

DESIGN AND FABRICATION OF HYBRID CLEANING ROVER

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Abstract

This journal paper aims to design and fabrication of hybrid cleaning rover. This research work predominantly offers an authentic and trustworthy solution for the typical garbage collection problems. Commercially available solid edge software was used for modeling the hybrid cleaning rover. Based on the research and calculation, carried out the fabrication of hybrid cleaning rover which aims to minimize manpower and time consumption in cleaning the land surface.

Keywords: *Cleaning Rover, Garbage, Waste, Eco-friendly*

I. Introduction

Waste Management is the major problem faced around the nation and world. Waste management is the practices and procedures needed to control from its origin to ultimate deposition. It typically comprises the collection, shifting, treatment and discarding the waste, along with supervising and controlling the waste management system. Waste management deals with different sort of wastes, which includes industrial, chemical, biological and domestical. Waste is produced by human activity, which can pose adverse effects on animals and human being ^[1].

India has been facing major problem related to collection of waste ^[2]. Present system in our country unable to deal with the large amount of waste generated from the different sources, which can have adverse effects on the environment ^[3]. Indian government has also been striving their best minimize waste from different sources. Government has also been launched different schemes towards cleanliness. Recently, Indian government has come up with an initiative called as “Clean India Mission”, through that initiative they are making awareness regarding waste management and their problems and solutions ^[4]. Thus, we come up with an idea of hybrid cleaning rover (Garbage Collector), which operates under the automation. The Hybrid Cleaning Rover is the solution for cleaning of foot path, public places, beaches etc., by reducing human efforts. This rover is a mechatronics-based project, which will be helpful for collection of garbage. Since this hybrid cleaning rover operates via remote or mobile application, it reduces the human effort and time consumption in the collection of waste. This hybrid cleaning rover mainly relies on rechargeable lead acid battery. In addition, it can also charge by the use of solar energy. Therefore, we have come up with a solution to establish a Hybrid Cleaning Rover.

II. Objective

To design and fabricate hybrid cleaning rover. To reduce pollution which is being generated from household, public places and beaches? To increase the performance efficiency. To reduce the human effort and time consumption in collecting garbage. To make an eco-friendly and economically reliable machine.

III. Methodology

Methodology is a process of project planning where all the major and minor steps of the project either it may be logical or creative fabrication application steps are systematically explained. Methodology is one of the paramount components in project planning where all the possible factors and their results effects are relatively considered for the optimum and effective project management. In the present work, the collections of methods or practices are done as follows:

A. Literature Review

The journal papers are having been reviewed because to comprehend and study the recent updates in the field of waste management process and garbage collection. Surveying of literature review helps us in simple understanding of the overall activities in our specific topic. It also helps us to implement further upgradation of work in our research.

B. Designing

Here, we have fully designed the model of hybrid cleaning rover in solid edge software with actual dimensions, which was useful for us during the fabrication work. We have done our fabrication work according to the actual design and dimensions. Designing of any machine is a pivotal work, because each and every dimension that we give is very significant. Consequently, every part is able to connect each other during the assembly. The figure (1) shows the design of the hybrid cleaning rover in solid edge software.

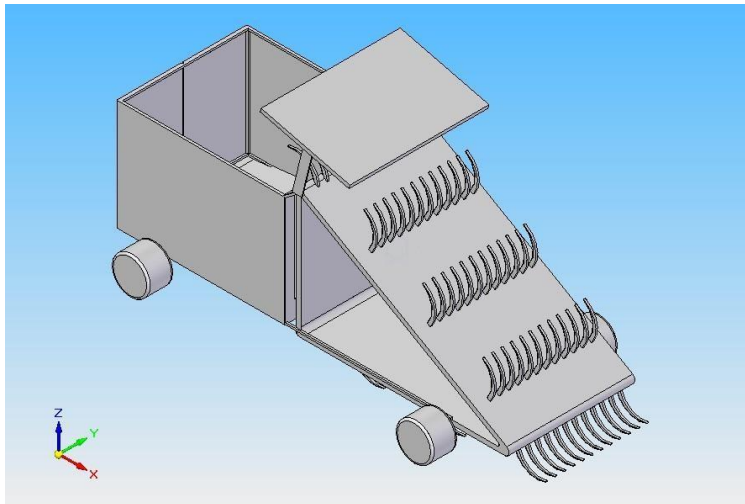


Fig. (1): Isometric view of Hybrid Cleaning Rover

Table 1. Represents the design characteristics of hybrid cleaning rover.

Table 1. Design characteristics

Battery type	Lead acid
Battery specification	12v, 7ah
Motor type	DC Geared Motor
Motor specification	12v, 100rpm
Solar Panel type	Polycrystalline
Solar Panelspecification	12v, 10 Watt
Bearing	2 bolt flange bearing
Mesh	Metal
Chassis	Mild Steel

IoT Master Controller	Esp32
Motor Controller	L298N
Conveyor Belt type	Incline Belt Conveyor
Waste Bin	ACP Sheet
Machine dimension	42 x 18 x 18 inches
Wheel dimension	6 inches

Battery

A rechargeable lead acid battery is used in our hybrid cleaning rover. Battery specifications are 12v, 7ah. Since the cost of the lead acid battery is cheaper, it is better for our hybrid cleaning rover prototype.



Fig (2): Rechargeable lead acid battery

Solar Panel

A solar panel of 12v, 10 Watt is used in our hybrid cleaning rover. The type of the solar panel is polycrystalline. As solar energy is available abundantly, it helps to recharge the battery continuously either when battery is down or in the operations of hybrid cleaning rover.



Fig (3): Polycrystalline solar panel

Motor

The DC Geared motor is used for the hybrid cleaning rover. The specifications of DC Geared motor are 12V and 100rpm. Since we require high output torque, the DC gear motor is the best option.

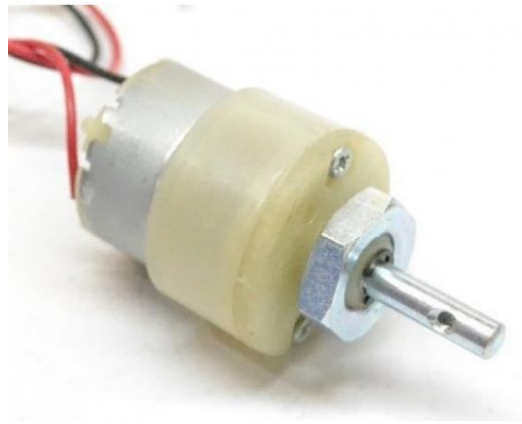


Fig (4): DC Geared motor

IoT Master Controller

An Esp32 IoT master controller is used in hybrid cleaning rover. This IoT master controller helps to pair the hybrid cleaning rover via Bluetooth for the starting of the hybrid cleaning rover. Its having port for the cable connection. One end of the cable connected to the Esp32 and other end is connected to the power source i.e., battery. Eventually, all the movements and monitoring of hybrid cleaning rover can be done using via mobile application or remote.



Fig (5): Esp32 IoT Master Controller

Motor controller

A L298N motor controller is used and which helps to control the speed and direction of the DC motor simultaneously. The main advantage of L298N motor controller is that they can control up to the 4 DC motors. The type of the motor controller is L298N.

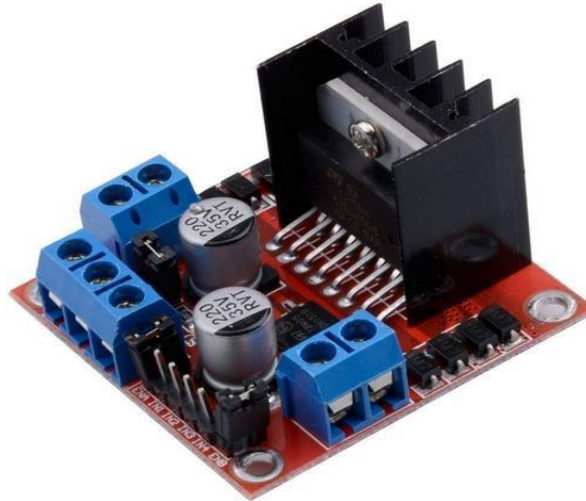


Fig (6): L298N Motor controller

Mesh

The type of the mesh is metal. The mesh is used here to collect the waste materials and garbage. It is attached to the conveyor. The mesh helps to collect the waste and poured into the waste bin.



Fig (7): Metal type of Mesh

Wheel

A 6-inch wheel is used for the hybrid cleaning rover. Hybrid cleaning rover consists of 4 wheels and which helps to smooth running.



Fig (8): Wheel

C. Fabrication

In this research fabrication work is the building of hybrid cleaning rover from the scratch. Building each part individually and assembling or welding it together is the major goal of our project. Fabrication is the most significant step following the literature survey and designing. The below figure shows the fabricated hybrid cleaning rover.



Fig. (9): Isometric view of fabricated Hybrid Cleaning Rover

IV Results

Final goal of our project fabrication work has successfully been completed. We have successfully conducted the test of our project and met required objectives. Since it does not emit any greenhouse gases, it is very eco-friendly. Human efforts are drastically decreased. It also relies on renewable source of energy. Maintenance cost is comparatively low. Operations are user friendly. As it uses solar power and solar power is one of the non-exhaustible sources of renewable energy, so it can be used to perform cleaning operations with the help of solar energy. Solar energy is free of cost. Solar energy is available abundantly. The main disadvantages of solar related things are that it requires high installation cost and material cost.

V. Conclusion

Hybrid cleaning rover prototype was designed. The design was analysed theoretically and then fabricated. The developed hybrid cleaning rover is very eco-friendly and reliable, it as relies on renewable source of energy. It reduces the human effort. However, the initial cost is comparatively high but very low maintenance cost.

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