Prototype Design of a Mini Car Vacuum Cleaner

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Abstract
A vacuum car cleaner, is identical to many other vacuum cleaner products, is made to use it stress-free and more efficient for customer to complete precise task. This paper introduces the purpose and important of a mini car vacuum cleaner design and exhibits the need of examining on the car vacuum cleaner. The vacuum innovations technologies are mainly focused in the reform of cars cleaning and applications to improve the way of collecting dust. The significance is designing a beautiful mini car vacuum cleaner is a useful item that can pick up a variety of average particles size such as dust and small object that is non-metallic. The project is produced from a simple, recycled material that is available, and environmental friendly. The amazing thing about the product is the pipe that was incorporated with magnetize nozzle that does not allow metal chips to pass through the rubber pipe to avoid damage. The vacuum cleaner has an enclosed axial fan that rotates to particularly produce vacuum and suck outside air into the suction chamber so that the dust, dirt and debris will be drawn within the cleaner.

Keywords: Prototype vacuum cleaner, enclose axial fan, suction box

I. Introduction

The axial enclose fan with electric motor rotates to produce a vacuum and such air from outside into suction chamber where dust, debris and dirt's will be drawn within the chamber through nozzle, the attached filter is used to remove the dust and the debris which will be reserved in the section B as a storage unit.

Designs define the terms strategy of a plan, cost, activities, and parameter on how and what to do within the legal policy which is social, political, economic control, safety and environment for desire goal Don 2011. Design is a creative plan formation for the product of an object by human numerical thinking and interaction through an engineering drawing, blueprints, circuit and many more. Also, Design is the main element positioning an innovative marketing basis by adding value to a product and its effectiveness by the response of an operational human brain in thinking practice Hong et al., 2007. The design is a thinking act of creativity to improve the image and the effect of ideas expressed in many ways. Therefore to achieve this kind of goal, creativity is absolutely an essential ability which designer must reach and without a doubt, should be an area that requires development pdts.semanticsschoolar.org.2019.

Fitting car vacuum cleaner is a device that uses air fan to create a partial vacuum to suck up dirt and dust usually from the surface of the floor such as draperies and upholstery. These dust and dirt are collected by small quantity or so, later to dispose of and is used for a car. The amazing thing about this product, the pipe was incorporated with a fitting magnetic nozzle not to allow any metallic particle to pass through the rubber pipe to avoid damage this product it was an attempt to build a merely wee cleaner by organizing simple material that is available, recycle, and environmental policy consideration. There are several categories of vacuum cleaner, vertical, straight, cane and many more, which virtually almost all are using electrical energy as a source of power.

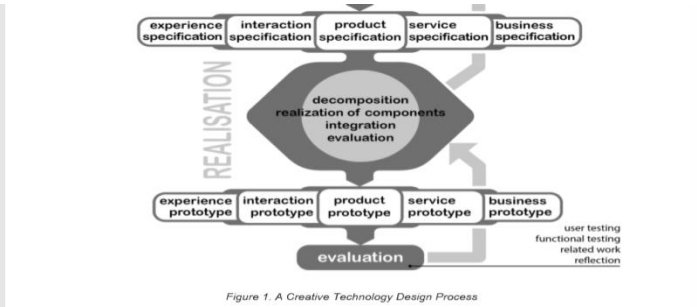
II. Methods of the Design Product

The desire of any social being in the product can be brief and classify into parts, this desire of having a potential of existence quickly expert, as well as being other economic and practical and some degree of relationship between the product and man. Therefore, the design has unique features such as symbols, potentials, aestheticism as design activities which aim to satisfy the desire of each regarding product modeling as so won 2001. The birth of the vacuum cleaner is in line to several advance innovations in technology and science which was brought by the industrial revolution. By the mid-1800, manufacturing was producing thousands of manufacturing then along with much pollution. Denial Hess seems to have been the first to patent a vacuum cleaner. Hess named his invention as a carpet sweeper as of them patent. Google .com 2019.

III. **Approach Products Design Technique**:

Why, Where, when, and how?

The design for roles is of concern not only to product designers but also to people involved in several professional aspects, including quality improvement and process. So, the designer should understand each product's function (valueanalysis.co 2019). The design technique classifies the functional relationship between parts at the individual level. The designer specifies the products function after studying, that will give a designer idea to create several different concepts on how to design, why designing, where to design and when to design mader and Eggink 2014.

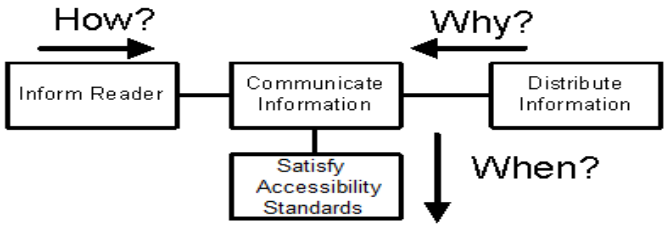


Source: Fig 1.mader and Eggink 2014.

Why, is to give dynamic and straightforward identification in the form of beautiful and why is it essential, the purpose of serving. The reason why designing is to create marketable product innovation. Where to design, whether you are an ambitious graphic designer, illustrator, hypsography, innovative professional and many more, you are always rapid search away from a never-ending and where do you find desire inspiration and how do you design, by developing a product idea step in creating something or test by having prototype chose plan method on how to create.

Functional Analysis System Technique (FAST)

Is a development of a value analysis process which creates a stimulus to discover innovative ways for performing, the figure shows the FAST development technique graphical representation which presents the rational relationship between the functions of product and process that built on the question inquire, why, where, who, when.



Source: Figure 2 Value analysis Ca, 2019.

The FAST help in thinking about the problem to resolve objectively, and in identify the scope of the product by presenting the logical relationship between function. The FAST diagram can be used to show and illustrate how a proposed solution attains the needs of the product, and to identify duplicate functions *value analysi. Ca, 2019.*

IV. Design CAD Modeling and Sketching Design Process

The situation is challenging to succeed in design aim without sketch drawing. Sketching does more than communicate ideas; it assists in visualizing, conceptualizing and understanding the methods and structures designers are working on Kumaragamage 2011. Hand Sketching on paper is criteria of procedure between designers during the initial design stage Aliakseyeu, 2003; Gross & Do, 1996 This stands because sketching records come from conceptual ideas so that they can be revisited (Ullman et al., 1990). The aids such as computer-aided design (CAD) models and sketches are essential rational activities during the initial stage of conceptual design. They are used to build environments design that supports the investigation of ideas and visual illustrations oxman, 2006. They also encourage the identification of specific problems while at the same time enhancing designers' intellectual activities Goldschmidt & Smolkov, 2006. The geometric power of CAD modelling has improve greater than before to such an extent that it can be merely used from start to end to achieve design aims and objective. These method substitutes' traditional methods like sketching and this labelled as digital design process. Even though traditional sketching methods are low-cost, 2D sketches but may not convey ideas about complicated 3D objects. IN a CAD modelling design environment, 3D graphics (e.g. different angles of viewpoint views) is employed in generating and manipulating 3D geometry oxman, 2006. Similarly, engineers use CAD models to estimate structural alternatives, and industry professionals use them to estimate costs and to plan cost-effective construction orders. These processes often extract design conflicts that can then result in costly construction defects.Moreover, the accurate visualizations made possible with CAD modeling may help designers alter and refine their design thinking *Salman et al., 2014*.

V. Discussion

These design components of vacuum cleaner focus on the development of fitting vacuum cleaner for a car. The vacuum cleaner is a device that uses a fan to create a partial vacuum to suck in dust and dirt, even though you almost certainly know vacuuming inside the car is not an easy job. These provide or able to clean in every crack and crevice in the car due to the facility of enough transferable suction rubber pipe for easy maneuvering by getting free of dirty. The most important factors when choosing a vacuum cleaner for your car these including maneuverability, size, and ease use, suction power cost which is value for money. Therefore, these reviewed or remodeling mini fitting car vacuum cleaners assist in choosing the right model with 90% recycling material. The problem is that with several quite a lot of vacuum in market option, it will be challenging to be picking the best among the model. Otherwise, you choose by guide to help you

pick the right choice. The design portable and lightweight was divided into the following step, according to morphological analysis; arrange the positions of a major component of the product.

Step1. Suction box: this section is separate into two parts with filter in-between, the half of the suction box (A) act as dirt, dust storage chamber, and another side of the suction box (B) consists of axial flow fan extruded from inside to outside the box and also the section B serve as dust storage.

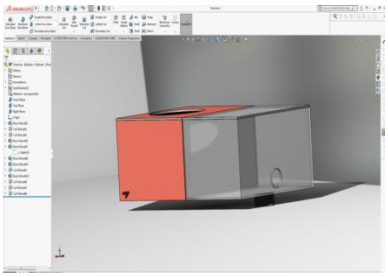


Figure3. Suction box section A&B

Step2. Axial Fan: the axial fan is enclose the main motor which creates lower pressure inside the square box; this fan is fitted into the extended square box as the fan rotate it produces suction pressure in the suction box. The process was by extruding two sets of perpendicular lines divided disk into six equal segments of wind at the center; the wing is twisted the same direction to produce baled while this casing was extruded.

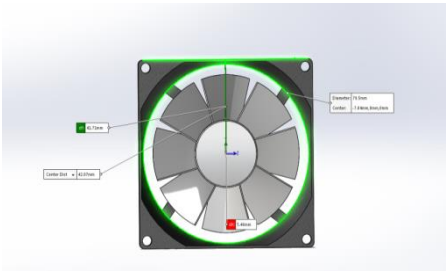


Figure 4 Axial Fan

Step3. Collecting dirt: this suction hose is a part which makes available suction surface area to create the desired suction pressure. The suction pipe has a magnetic cone attached connect to it to avoid passage of metallic dirt through which the suction dust is set to the suction box.

Step4. Switch: when the vacuum cleaner is switched ON, the fan blade turned, and the air forced forward towards the dissipate port as the air moves forward, the density of air increases and the pressure drop behind the fan.

Material uses

1	Material	Thermoplastic elastomer
2	Typical application - Thermoplastic	
		Polyurethane (TPV / TPE)
		Coplyestes TPC(TPE-E)
		Polyamides TPA (TPE-A)
3	Properties	Solid rubber, slip resistance, weather resistance, flexibility, soft texture.

Table 1

A thermoplastic elastomer is a solid material that can be molded and extrude onto hard thermoplastic material by making it great for a soft touch on products (Rubber, 2019).

1	Material uses	Polycarbonate sheet (translucent)
2	Typical application	-Heat deflection temperature 0.45Mpa -Izod impact strength
3	Key features	-high strength, weather resistance-recyclable-lightweight
4	specification	From 1mm thickness→

Table 2

Polycarbonate sheet is a clear plastic sheet which extreme versatile and robust material with high resistance to impact, because of its strength (Accessed 2.May, 2019).

1	Material	Nylon
2	Typical application	Insulator, switch house, external structures
3	Key features	Elasticity, high strength, good heat stability, abrasion resistance
4	specification	-Extruded nylon grades- type 6 nylon -Heat stabilized – type 6/6.

Table 3

Nylon is one of the durable strongest and most elastic substances, which uses between the wheels that are the tire of the vacuum to reduce wear due to its abrasion resistance (Fluorocarbon .co.uk 2019).

1	Material	Vacuum filter
2	Typical application	Cartridge filter – foam filter – washable filter- filter bag
3	Key features	-high strength, weather resistance-recyclable-lightweight
4	specification	From 1mm thickness

Vacuum filter is a paper bag filter made up of two physical materials. The outer on retain air through cellulose layer while the inner linings capture particles.

Components Part

ITEM NO.	PART	QUANTITY
1	Suction Box section A&B	2
2	Fan	1
3	Rubber Hose	1
4	Magnetic Cone	1
5	Guard	1
6	Screw	4
7	cable	1
8	USB Charger	1
9	wheel	2
10		

Table 5

VI. Design Methodology

The cross-section of the products is directly transferred from solid works design method. There are different ways to create ideas ranging from problem solving and initiation, therefore whatever method or idea apply, the objective is to discover and look for alternative to solve the problem. Related to this design it start with class work, prototype and sketch. The idea is to carry on with development of design CAD and prototype.

CAD output result is every so often in the form of electronic files for machining ,print, or other manufacturing procedures Duggal 2000. CAD is the procedure of using the computer systems (or workstations) to support in creating, analysing ,modifying, or optimising of any design Narayan2008. The

attached appendices show the complete CAD model of all the parts of the vacuum cleaner using Solid works.

VII. CONCLUSION

Design is a response of effective idea of human thinking that realizes success with ideological thinking and support. The development of fitting car vacuum cleaner has wheel which can be moved from one place to another, the suction box side A is the removable and can contain different box of its size and another side of the suction box (B) consists of axial flow fan extruded from inside to outside the box and also the section B serve as dust storage.

The fitting vacuum cleaner is a simple device and each component in the vacuum is a simple one and recyclable. The components are design in prototype model using solidworks CAD model technique.

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