

# Design and Fabrication of Hybrid Floor Cleaner

D. Karunakaran,  
Assistant Professor,  
Department of Mechanical Engineering,  
Sri Manakula Vinayagar Engineering College,  
Puducherry-605107.

B. Abilash, V. Ananda Prasanna,  
S. Naveen Kumar Varun Raj,  
Bachelor of Technology,  
Department of Mechanical Engineering,  
Sri Manakula Vinayagar Engineering College,  
Puducherry-605107.

**Abstract -** This project aims at the fabrication of Hybrid Floor Cleaning machine. The entire vacuum cleaner arrangement is kept in a tri-cycle setup which can be operated by both manual pedalling and solar assisted power source. This system can be used in hospitals, railway stations, metro bus stands etc. The major advantage of this system are keeping pollution free environment in the public, avoiding infections to sweepers and scavengers, fast and accuracy in cleaning methodology etc. Since this is dual powered, it does not require pedalling always. It also reduces human effort and less number of cleaning employees. By increasing vacuum effect even tiny particulate matters can be easily absorbed during the cleaning process. When cleaning is effective, occupational diseases can be minimized and pollution free public places are obtained.

**Keywords:** Cleaning, Chain drive, Mop, Alternator, Solar Panel, Vacuum Cleaner.

## 1. INTRODUCTION:

### THE CONCEPT OF CLEANING

Cleaning machine is very much useful in cleaning floors and outside ground in hospitals, houses, auditorium, shops, bus stands and public place etc. In modern days interior as well as outside cleaning are becoming an important role in our life. Cleaning of waste is a very important one for our health and reduces the man power requirement. Many of floor cleaning machines are available but we developed machine is very simple in construction and easy to operate. Anybody can operate this machine easily. Hence it is very useful in hospitals, any large area space. The time taken for cleaning is very less and the cost is also very less. Maintenance cost is less. Much type of machines is widely used for this purpose.

In our project we have made the machine to operate in a fully mechanical way with a little amount of electrical components. The Floor cleaner is of very simple construction and is very easy to operate, anyone can operate it without any prior training of any sorts with safety. It is very important one in any hospitals, hotels, bus stands etc.

## 2. COMPONENTS USED

### CHAIN DRIVE

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

### BEARING

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.

### 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.

### ALTERNATOR

An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current. For reasons of cost and simplicity, most alternators use a rotating field with a stationary armature. In principle, any AC electrical generator can be called an alternator, but usually the term refers to small rotating machines driven by automotive and other internal combustion engines. An alternator that uses a permanent magnet for its magnetic field is called a magneto. Alternators in power stations driven by steam turbines are called turbo-alternator.

### MOP

A mop (such as a floor mop) is a mass or bundle of coarse strings or yarn, etc., or a piece of cloth, sponge, or other absorbent material, attached to a pole or stick. It is used to soak up liquid, for cleaning floors and other surfaces, to mop up dust, or for other cleaning purposes.

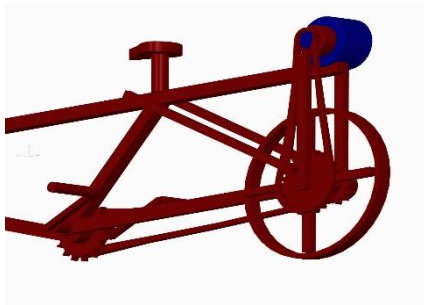
### SOLAR PANEL

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating.

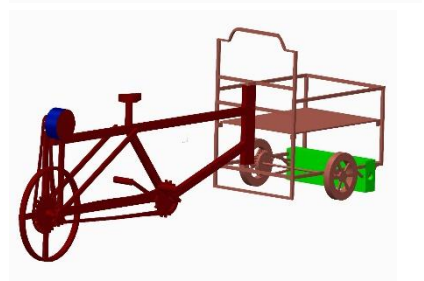
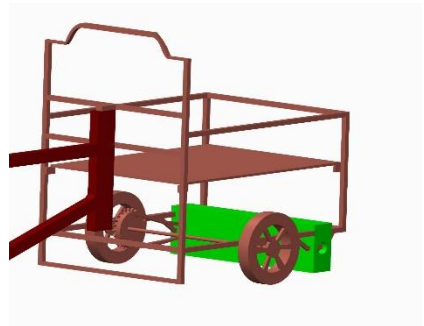
### VACUUM CLEANER

A vacuum cleaner is a device that uses an air pump (a centrifugal fan in all but some of the very oldest models), to create a partial vacuum to suck up dust and dirt, usually from floors, and from other surfaces such as upholstery and draperies. The dirt is collected by either a dustbag or a cyclone for later disposal.

### 3. DESIGN MODELS



Alternator Setup



Center Shaft and Mop Setup  
Full Complete Design

### 4. FABRICATION WORK

#### WELDING OF FRAME

- In this project, four L-Channel rods are used to make square joint of dimension 60x90cm. The upper portion consist of the hollow square rod which are welded together according to the dimensions required.
- There are two wheels are in front side. The wheel used here is taken from a vehicle is low on clearance and must carry a large amount of weight.
- All joints welded using electrode arc welding in the corner joints and after welding is done some amount of water poured to strengthen the joints.

#### FABRICATION OF TRI-CYCLE SETUP

- The project itself looks more like a Tri-cycle setup. There are two wheels in the front portion and a single wheel at the rear portion of the setup.
- We have chosen Mild Steel as the working material to withstand major loads. Two wheels are fitted at the center portion of the frame.
- The wheels in the front are held a (or) fitted to a shaft which rotates with the help of a bearing when there is movement.

#### MOUNTING OF DRY MOP

- The brushes has been mounted at front of the setup which acts as the dry mop. Four brushes are used at the front portion to compensate the size of the frame dimension.
- The brushes are fixed to a hollow square shaft and are connected to a bearing and a free wheel. The free wheel is connected to the main shaft where the wheels are fixed.
- So that when the wheel rotates the brush rotates in a faster rate than the wheels connected.

#### BATTERY CONNECTION SETUP

- The battery is the main source of power which is used to make the vacuum cleaner to work. But we are using rechargeable batteries which has to be recharged from time to time.
- The battery is of 12V and 7.5Ah which is enough to make the vacuum cleaner to work. We are using 2 batteries since it is necessary to make the vacuum cleaner to work.
- The battery is recharged using to two power sources. They are Solar panel and the alternator setup.

#### ASSEMBLING OF COMPONENTS

- After all the components are separately bought with the required specifications, the components are to be assembled to make the project to get to working condition.
- At first the Tri-cycle setup is fully assembled and welded at the joints strongly, so that it does not break done when the load is applied. Here the load is the person who is using the machine.
- The front portion of this setup is separated into two sections so that the lower portion may do the suction and the components for it. The upper portion contains the battery and the wiring is done there.
- The assembly is done and then the alternator is mounted at the rear portion of the tri-cycle setup. This alternator works over the pedaling of the tricycle.

#### SHEET METAL COVERING

The sheet metal covering is to make the whole setup look in a complete manner without which it seems to be just skeleton. The four sides of the tricycle setup is covered with this sheet metal.

#### WIRING SETUP

- The wiring is needed because we are using rectifier board to limit the power supplied to the battery. Two rectifier boards are placed here to satisfy the two mode of recharging used here. One for the solar panel and the other for the alternator setup.
- The rectifier board for the solar panel is kept in this setup to limit the power supply directed to the battery. When the temperature of the sun is high the solar panel may produce a high energy which may burn the battery. To avoid that a rectifier is kept here.
- The other rectifier board is to limit the supply from the alternator. When it works fast the power produced is very high, which may create the possibility of burning the battery. To avoid such situation the rectifier is placed here.

## 5. EXPERIMENTAL RESULT

When we experimented the project to find a result by running the HYBRID FLOOR CLEANING MACHINE in a floor area space of 102.4 m<sup>2</sup>, it took only 5min 20sec and when just a normal person manually cleans the same floor space of about 102.4 m<sup>2</sup>, it took about 20min to clean that amount of floor space. This shows that our project is more efficient in the cleaning process than a person cleaning the floor. It also helps in many ways that it avoids the direct contact with the dust particles which avoids the possibility of occupational diseases to infect the person. By increasing vacuum effect even tiny particulate matters can be easily absorbed during the cleaning process.

## 6. COMPLETED WORK



## 7. CONCLUSION

The equipment is purposely designed for cleaning floors, but can only be used in outdoors with large ground like the hospitals, bus stand, railway stations etc. The equipment will result more beneficial when it is compared to other existing floor cleaning machines. Our project is based on a very simple chain drive mechanism which can be easily operated by any person. The size of the machine is large, but it is very easy to transfer from one place to another place very easily since, it is working using the pedalling system. The cost for fabrication is very less. Any fault in the machine can be easily identified and can be corrected on the spot.

## 8. REFERENCES

- [1] The official journal for International Solar Energy Society: Yogi Goswami
- [2] Fundamentals of Automobile Body Structure Design: Donald E. Malen
- [3] Tire and Vehicle Dynamics: Hans B. Pacejka.
- [4] The Automotive Chassis: Jornsens Reimpell, Helmut Stoll, Juergen W. Betzler.
- [5] The Electric Power Generation in City Bus (using alternators): Lukasz Grabowski, Konrad Pietrykowski, Michal Geca, Grzegorz Baranski.