Design And Fabrication Of Automatic Floor Cleaning Machine

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Abstract-Automatic floor cleaner is a system that enables cleaning of the floor by the help of highly stabilized and rapidly functionalyzed electronic and mechanical control system. Current project work targets to use automatic floor cleaner for large floor in house-hold purposes and office floors. The cleaning purpose is specifically carried out by continuous relative motion between a scrubber and the floor surface.

Key words
Scrubber, Rapidly functionalized, Highly Stabilized, Relative motion.

I. INTRODUCTION

Floor cleaning is achieved by different technique which might be of different kinds. Different types of floor need different type of treatment. The floor should be totally dry after the cleaning process. Otherwise it may result in hazard. On some floors sawdust is used to absorb all kind of liquids. Our automatic floor cleaner will save huge cost of labor in future. This ensures that there will no need of preventing them from spill of the sawdust has to be swept and replaced every day. Household cleaning is a repetitive task carried out by number of people every day. Hence there is a need of bringing revolution in the area of science and technologies, which could help easily in repetitive tasks which we perform daily. It also giving consideration to the intensity of labor required and improving qualities to its optimum level. The need of designing a new technological based vacuum cleaner, which could overcome the short coming of existing vacuum cleaner.

II. LITERATURE REVIEW

Karthick.T (2015), The electrical aspects of robots is used for movement through motors. The mechanical aspects is mostly the creator’s solution to completing assigned task.

Dr.J.Hameed huission (2016), Micro controller & gear motor is attached to the front axis type model.

Aishwarya Pardeshi (2017), Development and fabrication of proto type floor cleaner type model.

Manya Jain(2017), DC motors & Hardwares are used.

Miss.Nayna H.Joshi (2017), Designed a cleaning machine is operated using Smartphone by various techniques are Arduino, PIC controller and so on.

Shubham Khade(2017), capable of performing cleaning of floor and corners effectively, semi-automatic water spray, cleaning of byre, dry as well as wet cleaning tasks. The machine will work on electricity. This work can be very useful to improve the life style of mankind.

III. CLEANING

Cleaning is the essential need of the current generation. Basically in household floors the floor has to be cleaned regularly. Different techniques are used to clean the different types of surfaces. The reasons for floor cleaning are

1. Injuries due to slips on the floors are cause of accidental injuries or death. Bad practice in floor cleaning is a major cause of accidents.
2. To beautify the floor.
3. Debris and obstructions are to be removed.
4. Allergens and dusts are to be removed.
5. Surface wear to be avoided.
6. To make the environment sanitary (kitchens).

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(p)-2230-235
7. Traction should be maintained at optimum level, so that no slip will occur.

Floor cleaning is achieved by different technique which might be of different kinds. Different types of floor need different type of treatment. The floor should be totally dry after the cleaning process. Otherwise it may result in hazard. On some floors sawdust is used to absorb all kinds of liquids. This ensures that there will no need of preventing them from spill of. The sawdust has to be swept and replaced every day. This process is still used in butchers but it was common in bars in the past. In some places tea leaves are also used to collect dirt from carpets and also for odor removing purposes. Different types of floor cleaning machines are available today such as floor buffers, automatic floor scrubbers and extractors that can clean almost all types of hard floors or carpeted flooring surfaces in very less time than it would have taken using traditional cleaning methods. Again the cleaning would be different for different floorings.

IV. COMPONENTS DESCRIPTION

Hence the total system can be sub-divided into different parts, such as:
1. Frames
2. AC-Motors-2
3. Speed controller
4. Wheels
5. Mop
6. Wires
7. Switch box (Remote control)
8. Bearings
9. Belt drive
10. Shaft
The complete system is operated automatically throughout the floor of any kind of room

V. MOTOR

1 HP, 230 V, 2.5A, 1440 RPM Induction motor is used. It gives sufficient torque at 360 RPM which is required to rotate the bracket loaded by 5 kg. Basically there is torque requirement of 16 N-M to revolve the bracket without getting any load. This motor gives torque of 19 N-M at the speed of 360 RPM.

VI. WOODEN FLOOR

Wooden flooring is treated differently depending on which type of coating it has, whether waxed or oiled, or whether it has a polyurethane coating. The very important thing in case of this 9 type of floor is which type of coating it is having and find out the proper way of cleaning it. Simple cleaning instructions followed are

1. The floor should be cleared of all the furniture those are easy to move.
2. All lose debris particles are to be swept or vacuum cleaner.
3. The floor is mopped going along grains. If the floors are polyurethane, the mop has to be dipped with water and a few drops of dishwashing liquid. The mop should be ringed out thoroughly before it is used on the floor.
4. The floor is to be buffed using a soft fabric to remove soapy dirt. The softer the cloth, the better it works because they have good absorbent capacity.

VII. TILE OR STONE FLOOR

Modern houses are equipped with tiles, marble flooring that can be cleaned easily. Few specific ways are:
1. Debris particles are to be removed using vacuum cleaner or else broom.
2. Floor cleaning solution should be used for appropriate floors. If it is stone surface, it should be cleaned using solutions for stones only. For ceramic floors acidic tile cleaning agent is to be used.
3. A mop or scrubber is used to scrub and clean the floor.

VIII. SCRUBBER

Basically the Indian floors are cleaned by rubbing the floor with a hard cloth or plastic like material called scrubber or mop. Hence design of scrubber is an important task while cleaning Indian floors. The motion of scrubber on the surface may be rotator or harmonic depending upon the type of material used or surface to be cleaned. Normally hard materials like heavy cloths are used for making the scrubber. The basic purpose of the scrubber is to clean the surface completely and also soak the water or liquid used for cleaning the surface.

In our case we have used a scrubber that is made up of a cloth wounded over a metallic bar (cylindrical rod). The additional purpose of the scrubber is to make proper flow of dirt water towards the direction needed. In some cases a single spot is to be scrubbed more than once. For this purpose harmonic motion is used which enable better removal of debris. But in our case the purpose is to clean
household flooring so relative rotation of scrubber is made to achieve required purpose.

IX. WORKING PRINCIPLE

The project is fully unified for cleaning application. It features the requirements needed for floor cleaning such as water supply, scrub and fan. It is a wheeled type machine with a movement control. This floor cleaning machine is comprised of several AC motors that drives the wheels and rotating objects for the scrub. Wiring of the motors are properly designed that the wheels set up considering the control is from two dual two way switches. A pushbutton is also set as ON/OFF switch of the rotating objects as scrubs. Plastic pipe are also designed in which it has holes and gate valve that manages the release of cleaning liquid on the floor. The machine is wired using LAN wires connected to its controller while the controller has the connection of the AC supply. This project is applicable for several floor cleaning activities.

Torque required to revolve the bracket is about 16 N-M. Motor gives 4.94 N-M at 1440 RPM. A smaller pulley is fixed on the motor shaft and bigger pulley is fixed on the main shaft so that speed is reduced to 360 RPM and torque is increased up to 19 N-M. Hence motor will run without getting any load on it.

The present work is aimed at designing a compact floor cleaner that can be useful for house-hold purpose.

The complete process of the machine starts from the front vacuum pump. It is used to suck dry debris from the floor. This is very much useful for the purpose of reclining the surfaces having heavier dirt particles. The debris thus sucked has to be stored so that it could be removed later. This is achieved by using a 12v vacuum pump with a debris chamber attached to it. The next aim is to make the surface wet which is carried out by sprinkling water on the floor. The aim is achieved by using a motor and a sprinkler system. This system has a shower like outlet and a chamber whose outlet is controlled by a dc motor pump.

To clean the surface scrubber has to move or scrub over the floor. The dirt should be completely removed and the debris laden water will flow towards the rear of the bot. the scrubber is fixed to the chassis using clamps. The construction of the scrubber includes fixing one side to the motor and the other to the ball bearing. The bearing is clamped to the chassis. At the rear of the system a vacuum mechanism is used to suck the debris laden dirty water. This is also the same type of pump and the chamber.

X. CHASSIS

It is the back bone of the system. All the systems and parts are attached to it. The solidity of the system is greatly affected by the chassis. It is a square of side 30cm. shown in fig.2

The next work of the machine is to make the surface wet. To achieve this we have designed a sprinkling mechanism. Water is stored in a chamber that has a opening controlled by a motor. By putting this motor to ON position water or cleaning liquid starts flowing from the chamber.

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Fig.3. Sprinkler system
It is connected to a shower type arrangement via connecting pipe. The sprinkler system has a number of holes arranged sequentially which can be modified manually. This arrangement ensures equal wetness across the width. The challenge here is not to put too much liquid over the surface which may lead to wet floor after the cleaning is complete. To overcome this the motor is automated with the control system. This is programmed such a way to put required amount of liquid according to the relative stay of the machine. Figure6 Sprinkle system The length of the system is equal to the width of the machine which is 30cm. Thus it covers the whole area. Its width is 5cm. which is optimum for required liquid flow.

XII. SCRUBBING MECHANISM

As discussed earlier scrubbing of surface is necessary for proper cleaning. For different type of floors different types of scrubbers are to be used. For stone flooring soft cloths, for cement floors hard plastics are used. In our case the scrubber is given a rotational motion to scrub the surface. The rotational motion is achieved by a 12v AC motor having 600rpm. The scrubber is as shown in fig5. One side of the scrubber is fixed with the dc motor which again clamped to the chassis by C-clamp and screw. The other part of the scrubber is connected to a ball bearing which is again clamped to the chassis by C-clamp and screw. The connection of bearing is done by a hub. The hub is a metallic object of cylindrical shape. On one side of the hub a hole is made and the scrubber is fixed. The bearing is fitted by transition fit to the ball bearing. Transition fit is the type of fit when the diameter of the shaft and the hole are same and hence the shaft is fixed by applying continuous force. The scrubbing process has 2 advantages.
1. It ensures the surface to be proper clean.
2. It makes the flow of water towards the rear side where vacuum pump is fixed.

XIII. MOTOR-WHEEL SYSTEM

The complete product is a four wheel drive automation process. 3 wheels are independently connected to 2 different 12v AC motors.

The purpose of the wheels is
1. To give the bot proper motion.
2. Provide traction in all sort of surfaces.
3. Make the movement easier in all direction
4. Not to slip of from its path.

The axis of motor is bolted to the axis of the wheel. The motor-wheel arrangement is fixed to the chassis using L-clamp and screw. The movement of the system can be achieved by giving power to required motor and/or making devoid of power.

For example if we need to make the machine give a turn towards right the front right wheel is stopped or slowed down. Again for left turn left front wheel will be slowed. Rear wheels are always in operation to pull the system. The diameter of the wheel is 7.5cm. Proper amount of rib for traction and movement on wet floor surface.

XIV. DESIGN CALCULATIONS

Torque requirement and selection of motor

Coefficient of friction in between sponge/ brush and floor = 0.8 Load on the bracket = 5 kg and diameter of bracket=40 cm.
Torque required = F x R = \(0.8 \times 5 \times 9.81\) x 0.4 = 16.87 N–M
Formula \(P = 2\pi NT / 60\)
Where,
\(P =\) Power \(N =\) Speed in RPM \(T =\) Torque
\(1\) hp motor torque = 4.94 N-M at 1440 RPM.
Then at 360 RPM Torque will be 19.78 N-M. Hence, here 1 hp motor at 360 RPM can be used.

Selection of Belt

Smaller pulley = 2” = 5.08 cm
Bigger pulley = 8” = 20.32 cm
Center distance (C) = 28 cm
Formula for length of belt = \(2C + \pi (D+d)/2 + ((D-d) * (D-d)) / 4C\)
used by them are not most effective. They are using algorithms which approximately provide 70% accuracy. They are not using any image processing algorithms to run their robot. But the robot designed by us is cost efficient which will cost around rs15000. Also we can use camera lens for small dust particle detection, so that it will give more efficient decision in governing the motion of the particle which ultimately save considerable amount of power and reduce the timing with better efficiency and sensitivity. Similarly when the robot will find the particular dust size on floor on one side of it and there are none on other 3 sides, it will head towards dusty area.

Time redundancy and power saving with low cost provides the best opportunity for marketing these consumer products. If we estimate the cost of manufacturing it cost Rs 8000 in our experimentation case. But for mass production it will be less than rs 5000. Including all other factors the market price will be well below rs1500. As we have utilized exchangeable scrubber, it can be used in any sort of floors. Basically it will be a boon for Indian house-hold.

### XV. MERITS

This makes possible to get more done in the same ,or even less time than a walk behind a machine. Employee productivity is also improved and production cost is low.

since the operator rides instead working, fatigue is reduced meaning they are physically able to maintain a more productive rate of work after they have finished cleaning the floor.

Generating savings in labor costs. Since they are mechanically propelled, navigating is easier when riding.

### XV. APPLICATIONS

The floor cleaning machine is widely used in following places:-Hospitals, colleges, Industrial floors, Airports, Offices, Hotels, Commercial Complexes, Dairies, Laboratories, Canteen, Health centers.

### XV. CONCLUSION

Automatic floor cleaner is a system that enables cleaning of the floor by the help of highly stabilized and rapidly functionalized electronic and mechanical control system. Current project work targets three wheels and moving left, right, front and back sides by using the single front wheel. the old model just only moving forward and backward motion. This is the main advantage our project.

### REFERENCES

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