Fabrication of Portable Street Vacuum Cleaner
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Abstract. This project is inspired by the Swachh Bharat Abhiyaan. Swachh Bharat Abhiyaan an initiative by the prime minister of India Mr. Narendra Modi. The aim of this project is to clean the streets and road efficiently in very less time and at a low cost. In developing country the streets are really filled with dusts and debris so there is a need make a machine to clean the streets. Scooter is used to move the machine from one place to another. Vacuum cleaner is used as the main thing in cleaning the road. The street cleaner is able to suck at least 25 grams of small dusts and debris from the ground. The portable street vacuum cleaner is really effective in cleaning the roads.

Keywords: Street cleaners, pollution control, vacuum cleaner.

1. Introduction
Street cleaning is a solid waste management system in which public awareness play important role. In literature very little information is available on aspect belong to street vacuum cleaner. The air pollutant of microscopic size creates lot of problem to the human body. The dust particles, soil are dangerous for health. They are responsible for many disease likes Irritation of the eyes, Coughing, Sneezing high fever, Asthma attacks etc. The wastes deposited on the streets adversely to the visitors and also indirectly distress the economy of the country. Asian manufacturers of sweeper developed very less sophisticated air sweepers. Taiwan and China both adapted mechanical sweeper for cleaning roads and streets by designing two brooms mounted vertically at the back of the hopper. The available street sweepers in market are PM10 certified, it means they are able to collect particle size less than 10μm. The effectiveness of this pollution may be examined by gross pollutants (> 5 mm) and sediment. Experimental studies reported that the street sweeping is highly effective for solids greater than the size of 2 mm. An attempt has been made by researchers for improving the air quality. Scholl et. al. [1-2] reported that the quality of the air is deteriorating day by day and it can be improve by using a proper cleaning of street. Banmerman et. al. [3] reported that we can remove solid pollutants upto 10-15% by using broom. Crites et. al. [4] reported in his research work that dust particles create number of problem for living things. Selbig et. al. [5] investigated various things in his project like effectively removing pollutants from highways and reducing the street surface load of fine particles (below 125 μm). These days we see there are lots of wastes lying on the streets so an idea was required to clean the streets at an efficient and effective way. So, there is a requirement of street cleaning machine for Rural and Urban areas of India which can reduce human efforts and improve air quality at low cost.
2. Methodology

2.1 Street Cleaning Processes

There are two process of street cleaning- (i) Manual process and (ii) Machinated process. In first process, cleaning is done with the help of broom and shovel. In this process a person is continuously swiping by a broom in the hand to clean the street by spreading the dust all over in the air. On the other hand second process is very costly. In this processes brooms and strong vacuum head(s) for picking-up both large and small materials attached within typical pavement structure. The concept of design was taken such as that it can balance the vacuum cleaner and motors very efficiently. Chassis was created and it was attached to the scooter. Motors were attached at the front of the tyres. Tyres were placed at one side and on another side the whole setup. The design was created with the help of solid works. All the necessary materials were attached with chassis. The design on solid works was created in such a way that it could be incorporate in real life.

2.2 Material Specifications

1) Vacuum Cleaner:
   - Operating voltage: 220 volts
   - Power: 1200 watts
   - Single phase AC
   - Product dimensions: 52 x 25.2 x 20 cm: 3.6 Kg
   - Suction pressure 20 kpa

2) Engine:
   - Engine displacement 125 CC
   - Engine type air cooled, 2-stroke
   - No. of cylinders used 1
   - Valves Per cylinder 2
   - Max power generated 8.7 Bhp @7000 rpm
   - Max torque 10.0 Nm @5500 rpm
   - Fuel type petrol
   - Fuel capacity 6.0 Litres

3) Wheels & Tyres:
   - Front tyre (Full Spec) 90/90-12, tube
   - Rear tyre (Full Spec) 90/90-12, Tube

4) AC Motors:
   - Single phase A.C motors
   - Operating voltage: 220 volts
   - 1400 r.p.m
   - Frequency: 50 Hz

5) Setup Dimensions:
   - Length 1825 mm
   - Width 711 mm
   - Height 1188 mm
   - Wheelbase 1275 mm
   - Ground clearance 165 mm
   - The dimension of the frame was (3x4) feet’s. The frame was made of mild steel.

6) Mop Dimensions:
   - Diameter 12 inch
   - Teeth 4 inches long each
The mop is attached with the hub. The mop will help in cleaning the road as it will rotate with the help of an A.C motor. The mop was placed on both sides of the scooter and it collects all the dusts in the middle of the scooter so that vacuum cleaner will suck up all the dusts and debris from the middle of the road by the vacuum cleaner.

![Fig.1: Final picture of the street cleaner](image)

This is the final picture of the street cleaner. It will be really helpful in picking up small debris from the streets and also dusts.

2.3 Fabrication Steps of Street Cleaner

First we purchase a scooter and vacuum cleaner from market. We first design the chassis by joining the two metals with the help of welding. The whole idea was to balance the scooter such a way that it doesn’t fall off. The sweeper was attached to the front of the wheel of the scooter one on both of the sides. The motor and the vacuum cleaner were operated by electricity 220 volt. The single phase A.C motor is attached to the sweeper. After assembling all the essential parts on scooter the rotation of the sweepers and the power of the vacuum cleaner were tested. Fig.1 shows the front view of the street cleaner in which two tyres are attached with the mop placed one on each side. The mop placed on the sides is free to move up and down according to the situation.

3. Result and Discussion

The motor is rotating properly and it is efficiently able to rotate the sweeper machine. The tyres are able to rotate properly in the desired direction. The vacuum cleaner is able to clean things properly and also able to suck dusts and debris efficiently. The portable street cleaner is able to suck dust particles of size less than 1 inch and approximate weight 25 grams or less efficiently. The bag is able to collect approximately 3-5 kg of debris and dusts in one time. The size of the debris collected by the street cleaner varied from some 10 millimetres to 4 centimetres. The debris collected also depended upon the weight of the debris collected. The PM10 certified cleaner are capable to collecting and holding particle sized less than 10μm. However a modern air street sweeper creates very high noise level due to this fact it requires an extra engine. But this portable street cleaner is very effective for developing country likes India.

4. Conclusions

During the experiment we have faced many problems for fabricating portable street cleaner. The problem with the rotation of the motor, which can be rectify by taking a more powerful motor. The dust and debris sucking are effectively depends on the power of the motor. No expertise is required for
operating street cleaner. The street vacuum cleaner is effectively clean the small dust particle and debris. The portable street cleaner is able to suck dust particles of size less than 1 inch.

5. Acknowledgments
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