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MINI VACUUM CLEANER

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Abstract: *In our daily lives, a major portion includes healthy lifestyle, cleanliness, sanitation and dust free environment. We use a cloth, broom, sometimes even our hands to wipe out dust. Our ultimate goal is to achieve cleanliness and a sanitized surrounding. Many of us are allergic to dust and get caught by severe allergies when we come in contact with dust. Since mankind came into existence and early humans learnt the importance and procedures for cleanliness, we have been constantly evolving ourselves to that and science has also played a major role in reduction of human effort and allergies even when in contact with dust- by reducing the manual interaction by an automated procedure. Technology has developed in such a way that today, we don't need to use our hands for cleaning. Instead, we use Vacuum cleaners which was built to automate cleaning procedures. Human effort has reduced but it has affected humans in another way which is the economical sector. Vacuum cleaners are among the widely bought products that reduce human effort but are quite expensive and not all can afford.*

Here, we present a prototype of the same in a smaller version but built in such a way that would consume less electricity as well as is less costly. People from different economical background could purchase this affordable product and reduce the manual labour required for cleaning and dusting.

Keywords: *automatomatic, economical, prototype, affordable, portable.*

1. INTRODUCTION

In this project, we have tried to make an Electric Mini Vacuum Cleaner using a 12v DC Motor, 12v DC Battery (as supply) and a propeller (Fan of a CPU). Vacuum Cleaner are simply designed to clean dust particles in a effective manner. Using the suction mechanism it helps us to restore cleanliness of a certain area. By spinning a Fan using

the motor it sucks up the debris of a particular area. After experimenting we have decided that 12v Dc battery is enough and much fruitful than using battery of higher voltages. Finally, we are able to run this extremely useful electrical appliance effectively. Components we have used

- A plastic bottle
- A small plastic pipe
- 12v DC motor
- 12v DC battery
- Separator (net kind of material)
- Propellor (Fan of CPU)
- Wires

1.2 Motivation

- After brooming and normal dusting, the clustered dust elimination process is tedious and dirty. This is where the need for an automatic cleaner arises.
- Generally, a normal middle class household uses the vacuum cleaner very few times a week or even a month due to electricity and fear of early damage. This is where the thought arises for an alternative which consumes less electricity and is also much more easily portable but purpose remains the same.
- A much more affordable version of the vacuum cleaner which could be purchased by any person having any financial stability, thus the idea of mini vacuum cleaner arises.
- Application of the Engineering knowledge acquired till date to solve problem.

2. METHODOLOGY

2.1 Working Principle

The working principle of a vacuum cleaner is based on the suction mechanism. When the motor is given a power supply, it makes the fan attached to its shaft also rotate, which creates a low pressure inside the vacuum cleaner and the outside pressure is greater. As we know, air travels from a high pressure to a low pressure area hence, the high pressure outside the vacuum cleaner forces the air and dust particles to get sucked by the pipe and gets collected in a collector. The separator or the filter, filters the polluted air, collects the dust and forces out the fresh air through and outlet.

In our model, the holes made in the back of the device act as the outlet, and we have a net as the filter or the separator. The motor makes the CPU fan rotate, which creates the low pressure and hence the working starts.

2.2 Block Diagram

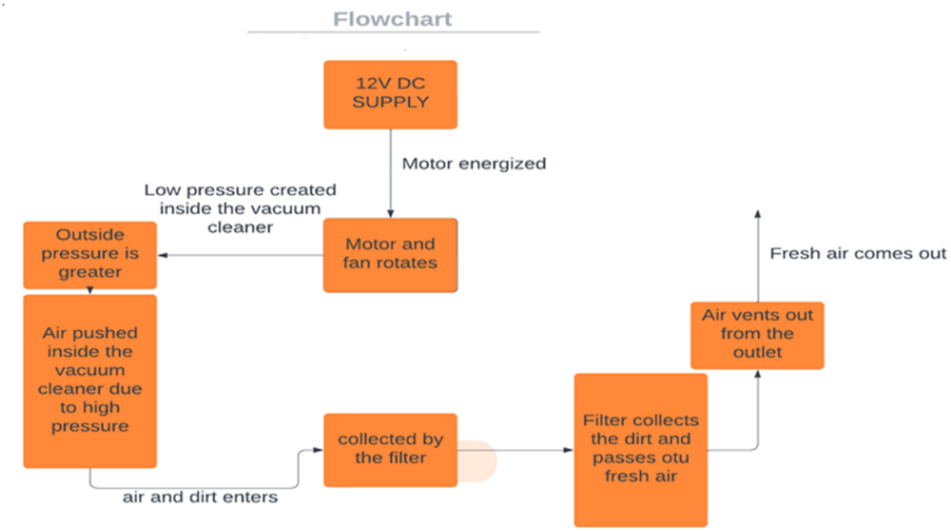


Fig.1: Block diagram of working principle

2.3 Technology

The vacuum cleaner uses the simple application of suction. It creates a negative pressure inside the device using the propeller connected to the motor as compared with the surrounding atmospheric pressure. The suction is achieved with the help of electric energy being converted to mechanical energy i.e., the motor is energized using electrical energy which drives the propeller which turns into mechanical energy.

Nowadays many emerging technologies have evolved which are applied to make a more efficient and updated smart Vacuum cleaners. The use of sensors have actually reduced the manual interaction with the device. Those are robotic vacuum cleaners. Once the device is on, they actually sense an obstacle in there and turn away and automatically sweeps the whole floor.

We have restricted ourselves to the conventional vacuum cleaner keeping in mind the economy. Also, the smart vacuum cleaners can clean only horizontal surfaces thus, carrying a drawback about cleaning the vertical surfaces, which still requires manual interaction.

With the help of a few cheap items, our vacuum cleaner is built, which is quite economical.

3. SOCIAL IMPORTANCE AND FUTURE PROSPECTS

3.1 Social Importance

The device would contribute a lot in the sanitation sector once it hits the market after being market ready. Though the device is still in the initial stage in terms of modification and certification, yet it could be put to use as and when required.

People nowadays are more keen towards technology that reduces human effort. This is a prototype of such a device in the very initial stage.

People who keep on travelling or people who are temporary to a particular place e.g hostellors, boarders in a mess, can use this product. It will help them to attain cleanliness at a very low cost, immediate cleaning, also consumes less space.

3.2 Future Scope

Once our product is market ready, there is provision for continuous up gradation of the product. We can easily extend this into an automated vacuum cleaner using ultrasonic sensors, Arduino etc keeping in mind about the economy of the product. With the progression of newest technologies, this could be even reduced in size someday so that it could be used while travelling as well.

4. RESULT ANALYSIS

4.1 Proposed Model Description

The Mini Vacuum Cleaner is made up a plastic bottle which can be replaced by any other material which is durable and long lasting. Our demo model is made up of plastic but any other materals include a hard plastic container or PVC material pipes – whose range may depend upon the materials and components used.

The motor used is a 12V DC motor which is a standard motor- easily available as well as affordable. Mainly, the power connection is planned to be battery connected with a switch that is why a DC motor is preferred. We have instead used a SMPS which was available to us instead of a DC battery and is connected to normal AC voltage plug points at homes.

The propeller used is a CPU fan which creates quite good low pressure area inside the vacuum cleaner and is also durable. Any other cheaper plastic fans would be weak and suction may not be upto the mark so a CPU fan is perfect for such a size of vacuum cleaner.

The separator or the filter can be made up of wither a nylon net, cotton or any materials with adequate pores and optimal pore size. Suction of fine particles such as sand or powder for instance crosses the nylon nets and may damage the motor. Thus keeping in mind about the different sizes of particles to be sucked, proper filter should be chosen. We have used a nylon net which was easily available to us.

4.2 Different case studies

Case study 1: We have tried to suck powder and found that our device is successful in sucking such fine particles. The only problem persisting is that our filter made up of nylon has pores way too large to filter out powder, which is crossing the separator or filter portion and is entering the motor portion.

Fig.2: Suction of powder

Case Study 2: We have sucked bigger and heavier particles like paper bits and thermocol bits which are also getting successfully sucked by our device and at this time, even getting filtered out by our nylon net.

Fig.3: Suction of thermocol bits

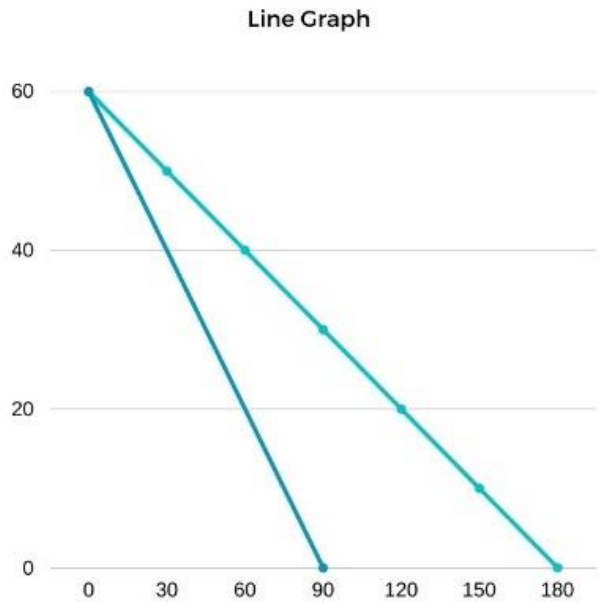
4.3 Data Chart

Material	Quantity	Time for suction
Powder	1 Table spoon	1.30 mins approx
Paper debris	1 Table spoon	1.50 mins approx

Table 1: Data Chart

4.4 Comparative study

It is seen that the suction is better in case of more fine particles like powder.



AXIS:-

Y axis: Supposed amount of dust particles
X axis: time taken to complete suction in secs

Paper

Powder

5. CONCLUSION

- We have tried to reduce manual effort for regular cleaning.
- Our mini vacuum cleaner is quite pocket friendly and serves the same purpose as a standard vacuum cleaner.
- Affordable for a large mass of people belonging to various financial stability.
- Easily portable, light weight, handy.

REFERNCES

[1] https://www.ti.com/lit/pdf/slva654#:~:text=A%20universal%20motor%20is%20typically,high%20speed%2C%20and%20are%20lightweight.

[2] http://enggyd.blogspot.com/2014/06/vacuum-cleaner-working-principle-design.html

[3] https://www.tmcnet.com/topics/articles/2020/07/02/445895-how-technology-has-changed-way-vacuum-cleaners-work.htm