

Fabrication and Testing of Mechanically Operated Floor Cleaning Machine

Nakka Siva Manikanta¹, Yandapali Mani Kumar², Sivagiri Narshima³, Senapathi Chandu⁴, Gandredi Veerababu⁵, P. Gangadhara Rao⁶

^{1,2,3,4,5}B. Tech, Aditya College of Engineering & Technology, Surampalem, A.P, India, 533437

⁶Associate Professor, Aditya College of Engineering & Technology, Surampalem, A.P, India, 533437

ABSTRACT

The main aim of this work is to fabricate the cleaning machine for the dust on the floor. In the early days, a floor is cleaned with a broom that is controlled by a human hand. This requires a continual movement of the human hand, which is exhausting and time demanding. The goal of this project is to provide a modernized procedure for wet and dry floor cleaning. This equipment is capable of cleaning floors in both dry and wet conditions. It also has a dust storage box. It was decided to fabricate dust cleaning machine that uses a DC motor to drive the rotary brush with pneumatic controlled dust shifting to assist users in removing waste and maintaining a clean and hygienic environment, thereby avoiding health in equalities and safety concerns for both workers and the general public. In this project we are used easily available materials with low cost and it can be easily fabricated and easy to use and control as compared to existing dust cleaning machines. The existing machines are costly and skilled workers are required. The present fabricated machine is the better alternative for existing machine. It can be driven by layman also. The manually operated eco-friendly floor cleaner can work very efficiently with respect to covering area.

INTRODUCTION

Cleaning has become a basic need for all human beings and it is unavoidable daily routine process. The conventional road cleaning machine is most widely used in railway stations, airports, hospitals, Bus stands, etc. also this machine needs electrical energy for its operation. It is not user friendly as well as eco-friendly. In summer time there is power crisis and most of the 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 Cleaning work can be physically demanding and a need has been identified to developed methods for systematic ergonomic evaluation of new products. In recent years, floor cleaning robots are getting more popular for busy and aging populations due to lack of workers. However in India, unemployment is more and hence there is a need to develop less labor oriented cleaning machine.

In recent years, conventional floor cleaning machines are most widely used in airports, railway stations, malls, hospitals and in many commercial places, as cleaning is one of the important parameter for the sanitation and government regulations. For maintaining such places, cleaning the floor is the major task which is necessary. There are conventional floor cleaning machines available to perform floor cleaning operations in above said places. Generally a conventional floor cleaning machines requires electrical energy for its operation. In India, especially in summer there is power crisis, in majority of places. Hence cleaning the floor using the conventional floor cleaning machines is difficult without electricity. In this project an effort has been made to develop a manually operated floor cleaning machine so that it can be an alternative for conventional floor cleaning machines during power crisis. A manually operated floor cleaning is developed with major list of objectives, one; to achieve simultaneous dry and wet cleaning in a single run, secondly to make the machine cost effective and thirdly to reduce the maintenance cost of the manually operated floor cleaning machine as far as possible. Cleaning is a must-have skill for today's generation. In general, the floor in the home must be cleaned on a regular basis. This machine is responsible for the design and manufacture of floor cleaning machines. The major goal is to merge the functions of three separate devices: a vacuum cleaner, a dryer, and a mop. Many different types of floor cleaning machines are available on the market, all with high ranges and weights. As a result, they are not affordable to everyone, both in terms of weight and cost.

For this function, a variety of machineries are extensively utilized. As a result, a multipurpose and cost-effective floor cleaning machine must be designed and developed. When it comes to weight criteria, machine assembly, and machine handling, the machine is extremely adaptable. It's straightforward to put together and operate. This machine is simple to run for everyone. The machine's size's also portable, allowing us to move it from one location to another with ease. As a result, brushes [Industrial roller brush] replace the vacuum approach in our project. This

system aids in the removal of solid trash (wood, vegetable waste, etc.), plastic objects, and other stuff. This initiative saves money by reducing human labor, time, and energy usage.

A manually operated floor cleaning is developed with major list of objectives: -

- To achieve simultaneous dry and wet cleaning in a single run.
- Lower Maintenance Cost and Time.
- Required less cleaning time.
- Clean more space in less time.

LITERATURE REVIEW

The literature of various researchers' on the cleaning machine has been studied & summary of their contribution is presented below:

Arjun V Murali et al. [1] (2017) in their research, they work on floor cleaning machine. Their aim to develop and modernized process for cleaning the floor with wet and dry. At first dust is collected from vacuum cleaner. After that Water is sprayed from water tank and floor cleanings done by rotating press which is coupled to the DC motor. Fan is used to dry the water which is fitted to the Back side of the vehicle.

Mr. S. Ramesh Kumar et al. [2] (2018) in their research, they work on Design and fabrication of multipurpose floor cleaning machine. In their work, modeling and analysis of the floor cleaning machine was done using suitable commercially available software. From the finite element analysis, they observe that the stress level in the manually operated floor cleaning machine is within the safe limit.

Ms. R. Abarna et al. [3] in their research, they work on Design and fabrication of automatic floor cleaning machine. Their system enables cleaning of the floor by the help of highly stabilized and rapidly functionalized electronic and mechanical control system. Current project work targets to use automatic floor cleaner for large floor in household purposes and office floors. The cleaning purpose is specifically carried out by continuous relative motion between a scrubber and the floor surface.

Himani Patel [4]

(2019) in her research, she works on wireless multipurpose floor cleaning machine. She focused on the problems of long wires so to overcome this problem she use battery system which can be rechargeable when electricity is available and work as required.

Samarth G. Gaikwad et al. (2019) in their research, they work on Design and development of multifunctional floor scrubber and cleaner. They focused on to design and develop a multifunctional floor scrubber and cleaner which will substantially reduce the cleaning time and cost of the machine. At the same time, the floor cleaning machine should be capable of cleaning rough as well as smooth floors and inaccessible corners effectively. Through efficient project management, aspects like minimization of manufacturing and operational cost, aesthetic and ergonomic considerations were taken into account. Eventually this machine will lead to hefty decrease in time, money and effort.

Shubham Khade (2017) In his research, he works on multi-use floor cleaning machine. He developed machine which is capable of performing cleaning of floor and corners effectively, semiautomatic water spray, cleaning of byre, dry as well as wet cleaning tasks. This floor cleaning machine is designed by keeping the basic considerations for machine and operational cost reduction, efforts reduction, environment friendly and easy handling.

Shubham Antapurkar (2018) in his research, he works on Arduino based dry and wet automatic floor cleaner. His aim is to construct a floor cleaner which will be fully automatic providing dry and wet cleaning as well as UV sterilization. The current market is occupied by cleaners with only one or two functionality. For its cost reduction and simplicity, he is using Arduino. The cleaner will be a step for providing comfortable life by resolving problems in traditional floor cleaning methods.

Methodology

Fabrication is an important industry that involves cutting, manipulating and assembling materials to produce desired structures. And while different fabrication companies use different techniques, most rely on three basic processes: cutting, bending and assembling.

1) Cutting

The first process of fabrication is cutting. During this process, the metal fabrication company cuts one or more pieces of raw metal for use in the creation of a new metal structure or product. Whether it's steel, aluminum, iron or any other common type of metal, though, cutting metal requires special tools. Some metal fabrication companies use torches to

cut metal, whereas others numerical control (CNC) machines involving lasers or water jets. When finished, the company will have clean, appropriate-sized sheets or sections of metal with which to work

2) Bending

After cutting raw metal, metal fabrication companies must bend it. Again, there are different ways to bend metal after cutting it. Some metal fabrication companies hammer the metal sheets or sections into the desired shape. Hammering can be done by hand, or it can be done using a machine (power hammering). Recently, though, many metal fabrication companies have begun using press brakes to bend their metal. This heavy industrial machine automatically presses metal sheets and sections into specific shape when engaged. It essentially clamps the metal between a punch die, forcing the metal into the desired shape.

3) Assembling

The third and final process of metal fabrication is assembling. As the name suggests, this process involves assembling the metal sheet or sections into the desired finished product. Assembling is typically performed via welding, though other steps may be included in the process as well. In addition to welding, for example, metal fabrication companies may crimp seams, apply screws or other fasteners, and apply glue. After assembling the metal, the company will finalize the product before shipping and selling it to its customers.

Metal fabrication is a driving force behind the country's ever-growing manufacturing sector. Although there are countless machines and techniques used by metal fabrication companies, must rely on a three-step process that consists of cutting, bending and assembling. These three processes allow metal fabrication companies to transform raw metal materials into new products.

Design Consideration

Several structural design considerations should be taken into account for economical and efficient manufacturing. Many of these apply to other joining methods, and all apply to both subassemblies and the complete structure.

1. The device should be suitable for local manufacturing capabilities.
2. The attachment should employ low-cost materials and manufacturing methods.
3. It should be accessible and affordable by low-income groups, and should fulfill their basic need for mechanical power
4. It should be simple to manufacture, operate, maintain and repair.
5. It should be as multi-purpose as possible, providing power for various agricultural implements and for small machines used in rural industry.
6. It should employ locally available materials and skills. Standard steel pieces such as steel plates, iron rods, angle iron, and flat stocks that are locally available should be used. Standard tools used in machine shops such as hacksaw, files, punches, taps & dies; medium duty welder; drill press; small lathe and milling machine should be adequate to fabricate the parts needed for the dual-purpose bicycle.
7. It should make use of standard parts wherever possible.
8. The device should adapt easily No permanent structural modification should be made
9. Excessive weight should be avoided, as durability is a prime consideration.

Design Procedure

1. Definition of problem
2. Synthesis
3. Analysis of forces
4. Selection of material
5. Determination of mode of failure
6. Selection of factor of safety
7. Determination of dimensions
8. Modification of dimensions
9. Preparation of drawings

PREPARATION OF DESIGN REPORT

Aesthetic Considerations in Design

- Appearance is an outward expression of the quality of the product and is the first communication of product with the user.
- Aesthetics is defined as the set of principles of appreciation of beauty. It deals with the appearance of the product.

Standardization

- It is the process of establishing the set of norms to which specified set of characteristics of a component or a product should conform

- Example: Standardizing the shaft consists of specifying the set of shaft diameters and material
- Objectives of standardization
- To make the interchangeability of the components possible
- To make the mass production of components easier

Design Drawing and Pictures

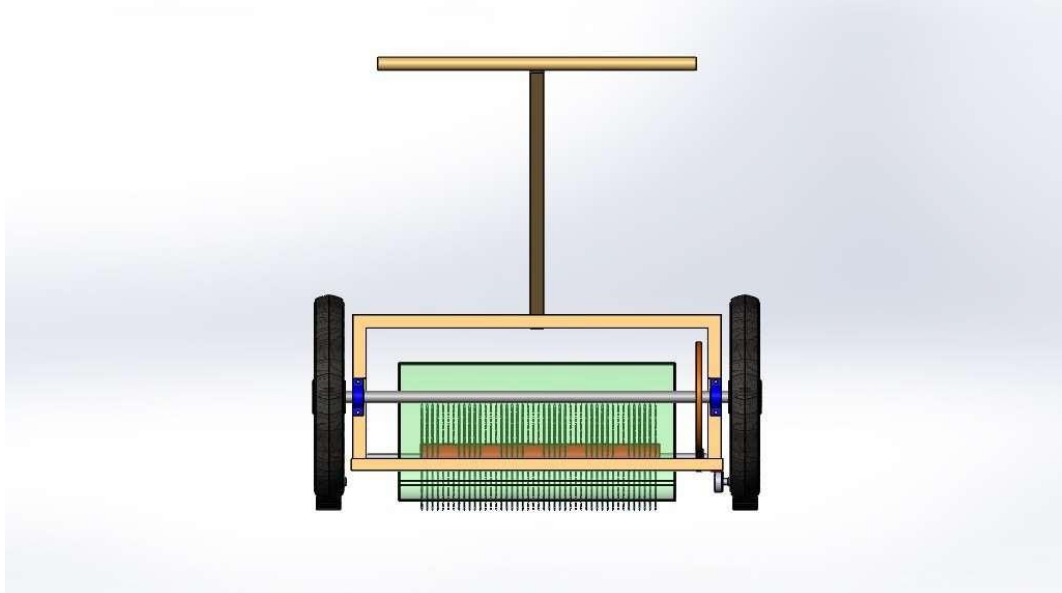


Fig.1

Frame



Fig.2 Frame

It is the system's foundation. It is connected to all of the systems and components. The chassis has a significant impact on the system's stability. It's square, rectangular, or circular. A chassis is an internal vehicle structure that supports and protects various internal sections of an artificial item during its creation and operation. The undercarriage of a vehicle, which consists of the frame, is an example of a chassis (on which the body is mounted). A rolling chassis is an assemblage that includes the running gear, such as wheels and transmission, and occasionally even the driver's seat.

Brush

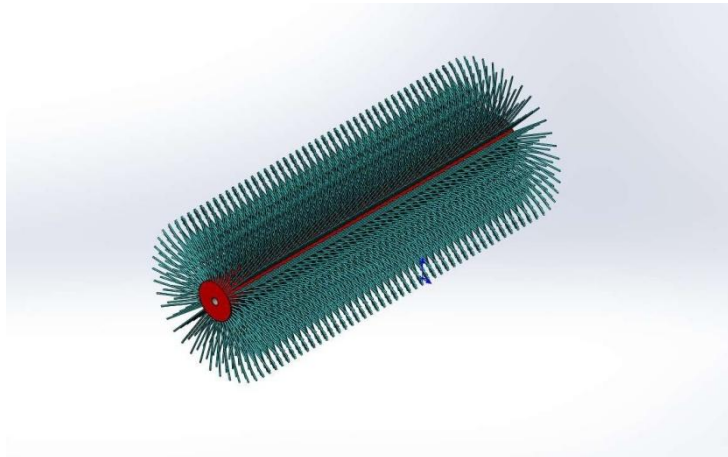


Fig. 3 Brush

A brush is a tool with bristles made of hair, wire, metal, synthetic fibers, or other natural materials linked to a wooden, plastic, wire, or metal handle. Some brushes have been designed to function with power equipment for heavy-duty tasks like removing paint or polishing metals. Brushes come in a wide range of sizes and shapes, from hair artist brushes to brushes with a few of feet in diameter that are used to clean floors and polish metals. Brushes are shaped and designed to accommodate a variety of purposes. The brush is essentially an abrasive tool for cleaning and removing paint and other materials from a surface. It's also used to clean surfaces and improve the environment.

Shaft

Axle is used for mounting sprocket and wheels. We use three axle first axle is used for transmission power, second axle is used for mounting sweeper brush, and third axle is used for mounting supporting wheels.

Wheel

A wheel is a circular block of a hard and durable material at whose center has been bored a circular hole through which is placed an axle bearing about which the wheel rotates when a moment is applied by gravity or torque to the wheel about its axis, thereby making together one of the six simple machines. When placed vertically under a load-bearing platform or case, the wheel turning on the horizontal axle makes it possible to transport heavy loads; when placed horizontally, the wheel turning on its vertical axle makes it possible to control the spinning motion used to shape materials.



Fig.4 Wheel

Fabrication Process

Metal fabrication is taking a raw material, typically sheets of metal and other flat materials, through a series of processes to create a finished end product. Virtually every industry relies on metal fabrication to operate efficiently, create the tools they need, develop products, etc. As you can see, it is a very broad industry that helps the entire world run.

Fabrication is the process of manufacturing sheet metal and other flat materials to make them conform to specific shapes. The process starts with sheet metal around a quarter of an inch thick or less. At this thickness, the sheet metal and other flat materials is pliable enough to assume different shapes. Using this metal, fabricators alter the sheet to create a specific shape. This takes place through cutting, stamping, shaping, folding and welding. Another related practice is custom fabrication, meaning the creation of new custom parts using novel combinations of these processes. All this work is completed by metal fabricators — highly skilled specialists who are trained to cut and manipulate metal with a surgeon's precision to the desired shape. These fabricators often work out of large-scale manufacturing operations or specialized fabrication shops. The shops themselves vary widely, offering general fabrication services or specialized fabrication for medical and IT industries. Sheet metal and other flat materials fabrication may require additional parts to be added during the process, including but not limited to.

RESULTS

The manually operated eco-friendly road and floor cleaner is successfully designed. This project works implements the manually operated eco-friendly road cleaner for road cleaning that reducing the cost, human efforts as well as time.

CONCLUSIONS

In our project introduced a floor cleaning machine. The main motive of the project is to cover the aspects of cleanliness in the society. The multiple applications provide a wide range of functions in which we can clean the pipe, scrubbing of surface for proper cleaning of the floor, remove dust and dirt from the road, provide a pick and place mechanism by which obstacles can be removed. This project will be very helpful for the society and plays a vital role in cleanliness of the country. The existing cleaning machine have some disadvantages, Few of those are the motor is not detachable and the high rpm leads to vibration of the whole system. If these features will be modified, this will work well. This design of automated floor cleaning system can be used to clean any kind of remote places. As the motors selected can consume much less power so it will be the power saving and cost saves too.

Future Scope

In future the scope is a fully autonomous cleaning machine which could perform several cleaning tasks and run on various eco-friendly powers like solar or wind energy without need of human interventions. Project construction is simple and effective.

REFERENCES

- [1]. Mr. S. Ramesh kumar, M. Selvakumar, S. Senthilkumar, P. Surya, I. Thilagavathi, Design Fabrication of Multipurpose Floor Cleaning Machine, International Journal of Advanced Science and Engineering Research, 2018.
- [2]. Arjun V Murali, Amal Raj, Anandhu Jayaram et al, "Floor Cleaning Machine", International Journal of Advanced Engineering and Global Technology, ISSN No: 2309-4893, Volume 5, Issue-03, 2017.
- [3]. Ms. R. Abarna, S.Devadharshini, S.Dhileep et al, "Design And Fabrication Of Automatic Floor Cleaning Machine", International Journal of Science and Engineering Research, Volume 6 Issue 4, 2018.
- [4]. Himani Patel and Mahima Patel, "Wireless Multi - Purpose Floor Cleaning Machine", International Journal of Latest Technology in Engineering, Management & Applied Science, Volume 8, Issue 4, 2019.
- [5]. Sandeep. J. Meshram, Dr. G.D. Mehta--Design and Development of Tricycle Operated Street Cleaning Machine! - Journal of Information, Knowledge and Research in Mechanical Engineering
- [6]. Anup Mendhe, Mayank Lalka, Dinesh Shende et al, "Multipurpose Floor Cleaning Machine", International Journal for Scientific Research & Development, ISSN (online): 2321- 0613, Volume 5, Issue 01, 2017.
- [7]. Sandeep. J. Meshram, Dr. G.D. Mehta - —Design and Development of Tricycle Operated Street Cleaning Machinel - Journal of Information, Knowledge And Research In Mechanical Engineering, Volume– 04, Issue-01,2016.
- [8]. Liu, Kuotsan, Wang Chulun, A Technical Analysis of Autonomous Floor Cleaning Robots Based on US Granted Patents, European International Journal of Science and Technology Vol. 2 No. 7September 2013, 199- 216.
- [9]. Muhammad Kashif Shaikh Ghaffar, M. Aadil Arshad, Nand Kishor S. Kale, Ansari M Bilal, Prof D. M. Ugle, A Research Paper on "Design and Development of Floor cleaning machine", International Journal of Advance Engineering and Research Development (IJAERD), 2018.