



# Design And Fabrication Of Solar Powered Multifunction Floor Cleaning Robot

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## Abstract -

The conventional floor cleaning machines are most widely used in airport platforms, railway platforms, hospitals, bus stands, malls and in many other commercial places. These devices need an electrical energy for its operation and are not user friendly. In India, especially in summer, there is a power crisis and most of the floor cleaning machines are not used effectively due to this problem, particularly in bus stands. Hence it is a need to develop a low cost, user friendly floor cleaning machine. In this project, an effort has been made to develop a manually operated floor cleaning machine so that it can be an alternative for conventional floor cleaning machines. In this work, modelling and analysis of the floor cleaning machine was done using suitable commercially available software. The conventionally used materials were considered for the components of floor cleaning machine. From the finite element analysis, we observe that the stress level in the manually operated floor cleaning machine is within the safe limit. This project is based on our innovative project of designing, developing and manufacturing a semi-automatic floor cleaning machine working on solar power, battery or electricity. A semi-automatic floor cleaning machine has been developed with basic considerations for low energy consumption, reduction in machine cost as well as operating cost, minimizing human effort, eco-friendly and easy to handle. The premise of the project was to use renewable energy that is abundant in most countries, which would have a lower environmental impact and would be easier to manufacture for commercial scale in the future.

**Keywords:** Floor cleaner , Floor dryer , Scrubber mechanism , water pump , remote control etc.

## 1. Introduction

Effective cleaning and sanitation directly and indirectly helps and protects human health. In addition, cleaning and sanitation reduce pest infestations by reducing residues that may attract and support bees, insects, etc. It also improves the shelf life of floors, walls etc. due to regular cleaning and maintenance. In recent years, most of the people prefer to use trains or buses for commuting and hence these places are littered with biscuit covers, cold drink bottles etc. Therefore, it is necessary to sanitize the bus stands and railway stations at regular intervals. There is no single cleaning method that is suitable for all locations and occasions, and effective

cleaning depends on the type of cleaning equipment, cleaning technique as well as whether the equipment must be user-friendly. Cleaning work can be physically demanding and the need for developed methods for systematic ergonomics evaluation of new products has been identified. In recent years, floor cleaning robots are becoming more popular for busy and aging population due to labor shortage. However unemployment is high in India and hence there is a need to develop less labor oriented cleaning machines. Therefore, the aim of the present work is to design, develop and evaluate a manually operated floor cleaning machine.

In our project we have made the machine with a small amount of electrical components to operate in a completely mechanical way. The floor cleaner is of very simple construction and it is very easy to operate, anyone can operate it safely without any kind of prior training. It is very important in any hospital, hotel, bus stand etc.

### 2. Problem Identification

The cleaning machine is very useful in cleaning the floor and outside ground in hospitals, homes, auditoriums, bus stands and public places etc. In modern days interior as well as cleanliness is becoming an important role in our life. Cleaning of waste is very important for our health and reduces the requirement of manpower. There are many floor cleaning machines available but the machine we developed is very simple in construction and easy to operate. Anyone can operate this machine easily. So it is very useful in hospitals, any large area.

### 3. Block Diagram

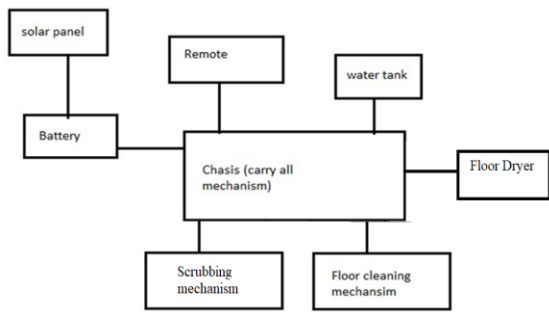


Fig. 1. Block Diagram

### 4. Working

When a 10w solar panel is installed and their electrical energy is stored in the battery. 12 V DC battery supply is provided to the electrical switch board of the machine. The mains supply from the power board is supplied to the SMPS and mopping mechanism, while DC is supplied to the mopping mechanism and SMPS during operation.

DC motors are used for the rotation of mop with higher torque than the motor used for brushes. The other two DC motors with higher RPM are used to clean the front part of the floor. The DC motor rotates the brush through the shaft which is connected to the shaft of the motor by means of nuts and bolts.

The rotational direction of the mop is opposite to each other so that more water is collected in the middle section and this mixture of water and dirt is collected in the mop through the inlet pipe which is located in the middle of the mop. Water spray pump is provided at the bottom of the water tank which

supplies fresh water for efficient cleaning of clean water and is controlled through control valves. Number of holes is made in the water flowing tube for the same amount of water. Separate buttons are provided in the electrical board to control the power supply of each appliance of the floor cleaning machine.

### 5. Construction Diagram

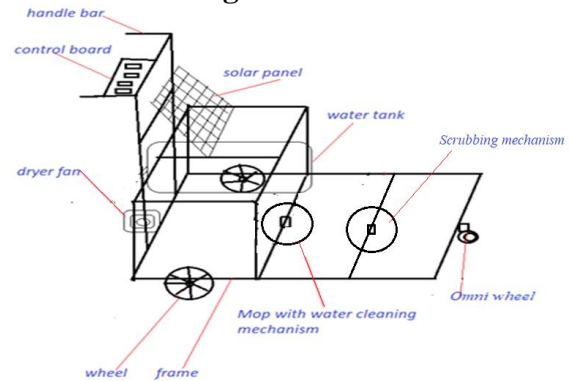


Fig. 2. Construction diagram

The manually operated floor cleaning machine consists of various elements such as DC motors, fresh water sprayer pump, mop, LED lights, chassis and fresh water tank. Switched Mode Power Supply (SMPS) is used to convert AC supply to DC. Fresh water tank is used to store water in this. It provides water as per requirement while doing wet cleaning. The switch board is mounted on the handle. It is used to start and stop the machine as per the wish of the operator, different buttons are provided to operate the different component. The chassis is the main part of the machine that holds all the other parts to itself. It is made of mild steel as it fulfills all the required conditions. Water is stored in a chamber with an opening controlled by a motor. Keeping this motor in the running position allows water or cleaning liquid to flow out of the tank. It is connected by means of connecting pipes to a shower type arrangement. Sprinkler systems consist of several sequentially arranged holes that can be modified manually. An arc is provided to adjust the position of the mop when there is no need for the mop.

## 6. Calculation

### For Motor,

Using tong tester,

For low speed

Current drawn = 0.07A

For high Speed

Current drawn = 0.25A

For low speed of motor

Maximum Power =  $V \times I$

=  $12 \times 0.07$

= 0.84 W

For High speed of motor

Maximum Power =  $V \times I$

=  $12 \times 0.25$

= 3W

- Time required to charge the battery of 12V by regular A.C supply is 2hr.
- Time required to charge battery with solar panel 4 hr.
- Battery backup is of 2hr at high speed and 3 hr. at low speed.

### Calculation of the speed of Mopping:

The rpm of the motor taken into consideration: 100 rpm

Diameter of the disk: 150 mm

The rotational distance that is covered in one revolution of the disk

Is equal to the circumference of the disk.

The Circumference =  $2\pi r$

=  $2 * \pi * 150/2$  mm

= 471 mm

The rotational distance covered in one revolution = 471 mm

Hence the distance covered in 100 revolutions

=  $100 * 471$  mm

= 47100 mm

The rotational distance covered in one minute is 47100 mm

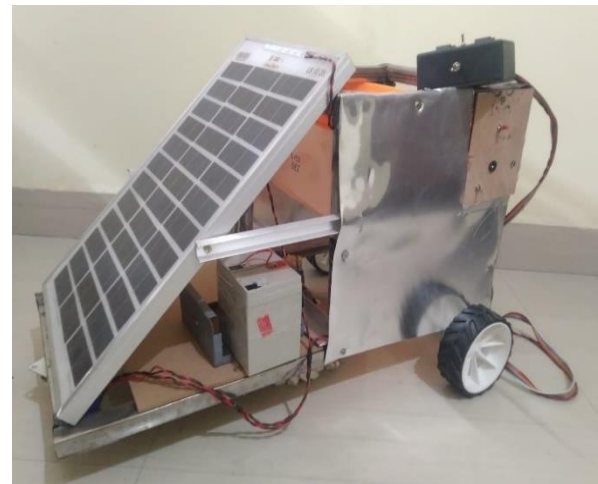
The speed can be varied depend on power.

## 7. Results and Discussion

Present work is aimed at working of wired remote controlled multifunction floor cleaning robot that could clean the floor of normal Indian house-hold as well as public places. Proper cleaning is achieved by motion of the mopping which is relatively rotational in manner. The cleaning process is carried out by making the floor wet and mopping it and again making the floor dry. The floor should be dry after the process is complete because wet floor leads to

different sort of problems as discussed above. For this purpose water pumps are to be used. The cleaning also meet challenges like which type of debris it will meet.

This leads to proper cleaning when heavier particles are there as debris particle. Thus leading to proper cleaning of the surface. There may be oily surfaces in some cases. To counter act this situation necessary disinfectants are to be used. wheel drive mechanism should be used for proper control of the machine. To control all the motors and water pumps basically arduino control board with Bluetooth communication is used. Robot can move to any direction and perform all necessary function of cleaning. Basically we are to design a portable floor cleaning machine that could move smart way all over the floor surface and cleaning the floor.



## 8. Advantages

- Manual effort is reduced
- Operating time is short
- Cleaning and polishing can be done at the same time:
- Power consumption is low
- This machine requires low maintenance cost.
- Easy control of the supply of cleaning solution by controlling valve in this machine.
- It can be used on various places other than rough surfaces.
- The drive or movement can be made automatic by further modification.

## 9. Disadvantages

- Floor Scrubber produces vibration when used on rough floors or rough surfaces.
- The floor sweeper is only suitable for flat surfaces.
- The floor sweeper is a semi-automatic machine.
- It is heavy to lift.
- It is not capable of clearing any building ladder.



- Maintenance of mop is required.

## 10. Applications

- Hospital - Hospitals use floor cleaning machines for both wet and dry cleaning. To get a clean surface.
- Computer Center - to maintain the desired cleaning surface finish.
- College - It is mainly used to clean the dust collected on the surface.
- Railway Station- It can be used in any weather on the railway station platform.
- Auditorium and Mall
- Cinema Hall

## 11. Future Scope

If the panel high watt is used, the machine can be used for garden lighting or room lighting at night. Because we can store more power. And at night though you put it aside. So battery power can be used for this purpose. By using a valve in the pipe, we can also use it for gardening i.e. to pour water for plants. By connecting a box type carrier we can use it to carry files, books or other items from one place to another office or any other place. Mowing can be made more efficient by adding two more motors with blades on the front of the machine.

## 12. Conclusion

In our project we introduced a floor cleaning robot that is capable of doing both vacuuming and mopping. The main objective of the project is to incorporate aspects of cleanliness in the society. The many applications provide a wide range of functions in which we can clean pipes, perform surface scrubbing for proper floor cleaning, remove dust and dirt from the road, provide a pick and place mechanism by which the barriers can be removed. This project is very useful for the society and plays an important role in the cleanliness of the country. Some of those motors are not detachable and the high rpm causes the whole system to vibrate. If these features will be modified, it will work well. Overall it is a successful product developed which can be used in current Indian homes.

The use of innovative technology not only significantly reduces costs, but also reduces human effort while increasing the effectiveness of floor cleaning. Less human effort means more frequent floor cleaning which results in increased overall cleanliness and supports healthy well-being. Thus small steps in technological advancement will have a high impact in the long run in the future, making India a better country.

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