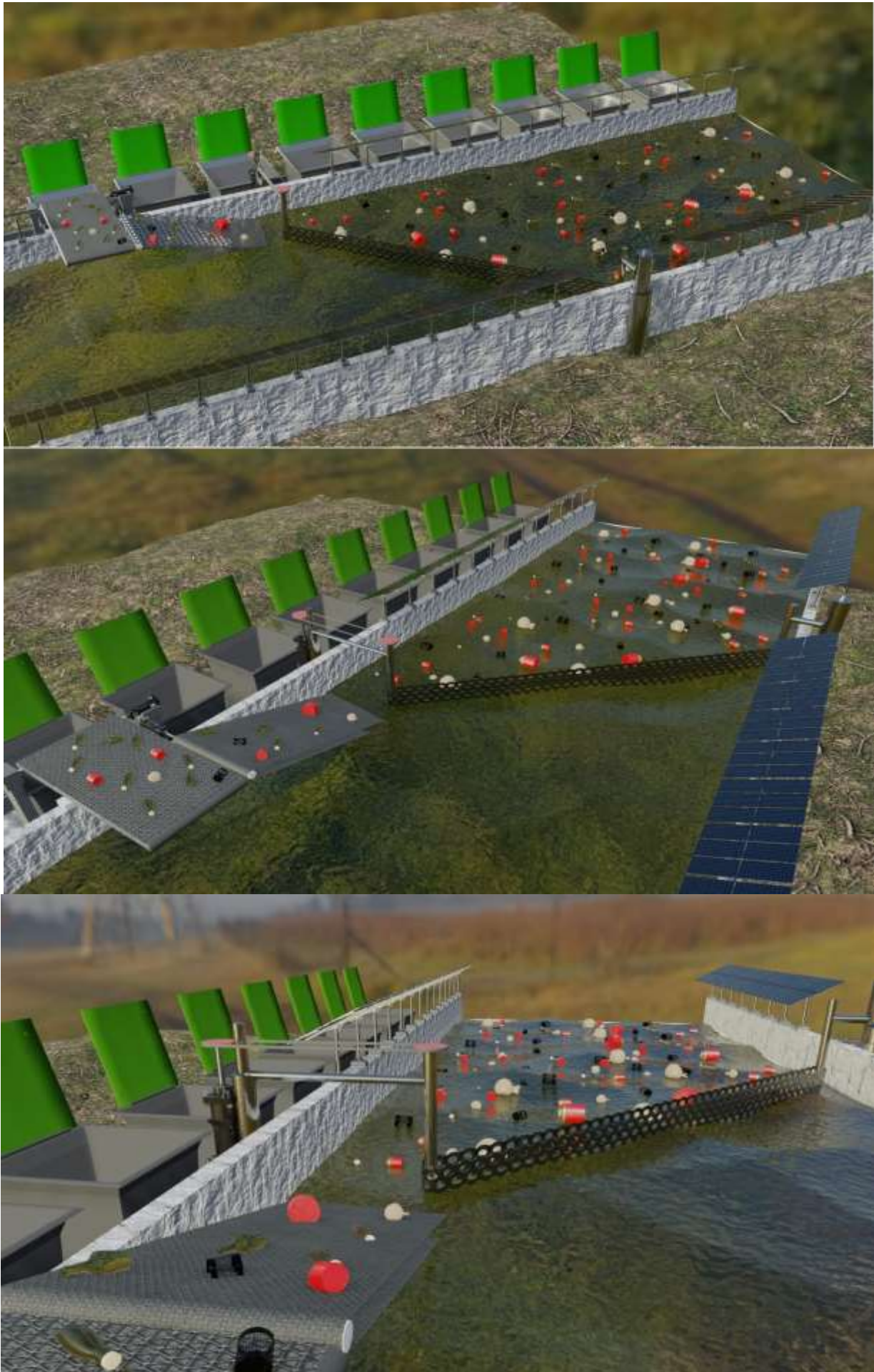




Fig 6.0 This design representation of our system is created using Blender 2.93 and a 3D model is generated to visualize and specify the function which is determined throughout analysis.

7. WASTE MANAGEMENT

Solid waste management is a term means collecting solid wastes and treating them to make it useful and for recycling wastes. Waste management is a major problem in our country because, generally people think about themselves if their work is done then they throw their belongings anywhere even

in water bodies. In this study we focus on a proper waste management from beginning to end we collect the waste off the surface water to storage. Then transfer it to SWM (Solid Waste Management) for further use of solid waste (recycling, plastic fuel, organic wastes) to dumping yard, a proper waste management was followed throughout whole process.

8. CONCLUSION

This study has successfully developed an eco-friendly idea to collect solid wastes off the surface water. We focused on the problem first, if we stop the flow of solid wastes into river up to certain limit then only we can stop the flow of solid wastes into oceans, so our aquatic ecosystem will be balanced. So we came up with this idea to stop the flow of solid wastes into the canals itself to avoid further flow to rivers. Also we came to know that there can be a problem occur like the flow of water is a crucial factor in effective removal of wastes off the surface. The power generation from solar panel may be fluctuate due to cloud and bad weather may influence the charging process. Since the system is dipped into the water, then it may damage the conveyor belt due to chemicals present into the water to avoid that we will take precaution such as coating, painting, lubrication and other techniques to resist the structure from corrosion. The problems that we faced can be enhanced and further improvements can be done in future to attain better technical output and efficiency. This idea of solid waste collector will make a motivational concern towards the government and society that how important our environmental cleanliness is for aquatic life as well as humankind and to make aware of the seriousness of these issues in future. The only way we can keep our environment clean is by changing ourselves.

9. REFERENCE

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