**A**

**PROJECT STAGE-I REPORT ON**

**"DESIGN AND FABRICATION OF ROAD CLEANING MACHINE BY USING SOLAR ENERGY"**

**BY**


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Shatabdi Institute of Engineering and Research, Nasik

# C E R T I F I C A T E

**This is to certify that,**

**Mr. Tejas Balasaheb Naik**

**Mr. Prasad Pandurang Londhe**

**Mr. Darshan Vikas Kshatriya**

**Mr. Sajid Rabbani shaikh**

**has successfully completed the Project Stage – I entitled "DESIGN AND FABRICATION ROAD CLEANING MACHINE USING SOLAR ENERGY" under my supervision, in the partial fulfillment of Bachelor of Engineering - Mechanical Engineering of Savitribai Phule Pune University.**

**Guide** **Internal Examiner**

**HOD** **Principal**

# ACKNOWLEDGEMENT

We would like to express our special thanks to our Project guide and source of inspiration **Miss. Prof D.J. Ganore mam** for his valuable guidance to make our project towards perfection.

We are also extremely grateful to our HOD Prof. **S. D. Ratanakar** for their various suggestions and all staff memberof Mechanical department for their constant encouragement and kind help during our project for providing all facility and help for smooth progress of our project work.

We would also like to express sincere gratitude towards our Principal **Prof. P. G. Vispute** for being supportive and always encouraging.

"We always pray to god to shower his blessing on us without nothing ispossible to be done."

Last but not least, the backbone of our success and confidence lies solely onblessing of my parent and my best friends.

Thanking You.

# LIST OF FIGURE

## CONTENT

# DESIGN AND FABRICATION OF ROAD CLEANING MACHINE BY USING SOLAR ENERGY

## ABSTRACT

Cleaning is the main basic need for all human beings and it is necessary for daily routine process. The conventional road and floor cleaning machine is most widely used in many applications such as example roads, railway stations, airports, hospitals, Bus stands, in multi buildings, colleges etc. also this machine uses human energy for its working operation. It is a user friendly as well as eco-friendly. In our project we are aimed to use easily available materials with low cost and it can be easily fabricated and easy to use and control. It is the better alternative for conventional machine. The manually operated eco-friendly road and floor cleaner can work very efficiently with respect to covering area, time and cost of road cleaning process compared with the existing machineries. Also it is economical to use.

The main aim of our project is to design and develop road cleaning. To draw 3 D model. All the parts will manufacture and then assemble together and then the testing of model will carried out.

# 1. INTRODUCTION

Effective cleaning and sanitizing helps and protect the health of the human beings directly and indirectly. Also, cleaning and sanitizing prevents the pest infestations by reducing residues that can attract and support bees, pests etc. It also improves the shelf life of the floor, 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 biscuits covers, cold drink bottles etc. Hence, it is necessary to clean the bus stands and railways stations at regular interval. There is no one single cleaning method that is suitable for all locations and occasions and effective cleaning depends upon type of cleaning device, cleaning technique and also the equipment should be user friendly.

Cleaning work can be physically demanding and a need has been identified to developed methods for systematic ergonomic evaluation of new products. In recent years, floor cleaning robots are getting more popular for busy and aging populations due to lack of workers. However in India, unemployment is more and hence there is a need to develop less labor oriented cleaning machine. Environment is a place where humans as well as plants and animals live. Keeping it clean and neat is our responsibility. It is necessary to keep our environment clean because we get fresh air, reduce pollution etc. An unclean environment leads to a bad condition of a society, arrival of diseases and many more.

In recent years cleanliness is becoming an important factor for the betterment of the nation and so, to support the cause we have conducted a study, prepared a design and working of a Semiautomatic Road Cleaning Machine. The cleaning machine is an approach to deliver easy and time efficient cleaning of roads, by reducing human efforts.

### 1.1 Numerous functions of the road cleaning machine.

1) Remove the dust from road by the use of scrubber which is operated by using engine.

2) Cleaning of dust and dirt by use of brush.

3) Collecting the dust into the collector tank.

This cleanliness can be achieved by utilizing all the functions of the road cleaner to the optimum level. The basic idea is to generate a machine which works on basic principles of physics, using mechanical, automobile components and devices. Making an assembly of the components and ultimately creating a machine which can be the answer to various cleaning issues in a single unit.

### 1.2 Background of Present Road Cleaning:

The manual operated machines are time consuming and laborious, on other side of the flip, the diesel operated machines are very costlier. These problems actually instigate to think an alternative arrangement which would nullify the limitations of former said processes. Further its initial cost is also less. The new evolved concept is a road cleaning machine is operated by human power. To accomplish this new idea, the present work is well carried out which is as under.

1. Firstly, the complete market review and literature survey based on the Road Cleaning processes been done.

2. On the basis of the demand power the machine component are designed.

3. On the basis of obtained designed dimensions the fabrication work of the proposed manually operated road cleaning machine is carried out.

4. At last, the testing and trails have been taken to ascertain the load capacity of the machine. Objective of Manually Operated Eco-Friendly Road Cleaner:

• To provide the alternative method for road cleaning

• To reduce human efforts

• To save the time

• To reduce the cost

• To avoid noise pollution

# 2. LITERATURE SURVEY

## 2.1 Design & analysis of manually Operated eco-friendly road Cleaner
**Author: Prof. Dr. A. Muniaraj, Aravind, K, Kadamban, T, Thirumalai Balaji.**

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 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. In our project we are using easily available materials with low cost. It is the better alternative for conventional machine.

## 2.2 Design of Dust Collector for Rear Wheel of Four-Wheeler
**Author: Abhishek Chakraborty, Ashutosh Bansal**

Vehicle traffic is responsible for the suspended road dust. Substantial fraction of PM10 in urban air is mainly due to non-exhaust traffic emissions and re-suspension from street surfaces. These road non-exhaust emissions are often uncontrolled and information about the effectiveness of mitigation measures on paved roads is still scarce. The present work is aimed to design a dust collector system for high clearance four-wheelers to minimize the level of non-exhaust emissions to some extent. The model consists of a centrifugal fan to absorb dust before it spreads and pollutes the air, which is to be placed on and above the rear side of a wheel. Calculation is performed to determine the accuracy of the model by using the reference concentrations of fugitive dust generated by a vehicle travelling on road. This system will help in controlling or decreasing the dust concentration behind a vehicle. The modeling and designing of the system is done on CatiaV5 to get better results.

## 2.3 Design & Development of Road Side Cleaning Machine
**Author: Ashish Patil, Pranav Patil, Jaywant Patil, Rohit Ingawale, Sanket Nalawade, Amar Patil.**

Our study shows that dirt besides the road causes uncleanness and accident problems. We had developed a semiautomatic road side cleaning machine that insures that dust and dirt in sides of road should be clean. Our design proposes and successfully implemented the use of scrubber and brush that will remove the dust and collect it into the storage box in which the scrubber is driven by engine which removes the dust and throws it into the path of brush. This brush is driven by speed amplification mechanism which consists of chain and gear drive separately. The motion of brush allows pushing the removed dust into the storage box. This is the best alternative method for cleaning road side dust.

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### 2.4 Design and Fabrication of Multipurpose Eco- Friendly Cleaning Machine
**Author: Praveen H, Harish Gowda GR, Anil G Ramageri, Arunkumar Kallammanavar, Prasanna P Kulkarni, Girish B Kallihal**

In our project we are aimed to use easily available materials with low cost and it can be easily fabricated and easy to use and control. It is the better alternative for conventional machine. The manually operated eco-friendly road and floor cleaner can work very efficiently with respect to covering area, time and cost of road cleaning process compared with the existing machineries. Also it is economical to use.

### 2.5 Design and development of tricycle operated street cleaning machine
**Author: sandeep j. Meshram, dr.g.d.mehta.**

This paper presents the design and fabrication of Tricycle operated street cleaning machine with the related search. At present we have few automated machines which are foreign made and can be used in our country. But the fact is that those machine are designed keeping in mind that their road condition. Here, in Indian market, the conditions are very different. On other hand in ruler area the road cleaning is done by an manual operation which renders fatigue hazards like asthma, bronchitis etc. to the worker. This basically instigates to thing for an alternative mechanism called Street cleaning process.

A tricycle operated street cleaning machine seems an alternative concept for avoiding such problems enlisted in first point. The tricycle operated machine can work very efficiently with respect to covering area, time and cost of street cleaning process compared with the existing machineries. Also it is economical. It was seen while testing of machine, that the cleaning is less effective where the street seems to be very rough and damaged.

## 3. PROBLEM STATEMENT

It is found that the existing street cleaning machines uses petrol and diesel. It can cause pollution and also the vibration produced in the machine causes noise pollution. While manual cleaning may cause health problem as the person directly comes in contact with dust. Also, the shoulder problem due to continuously sweeping occurs.

Now, workers are hired to do this stuff but it is impossible to work continuously for workers. So this is time consuming and also costly process because of workers salary. The important factor is eliminating traffic problem because of less manpower as well as accident.

Solar operated street cleaning machine seems an alternative concept for avoiding such problems enlisted in first point

The running cost of machine is low and initial cost of machine is covered by saving of workers salary.

Fig. 3.1 Existing street cleaning techniques

## 4. OBJECTIVES

1) Remove the dust from road by the use of scrubber which is rotate by using wheel motion.

2) To Design Semiautomatic Cleaning Machine for Rural and Urban Areas

3) To provide the alternative method for road cleaning.

4) Develop eco-friendly road cleaning technique.

5) Reduce the road cleaning cost.

6) To reduce human efforts.

7) To avoid noise pollution.

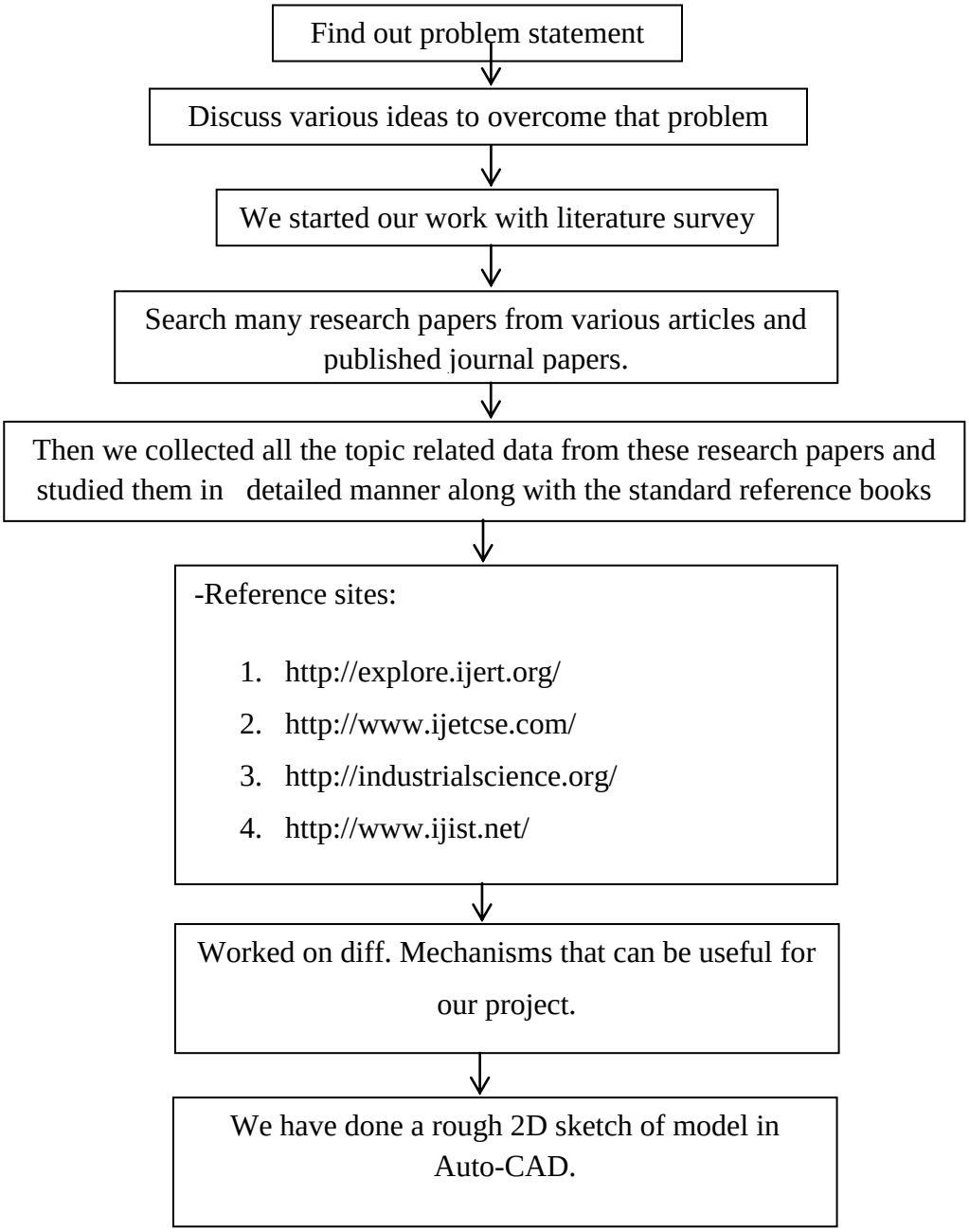
8) Cleaning of dust and dirt by use of brush.

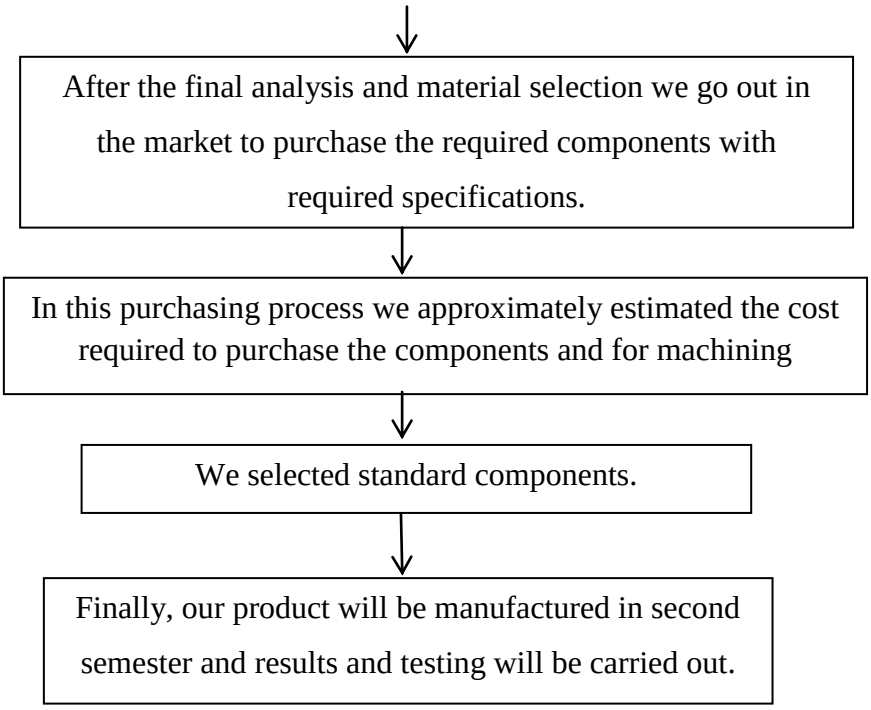
9) To support “SWACH BHARAT ABHIYAN”.

# 5. Methodology

## 5.1 Phase I

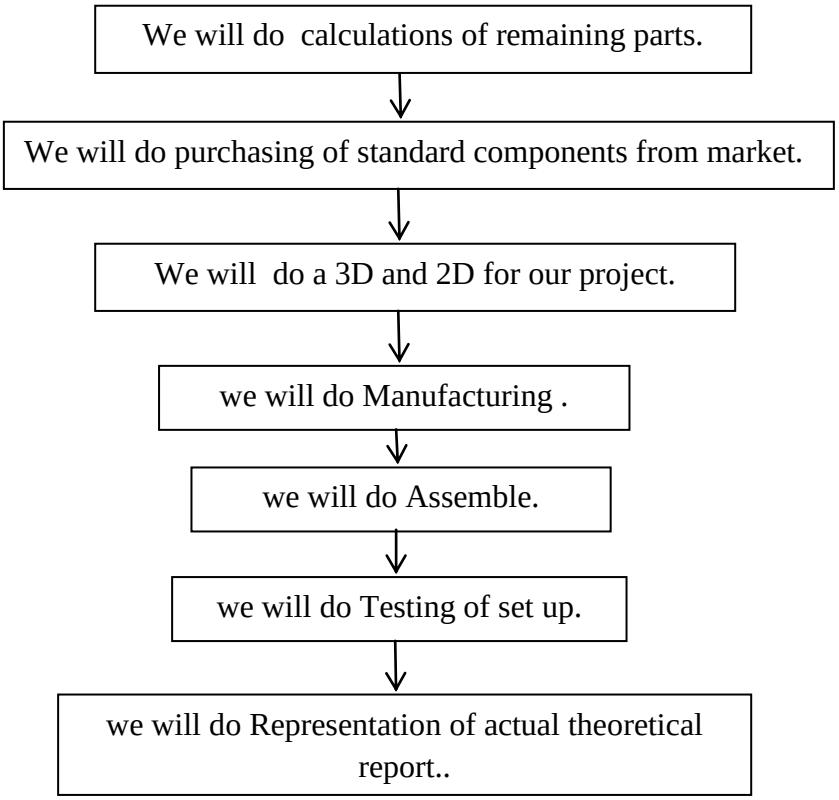
Work on project concept






## 5.2 TO DO IN PHASE II

Actual preparation of project:



## 5.3 WORKING PRINCIPLE

Eco friendly road cleaning machine is an advanced type of machine used for the roads or streets. The detail working of the Eco-friendly road cleaning machine is explained below Eco friendly road cleaning machine we are making without using fuels and engines. The machine is run by a solar energy which is stored in battery. The system is fixed with pair of wheels which are connected with the help of shaft.

The shaft makes the wheels connected to one and other. The wheels are moved for a desired position with a help of motor force. A chain drive is connected to the wheels and gear at both sides.

The chain is moved according to the wheel and gear. The brush moving opposite direction of the wheels move and the brush brooms the waste present on the road also it dumps the waste into the waste collecting box. The waste collecting box is removed to dump the waste into desired places.

# 6. COMPONENTS

1) Brush
2) Chain drive
3) Gear pair
4) wheel
5) Solar panel

## 6.1 Brush

The cleaning brush is located at outside of the machine and it is mounted on the shaft which is rotated with the help of chain and sprocket unit. The main work of the brush is to push the Garbage into storage tank.

Fig.6.1 Brush

A brush is a common tool with bristles, wire or other filaments. It generally consists of a handle or block to which filaments are affixed in either a parallel or perpendicular orientation, depending on the way the brush is to be gripped during use. The material of both the block and bristles or filaments is chosen to withstand hazards of its intended use, such as corrosive chemicals, heat or abrasion. It is used for cleaning, grooming hair, make up, painting, surface finishing and for many other purposes.

It is one of the most basic and versatile tools in use today, and the average household may contain several dozen varieties. A common way of setting the bristles, brush filaments, in the brush is the staple or anchor set brush in which the filament is forced with a staple by the middle into a hole with a special driver and held there by the pressure against all of the walls of the hole and the portions of the staple nailed to the bottom of the hole.

## 6.2 Chain drive

The main disadvantage of the belt drives and the rope drives is that the velocity ratio does not remain constant, but varies on account of slip. Since chain drives are positive drives there is no slip, hence the velocity ratio will remain constant.

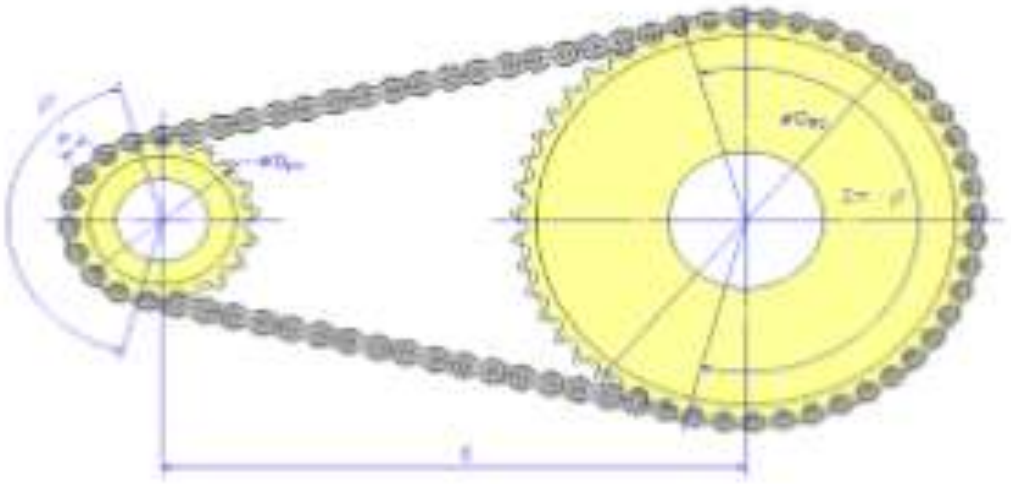


Fig.6.2 Chain drive

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.

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth.

## 6.3 Gear pair

A gear or cogwheel is a rotating machine part having cut teeth or, in the case of a cogwheel, inserted teeth (called cogs), which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine

Fig.6.3 Gear drive

The teeth on the two meshing gears all have the same shape. Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, called a rack, producing translation instead of rotation. The gears in a transmission are analogous to the wheels in a crossed, belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

When two gears mesh, if one gear is bigger than the other, a mechanical advantage is produced, with the rotational speeds, and the torques, of the two gears differing in proportion to their diameters. In transmissions with multiple gear ratios—such as bicycles, motorcycles, and cars—the term "gear" as in "first gear" refers to a gear ratio rather than an actual physical gear. The term describes similar devices, even when the gear ratio is continuous rather than discrete, or when the device does not actually contain gears, as in a continuously variable transmission. Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radically.

**6.4 wheels**

The invention of the solid wooden disk wheel falls into the late Neolithic, and may be seen in conjunction with other technological advances that gave rise to the early Bronze Age. This implies the passage of several wheel-less millennia even after the invention of agriculture and of pottery, during the Aceramic Neolithic.

In its primitive form, a wheel is a circular block of a hard and durable material at whose center has been bored a circular hole through which is placed an axle bearing about which the wheel rotates when a moment is applied by gravity or torque to the wheel about its axis, thereby making together one of the six simple machines. When placed vertically under a load-bearing platform or case, the wheel turning on the horizontal axle makes it possible to transport heavy loads; when placed horizontally, the wheel turning on its vertical axle makes it possible to control the spinning motion used to shape materials (e.g. a potter's wheel); when mounted on a column connected to a rudder or a chassis mounted on other wheels, one can control the direction of a vessel or vehicle (e.g. a ship's wheel or steering wheel); when connected to a crank or engine, a wheel can store, release, or transmit energy

Fig.6.4 Wheel

## 6.5 SOLAR PANEL:

Photovoltaic modules use light energy from the Sun to generate electricity through the photovoltaic effect. Most modules use wafer-based crystalline silicon cells or thin-film cells. The structural member of a module can be either the top layer or the back layer. Cells must be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones based on thin-film cells are also available. The cells are connected electrically in series, one to another to a desired voltage, and then in parallel to increase amperage. The wattage of the module is the mathematical product of the voltage and the amperage of the module. A PV junction box is attached to the back of the solar panel and functions as its output interface. External connections for most photovoltaic modules use MC4 connectors to facilitate easy weatherproof connections to the rest of the system. A USB power interface can also be used.

Module electrical connections are made in series to achieve a desired output voltage or in parallel to provide a desired current capability (amperes) of the solar panel or the PV system. The conducting wires that take the current off the modules are sized according to the ampacity and may contain silver, copper or other non-magnetic conductive transition metals. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated. Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

Fig 6.5. Solar panel

## 7. Advantages

- Eco friendly road cleaning machine.
- Eco friendly road cleaning machine is an advanced type of machine used for the roads or streets.
- Cost of machine is low.
- Maintenance of machine is less.
- Save the time.

## 9. Summary

In this Project we successfully completed the basic need & requirement for solar operated road cleaning machine. Now we can make calculation & prototype for road cleaning using solar energy.

## REFERENCES

1. Design & analysis of manually Operated eco-friendly road Cleaner by Prof. Dr. A. Muniaraj, Aravind, K, Kadamban, T, Thirumalai Balaji.
2. Design of Dust Collector for Rear Wheel of Four-Wheeler by Abhishek Chakraborty, Ashutosh Bansal.
3. Design & Development of Road Side Cleaning Machine by Ashish Patil, Pranav Patil, Jaywant Patil, Rohit Ingawale, Sanket Nalawade, Amar Patil.
4. Design and Fabrication of Multipurpose Eco- Friendly Cleaning Machine by Praveen H, Harish Gowda GR, Anil G Ramageri, Arunkumar Kallammanavar, Prasanna P Kulkarni, Girish B Kalliha
5. Design and development of tricycle operated street cleaning machine by sandeep j. Meshram, dr.g.d.mehta .