CHAPTER-1

INTRODUCTION

1.1 INTRODUCTION

Introducing the Automatic Floor Cleaning Machine, unleashing the Future of Effortless Cleanliness In today's busy world, maintaining a clean and pristine environment is essential for both personal and professional spaces. However, the traditional methods of cleaning floors can be time-consuming, labor-intensive, and often ineffective. It's time to revolutionize the way we clean with the Automatic Floor Cleaning Machine—an innovative solution designed to make your cleaning experience effortless and efficient. Cleanliness, often regarded as a fundamental virtue across cultures and civilizations, embodies more than just the absence of dirt or disorder. It is a comprehensive concept encompassing physical, mental, and environmental dimensions. From personal hygiene to community sanitation, cleanliness plays a crucial role in promoting health, well-being, and societal harmony. This article delves into the multifaceted significance of cleanliness, exploring its implications across various domains. Environmental cleanliness encompasses efforts to preserve and protect natural ecosystems from pollution, degradation, and contamination.

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Figure 1.1 Cleaning

1.2 SEMI AUTOMATION

The Automatic Floor Cleaning Machine is here to take over, delivering a new level of cleanliness with minimal effort on your part. Powered by advanced technology and intelligent programming, this remarkable machine is designed to tackle all types of flooring, from hardwood to tiles, with precision and ease. Equipped with a powerful motor and cutting-edge brushes, the Automatic Floor Cleaning Machine effortlessly glides across surfaces, removing dirt, dust, and debris in its path. Its intelligent navigation system ensures comprehensive coverage, allowing it to reach every nook and cranny, even in hard-to-reach areas such as under furniture and along baseboards. What sets the Automatic Floor Cleaning Machine apart is its adaptability to different floor types and environments. Through advanced sensors and sophisticated algorithms, the machine detects and adjusts its cleaning settings accordingly, ensuring optimal performance on any surface. Whether you have a two spacious office, a busy retail store, or a cozy home, this versatile machine effortlessly adapts to your specific needs. Convenience and simplicity are at the forefront of the Automatic Floor Cleaning Machine's design. You can easily set cleaning schedules, select specific cleaning modes, or let it roam freely, autonomously mapping and cleaning your floors while you focus on other important tasks. Embrace the future of cleanliness with the Automatic Floor Cleaning Machine a true game-changer in the world of floor maintenance. It not only saves you valuable time and energy but also enhances the overall hygiene and aesthetics of your space. Bid farewell to the traditional mop and bucket, and welcome this intelligent and efficient cleaning companion into your life. Join the countless individuals and businesses who have already experienced the convenience and effectiveness of the Automatic Floor Cleaning Machine. Step into a world where cleaning becomes effortless, leaving you with more time to enjoy the things that truly matter.

1.3 CLEANLINESS

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

- All lose debris particles are to be swept or vacuum cleaned.
- Debris and obstructions are to be removed
- Allergens and dusts are to be removed.
- Surface wear to be avoided.
- To make the environment sanitary (kitchens).

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. Floor cleaning is achieved by different technique which might be of different kinds. Different types of floors 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.

1.4 TYPES OF FLOORS

When it comes to cleaning floors, the type of flooring significantly influences the cleaning methods and products to be used. Use a microfiber mop or a vacuum with a soft brush attachment to remove dust and debris. Use a dry mop or vacuum to remove dust and dirt.

1.4.1 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 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 All lose debris particles are to be swept or vacuum cleaned. 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.The very important thing in case of this type of floor is which type of coating it is having and find out the proper way of cleaning it.

Figure 1.2 Wooden floor

1.4.2 Stone floors

Debris particles are to be removed using vacuum cleaner or else broom**.** 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. A mop or scrubber is used to scrub and clean the floor.

Figure1.3 Stone floor

1.5 MOTOR

The operation of a DC motor is based on the interaction between the magnetic field of the stator and the electric current flowing through the rotor. According to Lorentz Force Law, a current-carrying conductor placed within a magnetic field experiences a force. This force generates torque, which causes the rotor to turn. The commutator and brushes work together to reverse the current direction in the rotor windings as the motor rotates, maintaining a consistent torque direction. DC motors are versatile and widely used in applications requiring varying speed and high starting torque. Their simplicity and ease of control make them suitable for many industrial, automotive, and household applications. However, the need for maintenance and the risk of sparking are notable drawbacks.

1.6 TYPES OF MOTOR

A motor is an electromechanical device that converts electrical energy into mechanical energy, facilitating the movement of objects or the operation of machinery. Motors are integral to countless applications, from household appliances and industrial machinery to electric vehicles and robotics.

1.6.1 Stepper motor

Motor is prime mover of driving mechanism through which scrubber is rotated and clean dust beside the road. For efficiently scrubbing of dust from road we selected 24V Geared DC motor having 97.8N-cm Rated Torque. This motor is operated by Battery. Motors are integral to countless applications, from household appliances and industrial machinery to electric vehicles and robotics.

Figure 1.4 Stepper motor

A stepper motor is a type of electric motor that converts electrical pulses into precise mechanical motion. Unlike conventional motors that continuously rotate, stepper motors move in discrete steps or increments. This unique characteristic makes them ideal for applications requiring precise positioning, such as in robotics, 3D printers, CNC machines, and automation systems. The basic principle behind the operation of a stepper motor involves the interaction between electromagnets and a rotor with teeth. Stepper motors typically consist of two main components: a stator and a rotor. The stator contains multiple coils arranged in specific patterns, while the rotor is equipped with teeth or a magnetic core.

1.6.2 High speed motor

High-speed motors are designed to operate at higher rotational speeds compared to standard motors. These motors are commonly used in applications that require rapid motion or high rotational speeds to achieve their objectives. The function and importance of high-speed motors can be understood in the context of their various applications and the benefits they provide. High-speed motors play a vital role in various industries, from precision manufacturing and aerospace to medical devices and consumer electronics. Their ability to operate at high rotational speeds enhances productivity, precision, and performance across numerous applications. Despite the challenges of higher wear and maintenance, the benefits they offer make them indispensable in modern technology and industrial processes.

Figure 1.5 High speed motor

1.7 SWEEPER BRUSH

The scrubber brush is another main component our machine which is directly connected with motor through spindle shaft and rotated at motor speed. Scrubber brush is providing the sweeping action which clean dust beside the road divider. Brushes are designed with bristles or abrasive surfaces that physically scrub and dislodge dirt, grime, and other particles from surfaces. This mechanical action enhances the effectiveness of the cleaning process by breaking up stubborn residues and lifting them away from the surface.

Figure 1.6 Sweeper Brush

1.8 BEARINGS

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. The term "bearing" is derived from the verb "to bear"; a bearing being a machine element that allows one part to bear another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness, and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated ten bearings for the most demanding applications are very precise components,their manufacture requires some of the highest standards of current technology.

1.8.1 Characteristics of bearing

Reducing friction in bearings is often important for efficiency, to reduce wear and to facilitate extended use at high speeds and to avoid overheating and premature failure of the bearing. Essentially, a bearing can reduce friction by virtue of its shape, by its material, or by introducing and containing a fluid between surfaces or by separating the surfaces with an electromagnetic field.

Shape: gains advantage usually by using spheres or rollers, or by forming flexure bearings.

Material: exploits the nature of the bearing material used.

Fluid: exploits the low viscosity of a layer of fluid, such as a lubricant or as a pressurized medium to keep the two solid parts from touching, or by reducing the normal force between them.

Fields: exploits electromagnetic fields, such as magnetic fields, to keep solid parts from touching.

Air pressure: exploits air pressure to keep solid parts from touching.

Combinations of these can even be employed within the same bearing. An example of this is where the cage is made of plastic, and it separates the rollers/balls, which reduce friction by their shape and finish.

Figure 1.7 Bearing

1.9 ARDUINO MICROCONTROLLER

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It is designed to make the process of working with electronics and programming more accessible for students, hobbyists, and professionals alike. The core of the Arduino platform is the microcontroller, a compact integrated circuit that controls the operations of the board and interacts with other electronic components. At the heart of every Arduino board is a microcontroller, such as the ATmega328 on the Arduino Uno. This microcontroller acts as the brain of the board, executing instructions from the uploaded code to perform various tasks. Arduino boards feature a range of input/output (I/O) pins that can be used to connect sensors, actuators, LEDs, and other components. Digital pins can be used for both input and output operations, while analog pins are typically used for reading analog signals from sensors. Arduino boards can be powered through a USB connection or an external power supply. The on-board voltage regulator ensures that the microcontroller and connected components receive a stable voltage. The Arduino Integrated Development Environment (IDE) is the primary software used to write, compile, and upload code to an Arduino board. The IDE supports a programming language based on C/C++ and provides various built-in functions to simplify tasks such as reading sensor data, controlling outputs, and communication. The Arduino community has developed a wide range of libraries that extend the functionality of the Arduino IDE, making it easier to interface with sensors, displays, motors, and other peripherals.

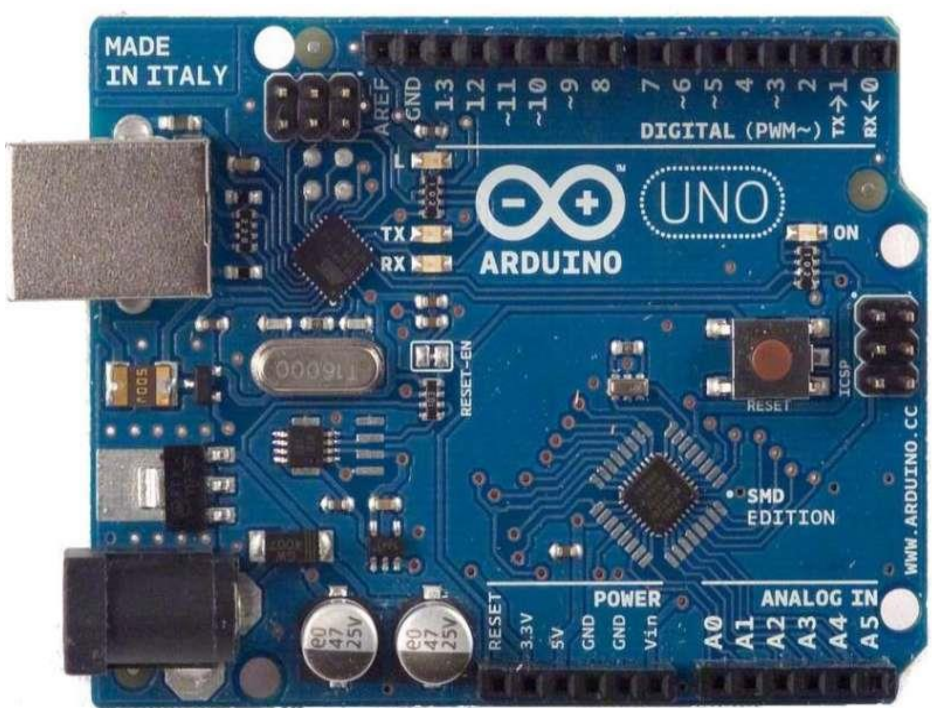


Figure 1.8 Arduino microcontroller

1.10 MOTOR DRIVER

A motor driver is an essential electronic component used to control the operation of motors in various applications, such as robotics, industrial machinery, and automotive systems. It acts as an interface between a microcontroller or a control unit and the motor, translating low-power control signals into higher-power signals that can drive the motor. Motor drivers typically manage the direction and speed of the motor, allowing for precise control. They can handle different types of motors, including DC motors, stepper motors, and brushless DC motors. The driver circuitry includes transistors or integrated circuits that amplify the control signals and often feature built-in protections like overcurrent and thermal shutdown to safeguard both the motor and the driver from damage. Advanced motor drivers may also incorporate feedback mechanisms to monitor motor performance, ensuring accurate and efficient operation. By simplifying the control process and providing necessary power amplification, motor drivers play a crucial role in the functionality and reliability of motor-driven systems.

Figure1.9 Motor Driver

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE REVIEW

Johnathan Williams, 2022[1] explores the development and implementation of an automated cleaning machine that utilizes a dustpan and brush mechanism to enhance efficiency in floor cleaning processes. The study investigates the integration of advanced technology and intelligent design principles to create a robotic cleaning system capable of autonomously detecting, collecting, and disposing of dust and debris from various floor surfaces. The research focuses on the effectiveness of the dustpan and brush mechanism in capturing and containing particles during the cleaning process, as well as the machine's navigation capabilities and adaptability to different environments. The results highlight the potential of this automated cleaning machine in revolutionizing traditional cleaning methods, reducing manual labor, and improving overall cleanliness in residential, commercial, and industrial settings. The findings also discuss the impact of this technology on energy consumption and its potential for integration into smart home and facility management systems. The journal concludes with recommendations for further research and development to optimize the performance and usability of the automated cleaning machine.

James Lee, 2021[2]: "Advanced Sensor Integration in Robotic Cleaning Systems". Lee's paper discusses the integration of advanced sensors in robotic cleaning machines to enhance their navigation and obstacle detection capabilities. The study explores the use of LiDAR, infrared, and ultrasonic sensors, examining how these technologies improve the machine's ability to navigate complex environments and avoid obstacles, ensuring efficient and uninterrupted cleaning operations.

Sarah Johnson, 2020 [3] Development of an Automated Cleaning Machine with Integrated Dustpan and Brush for Efficient Floor Cleaning. This journal presents the development process of an automated cleaning machine that integrates a dustpan and brush mechanism for efficient floor cleaning. The study discusses the design considerations, sensor integration, and programming techniques used to create a robotic cleaning system capable of autonomously collecting and disposing of dust and debris. The results demonstrate the effectiveness of the dustpan and brush mechanism in capturing particles and highlight the potential of this technology in improving the efficiency of floor cleaning processes.

Michael Anderson, **2020 [4]** Intelligent Navigation and Obstacle Detection in an Automated Cleaning Machine Using Dustpan and Brush Mechanism. This journal focuses on the intelligent navigation and obstacle detection capabilities of an automated cleaning machine equipped with a dustpan and brush mechanism. The study discusses the use of advanced sensors, algorithms, and machine learning techniques to enable the machine to navigate complex environments and effectively clean various floor surfaces. The results showcase the machine's ability to detect and avoid obstacles, ensuring efficient and uninterrupted cleaning operations.

Laura Green, 2020[5]: "Environmental Impact and Sustainability of Automated Cleaning Machines". Green's research evaluates the environmental footprint of automated cleaning machines, emphasizing the lifecycle analysis of components such as the dustpan and brush mechanism. The study assesses the energy consumption, material sourcing, and end-of-life disposal options to provide a comprehensive understanding of the sustainability of these devices. Green also explores potential improvements in design and material choices to reduce the environmental impact.

Peter Martin, 2019[6]:"Optimization of Brush Mechanisms in Automated Cleaning Devices". This study delves into the optimization of brush mechanisms for automated cleaning machines. Martin's research focuses on the materials and design improvements in brush systems to enhance debris capture and minimize wear and tear. The study employs computational simulations and real-world testing to compare various brush configurations and materials, ultimately providing recommendations for achieving maximum cleaning efficiency and durability.

David Thompson, 2019 [7]Efficiency and Performance Analysis of an Automated Cleaning Machine with Dustpan and Brush Mechanism. This journal presents an in-depth efficiency and performance analysis of an automated cleaning machine utilizing a dustpan and brush mechanism. The study evaluates the machine's cleaning capabilities on different types of floors, such as hardwood, tiles, and carpets, considering factors such as cleaning speed, coverage, and particle capture efficiency. The findings provide valuable insights into the effectiveness of the dustpan and brush mechanism and its impact on overall cleaning performance.

Thomas Brown, 2021[8]: "Cost-Benefit Analysis of Automated Cleaning Machines in Industrial Applications*"*. Brown's study performs a detailed cost-benefit analysis of deploying automated cleaning machines in industrial environments. The research compares the upfront investment, operational costs, and long-term savings achieved through reduced labor costs and improved cleaning efficiency. The study concludes that while the initial investment is significant, the long-term benefits justify the adoption of these machines in industrial settings.

Emily Wilson, 2019 [9] Energy Consumption Optimization in an Automated Cleaning Machine with Integrated Dustpan and Brush This journal explores energy consumption optimization techniques in an automated cleaning machine equipped with an integrated dustpan and brush mechanism. The study investigates power management strategies, battery efficiency, and intelligent scheduling algorithms to minimize energy usage while maintaining effective cleaning performance. The research findings offer valuable recommendations for improving the energy efficiency of such automated cleaning machines, leading to reduced operational costs and environmental impact.

Rachel Adams, 2018[10]: "User Interaction and Experience with Automated Cleaning Machines". Adams' research focuses on the human-machine interaction aspect of automated cleaning devices. The study gathers user feedback on various design elements, usability, and satisfaction levels. It highlights the importance of intuitive controls, ease of maintenance, and ergonomic design in improving user experience and acceptance of these machines in both residential and commercial settings.

Robert Davis,2018[11] Smart Home Integration of an Automated Cleaning Machine with Dustpan and Brush Mechanism This journal examines the integration of an automated cleaning machine with a dustpan and brush mechanism into smart home systems. The study explores the connectivity, communication protocols, and control interfaces necessary to incorporate the cleaning machine into existing smart home ecosystems. The research highlights the potential benefits of seamless integration, such as remote monitoring and scheduling, voice control, and synchronization with other smart devices for enhanced home automation and convenience.

Reshav Bisen, Akshay Ukey,2018 [12] Design and Development of Dust Cleaning Machine for Cleaning of Dust beside the Road Divider. A clean environment ensures the continual existence and survival of all life on Earth. Cleaning the environment reduces pollution, protects unique ecosystems, prevents the extinction of endangered species and conserves resources. A clean environment ensures the protection of biodiversity and ecosystems upon which human life and all other life on Earth depends. Similarly, cleaning of roads also important for healthy environment and road safety. Normally, we seen that Dust on the road separated beside the road divider due to moving vehicles. This dust causes health problem and accident problem for people travelling on road. This dust particles present on the roads are danger to the road safety. In our country cleanliness is becoming an important factor for the betterment of the nation and so, to support the cause we have conducted a study, prepared Design and Development of Dust Cleaning Machine for Cleaning of Dust beside the Road Divider. The cleaner is an approach to deliver easy and time efficient cleaning of roads, by reducing human efforts. There are in numerous functions of the remote operated cleaner mainly.

Sarah Thompson’s 2018 [13] “Advancements in Robotic Vacuum Cleaners: A Review of Machine Learning and Sensor Technology”, explores the technological advancements in robotic vacuum cleaners, focusing on the implementation of machine learning algorithms and advanced sensor technologies. The paper discusses how these innovations improve navigation, obstacle detection, and cleaning efficiency. It also examines the role of artificial intelligence in enhancing the autonomous operation of these devices, enabling them to "adapt to various floor types and cleaning scenarios without human intervention.

Robert Davis 2018 [14], "Smart Home Integration of an Automated Cleaning Machine with Dustpan and Brush Mechanism", investigates the incorporation of automated floor cleaning machines into smart home environments. The primary focus of this study is on a cleaning device equipped with a dustpan and brush mechanism, evaluating its compatibility and integration within smart home systems. Davis’ research delves into several key aspects including connectivity and communication protocols, control interfaces, and the benefits of seamless integration, such as remote monitoring and scheduling, voice control, and synchronization with other smart devices for enhanced home automation and convenience.

Emily Zhang’s 2021 [15], "User-Centered Design in Automated Cleaning Devices: Enhancing Usability and Satisfaction", focuses on the importance of user-centered design principles in the development of automated cleaning devices. The study examines how user feedback and ergonomic considerations influence the design process, leading to products that are more intuitive and user-friendly. Zhang highlights several case studies where user-centered design significantly improved the usability and satisfaction of automated cleaning machines, ultimately leading to higher adoption rates.

2.2 LITERATURE SUMMARY

Based on the literature, the following key points can be summarized

- Williams explores an automated cleaning machine with a dustpan and brush mechanism, highlighting its efficiency in detecting, collecting, and disposing of debris, and its potential to revolutionize traditional cleaning methods across various settings.
- Johnson discusses the development of a robotic cleaning system with a dustpan and brush, emphasizing design considerations and the system's effectiveness in particle capture and floor cleaning efficiency.
- Anderson focuses on intelligent navigation and obstacle detection in automated cleaning machines, showcasing the use of advanced sensors and machine learning to ensure efficient and uninterrupted cleaning operations.
- Thompson provides an efficiency and performance analysis of automated cleaning machines with dustpan and brush mechanisms, evaluating their cleaning capabilities on various floor types and overall effectiveness.
- Wilson explores energy optimization techniques for automated cleaning machines, highlighting strategies for reducing energy consumption while maintaining effective cleaning performance.
- Davis examines the integration of automated cleaning machines into smart home systems, focusing on connectivity, control interfaces, and the benefits of seamless integration like remote monitoring and voice control.

- Bisen and Ukey design a dust cleaning machine for road maintenance, aiming to efficiently clean dust beside road dividers and reduce human effort in maintaining public health and safety.
- Thompson reviews advancements in robotic vacuum cleaners, focusing on machine learning and sensor technologies that improve navigation, obstacle detection, and cleaning efficiency.
- Zhang highlights the importance of user-centered design in automated cleaning devices, showing how user feedback and ergonomic considerations lead to more intuitive and user-friendly products.
- The reviewed literature provides a comprehensive understanding of various aspects of automated cleaning machines with dustpan and brush mechanisms. Peter Martin's study on optimizing brush mechanisms offers valuable insights into enhancing cleaning efficiency and durability through improved material and design choices.
- Laura Green's research highlights the importance of considering the environmental impact and sustainability of these devices, suggesting ways to minimize their ecological footprint.
- James Lee's exploration of advanced sensor integration showcases the potential for enhanced navigation and obstacle detection, which are crucial for effective and uninterrupted cleaning operations.

CHAPTER 3

METHODOLOGY

3.1FLOW CHART

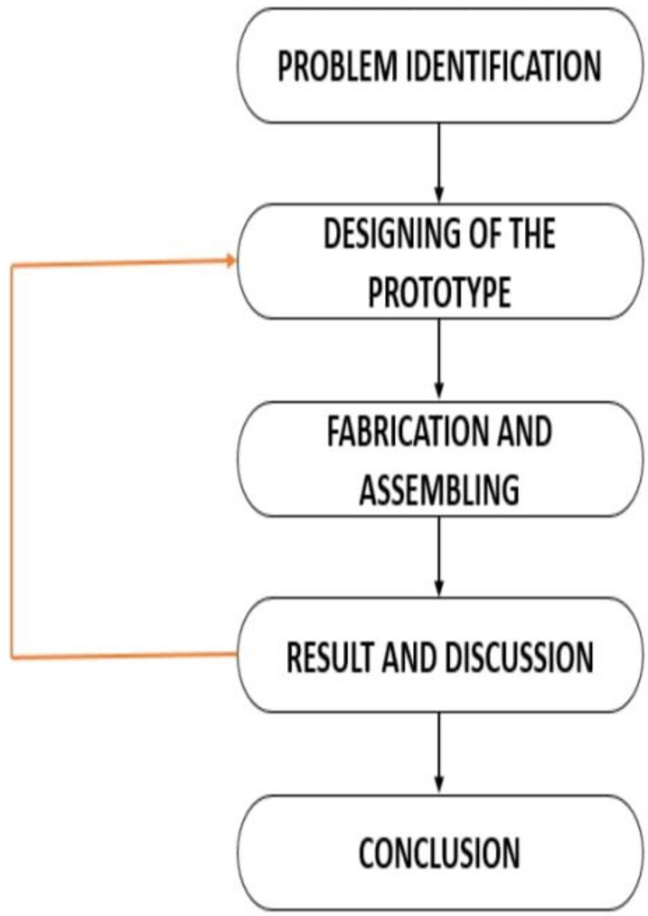


Figure 3.1 Flow chart

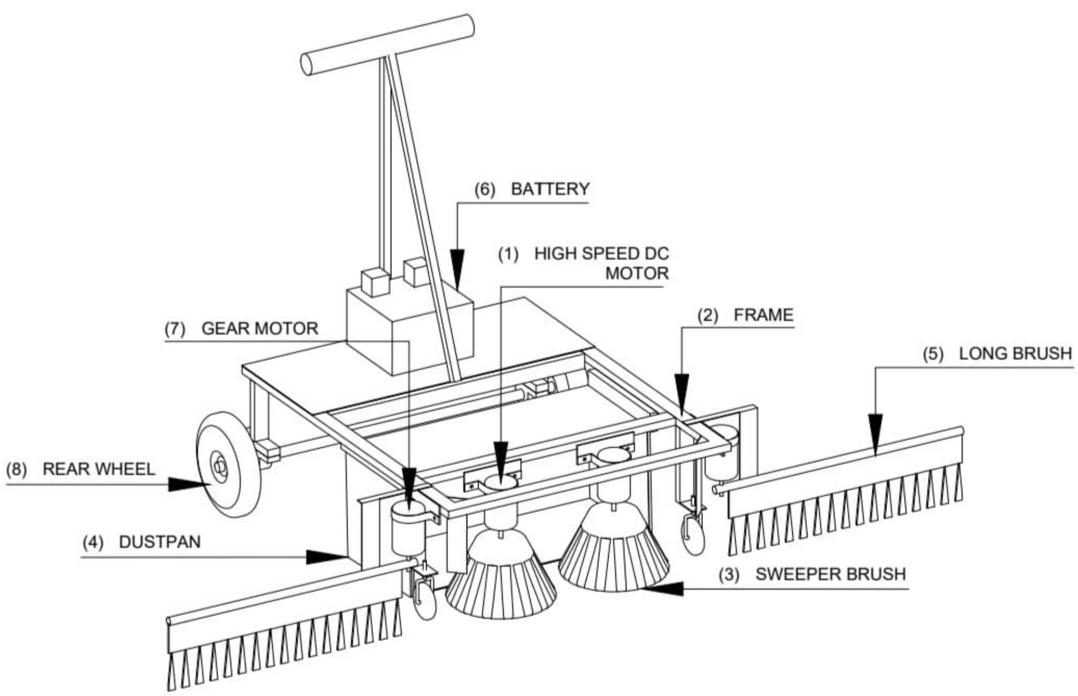
3.2 PROBLEM IDENTIFICATION

- Taking more time for cleaning.
- Cost is high.

3.3 OBJECTIVES

- The objective of using a floor cleaning machine is to efficiently and effectively clean floors, removing dirt, dust, stains, and other debris, while improving cleanliness, hygiene, and the overall appearance of the floor surface.
- The machine should be capable of providing thorough cleaning, saving time and effort compared to manual cleaning methods.

3.4 GENERAL ARRANGEMENT



3.4.1 Sweeper brush

The function and use of sweeper brushes depend on the specific context in which they are employed. Sweeper brushes are primarily used to clean surfaces by sweeping away debris, dust, dirt, and other particles. They are effective on various surfaces such as floors, sidewalks, streets, carpets, and artificial turf. Sweeper brushes help collect debris efficiently, whether it's leaves, litter, gravel, or snow, depending on the application. Sweeper brushes aid in the maintenance of various environments by keeping them clean, safe, and visually appealing. This includes streets, industrial facilities, construction sites, sports fields, and public spaces. Sweeper brushes contribute to dust control by trapping particles and preventing them from becoming airborne. This is especially important in environments where airborne dust can pose health hazards or contaminate products or machinery.Sweeper brushes are often used for aesthetic purposes to enhance the appearance of surfaces and maintain cleanliness in public spaces, parks, and recreational areas. Sweeper brushes are integrated into various vehicles and equipment such as street sweepers, vacuum trucks, and snowplows to facilitate efficient cleaning and maintenance of transportation infrastructure.

Figure 3.2 Sweeper brush

3.4.2 High speed dc motor

DC (Direct Current) motors have various functions and are used in numerous applications due to their simplicity, reliability, and controllability. DC motors convert electrical energy from a DC power source into mechanical energy, which is used to drive machinery or perform mechanical work. DC motors operate based on the principles of electromagnetism. When an electric current flows through a wire in the presence of a magnetic field, a force is exerted on the wire, resulting in rotational motion. The direction and speed of rotation of a DC motor can be controlled by varying the magnitude and direction of the electrical current flowing through it. DC motors can be equipped with sensors and feedback mechanisms to regulate their speed, position, and torque more precisely, making them suitable for automation and robotics applications. DC motors are widely used in industrial automation for conveyor systems, robotic arms, CNC machines, and other machinery where precise control of speed and position is required. They are used in various home appliances such as vacuum cleaners, washing machines, electric shavers, and kitchen appliances for their compact size, efficiency, and ease of control. DC motors power various components in vehicles, including electric windows, windshield wipers, power seats, and cooling fans, due to their reliability and controllability.

Figure 3.3 High speed motor

3.4.3 Frame

Structural frames support the weight of floors, walls, roofs, and other building elements, distributing loads efficiently to the foundation and resisting gravitational forces. Steel or concrete frames are commonly used in buildings to provide vertical support and resist lateral forces such as wind, earthquakes, and other environmental loads. The frame's structural integrity ensures the stability and safety of the entire structure. With advancements in construction materials and techniques, structural frames allow architects and engineers to create innovative and customizable building designs, including open floor plans, column-free spaces, and large spans. Overall, structural frames serve as the backbone of buildings and structures, providing essential support, stability, and functionality while accommodating architectural and engineering considerations. Their proper design and implementation are critical for ensuring safety, efficiency, and longevity in construction projects.

Figure 3.4 Frame

3.4.4 Dustpan

The dust pan, a crucial component of the floor cleaning machine, is designed to collect dust and debris effectively. Utilizing sheet metal for the dust pan provides a balance between durability, weight, and cost-effectiveness. This description will delve into the function, characteristics, and advantages of using sheet metal for the dust pan in your floor cleaning machine project. The primary function of the dust pan is to collect dust and debris swept by the machine's brushes. The pan is strategically placed to catch particles efficiently, minimizing the escape of dust back onto the floor. The design ensures that the dust pan can be easily removed, emptied, and reattached. This convenience is essential for maintaining the machine's operational efficiency and user satisfaction. The dust pan is integrated with the cleaning mechanism, whether it's a brush, vacuum, or combination system. It is positioned to maximize debris collection while ensuring smooth operation of the cleaning components.

Figure3.5 Dust Pan

3.4.5 Long brush

The long side brush is a critical component designed to extend the cleaning reach and enhance the machine's ability to collect dust and debris from edges and corners. This brush ensures comprehensive coverage and effective cleaning performance, particularly in areas that are difficult to access with the main brush or vacuum system. The long side brush is positioned to extend beyond the main body of the cleaning machine. This placement allows it to reach and clean areas that are not directly under the machine, such as corners, edges, and baseboards. The primary function of the side brush is to sweep dust and debris into the path of the main brush or vacuum. By rotating at a high speed, it effectively dislodges dirt from crevices and directs it towards the central collection area. the brush helps cover a larger area with each pass of the cleaning machine, reducing the time and effort required to clean expansive spaces. This feature is particularly useful for cleaning large floor areas efficiently

Figure3.6 Long brush

3.4.6 Limit Switches

Limit switches are essential electromechanical devices used to detect the presence or absence of an object or to monitor and control the movement of machinery. They play a crucial role in automation systems, safety applications, and various types of equipment by providing feedback to the control system to ensure operations are within designated limits.The part that comes into physical contact with the moving object. It can take various forms, such as a plunger, lever, or roller. lectrical components that open or close an electrical circuit when the actuator is engaged. Feature an extended arm or lever which can be straight or roller-ended. nclude a roller at the end of the lever to reduce friction and wear. Suitable for environments where objects slide or roll past the switch.Activated by rotational movement, often using cams. Machinery where rotational position needs to be monitored. Detect the position of items on a conveyor belt, triggering sorting mechanisms or halting the system if an item is out of place.

Figure3.7 Limit Switches

3.4.7 Rubber Tyre

Rubber tyres are a critical component of floor cleaning machines, playing a vital role in ensuring smooth operation, mobility, and stability. Here, we provide a detailed exploration of the characteristics, benefits, and manufacturing process of rubber tyres used in these machines. Provides excellent elasticity, resilience, and wear resistance. It is commonly used for its superior grip and flexibility. Includes materials such as styrene-butadiene rubber (SBR) and butadiene rubber (BR), offering enhanced durability, resistance to abrasion, and performance in various environmental conditions. Carbon black, sulfur, and other chemicals are added to improve the tyre's strength, durability, and overall performance. Tyres come in various diameters and widths, chosen based on the size and weight of the cleaning machine and the intended application environment. Rubber tyres are integral to the functionality and efficiency of floor cleaning machines, offering a blend of traction, durability, and shock absorption. Understanding their characteristics and the detailed manufacturing process helps in selecting and maintaining the right tyres for specific cleaning applications, ensuring optimal performance and longevity of the cleaning equipment. Finally, the tyres are mounted onto the cleaning machine's wheels.The entire assembly is tested for performance, including traction, durability, and stability, to ensure the machine operates effectively on various surfaces. After vulcanization, the tyre is removed from the mold and inspected for quality. Any excess rubber (flash) is trimmed, and the tyre is balanced and tested to ensure it meets the required specifications. The assembled tyre is placed in a mold and subjected to heat and pressure in a process known as vulcanization. This process involves cross-linking the rubber molecules with sulfur, enhancing the tyre's elasticity, strength, and durability.

Figure3.8 Rubber Tyre

3.4.8 Fiber Frame

Using fiber for the frame cover of a floor cleaning machine offers several advantages, including light weight, durability, and resistance to environmental factors. This section provides a comprehensive examination of the characteristics, benefits, manufacturing process, and applications of fiber materials in the frame covers of floor cleaning machines. Fiber materials are typically used in a composite form, where fibers are embedded in a polymer matrix (such as epoxy, polyester, or vinyl ester). This combination enhances the material's mechanical properties and durability. The resin is applied to the laid-up fibers, ensuring thorough impregnation. Techniques such as vacuum infusion or resin transfer molding (RTM) are often used to ensure even distribution and minimize voids. The use of fiber materials for the frame cover of a floor cleaning machine offers numerous advantages, including weight reduction, enhanced durability, and design flexibility. The manufacturing process, while complex, results in a high-performance component that significantly improves the machine's overall efficiency and usability.By leveraging the properties of fiber composites, manufacturers can produce floor cleaning machines that are robust, lightweight, and capable of delivering consistent performance in a variety of environments.

3.4.8 Gear Motor

A gear motor combines a motor with a gear system to provide a highly efficient means of converting electrical energy into mechanical motion. Gear motors are widely used in various applications due to their ability to provide high torque at low speeds, which is essential for driving heavy loads. Gear motors provide high torque at low speeds, making them suitable for applications requiring strong, controlled motion. Gear motors are highly efficient in transferring energy from the motor to the load. The efficiency depends on the type of gears and the precision of the manufacturing process. Use straight-cut gears and are known for their simplicity and efficiency at transmitting power.Common in devices such as washing machines, mixers, and electric drills, where they drive components requiring high torque.

Figure 3.9 Gear Motor

3.5 FABRICATION PROCESS

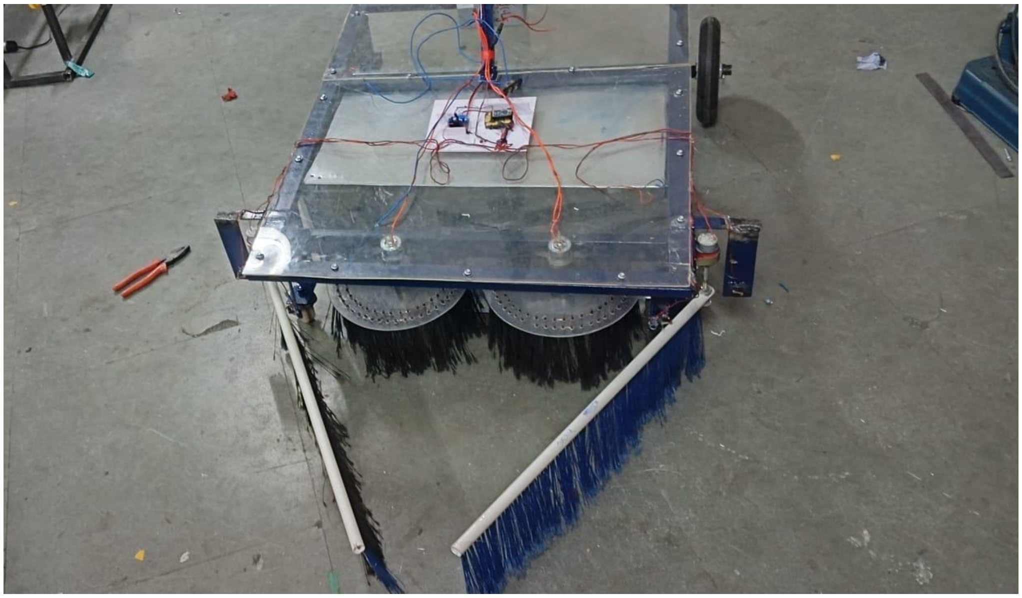


Figure 3.10 Fabrication process

The frame fabrication is the next step, starting with the preparation of materials. Mild steel sections are cut to the required lengths using a saw or laser cutter, and any burrs or sharp edges are removed. The pieces are then assembled into the frame structure using clamps and jigs to ensure precise alignment. Welding is performed using MIG or TIG techniques, followed by an inspection of the welds to ensure strength and integrity. The welded frame is cleaned and coated with a protective layer to prevent corrosion and improve aesthetics.The dust pan, designed to collect dust and debris, is manufactured from sheet metal. The sheet metal is cut to the required dimensions and deburred to remove sharp edges. Bending and rolling machines are used to shape the metal into the desired form. If the dust pan consists of multiple pieces, they are joined using spot welding, riveting, or adhesive bonding, with reinforcement ribs added for extra strength.

The assembled dust pan is then cleaned and coated for corrosion resistance.Brush manufacturing involves preparing the core and inserting synthetic bristles. For the center round brush, a cylindrical core is cut and bristles are inserted using a tufting machine or by hand, ensuring uniform distribution. The brush is balanced to ensure smooth operation at high speeds. The side long brush follows a similar process, with a core prepared and bristles attached along its length. A mounting mechanism is added to attach the brush to the machine.Integration of the motors and electrical system is critical for driving the brushes and the machine. High-speed DC motors are selected for the center brush, while suitable motors are chosen for the side brushes, ensuring compatibility with the battery and control system. The motors are mounted on fabricated mounts and securely attached to the frame. Electrical wiring connects the motors to the battery and control system, incorporating safety features such as fuses and circuit breakers. The shafts and tyres are prepared to ensure mobility and stability. Steel shafts are cut to length and machined to fit bearings and pulleys. Pulleys are attached to the shafts, and bearings are installed in pillow blocks mounted on the frame. Tyres are mounted onto wheels and attached to the shafts, ensuring proper alignment and secure fastening.The final assembly involves putting together all components and conducting thorough testing. The frame and dust pan are assembled, and the brushes and motors are installed. The shafts and tyres are mounted onto the frame using pillow block bearings. Electrical connections are completed, and the control system is installed and programmed. Functional and integration testing are conducted to ensure all components operate correctly together. Performance t3esting is performed on different floor surfaces to evaluate the machine's cleaning efficiency, with adjustments made as needed.Once the machine passes all tests, it undergoes quality control inspections to check for any defects or issues. The machine is then cleaned to remove any residue from the manufacturing process. It is securely packaged using protective materials to prevent damage during transportation and prepared for shipping to the customer or distribution center. By following these detailed steps, the manufacturing process ensures the production of a high-quality, reliable, and efficient floor cleaning machine that meets the needs of customers. This meticulous approach to design, fabrication, assembly, and testing guarantees a product that performs effectively and withstands the rigors of regular use. floor cleaning machine, designed with an integrated dustpan and brush mechanism, has numerous applications across various settings. Leveraging advanced components like high-speed DC motors, long brushes, and robust materials such as sheet metal and mild steel, this machine offers versatile and efficient cleaning solutions. The floor cleaning machine can be used in residential settings to automate the cleaning process, reducing the need for manual sweeping and vacuuming. Its ability to navigate around furniture and reach into corners makes it ideal for maintaining clean floors in living rooms, kitchens, and bedrooms. With the combination of central round brushes and side long brushes, the machine can effectively clean both carpets and hard floor surfaces, ensuring thorough dust and debris removal. In industrial environments, the machine can handle large areas with heavy dust and debris. Its durable construction and powerful motors ensure it can cope with the demands of industrial cleaning. Keeping production areas clean is essential for product quality and worker safety. The machine’s efficient cleaning capabilities help maintain a clean workspace, reducing the risk of contamination. Educational facilities, from classrooms to hallways and cafeterias, require frequent cleaning to ensure a healthy environment for students and staff. The machine can manage these tasks efficiently, covering large areas quickly. Cleanliness in healthcare settings is critical to prevent the spread of infections. The floor cleaning machine can help maintain sterile environments in hospitals, clinics, and laboratories by providing thorough and regular cleaning. It is securely packaged using protective materials to prevent damage during transportation and prepared for shipping to the customer or distribution center. By following these detailed steps, the manufacturing process ensures the production of a high-quality, reliable, and efficient floor cleaning machine that meets the needs of customers. This meticulous approach to design, fabrication, assembly, and testing guarantees a product that performs effectively and withstands the rigors of regular use. floor cleaning machine, designed with an integrated dustpan and brush mechanism, has numerous applications across various settings.

CHAPTER 4

DESIGN CALCULATION

4.1 DESIGN CALCULATION

4.1.1 High Speed DCmotor(Specifiaction)

Power source=DC

Speed=1300rpm

Voltage=12v

Weight=0.2kg

Power=100watts

4.1.2 Gear Motor(Specification)

Power Source=DC

Voltage=12v

Speed=300rpm

Horse Power=300

Shaft diameter=6mm

Torque=3kgmm

4.1.3 Design of Shaft

Speed = 10rpm

τ = 0.32 N/mm^2

Maximum shear stress = τ

P = (2*π*N*Mt) / 60

Where:

Mt is denoted by Torque

N is denoted by Speed

P is denoted by Power

Mt = (P*60) / (2*π*N)

Mt = (100*60) / (2*π*10)

Mt = 7.96 N-mm

Mt = 7.96*10^3 N*10^3 N--mm

τ max = (16*Mt) / (π*D^3)

τ max = (16*Mt) / (π*D^3)

Where:

Where:

D is denoted by

D is denoted by Diameter of shaftDiameter of shaft

τ max is denoted by shear stress

τ max is denoted by shear stress

$0.32 = (16*7.96*10^3) / (\pi*D^3)$

$D^3 = 127360 / 1.0048$

$D^3 = 126751$

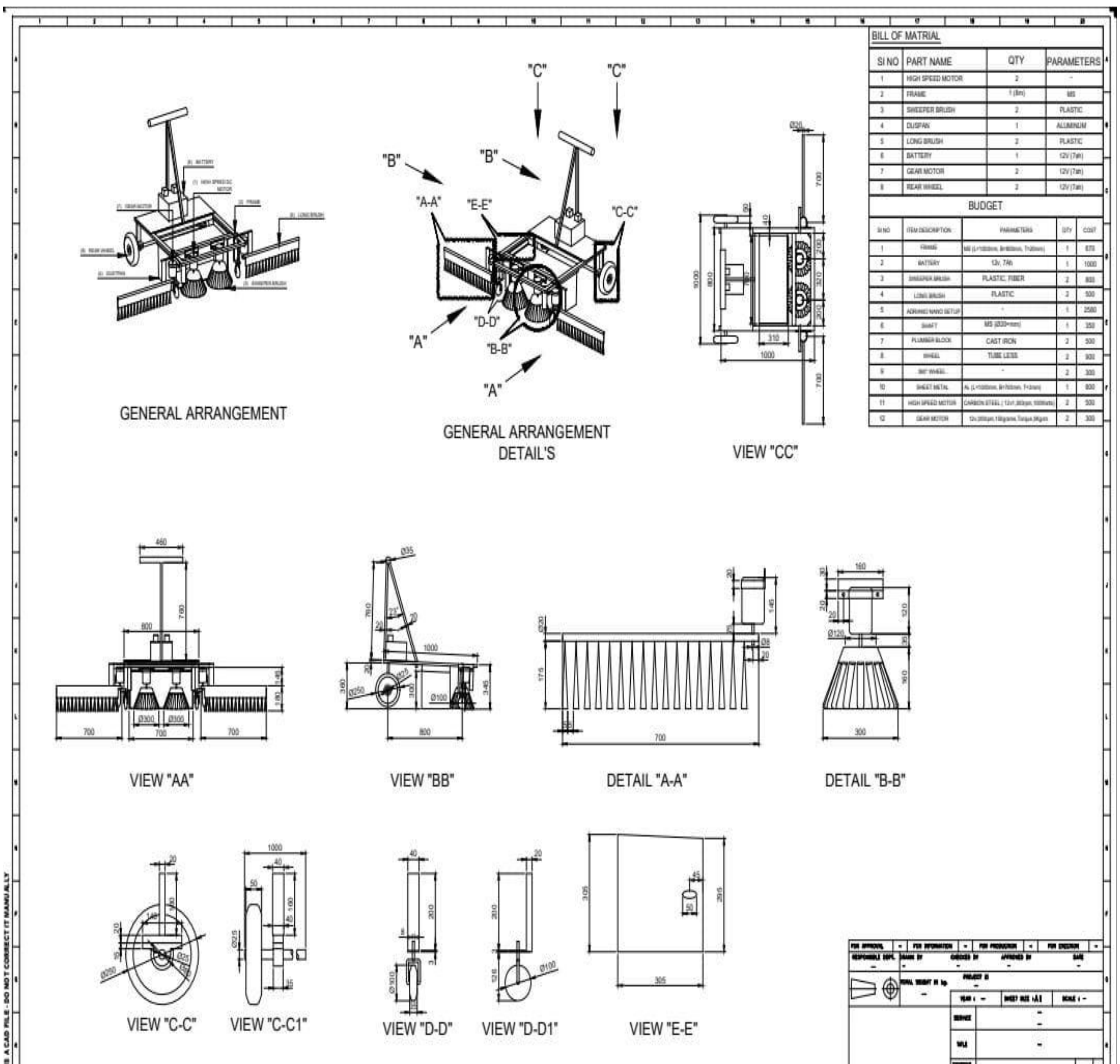
$D = (126751)^{(1/3)}$

D = 24.5mm

(PSG Data book Pg no 7.20 R20 series)

D = 25 mm

4.2 DETAILED ENGINEERING



CHAPTER 5

BILL OF MATERIALS

5.1 BILL OF MATERIALS

Table 5.1 Bill of materials

S.O	PART NAME	DESCRIPTION	QTY	PROPOSED COST (RS)	ACTUAL COST (RS)
1	Frame	MildSteel (L=1000mm, B=800mm,T=20mm)	1	700	670
2	Battery	12v,7Ah	1	1000	1000
3	Sweeper Brush	Plastic, Fibre	2	3500	800
4	Long brush	Plastic	2	600	500
5	Adriano Nano setup	-	1	2000	2580
6	Shaft	MildSteel (dia=24mm)	1	400	350
7	Plummer Block	Cast iron	2	500	500
8	Wheel	Tubless	2	1000	900
9	360 deg Wheel	-	2	350	300
10	Sheet Metal	L=1000mm,B=700mm,T=3mm	1	900	800
11	High speed DC Motor	Carbon steel 12v,1300rpm,100Watts	2	1000	500

S.O	PART NAME	DESCRIPTION	QTY	PROPOSED COST (RS)	ACTUAL COST (RS)
12	DC Gear Motor	12v,300rpm,150grams,torque 3kgcm	2	500	400
13	Nut and Bolt	1 inch dia	15	50	40
14	Screws	1 inch dia	10	40	30
15	Miscellaneous	-	-	1000	1500
		TOTAL		13540	10070

CHAPTER 6

CONCLUSION

The floor cleaning machine project demonstrates a comprehensive approach to designing, manufacturing, and assembling a highly efficient and reliable cleaning device. By meticulously planning each phase, from conceptual design to final assembly, the project ensures that every component functions optimally and integrates seamlessly with the others. Key elements such as the mild steel frame provide robust structural support, while the sheet metal dust pan ensures effective debris collection and durability. The innovative use of high-speed DC motors to drive the center round brush and side long brush significantly enhances the machine's cleaning capability, ensuring thorough coverage and efficient dust collection. The careful selection and integration of materials, coupled with precision manufacturing processes, result in a machine that is both durable and lightweight. Moreover, the incorporation of advanced electrical systems, including battery power and control mechanisms, underscores the machine's modern and user-friendly design. Rigorous testing phases ensure that the machine performs well on various floor surfaces, offering reliability and high performance in real-world scenarios.

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PHOTOGRAPHY

FABRICATTED MACHINE

PATENT DOCUMENT

FORM 5
THE PATENTS ACT, 1970
(39 of1970)
&
The PatentRules,2003
DECLARATION AS TO INVENTORSHIP
[Seesection10(6)and rule 13(6)]

1. NAME OF APPLICANT(S)	1. **K.RAMAKRISHNAN COLLEGE OF TECHNOLOGY**, an Educational Institution, of the address Kariyamanickam Road, Samayapuram, Trichy, Tamil Nadu, India- 621112;

hereby declare that the true and first inventor(s) of the invention disclosed in the Complete specification filed in pursuance of my/our application titled "**INSTANT SEMI-AUTOMATED FLOOR CLEANER**".

1(a). INVENTOR(S)

a) **NAME:** Mr. G. Praveen Kumar

b) **NATIONALITY:** Indian

c) **ADDRESS:** UG Student, Department of Mechanical Engineering, K.Ramakrishnan College of Technology, Trichy, Tamil Nadu, India- 621112

Dated this…..day of 2024

Signature………………………

Name of the signatory………………………………

a) **NAME:** Mr. V. Praveen Kumar

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Dated this…..day of 2024

Signature………………………

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PATENT DOCUMENT

Dated this.....day of 2024

Signature...........................

Name of the signatory.................................

a) **NAME:** Mr. R. Suriya Kumar

b) **NATIONALITY:** Indian

c) **ADDRESS:** UG Student, Department of Mechanical Engineering, K.Ramakrishnan College of Technology, Trichy, Tamil Nadu, India- 621112

Dated this.....day of 2024

Signature...........................

Name of the signatory.................................

a) **NAME:** Mr. R. Ramkumar

b) **NATIONALITY:** Indian

c) **ADDRESS:** Assistant Professor, Department of Mechanical Engineering, K.Ramakrishnan College of Technology, Trichy, Tamil Nadu, India- 621112

Dated this.....day of 2024

Signature...........................

Name of the signatory.................................

Dated this 26th Day of April 2024

A. Albert

Albert Francis

Registered Patent Agent

(INPA – 4655)

To
The Controller of Patents,The
Patent Office,
At Chennai