

Road Side Dust Collector Machine

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Abstract - With the disintegrating quality of air these days in major cities across Asia, numerous technologies have been proposed recently to mend the same. Vehicles travelling on road make up to 33% of air pollution just by kicking the dust on road sides into the air. The Road side dust collector machine proposed in this project has been designed and fabricated keeping in mind the stumbling blocks of the dust on the road sides in India. This machine involves different mechanisms by collecting the dust from side of the roads and dumping it away. The purpose of this paper is to present the comprehensive as well as qualitative study of system of the dust collecting machine.

Key Words: Air Pollution, Vehicles, Mechanisms.

1. INTRODUCTION

Road side dust is a common air pollutant generated by many different sources and activities which vary in size from invisible to visible. Dust kicked up by cars along Delhi's vast and growing road network contributes between a third and 56% of the most harmful pollutants in the city's atmosphere^[8]. Since, percentage of people who travel as pedestrians and also through two wheelers are at high risk, The Road side dust collector by dint of various mechanisms allow us to cumulate the particles disseminated near around the edges of the road.

However, many innovative machines have come up in recent years in order to promote cleaner roads such as "Tricycle operated street cleaning machine", "Manually operated road cleaning machine" & "Dust collector for rear wheel of four wheeler" with few claiming to remove the dust and waste to the side of the roads like "Multipurpose Road cleaning machine" but no machine till date has been designed and fabricated specifically with the objective to ensure cleaner side of the roads by collecting the scattered dust near edges promoting evenly cleaned roads. Although, very rare cases of accidents have been filed due to road dust, making up to 10% of total road accidents, but that cost as much as 0.02% of GDP in some developing countries i.e. \$800 million annually^[3].

Road side cleaner machine not only collects the layers of the dust from the sides but also transfers it into wheel barrow using bucket conveyer to carry it to dumping sites.

2. LITERATURE REVIEW

2.1 Prathmesh Joshi¹, Akshay Malviya², Priya Soni³

This paper is based on "Manual driven platform cleaning machine" which provides the basic need of cleaning very large floor areas such as railway platforms, hospitals, malls and many investments have been made for the same. In recent times Indian Railways has purchased platform rider scrubbers and platform cleaning machines from various companies to ensure hygiene. Due to absence of electricity at bus stand, railway platforms and other commercial places, the automatic cleaning machine isn't suitable in every condition. The author fabricated a four wheeler cart with the help of accessories such as belt, pedal axle, scrubber brush, U-clamp cleaning process is executed.

2.2 Sandeep J. Meshram¹, Prof. G.D.Mehta²

This paper deals with design and fabrication of tricycle operated street cleaning machine suggesting that we have few foreign automated machines that are used in our country according to the road conditions. The objective of the author is to propose semi- automatic machine for rural and urban areas in order to reduce human efforts and time.

A suggested solution over the current state of art is being explained through this article. The technique of this unique machine runs with the power of ten humans.

2.3 Ritvick Ghosh¹, H R Vinay Kumar², Dattatraya³, Pavan Kumar B. Hiremath⁴, Prof. Pradeep Kumar⁵

Pedal operated floor mopping machine is operated at low speed with the help of mechanical power using foot pedals. This mechanism is somewhere close to the spinning mop also known as "magic mop". For speed multiplication with right gear specification bevel gear has been used. And for better ergonomics the machine move on three wheels which is driven using pedals with the help of mechanical drive train. Attempts have been made to make the turning radius of the machines as small as possible so as to get efficient and effective cleaning without missing any spots. An additional mechanism is provided to remove dirty water by which the mop can be cleaned and fresh water is supplied to offer continuous floor cleaning.

2.4 M. Ranjit Kumar¹, N. Kapilan²

This paper elaborates manually used floor cleaning machine which differs from conventional floor cleaning machine which is dependent on electricity for the usage. Modeling and analysis of this machine is done by using available software called ANSYS, the stress level in the machine were found to be within safe limits after finite element analysis. This cleaning machine is uniquely designed to clean the floor which are smooth and plane such as tiles, mosaic and smooth surfaces. Manual cleaning machine is a better alternative than automated cleaning machine at the time of power crisis. Pedal operated body is used to achieve dry and wet cleaning concurrently.

2.5 Aman khan¹, Anurag Pannase², Amol Sharnagat³, Prof. Gaurav Gohane⁴

The objective of the paper is to propose a machine having multiple benefits with minimum usage of resources. This is based on basic principle of science; the project is a collusion of mechanical, electrical and electronic devices. The multipurpose road cleaning machine can be used on different roads in rural and urban areas. This machine resolves the issue of dusty roads, choked pipeline, manholes, removal of metal particles from road and obstacles.

2.6 Abhishek Chakraborty¹, Ashutosh Bansal²

Dust collector of four wheeler has been designed keeping in mind the slinging of the road dust due to vehicle movement. Considerable fraction of PM10 in urban air is usually due to non-exhaust traffic emissions and sling from the street surfaces. These road non-exhaust emissions are generally uncontrolled and detail about the productiveness of alleviation measures on paved roads is still scant. The main objective is to design and fabricate a collector system for high clearance to reduce the level of non-exhaust emissions to some extent. The model consists of a centrifugal fan to absorb dust before it open out and pollutes the air, which is to be placed on and above the rear side of the wheel. This system will help in controlling and reducing the dust concentration behind the vehicle.

3. PROBLEM STATEMENT

One of the major predicaments that developing countries face is cleanliness. To deal with it, every year new machines are either imported or purchased from domestic market. These machines have their own limitations and one of the major being their inability to enter every road or streets that are left untidy. Dust from construction sites, slinging of vehicles, metallic mineral dust from factories and wood dust collectively contribute towards untidiness of the road sides. The effect on health is severe as people experience irritation in eyes, coughing, sneezing, hay fever and even asthma attacks. For people with respiratory conditions like asthma, chronic obstructive airways disease (COAD) or emphysema even small increases in dust concentration can make their symptoms worse^[9].

On one hand cleaning machines are also taking the employment of workers in municipality, but Road Side dust collector is manually driven by operator and is suitable to collect dust from every street or road. Expenditure on importing the cleaning machines are really high even after knowing their inability to reach narrow roads and streets, Road side dust collector is cost efficient as compared to other cleaners available.

4. FIELD SURVEY

There is no such machine yet available anywhere, like the one described through this paper that not only saves human power but also saves time and money so it is important to find out what people are needed practically in the field. So interactions with the people who have been involved in road cleaning activities help us to identify the actual requirement of such machines.

Following are some important suggestions and experience given by highly experienced individuals:-

1. Interaction with an employee of MCD having experience of more than 22 years.

According to him his job has been made stressful, painful, tedious and hazardous. After cleaning the dust on the street continuously for four to five hours a day. It is very painful to their shoulder and arms. As suggested by him one should develop a machine or equipment which can lower the human effort while cleaning street.

2. Interaction with another women employee at Shaheen Bagh, Okhla, Delhi having experience for 10 years in road cleaning.

According to her she has been suffering from asthma due to dust stewed in the air while brooming the streets, roadsides, payments, corner etc, so she gave the suggestion that if any semi-automated machine could be developed by the government to clean the roads, it will be better to her health as well as other people health also.



Figure 1:- <https://scroll.in/article/730324/hyderabad-sweepers-can-take-the-heat-but-not-the-insensitivity-of-others>

5. OVERLOOK AT CURRENT TECHNIQUES

Some current techniques are:-

1. Manual sweeper
2. Vacuum cleaner rate
3. Shovel and spade

The manual operated machines are laborious, time consuming, hazardous, and tedious. On the other side of the flip the petrol and diesel operated machines are costlier. These problem ultimately starts to think for an alternative method which nullify the disadvantages of former said processes.

Further its initiation cost is low, the newly developed concept is a dust collecting machine is operated by human and dc motor power.

To accomplish this innovative idea, the current work is carried out by:-

1. Firstly, literature survey and the complete market review based on the street cleaning processes been done.
2. Prototype model was made to get the full view of the machine, ergonomics was studied for better comfort of the operator and some parts modification have been done out of it.
3. On the basis of the limited power the machined components are designed.
4. On the basis of designed dimensions the fabrication work of the proposed road side dust collector machine is carried out.
5. At last, the testing and traits have been taken to specify the load capacity of the machine and its feasible.

6. DESIGN METHODOLOGY

Design and fabrication of the machine involved the steps mentioned below :-

1. Identification of market review.
2. Design of the prototype model.
3. Evaluation of the design
4. Assembling major components of the machine.
5. Fabrication of dust collector machine.
6. Testing and trial run of the machine.

7. CONSTRUCTION

The figure below displays the basic design of Road side dust collector machine. The Double wheel barrow being the main component of the machine stores dust in its bucket and has supported bucket conveyer, motor panel and battery panel

on it also the side facing the operator can slide upwards to dump the waste. The material used is mild steel and thickness of metal sheet used is 0.1mm. The bucket conveyor is installed with the help of two supporting arms on wheel barrow. Conveyer has two rollers, driving and driven and 12 buckets. Conveyer is driven by a 12V DC motor through roller chain mechanism which is powered by the 12 volt battery both installed on wheel barrow. The metallic scoop is attached on bucket conveyor frame in front of the wheel barrow is made up of mild steel. The scoop is wired with a lever mechanism attached to the handle of the wheel barrow to lift the scoop upwards. The scoop also has guide path for dust entering using two metal plates. A battery used to counter balance the weight of the bucket conveyer on right.

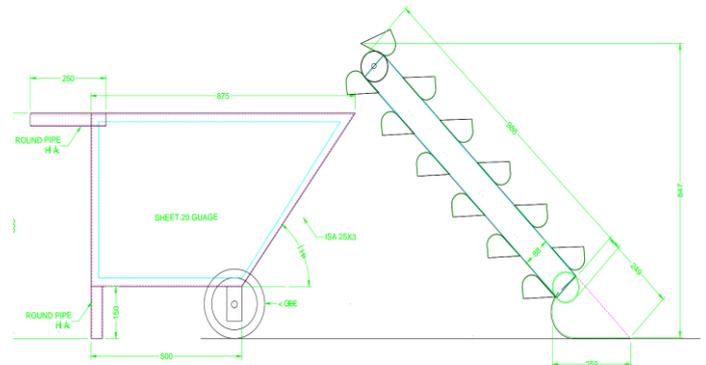


Fig -2:- Design made by AutoCAD software.

8. WORKING

8.1 Double wheel barrow

The double wheel barrow is the part where all the dust is to be stored with the help of bucket elevator. The side facing the operator can slide upwards while dumping the dust at different site. It has main frame of bucket elevator welded to it at 45° angle with two supporting arms towards the right side of the bucket elevator.

Double wheel barrow has housing for both battery and DC motor on it.

8.2 Bucket Conveyer

Bucket conveyer is at front of the double wheel barrow with total 12 buckets attached to the conveyer having driving and driven roller. The driving roller is attached to DC motor via roller chain mechanism.

Buckets after bringing the dust and dumping it in wheel barrow, returns back to fill itself at metallic scoop.

8.3 DC Motor & Roller chain drive

A DC motor mounted on front edge of the Double wheel barrow is powered by battery. It drives the bucket conveyer

through a roller chain drive connecting motor and driving pulley.

8.4 Battery

A 12V battery is installed in battery panel on the wheel barrow, which powers the DC motor to run the bucket conveyers. Battery is the power house of this machine. Battery panel is located to counter balance the weight of bucket conveyor frame.

8.5 Metallic scoop & lever

Metallic scoop collects the dust from roads when it's edge comes in contact with road surface. Buckets when almost come in contact with scoop surface, fills it selves to carry the dust to wheel barrow.

A lever is wired to metallic scoop to lift its front edge to prevent dust from sliding back to the road surface.



Fig- 3 :- Our Project Design.

FUTURE SCOPE

1. Machine can be made totally operator less thereby making it work with no human effort.
2. With the help of I.R. sensors and transducer the undesired collision can be prevented.

3. Conveyor can be made flexible to slide on the either side making machine usable on both side of the road.
4. Solar panel can be used to charge the battery making the machine more efficient by the use of renewable energy.

CONCLUSION

The project promises a clean environment by giving evenly cleaned roads in towns and cities. This also means less amount of dust in the surrounding, minimizing the levels of PM 2.5 - PM10 in the air giving cleaner and safer air in the environment. The machine is a priority over machines that are heavy, bulky and cannot be used for narrow roads or pavements. Additionally, it is much more cost efficient as compared to other machines in terms of both production cost as well as running cost. The machine more over also promises employment to the cleaners.

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