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AUTOMATIC FLOOR CLEANER

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Abstract - - *The cleaning of halls and large rooms is a tedious task as it requires a lot of labour and time. This paper aims to develop an automated floor cleaning machine that helps to clean the ground easily by machine wherever necessary. The time taken for cleaning is very less and cost is also very less. The size of the machine is compact, i.e. it is portable, so we can transfer it from one place to other place very easily. The machine is controlled by an electronic control board which makes the operation automatic.*

Key Words Automated floor cleaning machine, compact, electronic control board, portable.

1. INTRODUCTION

This project is designed for floor cleaning operation automatically with help of motor source. It reduces human effort and increases the uniformity of cleaning. As it is portable and automatic it can be used to clean larger areas like auditoriums, halls etc. The time taken for cleaning is very less and cost involved is also very less.

Traditionally floor was cleaned by hand using different handmade instruments. As the time passed new scientific era begins a lot of new methods are used to clean the floor. The first among those was the reciprocating action of brush actuated by muscular force. The brush design is changed time to time depending upon the floor structure and ease of washing personnel. As the electricity came into role vacuum cleaners were invented to clean a dry surface. As we know that manual cleaning process is time consuming and tedious. Then came the concept of mobile robot. Mobile robots have the capability to move around in their environment and are not fixed to one physical location.

1.1DESIGN, MATERIALS AND WORKING METHODOLOGY

A. DESIGN OF THE PROTOTYPE

All potentially useful solutions were thoroughly examined at the beginning of the preliminary design phase. Synthesis and comparative analysis led to the "best promising approach", which was modeled, after building sufficient confidence this approach was finalized. All components and systems were fully specified. Operating procedures were generated. A complete set of assembly and detail drawings were prepared. A cost analysis was conducted. Then, the prototype was fabricated and tested.

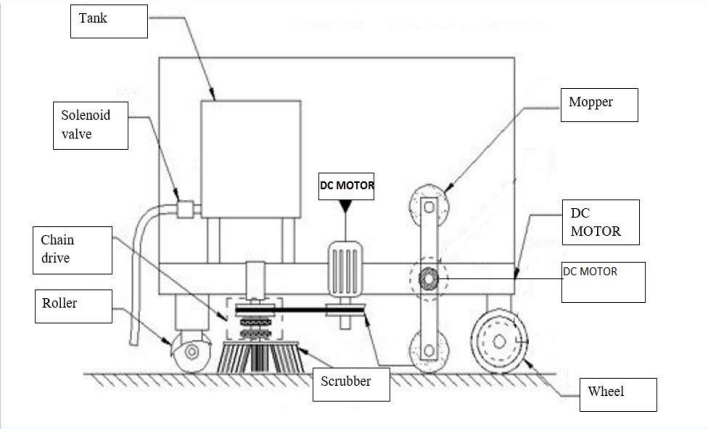

Fig.1. Design of the prototype

B. COMPONENTS DESCRIPTION

The major components involved in the design and the fabrication are.

1) MOTOR (DC)

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left-hand rule. A direct current (DC) motor is a fairly simple electric motor that uses electricity and a magnetic field to produce torque, which causes it to turn. At its most simple, it requires two magnets of opposite polarity and an electric coil, which acts as an electromagnet. The repellent and attractive electromagnetic forces of the magnets provide the torque that causes the motor to turn.

2) PULLEY AND BELT

I. PULLEY:

A pulley is a wheel with a groove along its edge, also called a sheave. For holding a rope or cable. It is mainly used for short distance power transmission**.**

II. BELT:

Belts are used to mechanically link two or more rotating items. they may be used as a source of motion, to transmit power at up to 98% efficiency between two points. Belts normally transmit power only on the tension side of the loop.

3) CHAIN DRIVE

It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. the power is conveyed by a roller chain, known as the drive chain, passing over a sprocket gear. the gear is turned, and this pulls the chain putting mechanical force.

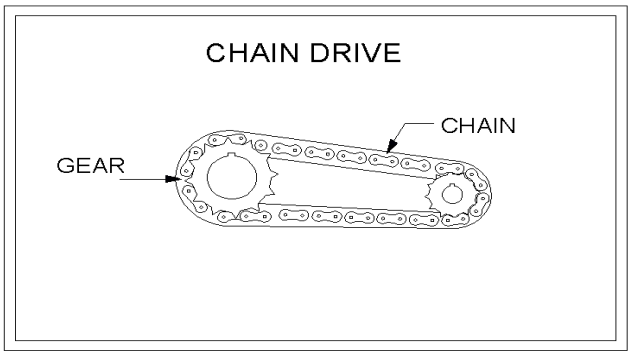

Fig.2. Chain drive

4) SOLENOID VALVE

The directional valve is one of the important parts of this cleaning system. Commonly known as DCV, this valve is used to control the direction of water flow in the cleaning system. This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to for mechanical operation which in turn operates the valve mechanism. Solenoids may be push type or pull type. The push type solenoid is one in which the plunger is pushed when the solenoid is energized electrically.

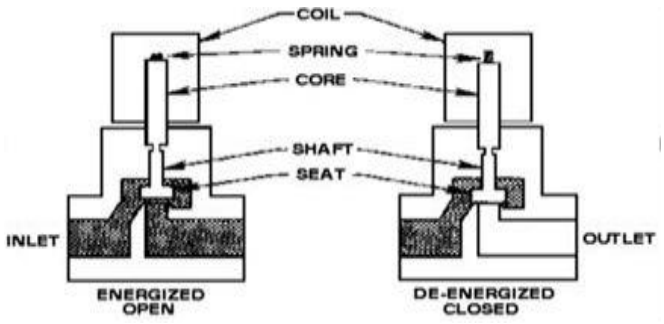

Fig.3. Solenoid valve

5) BATTERY

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact, for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

Specifications of the battery used are listed below:

- Material: Lead-Acid Free maintenance Battery
- Output Voltage :12 V D.C
- Output Power :40 Ampere-Hour

6) ARDUINO

Arduino is a hardware and software company, project, and user community that designs and manufactures computer open-source hardware, open-source software and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

1.2 CALCULATIONS

A. MOTOR CALCULATIONS

Speed N = 30 rpm
Voltage V = 12 V
Current I = 0.3 A
Power P =V x I=12x0.3 = 3.6 W
P= 0.0048 HP
Motor Efficiency = 36%
Electrical power of the motor is defined by the following formula:

$$P_{in} = I \times V$$

Pin – input power, measured in watts (W)

Angular speed, $\omega = N \times 2\pi / 60$
Efficiency of the motor is calculated as mechanical output power divided by electrical input power:

$$E = P_{out} / P_{in}$$

Therefore
$P_{out} = P_{in} \times E$
After substitution we get

$$T \times \omega = I \times V \times E$$
$$T \times N \times 2\pi / 60 = I \times V \times E$$

TORQUE OF THE MOTOR:

$$T = (I \times V \times E \times 60) / (N \times 2\pi)$$
$$= (0.3x12x0.36x60)/30x2\pi$$

Torque (T) = 0.412 Nm

B. CHAIN DRIVE CALCULATIONS

1. The drive ratio R (velocity ratio) given the input rpm and output rpm

Drive ratio=N1/N2 = T2/T1
VELOCITY RATIO = N1/N2
So,
N1/N2 = T1/T2

N1= 30
T1= 44
T2 = 18
N1/N2 = T1/T2
30/N2 = 44/18
N2 = (30) / (44/18)
N2 = (30)/2.44
N2 = 12.30 RPM
Velocity ratio = N1/N2
= 30/12.30
Velocity ratio =2.44

2. The number of teeth of the sprockets.
Minimum number of teeth on the sprocket = 18

3. Number of teeth on the larger sprocket
Number of teeth on the larger sprocket = 44

4. Velocity, v = (π D N)/60
=(3.14×0.0065×30)/60
=0.0102 m/s

2. DETAILED OPERATION OF THE MECHANISM

The main components required for constructing the floor cleaning machine are dc motor, water tank, water solenoid valve, ac motor, scrubber, belt & pulley, chain drive, battery, electronic control board. In this device, a motor is used as a power drive. It consists of scrubber, water tank, water solenoid value, belt, pulley arrangement and wheels. Foam water is stored in the water tank and is sprayed to the floor by actuating the water solenoid valve, and a scrubber will clean the floor by means of rotation of motor, the scrubber will rotate through motor and chain drive.

The chain drive is used to rotate three scrubbers simultaneously with the help of belt & pulley. Two roller provided at the back end of the machine is used to remove the excess amount of water present in the Floor. The device is fully automatic and is designed for floor cleaning operation automatically by means of a control unit configured for the purpose.

Fig.4. Final prototype (1)

Fig.5. Final prototype (2)

2.1RESULTS AND DISCUSSIONS

A prototype is made and the mechanism is fully automated, the machine can also be controlled by android mobile phones. Durability and maintenance considerations played an important role in the design. Maintenance requirements are minimized. Space, versatility, and simplicity were all rated at the same level of importance. The cleaning done by the machine is better than manual cleaning. The project is implemented with proximity sensors which increases the accuracy in movement and even reduces time. It can be sold as an individual product, to companies in search of solutions for easy and fast cleaning of floors.

3. CONCLUSIONS

The prototype was tested on the floor and it cleaned the floor automatically in an effective manner when compared to manual cleaning. The human effort required for cleaning large areas can be reduced by implementing this automatic floor cleaner. This project was designed and fabricated with an idea of simplifying and automating the process of floor cleaning. It was designed in such a way that it provides flexibility in operation and effortless cleaning at a reasonable budget. The design and fabrication was done in such a way that this machine could be operated by people of various age groups without any hassle. The automation helps the machine to operate without continuous human supervision. This project "AUTOMATIC FLOOR CLEANING MACHINE" is designed with the hope that it will be very much economical and helpful for industries, workshops and households.

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