

Design and Fabrication of Ground Waste Collector with Grass Cutter

Jithin P Menon, Jithu K C, Indrajith V V, Krishna Prasad K M

^{I,II,III,IV}Student, Sreepathy Institute of Management And Technology / APJ Abdul Kalam Technological University, Koottanad, Palakkad, Kerala, India

Abstract

This project deals with a totally different ground waste collecting mechanism from the existing ones. The current street and shoreline cleaning machines are automated ones which are controlled by radio frequency. The proposed machine is designed in such a way that it is 100% mechanically operated, so that the end users (people like uneducated street or shoreline cleaners) can work without much effort. Another advantage is that the regular maintenance is much simpler and a typical mechanic can undoubtedly repair and maintain the machine. The machine consists of a waste collector brush connected with a roller and a cutter blade is also attached in front of the brush for cutting grass and small shrubs. The wastes are collected on to a storage box with help of a conveyor mechanism. The machine is powered by 4 DC motors which actuates the motion of machine as well as the conveyor belt and cutter. This machine is ideal for ground and beach cleaning.

Keywords

Shoreline, Cutter, Blade, Conveyor, DC Motor.

I. Introduction

Garbage is a major problem worldwide attention. It can be seen from organizations that support and fix this problem, such as it took 96 weeks and thousands of volunteers to clean up Versova beach in Mumbai, India. At the present, more than 10 million pounds of trash along nearly 20,000 miles of coastlines were picked up by more than 550,000 people. In Thailand, this problem affects to the destruction of the beautiful scenery and attractions. Moreover, it causes to the death of sea animals. Therefore, the development of the technology for collecting the garbage is the one aspect that is interested. Marine litter and its accumulation on beaches is an issue of major current concern due to its significant environmental and economic impacts. Beaches play a major role in tourism economy and marine ecosystem. Pollution of the seashore and water bodies is the alarming threat in this arena. Eighty percent of marine debris consists of plastic pollutants. One of the hallmarks of the Anthropocene has been the dumping of millions of tons of plastic waste into the oceans. No part of the world's oceans is free from plastic debris. Plastic ingestion and entanglement are killing millions of marine organisms per year, including birds, sea turtles and marine mammals. Plastic pellets and micro beads are poisoning marine life with persistent organic pollutants. The removal of plastic debris from the oceans is far too great a task for us to manage. The debris is simply too widely dispersed and too abundant. The most important step in ridding the oceans of plastic is to clamp down on the plastic debris that enters the oceans. Lack of proper pollution controlling equipment in beaches makes the situation worse. Seashore cleaner is a machine which collects solid waste from the beach and water bodies using a specially designed conveyor and hook mechanism. It can be seen from organizations that support and fix this problem, such as Ocean Conservancy that is a non-profit environmental advocacy group based in Washington D.C., United States. The organization reports on 23 August 2013 that over the past 27 years, over 9.5 million volunteers have removed 163 million pounds of trash from more than 330,000 miles of coastline and waterways in 153 countries and locations. At the present, more than 10 million pounds of trash along nearly 20,000 miles of coastlines were picked up by more than 550,000 people. In Thailand, this problem affects to the destruction of the beautiful scenery and attractions. Moreover, it causes the problem

about the sea animal death. For example, the death of the whale on the beach, Patong, Phuket because it eats the plastic waste. Although, some organizations try to clean the beach but the amount of the trash on the beach is still increasing at all time. Therefore, the development of the technology for collecting the garbage is the one aspect that is interested. Developing countries like India, Syria, Bangkok, Pakistan, Bangladesh and other 39 countries are more polluted than any other countries in the world. Based on the statistics of Pollution Control Board of India, there are 670 million people living in polluted places. These countries are denser and have more means of transportation like railroads and road transports. According to the Resource Conservation and Recovery Act (RCRA) report the majority of railroad transportation and motor freight facilities are considered to be the largest hazardous waste generators. The other forms of waste management like treatment, storage and disposal facilities (TSDFs) are processed under strict regulations. The government of these countries are not able to take much action to clean and develop these areas as it is almost impossible to provide equipment like vacuum cleaners in slums and railway tracks because of financial crisis. It creates a big impact on health like illness, physiological abnormalities, disorder, physical irregularities, mutational changes in the genes, cancer and in extreme cases; it may lead to even death of those organisms that live in railroad areas and municipality roads. Among these, municipal waste is the primary one. Municipal waste includes papers, dry leaves, Plastic wastes etc. Here the light weight wastes like dry leaves, papers and other wastes are taken into our consideration. According to the statistics, solid wastes collected from streets increased considerably especially paper is the largest single part, by both weight and volume, of municipal solid wastes. A report says that every year there is more than 50 million tons of paper wastes disposed of at landfill sites.

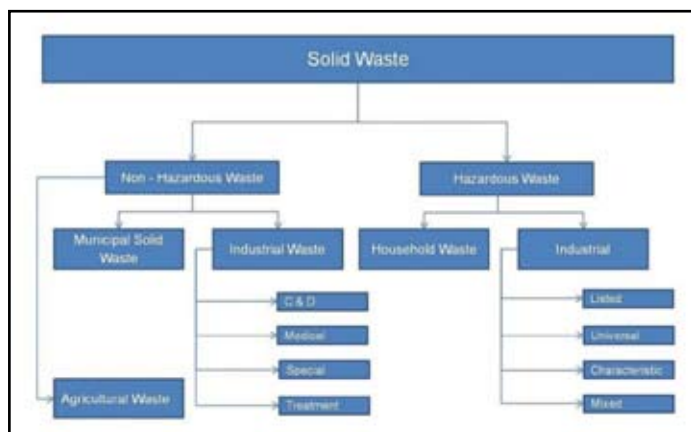


Fig. 1.1: Types of wastes

Collection and transportation of wastes take more than \$6 billion in the United States, which is one of the developed countries, where they move the most solid wastes to dumps and landfills and they burn a part of the wastes to ashes. To remove these wastes, municipality uses street sweepers and leaf collectors. As stated above, developing countries are not able to carry out costly systems to clean these light weight wastes. A street sweeper takes a considerable amount of gasoline energy to clean wastes like leaves, paper waste and other types of light weight wastes. Hence it is not good for the environment, as it uses fuel energy. The Industrial Revolution inspired new ideas of cleanliness in Europe and North America. Before the advent of the Industrial Revolution, people protected their carpets by covering them with druggets, or thick, heavy woollen goods that spread underneath tables and other exposed areas. Druggets protected against spills and other stains. Wealthy individuals used canvas cloth to cover carpet while away on vacations and during social events held in their homes. The lack of ventilation caused houses to fill with dust, dirt, and soot, which prompted people to search for ways to clean their homes. Societies placed significant value on their homes at that time, which sparked an innovative mindset to clean houses more efficiently. One of the most common techniques for cleaning carpet involved beating rugs with brooms to remove sand, dust, and soot; however, this method did not remove stains. Effective stain removal methods did not emerge until the 1830s, when creative housewives recorded their secrets for the removal of ink, grease, and oil. One stain removal method involved scrubbing carpet with lemon juice and a hot loaf of bread. During the late 1860s and 1870s, carpet cleaning techniques took a leap for the better with the advent of the first manually operated vacuum cleaner.

In the current context of environment protection, waste collector robots loom large because they locate, collect and dispose garbage in a controlled, autonomous and fast way. In this specific case, it was implemented an autonomus robot capable to navigate in sand, collecting cans and transporting them to a particular deposit. Here the components are mounted and made of steel and the body is formed of various materials like MDF (Medium Density Fiber board) and acyclic, while the arms is mainly made of acyclic to reduce its weight. The design includes an arm that allows the robot to pick up the can in any position, while a fixed "ramp" is responsible for depositing the cans aided by its own weight. The robot has four wide tires allowing it to move under the same principle on which the caterpillar track perform its movement. It was initially of using caterpillar track, but the

low pressure could make, coupled with construction problem that might arise finally made to decide to use wide tires. The movement consists three variations [1].

The aim is to design and develop process for cleaning the floor having wet and dry surfaces. In modern days interior decorations are becoming an important in our life cleaning of floor is very important for our health and this floor cleaning machine reduces the effort required for cleaning. It is very simple in construction and easy to operate. This floor cleaning machine consist of moisture cotton mop, swiping brushes, wipers and vacuum cleaner for reducing the cleaning time. The dust or water present on the floor is scrub by the front two brushes. This dust and water is collected by the vacuum cleaner and the detergent water is sprayed on the floor the mope present in the middle section of the chassis perform rotary motion on the floor which cleans the dirt or dust. The remaining water on the floor is wiping by the wiper present in end of the cleaning machine [2].

A street sweeping person would use a broom and shovel to clean off litter, animal waste and filth that accumulated on streets. Later, water hoses were used to wash the streets. Machines were created in the 19th century to do the job more efficiently. Today, modern street sweepers are mounted on truck bodies and can vacuum debris that accumulates in streets. Four wheel drive sweeper is working on same principal but in correction are this sweeper are used only big dust and dry surface use and this are weight are more and costly. Four wheel drive in use so many component used so design are complicated so this all correction solution by hand drive sweeper machine so this sweeper we modification in this design [3].

Cleaning has become a basic need for all human beings and it is unavoidable daily routine process. The conventional road cleaning machine is most widely used in railway stations, airports, hospitals, bus stands, etc. Also this machine need electrical energy for operation. It is not user friendly as well as eco-friendly. In summer time there isa power crisis and most of the road cleaning machines are not used effectively due to this problem. Particularly in air project we are using easily available materials with low cost. It is better alternative for conventional machine. Existing road cleaning methods are of two types. i) Electrical operated, ii) Manually operated. Manual cleaning may cause shoulder problem due to continuous sweeping. Electrically operated road cleaner uses electrical energy to run the motor. [4].

II. Project Methodology

The world is turning to be a digitalized one. Nowadays, no one depends on any kind of books for some reference. So here, we are implementing a web application where anyone can easily learn to read and write Malayalam language. The application is simple and user-friendly. With each of the Malayalam alphabets, an audio button is provided where the learner can click to hear the pronunciation. There will be a canvas provided where the learner can write on it using unistroke and then the corresponding alphabet will be identified.

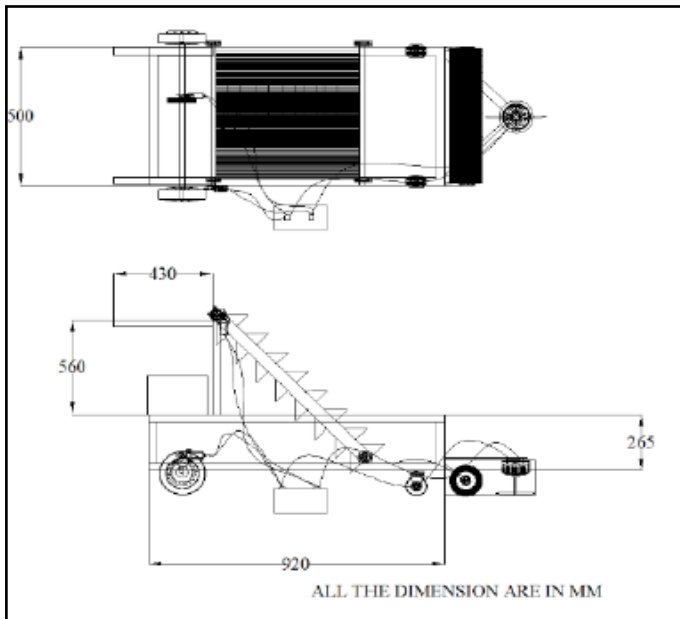


Fig. 2.1: 2D top view and side view respectively

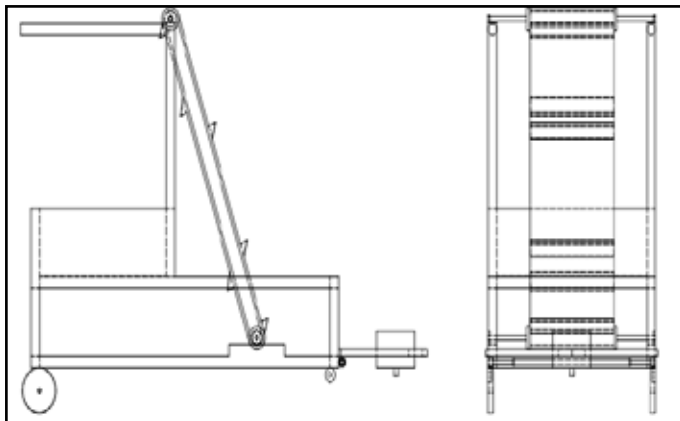


Fig. 2.2: 3D side view and front view respectively

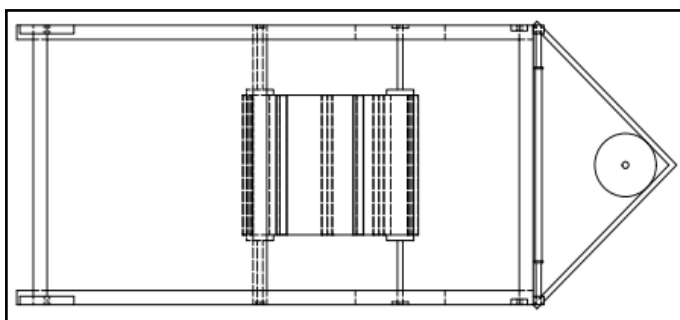


Fig. 2.3: 3D top view

III. Construction and Working

The machine consists of a body frame made of mild steel bars. The four wheels are attached to the corners of the frame. A DC motor is mounted on the frame which powers the forward and backward movement of the machine. A conveyor belt is fixed on the frame, one end of which is mounted on two bearings attached to the two pillars which are welded to the frame. The lower end of the conveyor is mounted on the base of the frame. A rotating brush is attached on the front side of the conveyor which is rotated with the help of a DC motor. A small extension is provided in front of the brush in order to mount a rotating cutter which serves

the additional purpose of cutting grasses and shrubs. A storage box is mounted behind the conveyor belt in order to collect and store the waste.



Fig. 3.1: Ground waste collector with grass cutter

The movement of the machine is controlled by a Toggle switch which operates a DC motors. When the conveyor belt and the brush is switched ON both starts to rotate. The waste materials on the ground are displaced on to the metallic buckets which are attached to the conveyor belt. This wastes are carried upward by the bucket and are finally deposited on the storage box mounted behind it. An additional cutter blade located in front of the brush can be rotated with the help of another DC motor, if grass cutting is necessary.

IV. Material and Component Selection

The major components involved in the machine are as follows:

- Frame
- Bearing
- Battery
- Spur Gear
- Wheel
- Conveyor
- DC Motor
- Cutter
- Roller

Frame

The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.
 Material : Mild Steel

Bearing

The bearings are pressed hydraulically to fit into the shafts because if hammered the bearing may develop cracks. The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is mild steel.

Material : Steel

Battery

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

Material : Lead acid battery

Rating : 7.2 AH

Voltage : 12V

Spur Gear

Spur gears, which are designed to transmit motion and power between parallel shafts, are the most economical gears in the power transmission industry. Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly involute but less commonly cycloidal), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts.

Material: Mild Steel

Gear ratio : 1:4

Pitch : 3 mm

Wheel

The two wheels are fitted to the body of the vehicle with the help of end bearing and bearing caps. The wheels are made up of rubber material 8 inches diameter.

Material : Poly Propylene Tyre

Conveyor

A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyors. Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volumes of resources and agricultural materials, such as grain, salt, coal, ore, sand, overburden and more.

Material : PVC

DC Motor

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that

when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

Roller

A cylinder that rotates about a central axis and is used in various machines and devices to move, flatten, or spread something.

Cutter

There are two blades are used in this machine, fixed cutter and moving cutter. A blade is the flat part of a tool, weapon, or machine (such as a fan) that normally has a cutting edge and/or pointed end typically made of a flaking stone, such as flint, or metal, most recently steel. A blade is used to cut, stab, slice, throw, thrust, position and/or place (an example of this is razor wire), shoot (an example of this is the ballistic knife) or scrape. It is made of 6mm thick H.S.S.S. materials.

V. Manufacturing Processes

Manufacturing involves turning raw material to finished products, to be used for various purposes. There are a large number of processes available. These are the processes that are used in the fabrication of this machine:

- Casting processes
- Forming processes
- Fabrication processes
- Material removal processes

VI. Conclusion

The design, fabrication and testing of the "Ground Waste Collector With Grass Cutter" was successfully completed. This machine helps to reduce the physical effort and difficulties faced by the workers. Presently the mass collection of paper waste, plastic cover, and paper cup are carried out by hand by the labours but it is not convenient method. So this project helps to collect this mass waste in limited period of time and also reduces the difficulties faced while the time of disposal. With the huge respect the project is eco-friendly and user friendly. The major alterations recommended are:-

- It can be fully automated by controlling with radio frequency
- By modifying the wheels we can use the machine in any physical condition
- By altering the brush on the frame large amount of waste can be collected
- By placing metallic conveyor seashore sand can be filtered to collect cigarette bud and bottle caps

The "Design And Fabrication Of Ground Waste Collector With Grass Cutter" is working satisfactorily. A few difficulties were identified in collecting heavier garbages. This machine developed is a helping hand for the people who are organized in the cleaning sector which makes their work more efficient. It helps the work to be done easier in the municipal and kudumbasree sectors in collecting the wastes and for its proper disposal.

References

- [1]. Rel Guzman Apaza, Edwin Gutierrez Linares, Enrique A.

- Soto Mendoza, Elvis D. Supo Colquehuanca, “*HS-Green Fist: Beach Cleaner Robot*”, Team Description Paper - LARC, 2013.
- [2]. Muhammad Kashif Shaikh Ghaffar, M. Aadil Arshad, Nandkishor S. Kale, Ansari M Bilal, Prof. D. M. Ugle, “*Design And Development Of Floor Cleaning Machine*”, International Journal of Advance Engineering and Research Development, Vol.5, April 2018.
- [3]. Charles C. Tappert, Ching Y. Suen, Toru Wakahara Ravi Tandel, Pinkesh Patel, Mehul Tandel, Ronak Tandel, “*The Study About Mechanical Waste Collector*”, International Journal of Scientific Research in Engineering (IJSRE) Vol. 1 (3), March, 2017.
- [4]. Prof. Dr. A. Muniaraj, Aravind K., Kadamban T., Thirumalai Balaji, “*Design And Analysis Of Manually Operated Eco-Friendly Road Cleaner*”, International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), Vol. 4, Special Issue 19, April 2017