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Design and Fabrication of Automatic Floor Cleaning Machine

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Abstract: ***Cleaning is essential one to make the environment sanitary. This work deals with design and fabrication of automatic floor cleaning machine. Here in this project, we reducing the vibration that produced by motors in machine during cleaning process. And reduce the cleaning time to save the time and reducing the human effort to make the environment clean. And also providing the easy way of Bluetooth control system to control the machine effort less. The machine cleans the 100 m^2 room within 18 min both sweeping and wet moping operations with the speed of 0.51 km/hr. The purpose of this project is to clean the floors in hospitals, malls, auditoriums etc.***

Keyword: Floor cleaning, machine, wireless, automation, design and fabrication.

I. INTRODUCTION

This project deals with designing and fabrication of floor cleaning machine. The main aim is to reduce the cleaning time and manual effort. For public and office buildings about 80 to 90% of the dirt is tracked in from outside. Clean more space in less time to reduce the manual effort. There is no machine in the markets which can be used on smooth surface. In manufacture very simple drive mechanism we used as possible as and easy to operate, time taken for cleaning is very less and maintenance cost is also less as compared to other. Floor scrubber is a machine capable of polishing both hard surfaces and carpets. It comes with brushes that are used for scrubbing the floor which allows sticky dirt to loosen up and eventually removed. It is a great alternative to mop and bucket and can enormously cut down the cleaning time. We certainly undergo considerable development from the traditional brooming to vacuuming our floors. Modern cleaning equipment permits us to finish our household tasks easier and faster.

II. PROBLEM IDENTIFICATION

A. A machine produces a high vibration by motors during the cleaning process.
B. There is difficult to clean uneven surfaces in the floors because a machine does not run on that surfaces properly.
C. Improper water supply from the water spray pump to the mop for cleaning the floor surface.
D. Takes more time for cleaning the floor in traditional floor cleaning and other cleaning machines.
E. There is lot of manual efforts during cleaning the surface of the floor.

III. LITERATURE REVIEW

[1] Himani Patel, (2019) Wireless Multi-Purpose Floor Cleaning Machine-The creators clarified about the multi-use floor cleaning machine in emergency clinics, houses, theatre, shops, PC focus and so forth. It is an extremely basic in development and simple to work. Anyone can work this machine is without any problem. It comprises of dampness cotton brush, cleans the floor and dried with help of little blower. Support cost is less. Much sort of machine is generally utilized for this purpose.[2] Aishwarya Pardeshi (2017) Automatic Floor Cleaner. In this venture she reasons that the arrangement of equipment with a mix of programming gives better precision and decreases the responsibility. Labour is limited. It has Low expense. It is a Time-Consuming Device Making a little machine carries an adaptability to do work.[3] M. Ranjit Kumar (2015) Design and Analysis of Manually Operated Floor Cleaning Machine In this the creator clarifies that physically worked floor cleaning machine is an option for a mechanized floor cleaning machines during power emergency.

Body is pedal worked to accomplish dry and wet cleaning simultaneously.[4] Shubham Khade (2017) Multi-Use Floor Cleaning Machine With the headway of innovation, computerized floor cleaning machines are standing out enough to be noticed of analysts to make life of humankind agreeable. The idea is creating in financial nations however the purposes behind non-prevalence is the plan intricacy, cost of machines, and operational charges regarding power duty. In this paper, a story cleaning machine is proposed.[5] Prof. Dr. A. Muniaraj (2016) Design and Analysis of Manually Operated Eco-Friendly Road Cleaner. He has built up the physically worked eco-accommodating street cleaning. In this he reasons that while testing of machine, that the cleaning is less powerful where the street is by all accounts harsh and harmed. It can give occupation to the uninformed individual who is deprived for such positions as human energy is expected to drive the machine.

IV. EXPERIMENTAL SETUP

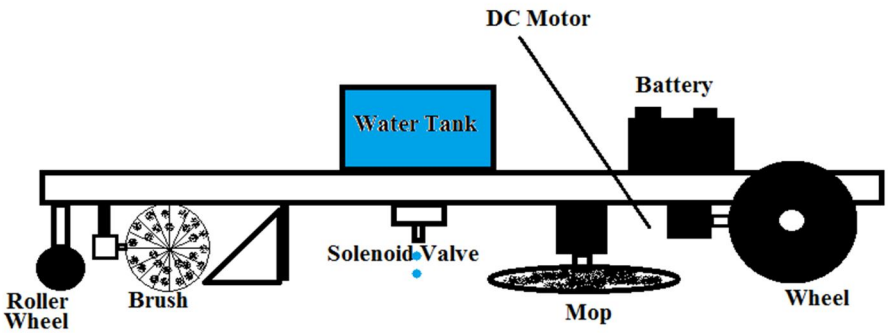


Figure 1. Experimental setup of automatic floor cleaning machine

V. DESIGN MODEL AND CALCULATION

A. Design Calculation

1) Wheel: Diameter = 15 cm, radius = 7.5 cm
2) Roller Wheel: Diameter = 5 cm, radius = 2.5 cm
3) Frame: length = 100 cm, width = 60 cm, height = 25 cm
4) Cleaning Mop: Diameter = 25 cm, radius = 12.5
Thickness of thread = 0.7 cm
5) Water Tank: Capacity = 5 lit
6) Nozzle: Diameter = 0.5 cm
7) Cleaning Brush: Length = 30 cm, diameter = 6 cm
8) DC Motor
Speed = 30 rpm
Voltage = 12 V
Watts = 18 W
9) Power: P = I x V
V=12, W=18
Current I=W/V
I=18/2
I=1.5 A
10) Torque of Motor
Torque = (P x 60) / (2 x 3.14 x N)
=1080 / 188.4
Torque = 5.72 Nm

B. Design Model of floor Cleaning Machine

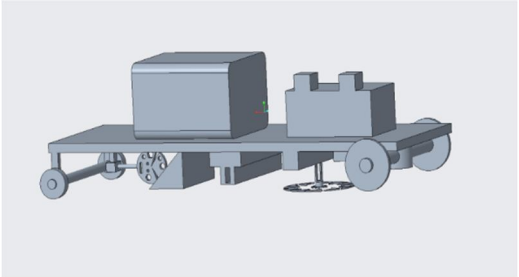


Figure 2. 3D model of automatic floor cleaning machine

VI. COMPONENTS USED

A. DC Motor

Direct current motor is a machine that convert electric power resulting in mechanical power output. Normally the motor output is a rotational motion to the shaft. The input is to be direct current supply. But in case of DC motor direct current is used. The mechanism of direct current motor is like a bar wound with wire is placed in between 2 magnets having North and South Pole. When it is provided with electric supply the wire becomes energized resulting in rotational motion which leads to rotational output. The universal motor can operate on direct current but it is a lightweight motor used for portable power tools and appliances.

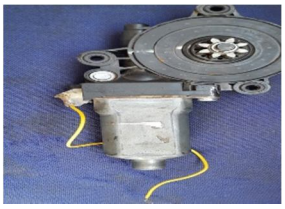


Figure 3. DC power motor

B. Arduino

Arduino Uno is a microcontroller it is based on board dependent on the ATmega328P (datasheet). It has 14 advanced info/yield pins (of which 6 can be utilized as PWM yields), 6 simple information sources, a 16 MHz artistic resonator (CSTCE16M0V53-R0), a USB association, a force jack, an ICSP header and a reset button. It contains all that expected to help the microcontroller; essentially interface it to a PC with a USB link or force it with an AC-to-DC connector or battery to begin.

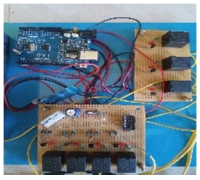


Figure 4. Arduino

C. Battery

A 12 V battery has six single cells in series producing a fully charged output voltage of 12.6 volts. A typical 12-volt battery used in a power supply where needed up to 12 V has a rating 125 AH, which means it can supply 10 amps of current for 12 hours or 20-amps of current for a period of 6.2 hours.

Figure 5. 12V battery

VII. WORKING PRINCIPLE

This model consists of a scrubber, motor, water tank with valve arrangement and wheels. The scrubber will clean the floor by means of rotation of motor. The equipment contains dc motors and wheels to move from one place to another. The cleaning brush is used to remove the stains in the floor. A cleaning brush is fixed at the bottom of the vehicle. The cleaning brush is coupled with a motor. The two-wheel shafts are coupled with the motor to drive this equipment. The outer casing is used to avoid the spreading of dust which is collected by the cleaning brush. A solenoid valve is fixed with the water tank which is located at a certain height in the same vehicle. This helps to wipe out the stains in the floor. The dc motors are controlled by the control unit. A sponge roller is mounted next to the motor. After the water is poured and cleaning brush cleans the floor the water in the floor is absorbed by the sponge roller hence the floor is cleaned efficiently.

VIII. RESULT AND DISCUSSION

A. *Velocity and speed of machine (without water)*

velocity = Displacement / Time

Displacement = distance travelled – initial distance
= 10 m – 0m
= 10m

Time = time taken to travel 10 m
= 50 sec

velocity = 10 / 50
= 0.2 m/s

speed = 0.72 km/hr

B. *Velocity and speed of machine (with water of 5 lit)*

velocity = Displacement / Time

Displacement = distance travelled – initial distance
= 10 m – 0m
= 10m

Time taken to travel 10 m
= 70 sec

velocity = 10 / 70
= 0.14 m/s

Speed = 0.51 km/hr

With 1 lit	2 lit	3 lit	4 lit
0.18 m/s	0.16 m/s	0.15 m/s	0.14 m/s

C. *Graph for speed variation*

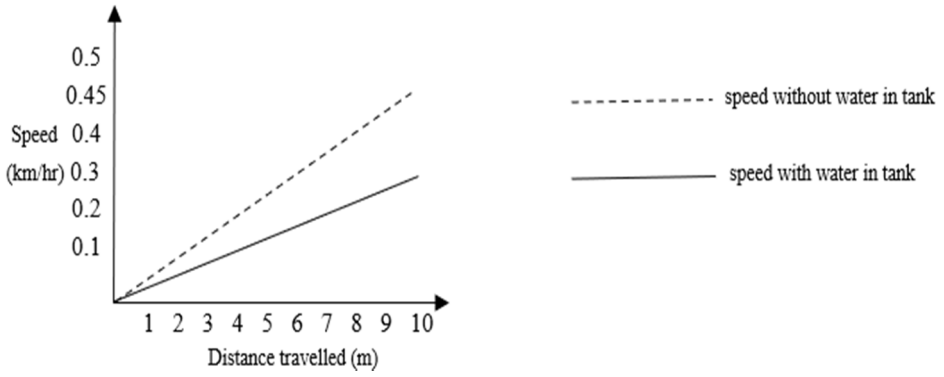


Figure 6. graph for speed variation

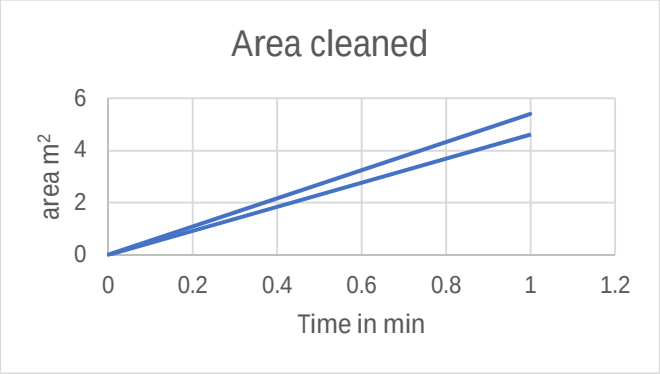
Mop and rolling brush rotation = 60 rpm
The rolling brush collecting the dust like chocolate covers, paper pieces, leaves, sand particles etc. under 60 rpm rotation of brushes.
The rolling brush cleaning 95% efficiently because it cleaning sand particles also.
The cleaning mop cleans the surface using water sprayer and it cleans 1 µm – 50 µm dust particles at rotation speed of 60 rpm.

D. Area cleaned with speed of 0.72 km/hr in 1 min

area = length x breadth
= 12 x 0.45
= 5.4 m^2 or 58.13 ft^2

E. Area cleaned with speed of 0.51 km/hr in 1 min

area = 10.4 x 0.45
= 4.64 m^2 or 50 ft^2



F. Comparison Between Manual and Machine Cleaning

PARAMETER	MANUAL CLEANING	MACHINE CLEANING
Cleaning time for 100m^2 (sweeping and wet moping)	10 + 20 = 30 min	18 min (both operations in same time)
Dust particles cleaned	1-20µm	1-50µm (at 60 rpm)
Water used	10 lit	6 lit
Human effort	High	Very low

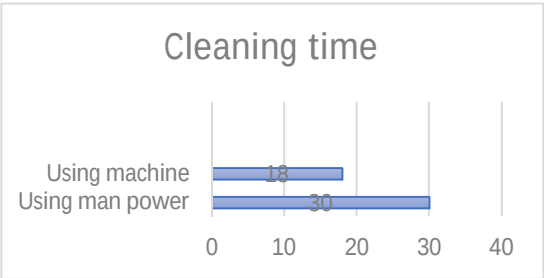


Chart for cleaning 100m^2 room using both man and machine powers

G. Cleaning Comparison

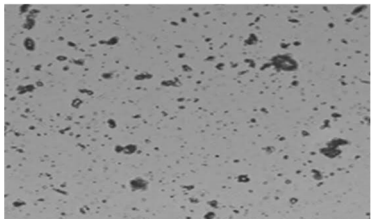


Figure 7. Microscopic Image of floor before Cleaning

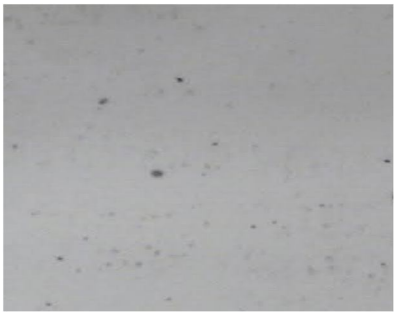


Figure 8. cleaning using manual

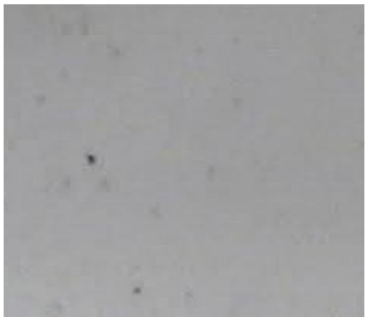


Figure 9. cleaning using machine

Parameter	Manual in floor	Machine in floor
Before cleaning	50µ	50µ
After cleaning	5µ	5µ

A remote controlled automatic and eco-friendly and user-friendly floor cleaning machine by studying the various journals and the review papers and documents based on floor cleaning machine and automation. This project work implements the easily operated machine that reduced the human effort and the cleaning time and reducing the vibrations produced in the machine and also it is low cost.

IX. FEATURE SCOPE

In today's era, 95 percent of the cost of cleaning a floor is labour. Naturally, the high cost of this simple task has inspired alternative solutions and that is Automatic Floor Cleaner. From industries to homes automatic floor cleaner is used and is becoming a very important part of life as it saves time, money and reduces human efforts to a great extent. It is the future of cleaning in our fast-moving life. It is no surprise that they would probably be more reliable than the manual sweeping.

X. CONCLUSION

We concluded that, automatic floor cleaning machine with the help of DC motor. This machine is designed in order to enable easy operation and to reduce the effort of human being. The need of this project is satisfied and with the help of this machine we can clean the floor easily. Designed with the that it is very much economical and help full to many industries and workshops. This project helped us to know the steps in completing a project work. Thus, completed the project successfully.

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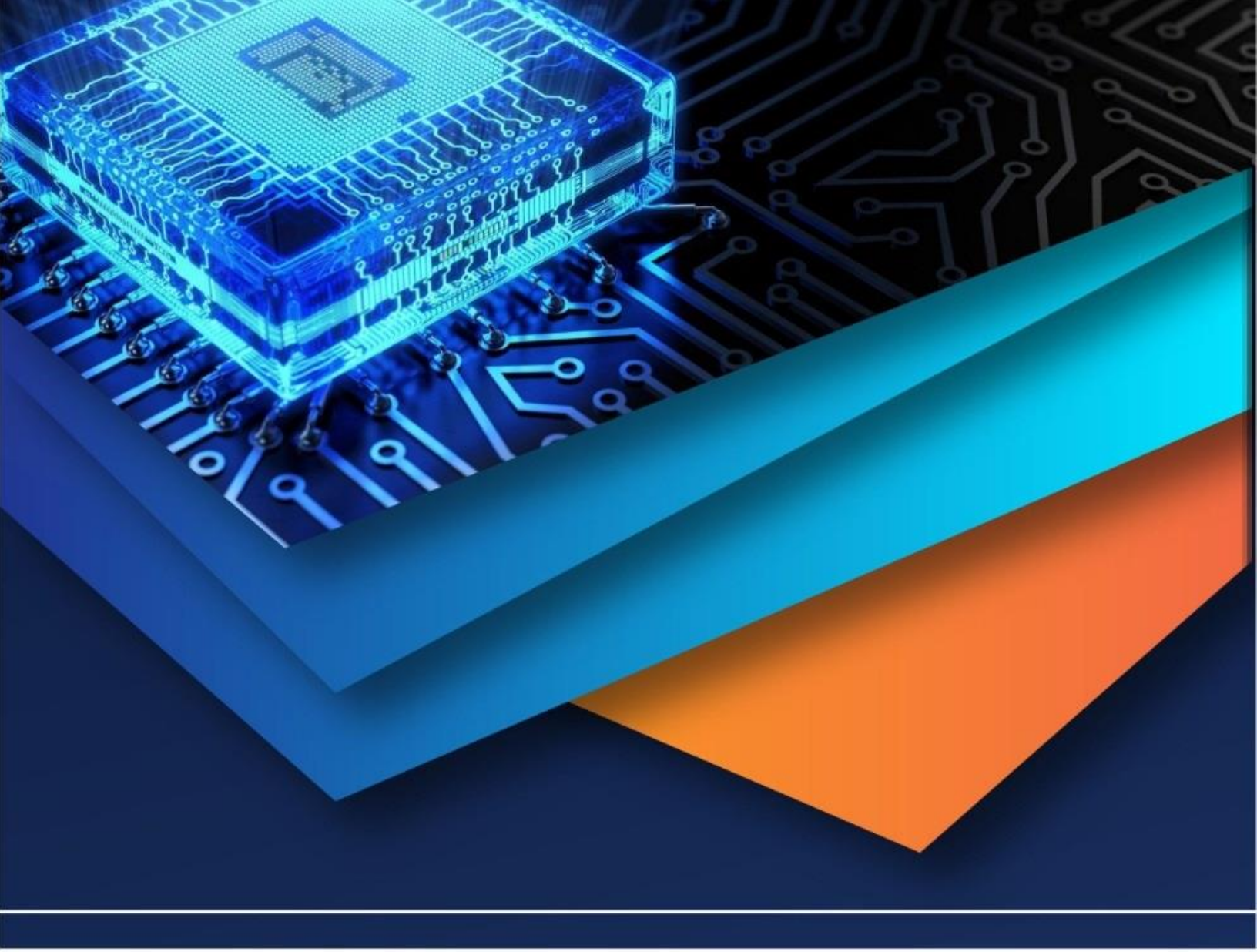

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