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Design and Development of Eco-Friendly Road Sweeper Machine

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Abstract: ***This project is related to design and development of most effective machine that is manually operated mechanical pollution free road cleaner. The Road cleaner is used to keep our mother earth clean. So that we feel fresh while walking on streets. Generally, in era of modern technology, different devices such as electric motors, diesel engines and robots are being used to clean floor, road. These methods make much pollution, maintenance and very tough to carry out. The main objective of this paper is to spread this idea of our prototype road cleaner to each one which aims to. Hence, the present work is aimed to design and develop a manually operated road cleaning machine which is eco-friendly, cost effective, portable and less maintenance. Cleaning has become a basic need for all human beings and it is unavoidable in our daily routine process. The conventional floor/road cleaning machine is most widely used in railway stations, airports, hospitals, Bus stands, colleges etc. also this machine needs electrical energy for its operation. It is not user friendly as well as ecofriendly. In summer time there is power crisis and most of the floor/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. Hence this project is very useful in our day to day life.***

Keywords: eco-friendly, floor clean, sweeper roller, effortless, manually operated etc.

I. INTRODUCTION

Cleaning is a necessary factor of daily routine process. Directly and indirectly, good cleaning and sanitizing promote and safeguard human health. To maintain the area around us clean, we utilize the road cleaner. so that we can roam the streets feeling revitalized. Robots, diesel engines, electric motors, and other technologies are frequently employed to clean the ground and roads in the age of contemporary technology. But these procedures are difficult to carry out, produce a lot of pollution, and require a lot of upkeep. Therefore, user-friendly road and floor cleaning equipment must be developed in order to conserve energy and protect the environment. A machine that must be manually operated in order to replace the standard electric cleaning machine. A set of wheels that are fixed to the dust-cleaning machine system and connected by a shaft. The shaft connects the wheels to each other. With the use of manual force that can manage it, the wheels are shifted to the proper position. At either side, a chain drive connects the wheels and gear. The wheel and gear determine how the chain is moved. The brush sweeps up any debris on the road and deposits it in the waste-collection box while travelling in the opposite direction of the wheels. To dispose of the waste where you want it to go, remove the waste collection box. We used such type of materials for manufacturing of road cleaning machine finally. We have observed that all the components are with in safe limit in the manually operated road cleaning machine.

Cleaning machine is very much useful in cleaning around us like road and ground and our colleges campus and outside ground 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 road 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 cleaning the cricket ground, 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. Cleaning is essential need of this generation. Basically in colleges ground cricket ground and road for cleaning regularly different...rotary motion on the floor which cleans the dirt or dust. The remaining water on the floor is wiping by the wiper present in end of the cleaning machine.

Road cleaning machines or floor cleaning machines are used in private as well as commercial area such as hospitals, bus stand, malls, lawns, floors etc.

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Many of these devices required high amount of electricity or fuel like petrol diesel for their operation. They produce enough pollution to pollute environment. So in order to save energy and save nature, it is need to develop low cost, user friendly road cleaning machine. Our focus is to develop a machine which should be operated manually so that it can be alternative for conventional electric road cleaning machine. In this work we have done modeling and analysis of the road cleaning machine. We used such type of materials for manufacturing of road cleaning machine finally. We have observed that all the components are with in safe limit in the manually operated road cleaning machine.

II. PROBLEM DEFINITION

1) The conventional road sweeper machines used for cleaning streets and public areas contribute to environmental pollution and resource depletion due to their reliance on fossil fuels, emission of harmful pollutants, and inefficient waste management practices.
2) In light of increasing environmental concerns and regulatory pressures, there is a pressing need to develop eco-friendly road sweeper machines that minimize environmental impact, reduce energy consumption, and promote sustainable cleaning practices.
3) In response to these challenges, the development of an eco-friendly road sweeper machine presents an opportunity to mitigate environmental harm while improving cleaning efficiency and operational effectiveness.
4) The proposed road sweeper machine aims to incorporate sustainable technologies such as electric propulsion systems, renewable energy sources, advanced waste management systems, and efficient cleaning methods to achieve.

III. BLOCK DIAGRAM

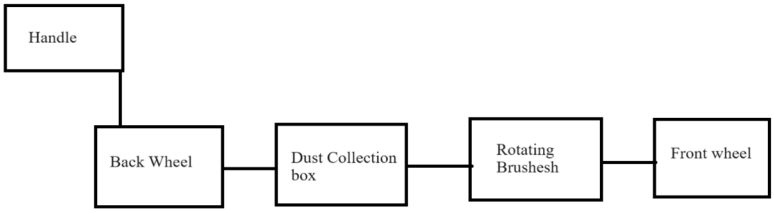


Fig.1.Block Diagram

IV. WORKING

In the design of the road cleaning machine is very compact as compare to other cleaning machine are available in the market but has the attractive design and high durability and cheap cost as compare to other road cleaning machine.

1) It cleans the surface as well as catches all unwanted material from road.
2) It is a tricycle operated system we have given motion to sweeper using chain drive mechanism.
3) After main shaft secondary chain used to rotate secondary axle which are directly connected to sweeper axle.
4) Third axle also connected to system which has cotton brush which clean surface.
5) For properly working of sweeper addition of new shaft.
6) Addition chine drive in both side used to increase gear ratio.
7) Addition of two wheel in back side of machine for giving support to frame.

A. *Design*

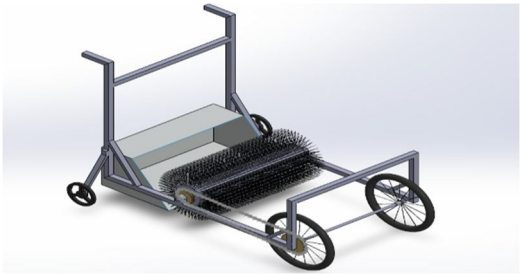


Fig.2.Design of system

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B. Components Used

1) Chassis

One of the main parts that various parts like brushes, shafts, bearings, containers, and other parts are placed on is the chassis. It bears the weight of the particulates of dust gathered during operation as well as the weight placed on it by different components.

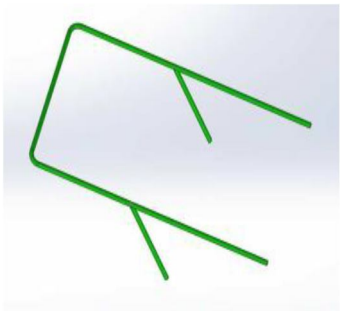


2) Wheel

The wheel is used to provide rotational motion and power to the machine while it is being pushed forward because of friction between the floor and the friction material in the tyre. The choice of tyre for the bike is made. It absorbs vibrations, distributes the weight of the chassis into the ground, and supplies the machine's balancing loads.



3) Handle



4) Brush

The brush is made comprised of the brush support, ring, and brush tool. The brush is securely held in place in a groove by the brush support. The ring that secures the brush support is soldered to it. The ring is a circular construction composed of flat bar with a bore in the centre to attach it to the rotating brush shaft.

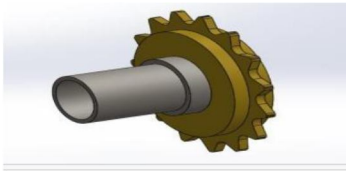


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5) Sprockets

With the aid of chain drives, sprockets with various diameters have been utilised to transfer power to additional shafts at differing speeds and torque by functioning as spur gears. The rickshaw's spur was chosen. I chose the smaller sprocket from the bike store.



6) Chain

Because the centre distances between shafts are greater, the chain drive is employed to transfer power from one shaft to another. Since the chain drive transfers rotation in the same direction as the driven shaft, it functions as an open belt drive and a basic gear train. It is made up of different chain elements, both external and internal. It is inserted into the space between succeeding teeth together with the sprockets.



7) Container

The dust particles that the cylindrical brush throws are collected in a container. Additionally, this offers a steel guide plate to direct the dust particles into the containers. In order to stabilise it in a horizontal plane when inserting it into the groove, a holding rod is also included. To provide stability in a vertical plane, L-shaped supports are positioned vertically on both sides. To make carrying the container and emptying the gathered dusts easier, two handles are included.



8) Bearings

Bearings on machines limit relative motion to just that which is desired, therefore reducing friction between moving components. For example, the design of the bearing may permit the moving part to freely rotate around a fixed axis or move freely in a linear path. It may also be used to stop motion by adjusting the vectors of the normal forces impacting on the moving parts.



V. CALCULATION

Diameter of the wheel = 62 cm
Radius of the wheel (r) = 31 cm
Circumference of the wheel = 2 * π * r = 2 * π * 31 cm = 194.77 cm
RPM of the cycle wheel = 30 revolutions per minute
Since 1 revolution of the cycle wheel corresponds to 3 revolutions of the brush, the brush makes 3 times as many revolutions as the wheel.

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Now, let's calculate the distance covered by the brush in one minute:
Distance covered by the wheel in one minute:
Distance = Circumference of the wheel * Number of revolutions per minute
= 194.77 cm * 30 revolutions
= 5843.1 cm or 58.43 meters

Distance covered by the brush in one wheel revolution:
Since 1 revolution of the cycle wheel corresponds to 3 revolutions of the brush, the distance covered by the brush in one wheel revolution is 3 times the circumference of the brush:
Distance per wheel revolution = 3 * Circumference of the wheel
= 3 * 194.77 cm
= 584.31 cm or 5.8431 meters

Total distance covered by the brush in one minute:
Distance covered by the brush in one minute = Distance covered by the wheel in one minute * Distance per wheel revolution
= 58.43 meters * 5.8431 meters
= 341.47 meters (approximately)
So, the brush covers approximately 341.47 meters in one minute.

VI. RESULTS AND DISCUSSION

For superior industrial/professional cleaning and sweeping needs, use a mechanical sweeper. The dust and debris are propelled to a great extent by the brooms' motion. hefty machinery. Machine with High Pressure.
Cleaning machines come in quite handy when it comes to cleaning floors and outdoor areas in public spaces such as bus stops, stores, auditoriums, and hospitals. Although there are several floor cleaning machines on the market, the one we designed is really straightforward to assemble and use.
Anyone may simply run this equipment. For this reason, it is highly helpful in hospitals and other vast spaces. Both the time and the cost of cleaning are quite low. There are lower maintenance costs.
We built the machine in our project such that it functions entirely mechanically.

A. Testing Output

Quantitative testing						
			For man		For machine	
S.N	Area taken(sq cm)	Mass of dust spread (kg)	Time taken(s)	Mass collected(kg)	Time taken(s)	Mass collected(kg)
1	20600	1.2	43	0.638	09	0.6559
2	51000	1.5	104	0.99	24	1.2
3	90000	2.1	178	1.29	44	1.33

After conducting an examination and observation, it was evident that a machine-cleaned area yielded a significantly cleaner and dust-free surface compared to an area cleaned manually with a basic broom. However, it was noted that the machine's fast brush speed might lead to the forceful dispersion of dust particles.
In situations where there is a power outage, the manual eco-friendly road cleaner serves as an ideal substitute for automatic road cleaning machines, especially considering that traditional road cleaning equipment typically relies on fuel or diesel, contributing to pollution and noise. Moreover, manual cleaning exposes individuals directly to dust, potentially causing health issues such as shoulder strain.
To address these concerns, an environmentally friendly road cleaner operated manually offers a viable solution. Despite its manual operation, this cleaner can cover a significant area efficiently, saving both time and cost compared to existing machinery. Additionally, it proves to be cost-effective and provides employment opportunities, particularly for unskilled individuals who require such jobs.

During testing, it was observed that the manually operated eco-friendly road cleaner may face challenges in effectively cleaning severely broken or bumpy roads. However, the manual labor required for operating the machine ensures job opportunities for individuals who may lack formal education or specialized skills.

VII. ADVANTAGES

Manual effort is reduced.

1) Effective cleaning
2) Power consumption is less.
3) Design is very simple.
4) Easy fabrication.
5) Brush occupies large cleaning area.
6) Net weight is less.
7) Maintenance cost less.
8) It can be used in various floors.
9) Smoother operation.
10) By further modification the drive or movement can be made automatic.

VIII. CONCLUSION

The manual eco-friendly road cleaner has been successfully conceptualized, analyzed, and constructed, presenting an effective solution for road cleaning that reduces costs, human labor, and time. Particularly useful during power outages, this manually operated cleaner serves as a viable alternative to automated machines, which often rely on petrol or diesel, contributing to pollution and noise. Unlike traditional cleaning methods that pose health risks due to direct contact with dust and can lead to shoulder strain from continuous sweeping, the manual eco-friendly road cleaner prioritizes operator safety and comfort. Its ergonomic design and efficient cleaning mechanisms ensure a comfortable and effective cleaning experience.

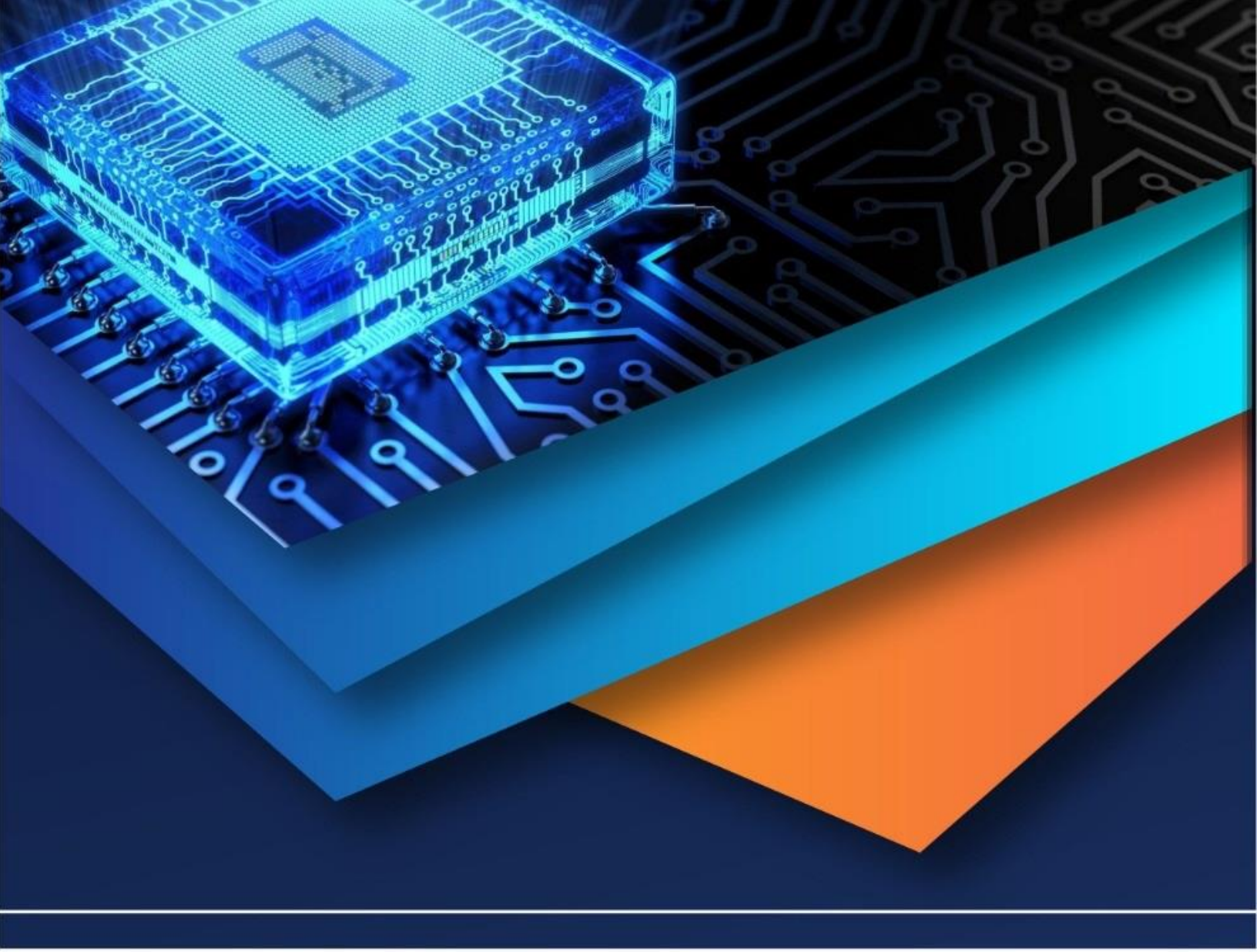
In summary, the development of this manual road cleaning machine represents a significant step forward in maintaining cleanliness across various environments. By addressing key issues such as pollution, noise, and operator health, this innovative solution offers a practical, efficient, and cost-effective approach to road maintenance.

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