
Design and Implementation of Low Cost Vacuum Cleaner

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ABSTRACT

The goal is to build an electric vacuum cleaner using a 12V battery. We concluded that 12V battery is enough to build an electric vacuum rather than using battery of higher Volts .So that 12V battery works effectively and easily. The machine functions even better by using low volts machines. Materials used to build the vacuum cleaner are:2litre plastic bottle, 12V dc motor, switch, m-seal, one water bottle cap, an empty deodorant can and an empty Otrivin plastic bottle.

KEY WORDS: Vacuum cleaner, Plastic bottles, Deodorant cans, Meshes, Flexible pipes

INTRODUCTION

A **vacuum cleaner** is a device that uses an air pump to create a partial vacuum to suck up dust and dirt, usually from floors, and from other surfaces such as upholstery and draperies. The dirt is collected by either a dust bag or a cyclone for later disposal. Vacuum cleaners, which are used in homes as well as in industry, exist in a variety of sizes and models small battery-powered hand-held devices, domestic central vacuum cleaner, huge stationary industrial appliances that can handle several hundred litres of dust before being emptied, and self-propelled vacuum trucks for recovery of large spills or removal of contaminated soil. Specialized shop vacuums can be used to suck up both dust and liquids.

The birth of the vacuum cleaner is due to a number of advancements in science and technology brought about by the Industrial Revolution. By the mid 1800s factories were producing tens of thousands of manufactured items along with tons of pollution. Dirt and soot were everywhere. About that time scientist Louis Pasteur made several significant discoveries which led him to theorize that infectious diseases were caused by microorganisms or “germs.” Thus the development of the germ theory and the reaction against industrial pollution caused people to focus for the first time on hygiene and cleanliness.

Daniel Hess appears to have been the first to patent a vacuum cleaner. Hess, a resident of West Union, Iowa, called his invention a carpet sweeper, not a vacuum. The machine did, in fact, have a rotating brush like other sweepers, however, the machine also possessed an elaborate bellows mechanism on top of the body to generate suction. The amazing thing about his machine was that it incorporated two water chambers to capture the dust and fine dirt. He states that the air is cleansed as it passes through the device. There is no record that this machine was ever produced.

In this project we have made an attempt to build a simple vacuum cleaner by organizing the simple materials that are available in our surrounding environment. The simple materials we used here are Plastic bottles, Deodorant cans, Meshes, Flexible pipes.

MATERIALS USED TO BUID A VACUUM CLEANER

Here we used two empty plastic bottles. one is a 2 litre bottle to provide mechanical support and other is a small plastic bottle (otrivin) for making the nozzle and a deodorant bottle for preparing a fan, scissor to cut the deodorant can and a 12v DC motor and a ballpoint pen for marking purpose and soldering gun for making holes on the base of the 2 litre bottle. An M-seal glue and a small bending pipe are also used for making the nozzle.



Figure 1: The basic materials needed to build a vacuum cleaner

STEPS WE FOLLOWED TO BUILD A VACUUM CLEANER

STEP1:

The 2litre plastic bottle was marked around the circumference by using a marker and made two halves with the help of a cutter and a scissor. Next, the deodorant bottle was cut off at the top and bottom to produce a nice flat sheet of metal.

STEP2:

In order to making a fan, we took the nice flat sheet that we obtained from the deodorant bottle. The open circumference of the plastic bottle was marked with a marker, fairly sketched and cut. We then cut the marked bit out of the metal sheet and made a nice round metal disc. The obtained metal ruler was drawn with two sets of perpendicular lines and divided the disk into eight equal segments meeting at the center. We cut along, not all the way to the center, Left a little room away from the hole. That produced eight wings connected by a small segment of the disk. The wings are twisted in the same direction to produce our own fan blades.

STEP3:

Now the fan and motor are assembled. The either side of the crafted fan's center is glued with m-seal attached to the rotating rod on the 12v dc motor and pressed hard to tighten it. Here we used m-seal because it provides an extra strength around the joints. Then a circle is marked out around the base of the plastic bottle to fit the DC motor. With the help of a soldering rod, we drilled around the bottle's base and made a series of small holes to allow the exhaust air to escape. The motor is wired and then added a cap to cover the wiring which we glued inside the base of the bottle and cut out the central circle made the DC motor to fit into the bottle. Once completion, the motor is placed inside the bottle, After making sure that the fan blades are inside the bottle. Then the vacuum is started to take a shape. Now an open part of the top section of the other half plastic bottle is trimmed around the edge of the bottle leaving about 10mm excess. This formed a basic filter for the cleaner. We mounted this on a handmade ring of wire that will be removable and taped outside of the bottle using double sided sticky plastic tape and placed a mesh towards it. Then we connected the front assembly into the open section of the base with motor and fan .Secured the seal with sticky plastic tape to form a nice airtight seal that completed the main assembly.

STEP 4:

The bottle cap from the previous bottle is taken and made a large hole in the center big enough to accommodate the bendy plastic tube we made sure we acquired before beginning this build and then Glued in that place. The small Otrivin plastic bottle is taken to make a similar hole in the base and glued it to the other end of the pipe and made the nozzle.

Step 5:

We screwed the bottle cap end onto the top of the main body. Finally, we wired up the motor and attached to a plug assembly to connect it to the mains. Plug that in, Depending on which options we went for to empty either take the top off or simply take off the nozzle and tube.

II. COMPONENTS

Materials used to build a vacuum cleaner are as follows:

- 2 litre plastic bottle
- Small otrivin plastic bottle
- 12v DC motor
- M-seal glue
- Exhaust fan
- A suction pipe
- Mesh

1. PLASTIC BOTTLE:

A plastic bottle is a bottle constructed from plastic. Plastic bottles are typically used to store liquids. Here in building a vacuum cleaner, it is the basic material which acts as **mechanical support**.



Figure 2: A plastic bottle

2. SMALL (OTRIVIN) PLASTIC BOTTLE:

It is used to make a **nozzle**. The base of bottle is made hole and it is glued to the pipe to make a nozzle so that it helps in sucking the dust by its opening.



Figure 2 : Otrivin bottle

3.12V DC MOTOR: It helps to run the **exhaust fan**.



Figure 3: 12V dc motor

3. EXHAUST FAN:

An empty deodorant is helpful in making a nice flat sheet of metal through which an **exhaust fan** is made. As the fan blades turn, they force air forward, toward the exhaust fan. The density of particles increases in front of the fan and decreases behind the fan when air particles are driven forward.

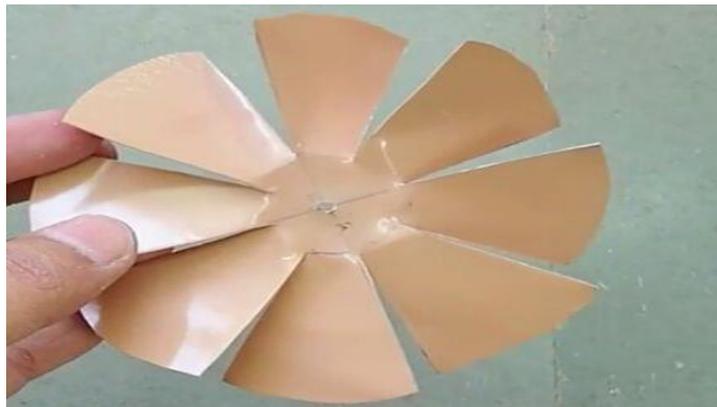


Figure 4: Exhaust fan

4. M-SEAL GLUE:

It is used to place and fix the motor inside the bottle and also it acts as glue material in which the exhaust fan is glued to the motor rod.

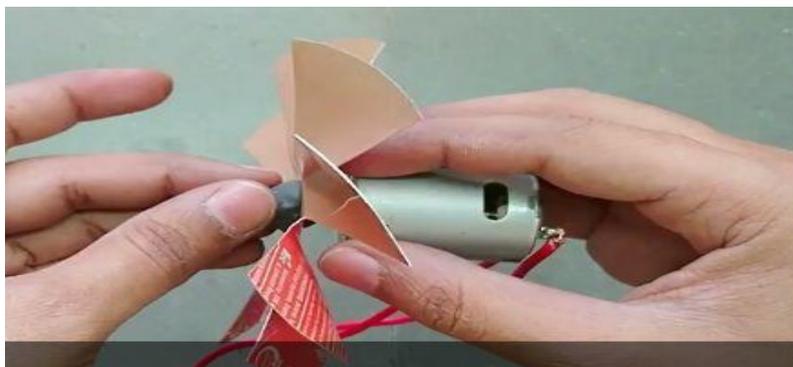


Figure 6: Fixing the motor using m-seal glue

5. SUCTION PIPE:

Suction pipe along with a small plastic bottle(otrivin) helps in making a nozzle through which dust is sucked.



Figure7: suction pipe

6. MESH:

It helps in preventing the dust that enters into the exhaust fan chamber. It is optional to use but it is recommended.



Figure 8: Mesh

III. BLOCK DIAGRAM

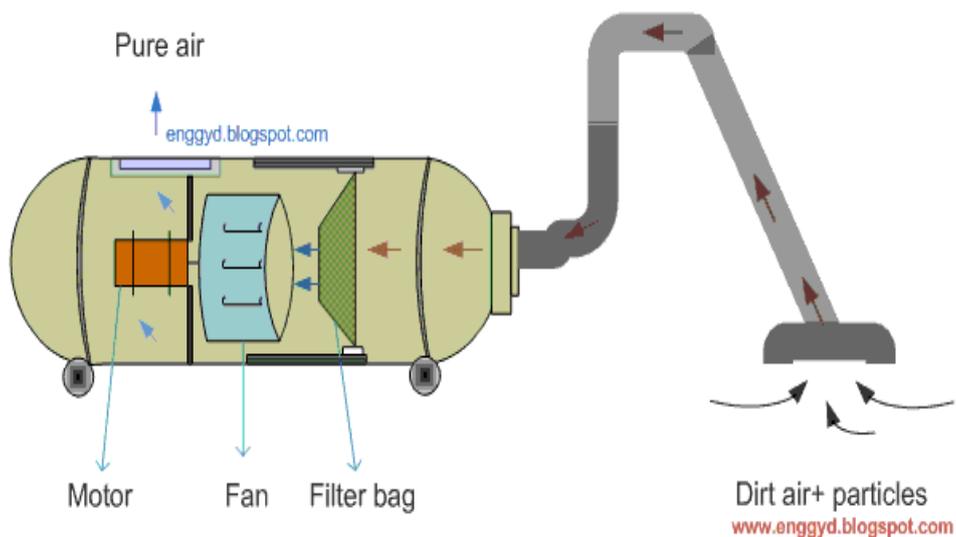


Figure 9: Block diagram of a sample vacuum cleaner

IV. FINAL MODEL OF VACUUM CLEANER



Figure 10: Final model of the vacuum cleaner (side view)



Figure 11: Final model of the vacuum cleaner (front view)

V. CONCLUSION

Usage of lesser volts in the system increases the efficiency and performance of the Vacuum cleaner technology.

VI. FUTURE REFERENCE

- Instead of using water bottles we can also use of PVC pipes to increase its durability.
- It is even better to use motor with lesser volts as it increases the efficiency of the machine. As the efficiency increases performance also increases.

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