

Design And Fabrication of Solar Floor Cleaner

Mahendra Babu K J¹, Girish T M¹, Hari Krishna L S¹, Murali M E¹, Yellaling¹,
Department of Mechanical Engineering
P. E. S. College of Engineering
Mandya, Karnataka, India

Abstract— Cleaning is a basic need for all human beings and it is unavoidable daily routine process. In recent years a greater number of devices are introduced for the purpose of collecting the leaves and debris from the ground or floor. In these, people are facing difficulties such as size of the disposable bag, noise produced by the device, safety precaution when it is operated by current etc. The conventional road cleaning machine is most widely used in colleges, hospitals, houses, auditorium, shops, bus stands and public place etc. also, this machine needs electrical energy for its operation. It is not user friendly as well as eco-friendly. In summer time there is power crisis and most of the roads cleaning machines are not used effectively due to this problem particularly. The purpose of this project is to design and create a floor and road cleaning machine for colleges, hospitals, auditoriums, and workshops. In our project we are using both solar energy and power supply to Charge the machine, so that it is functional as well as eco-friendly by keeping cost of the project as low as possible. It is one of the better alternatives for most of the machines which are available in market for the purpose of cleaning leaves and debris. It is very easy and safe to use. anyone can operate this Floor Cleaner without any prior training of any sorts.

Keywords— Cleaning, Vacuum Cleaner, Solar, Floor Cleaner, Leaf Cleaner

I. INTRODUCTION

Solar floor cleaner is a basic Semi-Automatic Type Cleaning Machine Which is Effective in cleaning. It helps and protects the health of the human beings directly and indirectly. It also improves the shelf life of the floor, roads etc. During Autumn (Spring) Season the leaves are found to be large in number, thus the people are spending more time and energy in cleaning the leaves. The cleaning job can be physically demanding and the need for methods developed to systematically evaluate the ergonomics of new products has been identified.

A vacuum cleaner, also known as a sweeper or Hoover, is a device that uses suction arrangement to create a partial vacuum to suck up dust, dirt and waste usually from floors or from surface. The waste is collected by a storage bag. There are wide variety of technologies, designs, and configurations That are available for both domestic and commercial cleaning jobs. For the regular cleaning of the roads, floors, and different types of surfaces, different types of Machines are used which depends on the place where it is used. There is hardly any device used for the cleaning purpose of all types of surfaces and effective cleaning of that particular surface or area. The cleaning job can be physically demanding and the need for methods developed to systematically evaluate the ergonomics of new products has been identified. Many surface cleaning machines are available in the market but we are developing a machine that is not only easy in construction but also it is easy to use. People can easily adapt in operating this

machine. Fully automatic and semi-Automatic machines that are available in the market are of high prices and heavyweights. So, by focusing on both weight and cost, they are not affordable for everyone, such as the organizing committee of hotels, hospitals, hostels, etc. Hence, there is a need to design and develop such a floor cleaning machine that can be easily used and cost-effective. Everyone can use this machine easily and not only the time for cleaning is less the cost is also low. Maintenance costs is also relatively less.

II. CONSTRUCTION

Solar Vacuum floor cleaning machine constructed by using vacuum blower Which is Ideological Designed and Built, DC electric motor (12V – DC, 3000 rpm) is selected for working of this machine, suction arrangement and frame are sheet metal Material mainly used for building the required body. Motor is coupled with the impeller which is mounted inside the impeller housing. Suction pipe is attached to inlet of the blower which helps in Suction of debris, dust and dried leaves. Delivery pipe is attached to outlet of the housing. The frame is mounted on four wheels which are fixed in corresponding dimension to obtain the forward and return movement of the machine. Solar panel is also called as ‘**Photovoltaics**’ that collects energy from sun in the form of sun light and convert it into electricity that can be used for Running the machine by charging the batteries of the machine. On the frame, assembly of impeller, housing, battery, solar panel and motor is mounted. A plastic bag is tied on back side of the delivery pipe for collecting the waste which is observed through suction end. All these parts are assembled together to build a Solar vacuum floor cleaning machine.

III. WORKING

Vacuum cleaner works on the principal of Bernoulli’s equation. Which state that as the speed of air increases, the pressure decreases. Air will always flow from a high-pressure area to low pressure area. The power supply from battery is applied to the D.C motor. The suction arrangement consists of impeller (fans), and flexible housing. The D.C motor is coupled with the impeller (fan) and it consists of a greater number of blades. It is fixed above the frame stand, so that air suction is forced from the ground. An impeller gets the rotating motion through DC motor which can be powered by either power supply or from battery which can get charged by solar power. Then there's the housing of the impeller which is connected to exhaust and intake hoses. When the fan starts rotating, pressure inside the housing decreases as the impeller throws out all the air from the exhaust hose. A low-pressure area (partial vacuum) is left behind in the compartment. When air enters through the suction tube to fill this area and leaves this airflow, like the flow of water, suction is created. Dust and Leaves will enter the housing. The Waste and leaves will

be fed into the blades. Collected waste through delivery pipe can be disposed easily.

IV. METHODOLOGY

According to usage conditions of the machine and considering the parameters we carried out below mentioned methods.

- Identified the problem and requirement of the project.
- Prepared the modeling of the components.
- Perform required design calculation for fabrication.
- Selection of the suitable material for the fabrication.
- Analysis of design parameters.
- Tested the overall performance.

V. DESIGN CALCULATIONS

Fan Pulley Diameter

$$\begin{aligned} \text{Fan Pulley Diameter} &= \frac{\text{Motor Pulley Diameter} \times \text{Motor Speed}}{\text{Fan Speed}} \\ &= \frac{5 \text{ mm} \times 3200 \text{ rpm}}{1600 \text{ rpm}} \end{aligned}$$

Fan Pulley Diameter = **10 mm**

Fan Speed

$$\begin{aligned} \text{Fan Speed} &= \frac{\text{Motor Speed} \times \text{Motor Pulley diameter}}{\text{Fan Pulley diameter}} \\ &= \frac{3200 \text{ rpm} \times 5 \text{ mm}}{10 \text{ mm}} \end{aligned}$$

Fan Speed = **1600 rpm**

Capacity of Fan

AT STP condition, Velocity of air is **484 m/s**
(Calculated by taking the reference values from HMT Data Handbook)

$$\begin{aligned} \text{Suction Area} &= \frac{\pi \times D^2}{4} \\ &= \frac{\pi \times 90^2}{4} \end{aligned}$$

Suction Area = **6361.72 mm² = 0.0064 m²**

Fan capacity = Suction Area × Velocity of air
= 0.0064 × 484

Fan Capacity = **3.0976 $\frac{\text{m}^3}{\text{sec}}$ = 185.856 m3/min**

VI. CAD MODEL

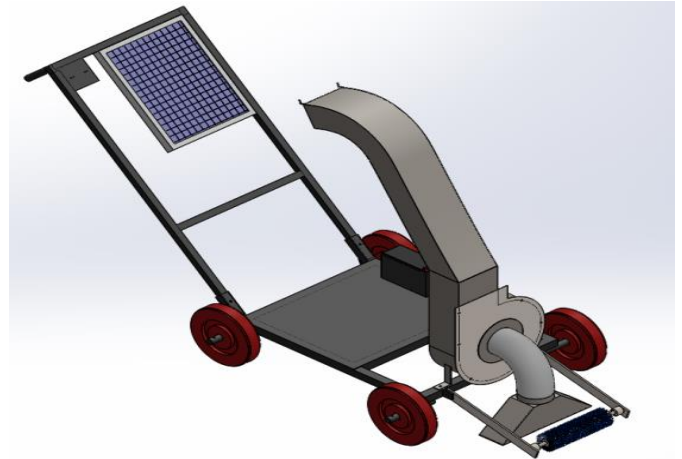


Fig 1: Assembly of Solar Floor Cleaner CAD Model

VII. PREPARED MODEL



Fig 2: Fabricated Solar Floor Cleaner Model

VIII. CONCLUSION

This dual powered floor cleaning machine can power the machine by battery which can get charged by either electric power supply or by solar panel. This feature of the machine makes it very functional and eco friendly to use and is better than most of the floor cleaning machines available in the market.

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