A Review on the Floor Cleaning Machines

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***Abstract*—In this paper a brief review of literature on the floor cleaning machine has been done. The review covers latest papers from year 2015 to 2022. The paper is arranged as follows. First section gives the introduction about the floor cleaning machines, second section gives literature survey on the floor cleaning machine followed by conclusion and references used for the literature review.**

Index Terms – Floor cleaning machine, automated, wireless and Internet of Things (IOT).

I. INTRODUCTION

The floor cleaning machines are very much required in places like schools, colleges, hospitals, bus and railway platforms, airport lounges, stadiums, parking areas, footpaths and many other commercial areas, majorly because these places have large areas to be cleaned. These machines can be manually operated, mechanically operated, fully automated, semi-automated, wire controlled or remote controlled, fuel powered or solar powered.

In this paper a review of the different types of floor cleaning machines has been done.

II. LITERATURE SURVEY ON FLOOR CLEANING MACHINES

M. Ranjit Kumar, et. al. [1]mentioned that floor cleaning machines that work on electrical power are not user friendly. They have also mentioned that the there is a power crisis in India during summer season. They identified that most of the electrically operated floor cleaning machines are not used effectively because of power crisis. They identified the need to create user friendly and low cost floor cleaning machine, so they developed a manually operated floor cleaning machine as alternative to the electrically powered floor cleaning machine. They used a suitable commercially available 3D modelling software for 3D modelling and used finite element analysis software for the analysis of the cleaning machine. The material properties of the floor cleaning machine were of conventional materials. From the finite element analysis results they found that the stresses developed in the manually operated floor cleaning machine are within the safe limit and hence decided that the design of the manually operated floor cleaning machine is sage [1].

Dhiraj M. Bankar, et. al.[2] developed an equipment for cleaning the floors which is based on the simple chain drive mechanisms which is easy to operate and repair [2]. J. Hameed Hussain, et. al. [3] developed floor cleaning machine for mopping and sweeping operations which work in both manual and automatic mode. The machine is capable of detecting any obstacles within a range of 1foot in its path. The developed robot the radio frequency based wireless communication between the machine and the remote with a range of 50m. The hurdle detection information will be sent to the remote and gets displayed on the monitor of the remote. The developed machine performs all operations autonomously and can be used in multipurpose environments such giving access to confined spaces [3].

Priya Shetty, et. al. [4] have developed a floor cleaning machine which is Arduino controlled to perform required cleaning operation. While designing this device they concentrated on developing low cost, versatile and low maintenance floor cleaning machine which is suitable for wet and dry cleaning of the floor. It can also act as vacuum cleaner and ultraviolet sterilization for the floor [4].Nirav Shah, et. al. [5] developed a floor cleaning machine which simple in fabrication and works on electricity. It has a custom chassis with wheels and other components like motor, compressor, vacuum pump, mop, brush, nozzles, battery, water tank and storage tank. They have claimed in paper [5] that their product is simple and effective in construction and also the operation and construction cost is less compared to other products available in market.

Ansari M Bilal, et. al. [6] developed an easy to operate floor cleaning machine which is simple in construction also. This machine had wipers, sweeping brushes, cotton mop and vacuum cleaner for reducing the cleaning time. In this paper they have claimed that their machine satisfies the cleaning needs in India [6]. R. Abarna, et. al. [7] developed an automatic floor cleaning machine which is electromechanically controlled suitable for office floors and household purposes. The continuous relative motion between the floor surface and a scrubber is the main technique of cleaning in their machine.This machine has three wheels and moves left, right, front and back sides by using the single front wheel and this is mentioned as the main advantage of their machine because the old model had only the provision for forward and backward motion [7].

P. Vignesh, et. al. [8] developed a floor cleaning machine having liquid container, scrubber pad and fan, with rapidly functionalized mechanical control system. The machine designed has the capacity of cleaning maximum area compared manual cleaning.The cleaning area from the developed cleaning machine is $0.543m^3$/min. Because of the fan fitted to the machine it has the ability to dry the floor instantly after scrubber with liquid. It also has smart alternate for covering large area and removing dust. That developed machine covers the surface area which is 3.75% greater than the manual cleaning. They have mentioned that the developed cleaning machine can only be used in outdoors with large ground and it is also mentioned that the developed machine will result more benefits compared to other existing floor cleaning machines. Their machine is based on very simple belt drive mechanisms [8].V. Vadivel, et. al. [9] developed a floor cleaning machine suitable for large floor which works based on the continuous relative motion between a scrubber and the floor surface. The machine has propulsion mechanism of driven wheels and guide wheels for tracking area on the floor to be cleaned. If the water is present it will be detected and sucked by the vacuum pump followed by the scrubbing action is done by the scrubber which directs the towards rear end. The machine has a sweeper mechanism is mounted on the machine followed by propulsion mechanism. The propulsion mechanism has a control system for advance sweeping of a debris-laden floor surface. The motion of the system is controlled by a proportional integral derivative which takes the input from sensor circuit and feeds it back to microcontroller which send signal to the simulation of wheel in a synchronized manner. The basic advantage of the cleaning machine is stated as, it will be cost effective and automatic. It is also stated in the paper that, once switched on it will clean the whole room automatically without any human intervention [9].Balasaheb Kasure, et. al. [10] presented a Robot Based mechanism for cleaning between the railway track. The design is aimed to overcome all the disadvantages of the current machine to have super clean railway tracks. In this machine a vacuum technology has been used in which all types of waste material like, empty plastic water bottles, human waste, waste paper etc. will be collected. This machine suitable for all climatic conditions and can be attached to an existing compartment of train and this compartment can be made standalone and engineered low cost communication techniques. It is also mentioned in the paper [10] that the developed machine is time saver, dirt destroyer, cost effective and eco-friendly as well.

Himani Patel, et. al. [11] designed a prototype model of a floor cleaning machine suitable for cleaning floors in hospitals, houses, auditorium, shops, computer centre etc. The machine consists of moisture cotton brush to clean the floor and is dried by small blower. The developed machine performs sweeping and mopping operations. The machine is proposed as the effective cleaner of floors, even at the corners of the floor. Further the machine has semi-automatic water spray and dry as well as wet cleaning provisions which works on electricity. They have used DC motor and a single vacuum pump instead of using two vacuum in order to save power which saves power. It is stated in the paper [11] that the time taken for cleaning by the developed machine is very less and the machine is cost effective and need low maintenance. Raveena Ishalavath M, et. al. [12] developed floor cleaning robot using IEEE Standards which is Bluetooth controlled. The robot scans and detects the obstacles to avoid collision. Raspberry Pi3 is used for control of the robot and an ultrasonic sensor transmits the signal and receives the signals, the received signal is sent to the Raspberry Pi3.The servomotor works

based on the signals from the ultrasonic sensor. The Pi3 will stop the robot based on the space measured from the ultrasonic sensor between the robot and obstacle and also the buzzers are actuated based the measured space which provides the operating status of the robot. The operation status is displayed on the LCD screen. The moping operation is done by moping brush which is actuated by the DC motor and the motor signalled by the controller. It is mentioned in the paper [12] that the scheduling features can be operated by computing only and hence android and windows applications make it user friendly.

Saravanan N, et. al. [13] developed anaffordable floor cleaning machine consisting of AC motors, brush in the form of belt, conveyor belt, wipers, belt roller, trashcan, trash pan and frame. The belt roller gets input from the AC motor through the belt. Throughout length of the belt brush is attached, which connects the two rollers. Both roller and conveyor brush belt arrangement rotates in clockwise direction. The dustpan is kept at small clearance from the floor to sweep any dust on the floor through the brush and put in trashcan mounted on backside of the chassis. All the parts are mounted on the frame 13].Shailesh Dhomne, et. al. [14] have proposed a manual floor cleaning machine with modernized process for cleaning both the wet and floor. It has a storage box to store a dust. The floor design of the machine has basic considerations for easy handling, efforts reduction and being environment friendly. It is electrically powered machine and does not require any training for operation. The paper [14] has also mentioned the future scope as, to reduce the space consumption by vacuum cleaner and to reduce the vibration due to high rpm.T. Jayananda Kumar, et. al. [15] developed a floor cleaning machine to clean office and household floors have IOT based control system. The relative motion between floor and scrubber is cleaning technique in this machine for wet floor and vacuum cleaner technique is used dry floor cleaning. The future scope is mentioned as [15], it can be modernized by using electric motors.Rupali Shinde, et. al. [16] developed a floor cleaning machine having three capabilities in a single machine namely the vacuum cleaning, mopping and UV sterilization. The cleaning is done by using relative motion between a scrubber and the floor surface, and bacteria cleaning by UV LED strip.Avinash Chahare, et. al. [17] proposed a manual floor cleaning machinecapable of cleaning both wet and dry floors. It has DC drive powered rotary brush with pneumatic controlled dust shifting to assist users in removing waste.

III. CONCLUSION

The literature on floor cleaning shows that there are many works on the floor cleaning machines which have their unique feature. Many are electrically or battery powered. Some are having advanced control systems based on microcontrollers and Internet of Things (IOT) based, while some are manually controlled. Some of the developed machines are economical also. There is a scope for development of fully mechanically operated simple floor cleaning machine having intelligently developed mechanism which can be operated without the need of electronic equipment or electric power or microcontroller.

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