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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
OPTION OF ELECTRICAL TECHNOLOGY

FINAL YEAR PROJECT:

DESIGN AND IMPLEMENTATION OF AUTOMATIC DUSTBIN, VACUUM CLEANER

Submitted in Partial Fulfillment of the Academic Requirements for the Award of an Advanced Diploma (A1) in Electrical Technology

Presented By:

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Kigali,September 2024

Declaration A

This research study is my original work and has not been presented for a Degree or any other academic award in any University or Institution of Learning". No part of this research should be reproduced without the authors' consent or that of Ulk Polytechnic Institute.

Student name: NGABO Janvier

Sign: _____ Date: _____

Declaration B

I/we confirm that the work reported in this research project was carried out by the candidate under my supervision and it has been submitted with my approval as the UPI supervisor.

Name: Eng. Birali Steven

Sign: _____ Date: _____

Dedication

I dedicate this final year project(FYP) to my mothers, Mukandoli Beatrice, Amanda Good Tailor and Mutesi Chantal, for their unwavering support, prayers and encouragement throughout my academic journey. Their believe in me has been a constant source of inspiration.

Acknowledgement

I am passionate to express my sincere gratitude to my Head of department(HOD), Karikurubu Emmanuel, for his practical knowledge, real life engineering advice, and his incomparable service with active listening to student problems and prompt solutions. This helped me to study well and enhanced my reading habit.

I would also intensively like to express my thanks to my supervisor, Birari Steven, for his unwavering support on my final year project and his wisdom, skills and humbleness in his work of teaching us. This remarkable milestone, I am stepping ahead of, he provided me with effective knowledge, skills and an exemplary way of teaching what you have in mind without humming the learners.

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Abstract

The World living situation and condition is getting critical especially in Africa as is with all developing countries due to: time shortage, Cleanness, size and accuracy. It is our task as engineers to make machines that will help people to adapt in current time with minimum negative effects. For the sake of people's time management and human power saving in cleaning, We thought about an automatic dustbin vacuum cleaner (ADVC). The machine(ADVC) is a combination of two general systems which are Automatic dustbin system and vacuum cleaner system. Automatic dustbin is an improved normal dustbin to automate the lid with the help of : servo motor, which drive the lit at 90 degree and release it after; Arduino uno R3, to receive signal and command servo as it have been programmed by arduino IDE; ultrasonic sensor, is there to detect signal the hand approach to calculated and programmed limit and directly send signal to arduino uno R3 . Vacuum cleaner system is mainly made up of: Carbon brush DC-motor,RS445PA14233R, to rotate fan when supplied by 230v ac/dc; fan will play role of rotating to create vacuum region in the system; filter will prevent effective waste to reach the fan. The machine will open automatically if a hand is approached to cast the wastes and the cleaner will be able to remove waste particles by pointing the nozzle and press switch. This project is practical based on different theories and I recommend the lecture to teach with case studies such as the system of this machine(ADVC) and these important machines should be helped to be made on our land so as to limit decay of our economy in importation.

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List of acronyms and abbreviations

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FVP: Final year project

ADVC: Automatic dustbin, vacuum cleaner

IDE: Integrated development environment

Fig:figure

Tab:table

DC: Direct current

AC: Alternating current

PWM: Pulse wave modulation

CFP: Cubic feet per minute

kpa:Kilo-pascal

VIN MAX. VIN: Maximum input voltage
SRAM: Static random access memory
EEPROM: Electrically Erasable programmable read only memory
VUSB MAX: USB Connector maximum input voltage
USB: Universal serial bus
AVR CPU: Automatic voltage regulator central processing unit
MHz: Mega hertz
KB:Kilobyte
EPR: Extended producer responsibility
Q1:First Quarter
Covid-19:Corona virus disease of 2019

Definition of key terms

ALDA: a Polish company known for manufacturing waste management products, among which are dustbins and recycling containers. Just feel free to ask me any question you might have connected with their products or services.

Dustbin
A dustbin may be defined as a container to hold onto wastes or garbage prior to disposal or collection through services concerned with the disposing of waste. General locations where dustbins may be placed include but are not limited to the home, offices, the area surrounding public spots, and outdoors. They come in different shapes and sizes and of various makeups for use in different locations and situations.
Automatic dustbin

It is The waste cane, designed to ease the process of disposing of waste with minimum human effort; it typically includes a sensor or touchless mechanism that opens its lid automatically, either through the detection of motion or the approach of an operator. This further enhances hygiene in operation, as nobody has to physically touch the bin-something that can be of specific importance in places where hygiene is of utmost essence.

Vacuum cleaner

A vacuum cleaner is an electric appliance whose function is picking up dirt, dust, and debris from floors, carpets, upholsteries, and other surfaces. It provides a vacuum-a partial vacuum or low-pressure area-inside the machine to suck air and the particles in the air in through a nozzle or brush attachment. The dust and dirt it picked up would fall into an internal dust bag or collection canister for proper disposal. They come in a number of varieties that can fit into any cleaning need and environment: upright, canister, handheld, and robotic models.

Automation

Automation refers to the use of technological know-how in doing tasks with minimal involvement of the human factor. Employment of a control system, such as computers or robots, is the general application of automation in operating pieces of equipment in diverse industries and settings. It mainly works toward the objectives of increasing efficiency, consistency, and accuracy while minimizing involvement to so much manual labor and possibilities of human error. Automation can be realized in many ways, which include the following:

Manufacturing: The manufacturing of products using automated machinery and robots, material handling/repetitive tasks are also tractable. Office Tasks: Most office tasks have been automated through applications that perform such tasks as data entry, scheduling, and communications. Home: At home, smart home thermostats may automatically control various devices according to user preferences or schedules, lighting systems, and appliances. Transportation: It runs traffic light controls, car drives, including driverless cars, and controls logistic and supply chains. Generally speaking, automation tends to smoothen processes and enhance productivity while releasing human resources for more complex and creative work.

Suction power

The suction power is the power of every vacuum cleaner or suction-based device that possesses the force and efficiency in pulling air and debris into it. It is one of those essential factors that decides how well the cleaning of several surfaces will go on. Suction power is normally measured with:

1. Air Watts: The measure of a combination of airflow and suction pressure, hence giving the actual indication of cleaning power. The more air watts a vacuum has, the stronger the suction.

2. Cubic Feet per Minute (CFM): The amount of air that can be moved by a vacuum cleaner in one minute; higher CFM moves more air, potentially doing a better job in suction.

3. Suction Pressure (in inches of water lift or pascals)**: The amount of power your vacuum possesses in sucking in dirt and other material against gravity. Generally speaking, the higher the suction pressure, the more dirt it's able to pick up from deep within carpets or other surfaces.

Suction power, therefore, enables this cleaner to clean dust, dirt, and debris with efficiency from different kinds of surfaces, like carpets, hard floors, and upholstery.

3. Vacuum

space in which there is no matter or in which the pressure is so low that any particles in the space do not affect any processes being carried on there. A condition well below normal atmospheric pressure, measured in units of pressure *, the pascal.

CHAPTER 1: GENERAL INTRODUCTION

1.0 Introduction

In the modern household, efficiency and convenience are paramount. The integration of smart technologies has revolutionized various aspects of home management. One such area with immense potential for improvement is waste management and cleaning. This proposal aims to explore the concept of integrating smart dustbin technology with vacuum cleaner functionality to enhance household efficiency.

1.1 Background of study

Vacuum cleaners are crucial household tools that are used to clean floors, upholstery,carpets, and other surfaces. These machines use suction to remove dirt, dust, and other debris from surfaces and automatic dustbin(waste bin) is a robotic dustbin which opens and closes lid when human hand approaches in front of the dustbin.

It is observed that everybody feels highly comfortable in his room if everything is clean and arranged(alda, Mon, 03-01-2022) so everybody should have a waste bin in his room. In daily cores, cleaning is still time and energy consuming to the extent where It can a bit hinder people from accomplishing their job assignment and some places especially need vacuum cleaners because of components inside like in cars and buses which are not friend of being wet. It means that we need a machine that will help us to clean and keep useless particles from our rooms quickly and easily.

It has been our focus as engineers to design and implement a mechatronic device of automatic dustbin, vacuum cleaner (my-muelltonne .Why bin design matters. May 3, 2023). This machine is going to help at the offices, sleeping rooms, cars, and sitting rooms. It will allow people to not open and close the lid of the bin frequently so as to dump in it, because it will happen automatically as the hand approaches in front of the dust or waste bin. It will also help to automatically clean the small particles or debris with the help of vacuum cleaning systems of suction power. As this work succeeds, it will be the foundation of our future research.

1.2 Problem statement

In the residence rooms , offices, cars, and accommodations proper waste management in short period of time with rarely energy consumption is still a big problem because there are manually fixed dustbins which require energy, time and strong focus of human intervention to Manage wastage in their rooms which frequently change the mood of work. Previous set of actions are: to pick the wastes, To open a dustbin, to put the wastes into the dustbin, and then to close the dustbin which is a complex and difficult sequence of actions.

As an electrical engineer, I am going to make a robotic machine that will open and close automatically once a person's hand is approaching to cast the wastes in it, in the case of big and heavy particles. It will clean small particles by pointing the nasal to them with the help of its vacuum cleaning system. Current set of actions are: To pick the wastes, To put the wastes into the machine; In the case of big and heavy particles: Pick the nasal and point it to the small particles, and Release the nasal. In the case of small particles.

This will happen by integrating the vacuum cleaner into an automatic dustbin. Vacuum cleaner system is composed of a motor, fan, filter, vacuum region and nasal. Motor will receive electrical power and provide mechanical, circular motion power to the fan. Fan will rotate and provide a vacuum region in the system. Filter will accumulate particles from the nasal at certain limits. Suction nasal will allow the particles to pass through it to the vacuum region.

1.3 Purpose of the study

Project is about designing and implementing an automatic dustbin(wastebin), vacuum cleaner. It will happen by combining three main systems which are physical waste bin, vacuum cleaner, and microcontroller system. This machine will help people to save energy and time during waste management at particular places such as offices, cars, bed rooms, and sitting rooms.

1.4 Research objectives

Specific objectives

Here are some specific objectives for an automatic dustbin vacuum cleaner:

I. Autonomous Operation: Develop a system that can autonomously navigate and clean designated areas without user intervention.
II. Efficient Waste Collection: Design a mechanism that effectively identifies, collects, and compacts various types of waste, including small debris and larger items.

III. Obstacle Detection and Avoidance: Implement sensors to detect and navigate around obstacles to ensure thorough cleaning without damage to furniture or the device itself.
IV. Smart Waste Sorting: Integrate technology that allows the vacuum cleaner to sort waste into recyclables, compostables, and non-recyclables.
V. User-Friendly Interface: Create an intuitive app or control panel for users to set schedules, monitor cleaning progress, and receive notifications.

Main objectives

The main objective of an automatic dustbin vacuum cleaner is to autonomously collect and dispose of waste, enhancing cleanliness and hygiene in indoor environments. Key goals include:

I. Efficiency: Reduce manual cleaning efforts and time spent on waste collection.
II. Automation: Operate with minimal human intervention, using sensors and AI for navigation and obstacle avoidance.
III. Versatility: Adapt to various surfaces and types of waste, including solid debris and smaller particles.
IV. User Convenience: Simplify waste management by integrating features like scheduled cleaning and easy emptying.
V. Sustainability: Promote eco-friendly practices by efficiently managing waste and potentially integrating recycling features.

1.5 Research questions

Here are some potential research questions for an automatic dustbin vacuum cleaner:

I. Design and Efficiency: What design features enhance the efficiency of automatic dustbin vacuum cleaners in various environments (e.g., homes, offices, outdoor spaces)?

II. Sensor Technology: How do different sensor technologies (e.g., infrared, ultrasonic) affect the navigation and obstacle avoidance capabilities of automatic dustbin vacuum cleaners?

III. Suction Mechanisms: What are the comparative efficiencies of various suction mechanisms in capturing different types of debris (e.g., fine dust, larger particles)?

IV. Energy Consumption: How can energy consumption be minimized in automatic dustbin vacuum cleaners without sacrificing performance?

V. User Interaction: What are user preferences regarding the interface and control systems of automatic dustbin vacuum cleaners, and how can these be optimized for better usability?

VI. Maintenance and Longevity: What design considerations can enhance the maintenance and longevity of automatic dustbin vacuum cleaners?

VII. Integration with Smart Home Systems: How can automatic dustbin vacuum cleaners be effectively integrated with existing smart home ecosystems for improved functionality?

IIX. Environmental Impact: What is the environmental impact of automatic dustbin vacuum cleaners in terms of material usage, energy consumption, and waste generation?

These questions can guide research towards improving the design, functionality, and sustainability of automatic dustbin vacuum cleaners.

1.6 Scope statement

Traditional methods of removing and daily store of dirt particles are tiresome, match attention required, and they cannot be held in cars and buses to support, but the research about the design and

implementation of automatic dustbin, vacuum cleaner will change this. It will be done in accordance with this deliverables:

Design mechanical and internal electrical or electronic integral parts of the project. Buying appropriate materials required to make a project. Combine all materials so as to make a whole automatic dustbin, vacuum cleaner. Programming of a microcontroller (Arduino) to open and cross automatically the lid of the dustbin. The project will be tested, measured to know if, it fits with pre-designed criteria

To conduct this research key people are: Researcher, Ngabo Janvier; Supervisor,Eng. Birali Steven.

1.7 Significance of the study

The proposed integration of smart dustbin technology with vacuum cleaner functionality has the potential to revolutionize household cleaning and waste management. By automating these processes, users can enjoy a cleaner and healthier living environment with minimal effort. Furthermore, the efficiency gains can contribute to resource conservation and environmental sustainability.

1.8 Organization of the study (Process chart)

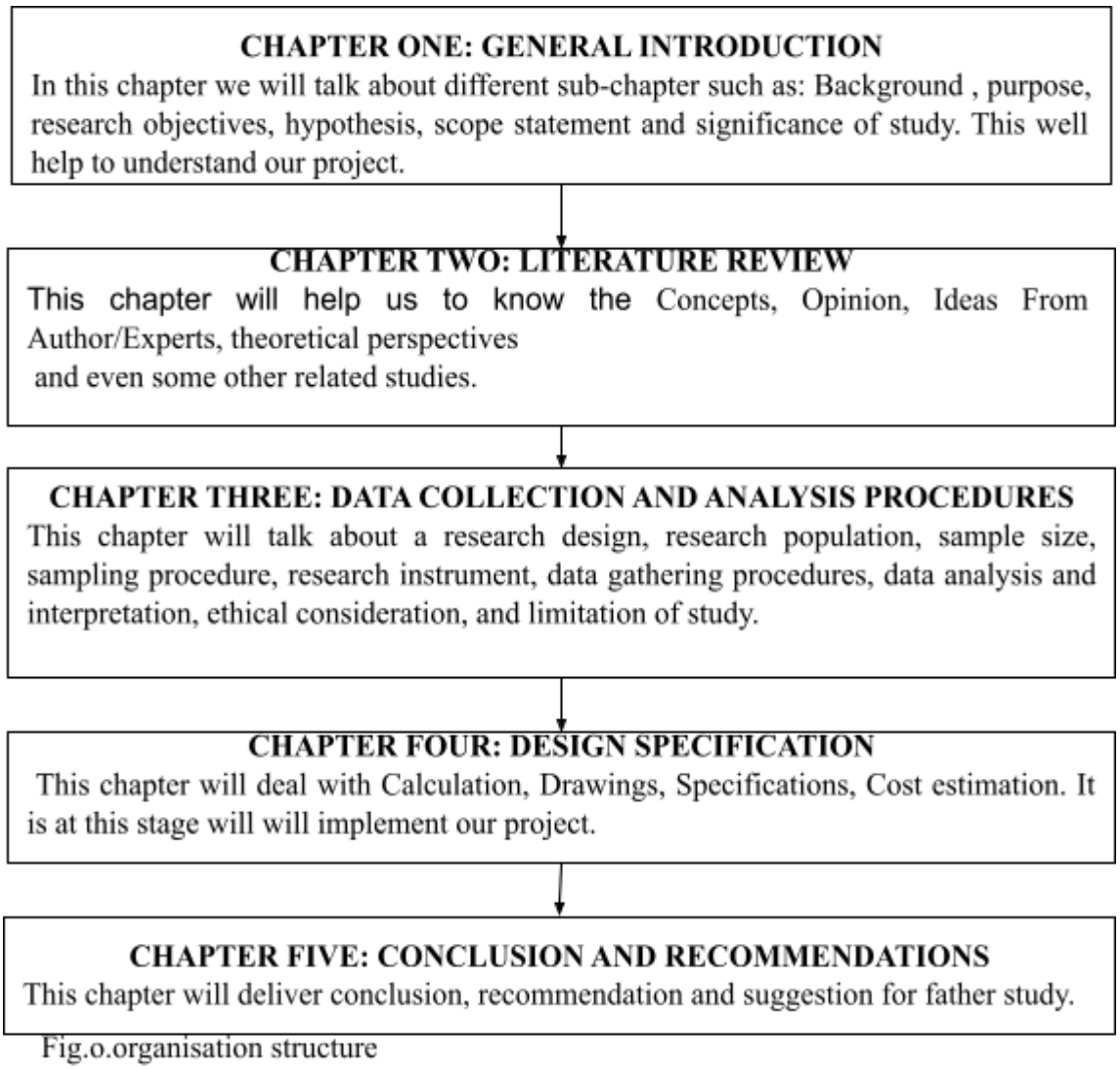


Fig.o.organisation structure

Figure 1**. I Organization structure**

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

Many people have written about vacuum cleaners and automatic dustbins. Vacuum clean is becoming the best future cleaning system and it is spreading at the rate of development in the region. I have used internet websites such as wikipedia and other writers that have written about it so as to improve my understanding and make a vacuum cleaner. Automatic dustbin is a very good system of automation and it is going to be a problem solver system in a different field. My purpose is to build a good machine that will combine both automatic dustbin and vacuum cleaner. This project is going to solve many problems in greening, ecosystem and climate change areas. I have read to know and develop my idea into reality. Many different materials have been used to make it. The materials used are:

Carbon brash DC-motor,RS445PA14233R; This motor is supplied with alternating voltage or Direct voltage to provide rotational mechanical energy to the fan; Servo motor: This kind of motor is supplied by Direct voltage and rotates at 90 degree to pull the lid of the dustbin; Fan: This material called fan is the one to make vacuum region is the machine and due to this region the suction power is developed in the nasal; Filter: this is a flat piece which is composed by the smallest air holes, it is placed in the vacuum region and will limit the collected wastes to the fan; Flexible pipe: this pipe is narrow volume which is going to make suction; Plastic housing: This is cylindrical vacuum system cover that will limit it to the external environment from a both sides and provide mechanical strength of it; Arduino uno R3: This is microcontroller to be programed to automate the lid of dustbin once the hand approached the front side of the dustbin; Connecting wires: The wires are the one to connect the the arduino, sensor and servo motor, so as to transfer signals; Adapter: this is the device to reduce and convert and convert AC to DC voltage where 230 V AC is converted to 7 -12 DC which is appropriate to arduino supply voltage; Switch: the the most of electrical and electronic systems require switching on and off as regulation, protection, start and stop; Supply cable: The supply cable is crucial to provide electrical power to the machine from the main and supply cable should be protected from any short circuit and electrocution; Dustbin: This is the wast contain with lid to open and handle to pick it and is with inner volume to keep wastes; Rope; this is the material to transfer mechanical energy from server motor to the lid of dustbin.**2.0.1 materials used**

A carbon brush-DC motor,RS445PA14233R

This motor is used to create pressure differences in vacuum cleaner systems. The system needs air at a certain velocity. This velocity will be provided by the source of mechanical energy which is the speed rotating motor.

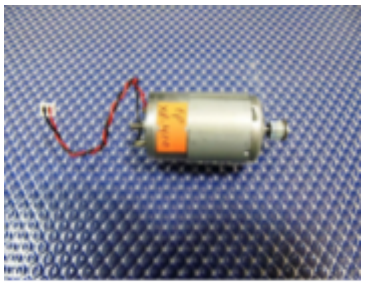


Image.1.Carbon brushes-DC motor

Figure 2. 2.1.Carbon brushes-DC motor

Servo motor

Servo motor (or servomotor) is the general term applied to a class of motor that is used as an actuator. Highly precise control application requires the use of servo motors, either in rotational or linear motion. Normally, this is equipped with a sensing device for accurate positioning using a control signal, which usually indicates the desired move of the motor to a particular position. It controls the lid on the dustbin.

Image.2.servo motor.MG 996R

Figure 3. Servo 996R

Fan

Fan-An apparatus with rotating blades to provide an air current in a system. It creates the pressure difference in the system vacuum cleaner. It is fixed to the motor.

Figure 4**. Fan**

Filter

Filter is a sheet of small holes to limit the bigger particles to pass through. It will stop waste to the fan. It will limit the waste to the fan and motor.

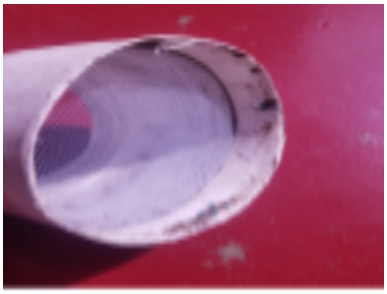


Figure 5**. Filter**

Plastic housing

Plastic housing is cylindrical shape material to cover internal parts of the system, vacuum cleaner.will be used to create system limits in order to avoid collision.

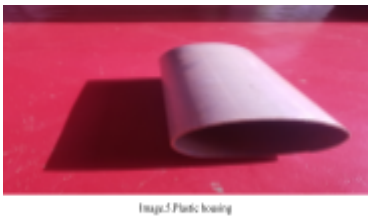


Image.5.Plastic housing

Figure 6**. Plastic housing**

Flexible pipe

The pipe is a small existence that will allow any minimum size particle compared to the size of it to pass through. It will be a high pressure region.

Image.6.Flexible pipe

Figure 7**. Flexible pipe**

Arduino board

Arduino is microcontroller hardware with accessories, to receive signals from the sensors or any input to manipulate the output signals with the help of programs loaded from arduino ide software. It will receive a signal from an ultrasonic sensor so as to control servo with Pulse wave modulation(PWM) signal.

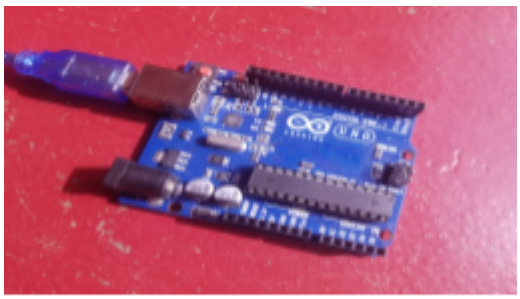


Image:7.Arduino uno R3

Figure 8**. Arduino uno board**

Ultrasonic sensor

Ultrasonic sensor is an instrument used to measure the distance of the object in front of it, by using sound waves transmitted to it and measuring the feedback detected by the receiver.This sensor will detect the objects in front of it by using sound waves: it sends the sound waves through the trig pole to the transmitter and detects the reflected sound from the object to the echo pole via the receiver. One can then easily calculate the distance by multiplying the time with the speed of sound in the atmosphere. I will also need code whereby the library #include<Servo.h> is used in order to program the microcontroller; Arduino uno R3. This command will then be followed by an automated system.

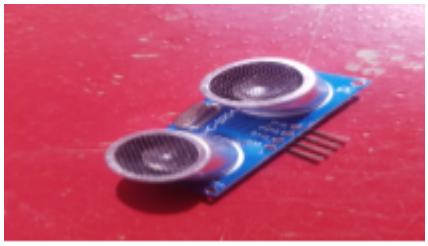


Image:9.Ultrasonic sensor

Figure 9**. Ultrasonic sensor**

Brade board

Brade board is the connection board from the different materials in the circuit.

Image:9.Blade board

Figure 10**. Brade board**

Supply cable

Supply cable is three wires cable that will provide the input power from the main to the machine.

Image.10.Supply cable

Figure 11**. Supply cable**

Dustbin

Dustbin is a plastic container to keep waste from the flow or elsewhere.

Image.11.Dustbin

Figure 12**. Dustbin**

Adapter

Adapter is an electronic device to reduce and convert AC into DC with the help of a transformer and bridge rectifier inside it. It will provide a steady 12 v DC voltage.

Image.12.Adapter

Figure 13**. Adapter**

2.1 Concepts, Opinion, Ideas From Author/Experts

2.1.1 Automatic dustbin

According to ALD (2022), anyone would be feeling very much comfortable in his room if the room is tidy and organized. It's therefore necessary to have rubbish disposed of from time to time so that such an organization could be achieved, and having the rubbish bin close to you will definitely facilitate this. Different types of bins exist, and some of us even have more than one within our house. We all produce wastes-whether adults, teenagers, or even children-when working on the desk. We would thus need a bin in which to dispose of office items. The same case would occur both in the bathroom and in the kitchen. You do not place all of your refuse in a central bin, generally located under the sink in the kitchen; this is too awkward and would prove immeasurably inconvenient. Even apart from its rather dreary function, the trash can has other functions that make life at least somewhat easier for everyone.

A pedal bin is a bin fitted with a lid that opens up using the pedal provided by your foot. The pedal bin was first invented in the 1920s by an industrial engineer and efficiency expert named Lillian Moller Gilbert for waste disposal in the kitchen. It will enable the user to open the lid provided without having to fumble around and touch it with his hands.

According to Wikipedia, in the 2010s, some bins began to integrate automated mechanisms. These include infrared detectors fitted at the top of the can-lid powered by batteries. This opens rather than

by a foot pedal and hence relieves the user from touching the bin in whatever manner. It stops the bin lids from getting clogged with trash.

According to recyclobin, Assure Health and Safety With RecycloBin Smart Dustbins,
RecycloBin Smart Dustbin is an intelligent dustbin that provides you with a 100% hygienic solution to everyday waste management.
With the powerful sensors integrated inside, it can enable the input flap to open and close every time it detects that there is a human in front. It comes with a waste level indicator attached on its front panel.
RecycloBin is what you need to dispose of waste materials in the cleanest possible way.

2.1.2 Vacuum cleaner

The Encyclopedia of Cleveland History, which began as a joint effort of the Western Reserve Historical Society and the History Department at Case Western Reserve University,.

SCOTT AND FETZER CO A diversified conglomerate, was founded in 1914 when George H. Scott and Carl S. Fetzer founded the George H. Scott Machine Co. at 118 Noble Ct. The company incorporated on 30 Nov. 1917 as the Scott & Fetzer Machine Co. and then moved to the corner of Locust Ave. and W. 114th St. Two years later it shortened the name to Scott & Fetzer Co. In 1922 the company was manufacturing the vacuum cleaner designed in 1918 by Cleveland inventor James B. Kirby.

Household chores are simply one of those things in life that cannot be avoided. It's during moments of the ordinary, however, that it's taken-for-granted technologies like the humble vacuum cleaner that have changed home cleaning forever.

Adapted from sciencemuseum.org.uk, Published: 3 April 2020, What do you think of when you think of housework? You probably think of loading the washing machine, hanging out the laundry, doing the dishes, or hoovering.

Many of the simple cleaners used through the ages would be recognisable to us today - clothes to brooms, brushes and buckets. But more recently, the technological responses to household dust and dirt - vacuum cleaner and so on - have altered our expectations of what 'clean' really means.

Diagram of the Vacuum Cleaner's evolution timeline: The vacuum cleaner has completely changed the tidiness of everything. Because it took several developments to come to the vacuum cleaner we now know, I have researched the evolution of the vacuum cleaner from its first beginnings to now. One of the very first vacuum cleaners was quite literally a contraption that was pulled down the street by horses, to give example. See the complete vacuum cleaner timeline.

Until 1860, for the first time, equipment to clean carpets was tested. Daniel Hess from Iowa (U.S.A) developed the Carpet Sweeper1. The device had to be operated by two persons and was heavy and bulky. Partly due to this, this 'first vacuum cleaner' never led to mass production.

In 1869, a machine came on the market that was quite like a vacuum cleaner. The machine had to be turned on during the vacuuming operation and created a suction force. 'Whirlwind', developed by Ives W. McGaffey, was still a big machine.

It was in 1876 that Melville R. Bissell and his wife created the Grand Rapids. It had a rotary mechanism which sucked up dirt. Bissell is still extant and is among the oldest American vacuum cleaners.

It was not until 1898 that an apparatus was developed by John S. Thurman that did not suck but blew. The dirt was blown out of the carpet and then was collected in a reservoir. That 'dust blower' was called the Pneumatic Carpet Renovator.

According to The Booth Machine: first powered vacuum cleaner, the first powered vacuum cleaner was invented in 1901. This 'The Booth Machine' is referred to by many as being the very first vacuum cleaner ever made. The vacuum cleaner was invented by the founder of the British Vacuum Cleaner3, Hubert Cecil Booth. The cleaner was drawn down the street by horses. It had long vacuum cleaner hoses which passed through the windows of houses. It contained a transparent plate attached on the side so that one could easily see just how much dirt was collected.

The first vacuum cleaner was invented with a motor back in the year 1901. This 'Booth Machine' has been described by many to be the actual first vacuum cleaner to have been made.

In 1905, a slightly more compact vacuum cleaner, which could be operated by one person, was designed by Walter Griffiths. The vacuum cleaner bearing the name 'Griffith's Improved Vacuum Apparatus for Removing Dust from Carpets' worked with the use of a pump technique. Through pumping, a vacuum occurred, through which the dirt could be sucked in.

Later in 1906, there came again another special vacuum cleaner development. James B. Kirby developed a vacuum cleaner which could collect dirt using water: the Domestic Cyclone.it was time again for a special vacuum cleaner development. James B. Kirby developed a vacuum cleaner that could collect dirt using water: the Domestic Cyclone.

Hoover: First compact vacuum cleaner with a motor. The first compact vacuum cleaner powered by a motor was developed in 1908. James Murry Spangler sold his idea to Mr. William Henry Hoover, who founded the Hoover Suction Company. This first Hoover was named the 'Hoover Model O'. Because around that time, there was still much mistrust about the operation of vacuum cleaners, door-to-door demonstrations were given.

Demonstrations were given door-to-door since around that time, there was still a lot of mistrust about the operation of vacuum cleaners.

Then, Hoover was dominating the world of vacuum cleaners. In fact, Hoover started to become a synonym for the word 'vacuum cleaner' and people even talked about 'hoovering the carpet' when people started vacuuming the carpet.

One year later, in 1909, the Eureka Vacuum Company4 by Fred Wardell was established. It is still in business today, and it released its first vacuum cleaners starting from 1913.

Meanwhile, in 1910, the vacuum cleaner was introduced into Europe. The first company to sell a vacuum cleaner there was a Danish company called Fisker and Nielsen Company, which is nowadays known as Nilfisk. Up until that time, it had the C1 model, weighing 17.5 kg.

According to Disposable vacuum cleaner bags, In 1920 disposable vacuum cleaner bags were first put to use. These were developed by Air-Way Sanitizer. A year later-in 1921-the company Electrolux launched its first vacuum cleaner: the Electrolux Model V5. Actually, this was the first canister vacuum cleaner, as we know it today. However, it was not yet equipped with wheels, but two iron strips with which to slide it over the ground.

It wasn't until 1935 that the first Kirby vacuum cleaner was made available for purchase: the Kirby Model C. Additionally, a vacuum cleaner was developed called the Vacuette, which worked by means of a spring. One provided a sucking force by pulling the vacuum cleaner backward and forward.

From that day forward, little further development of vacuum cleaners was done until well into the Second World War, primarily because carpets and the machines were very expensive. In the meantime, carpets were cleaned by being taken outside and beaten.

Both the Automatic Dustbin and the Vacuum Cleaner are considered the most important domestic tools in daily chores, such as keeping the wastes by self-opening for the Automatic Dustbin and cleaning the dust from the carpet and different types of dirt surfaces. We think as an engineer, make a multi-purpose machine that is going to play both roles for an automatic dustbin and vacuum cleaner. This will be a multi-purpose machine, joining both the automatic dustbin and vacuum cleaner systems.

2.1.3 Automatic dustbin,Vacuum cleaner, Historical background invention.

The Automatic smart dustbin vacuum cleaner consists of two combined plants. These plants are known as Automatic dustbin and a vacuum cleaner. Each of the plants has different history and background.

All vacuum devices of nowadays have been born after the invention theory called "Atomos" of Democritus who lived in 460 to 375 BC. His theory stated that "everything is made up of tiny, invisible particles". After this theory many people started thinking and arguing with one another about vacuum space. While people were thinking about vacuums and discussing and doing

experiments, scientists and engineers came up with machines with the help of vacuum theory, such as the water pump by the incandescent light bulb by Thomas Edison in 1879, a water vacuum pump by a German scientist and politician Von Guericke around 1650, and many more. Now, we are dealing with vacuum cleaners, in which various industries are investing.

Why does everybody have to make use of the dustbins in some cities? Waste containers were introduced into Paris by a Frenchman named Eugène - René Poubelle and he made their use compulsory on 7th March 1884. He came up with ideas of dustbins apart from coming up with the idea of recycling. Since the invention of Poubelle, many engineers redesigned and upgraded this dustbin, and nowadays we integrate its mechanics with electricity and computer systems such that it would become a mechatronic plant.

There are so many pieces of literature written and done by many people about dustbins, waste cans, waste management, and recycling that are complete, tidy, and healthy in our lives. Here are some notes concerning its literature.

According to ResearchGate, Er. Amar Nariya & Krunal Ghodeswar, in this recent world, urbanization has increased tremendously. In that phase, there is more production of waste. Waste management has been a crucial issue to be considered. Hereby, this report is one other way to achieve this good cause. An ultrasonic sensor-interfaced smart bin is built on Arduino-the basis of a microcontroller-based unit. This would avoid the scenario of dustbins overflowing along roadsides and localities because smart dustbins are handled in real time. When large-scale implementation replaces traditional bins with these smart bins, it would be easy to manage the wastes to their efficient level at a very fast pace as it avoids unnecessary lumping of wastes on roadsides. The heinous smell emanating from these rotten wastes that remain unprocessed for days together may lead to long-term effects due to negligence of authorities and callous attitude of the public. This makes a lot of nuisance around while also promoting an unclean environment. The breeding of insects and mosquitoes may even cause dreadful diseases. Keeping our environment clean is the motive of this project. Apart from that, it targets the creation of an environment that is clean and green.

2.2 Theoretical perspectives

Automatic dustbin, vacuum cleaner, is a very smart machine which is a combination of two plants. plants are smart dustbin and vacuum with 5 watt and 7.8watt respectively and total power is 10 watt of a machine.The machine has 1 Kg and the volume is 0.03182577347 m^3

and density is 31 kg/m3. The cylindrical shaped machine with lid and pipe tail.

The machine's lid opens automatically when a person's hand approaches it. It is able to remove dust or small particles on the surface once the nozzle is pointed to them and the switch is pressed manually and the work is done with the help of suction force of motor and fan in tube.

2.3 Related studies

In the year of 1906 a man called James B. Kirby made the vacuum called the " Domestic cyclone". It used water to separate dirt. Its revision came to be known as the Kirby vacuum cleaner. In 1916, The Cleveland, Ohio factory was built and continues to be open right now all kirby vacuum cleaners are manufactured in the U.S.

In 1907 department store janitor James Murray Spangler (1848–1915) of Canton, Ohio, Made the first portable electric vacuum cleaner, obtaining a patent for the Electric Suction Sweeper on 2 June 1908. Very importantly, in addition to suction from an electric fan that blew the dirt and dust into a soap box and one of his wife's pillow cases, Spangler's design utilized a rotating brush to loosen debris. Unable to produce the design himself due to lack of funding, he sold the patent in 1908 to local leather goods manufacturer William Henry Hoover (1849–1932), who had Spangler's machine redesigned with a steel casing, casters, and attachments, founding the company that in 1922 was renamed the Hoover Company. Their first vacuum was the 1908 Model O, which sold for $60 ($2,035 in 2023 dollars). Subsequent innovations included the beater bar in 1919 ("It beats as it sweeps as it cleans"), disposal filter bags in the 1920s, and an upright vacuum cleaner in 1926.

2.3.1 Recent developments

In 2004 a British company released AiRider, a hovering vacuum cleaner that floats on a cushion of air, similar to a hovercraft, to make it light-weight and easier to maneuver (compared to using wheels).

A British inventor has developed a new cleaning technology known as Air Recycling Technology, which, instead of using a vacuum, uses an air stream to collect dust from the carpet. This technology was tested by the Market Transformation Programme (MTP) and shown to be more energy-efficient than the vacuum method. Although working prototypes exist, Air Recycling Technology is not currently used in any production cleaner

2.3.2 Upright vacuum cleaners

Upright vacuum cleaners are popular in the US, UK, and numerous Commonwealth countries, but unusual in some Continental European countries. They take the form of a cleaning head, onto which a handle and bag are attached. Upright designs generally employ a rotating brush roll or beater bar, which removes dirt through a combination of sweeping and vibration. There are two types of upright vacuums; dirty-air/direct fan (found mostly on commercial vacuums), or clean-air/fan-bypass (found on most of today's domestic vacuums).

The older of the two designs, direct-fan cleaners have a large impeller (fan) mounted close to the suction opening, through which the dirt passes directly, before being blown into a bag. The motor is often cooled by a separate cooling fan. Because of their large-bladed fans, and comparatively short airpaths, direct-fan cleaners create a very efficient airflow from a low amount of power, and make effective carpet cleaners. Their "above-floor" cleaning power is less efficient, since the airflow is lost when it passes through a long hose, and the fan has been optimized for airflow volume and not suction.

Fan-bypass uprights have their motor mounted after the filter bag. Dust is removed from the airstream by the bag, and usually a filter, before it passes through the fan. The fans are smaller, and are usually a combination of several moving and stationary turbines working in sequence to boost power. The motor is cooled by the airstream passing through it. Fan-bypass vacuums are good for

both carpet and above-floor cleaning, since their suction does not significantly diminish over the distance of a hose, as it does in direct-fan cleaners. However, their air-paths are much less efficient, and can require more than twice as much power as direct-fan cleaners to achieve the same results.

The most common upright vacuum cleaners use a drive-belt powered by the suction motor to rotate the brush-roll. However, a more common design of dual motor upright is available. In these cleaners, the suction is provided via a large motor, while the brushroll is powered by a separate, smaller motor, which does not create any suction. The brush-roll motor can sometimes be switched off, so hard floors can be cleaned without the brush-roll scattering the dirt. It may also have an automatic cut-off feature which shuts the motor off if the brush-roll becomes jammed, protecting it from damage.

CHAPTER 3: DATA COLLECTION AND ANALYSIS PROCEDURES

3.0 Introduction

In Every people occupations such as a residence rooms , the offices, cars, and accommodations proper waste management in short period of time with rarely energy consumption is still a big problem because there are manually fixed dustbins which require energy, time and strong focus of human intervention to Manage wastage in their rooms which frequently change the mood of work. Previous set of actions are: to pick the wastes, To open a dustbin, to put the wastes into the dustbin, and then to close the dustbin which is a complex and difficult sequence of actions.

As electrical engineers we are going to make a robotic machine of 10 watt and 1 kg and volume of 0.03182577347 m^3 that will open and close the lid automatically once a person's hand is approaching to cast the wastes in it, in the case of big and heavy particles. It will clean small particles by pointing the nasal to them with the help of its vacuum cleaning system. Current set of actions are To pick the wastes, To put the wastes into the machine. In the case of big and heavy particles. Pick the nasal and point it to the small particles, and Release the nasal. In the case of small particles.

To solve problems we needed to carry out research on this topic. The approaches are both qualitative and quantitative. We deal with numbers sizing of different parameters and word meanings.

3.0.1 Materials used in data collection

With the help of the Computer, Internet and Recording sheet and checklist, we discovered and tested a machine, which will be used To pick the wastes, To put the wastes into the machine. In the case of big and heavy particles. Pick the nasal and point it to the small particles and Release the nasal. In the case of small particles.

3.1 Research design

Quantitative and Qualitative data has been acquired with computer and internet materials. Through the computer and internet, we search for information relating to the project. Quantitative and Qualitative data is conducted by observation through experiment in trash material such as motor, Fan, plastic bottle, filter and flexible pipe. The vacuum cleaner machine made was with low suction power due to its low electric power.

The research will use materials like internet websites and check list in experiment. The problems well: what to facilitate in cleanance of the world and how to improve our local existing existing system? At the time I came up with an automatic dustbin, vacuum cleaner. The plant is made of two systems: the one is for vacuum cleaner and another is an automated lid of a dustbin. The next is to know why do people want this and how the people will continue to increase in number of the ones who want the machine.

Considering the development of Rwanda and their trustworthiness in population census and statistical data, we have taken Rwanda as a sample. With the help of small materials in size and power, we have to know and make sure how to create suction of vacuum cleaner and power related input and output.

3.2 Research Population

The world demography,Rwanda especially : The purposive research is conducted in order to know, who is going to use the machine and at which rate they are increasing in the region. Electrical machines and electronic machines : This is the population of experimental research to know well the machine we thought about, how materials are connected, interrelated and processed .

3.3 Sample size

Research population: It involves the demography of the world, particularly Rwanda. Sample size: 14 million is the sample size that makes up the demography of Rwanda.

Sample size would entail the demography of Rwanda; we need to know who the people are who shall understand and, therefore, be able to use this important machine so as to facilitate them in their daily activities. It is a fact that as long as the country is being developed, the people get busier since every work becomes payable. Therefore, in this case, a huge number of the population is educated, working in offices, and living a very productive life. This is with the help of the EICV5 Education Thematic Report, a report produced by the National Institute of Statistics of Rwanda. All over Rwanda, ever attended school has remained high and stands at 87% over the last three years. Among those aged 6 and above, 90% of all men and 85% of all women have ever attended school. Generally speaking, ever attended school is slightly higher in urban areas at 95%, as compared to rural areas at

88%. Besides, Kigali City has the highest proportion of people who have ever attended school at 95% compared to other provinces.

Generally speaking, education is usually the backbone of development for any country. Education has to reach all sections of society, and it has to be quality enough to meet the demand in the labor market. The ethical imperative of the United Nations' new development agenda is that 'no-one should be left behind'. Underpinning this is provided by the 17 Sustainable Development Goals, now replacing the 8 Millennium Development Goals that had-so it was hoped-specifically achieved universal primary education by 2015, amongst other targets.20 May 2024, Unemployment rate of Rwanda decreased by 4.3 p.p. in Q1 2024.

3.3.0 Unemployment

The latest Labour Force survey (2024 Q1) reveals a significant decline in Rwanda's unemployment rate, dropping by 4.3 percentage points in quarter 1 of 2024 compared to the same period in 2023. This remarkable improvement has brought the unemployment rate back to the pre-COVID-19 estimate of 13.1%. In 2024 (Q1), the unemployment rate stood at 12.9%, indicating a positive trend where approximately one person was unemployed for every eight in the labor force.

Gender disparities persist in unemployment, with females experiencing a higher rate at 14.5% compared to males at 11.5%. Furthermore, youth face a notably higher unemployment rate of 16.6% compared to adults at 10.3%. Urban areas also bear a heavier burden with an unemployment rate of 14% compared to rural areas at 12.3%.

Despite these challenges, there is progress in narrowing the gender gap in unemployment, which was recorded at 3 percentage points in 2024(Q1), showing improvement from 3.7 percentage points in the same quarter last year. This data underscores the need for targeted interventions to address unemployment disparities across demographics and regions, ensuring inclusive economic growth and opportunities for all Rwandans.

3.3.0 The Labour force

The latest labour force survey puts into great detail the nature of Rwanda's workforce, estimating about 8.2 million people in the working age, 16 years and above, out of which it is estimated that 4.37 million people are employed. About 648,000 are recorded as unemployed, while 3.2 million are considered out of the labour force. This makes both the employed and unemployed add to the labour force of 5.0 million individuals.

More specifically, labour force participation rate, defined as the percentage of the resident population aged between working ages who were working or actively looking for work, continued to rise unabated since 2021 Q1. The labour force participation rate in 2024 Q1 was 61.0%, up from the estimated 57.6% in the previous year by 2.4% points.

Notably, the labour force participation rate continues to indicate a wide gender gap, with male participation always outpacing that of females. This gender gap was around 14.6 percentage points in February 2024 (Q1), a difference similar to that observed in the same period of the previous year.

3.3.0 Employment

The employment-to-population ratio is a meaningful labour market indicator because it represents the capability of the economy to generate payroll jobs for the people in the working-age group. Moving along with population growth, aggregate employment usually rises to reflect economic health.

By gender, the EPR increased from 47.7% in 2023 Q1 to 53.1% in 2024 Q1. In that sense, growth has indeed been quite broad-based, representing a rise of about five percentage points each for both males and females.

However, there is still inequality in the distribution of employment between genders and ages. For example, it was way higher, standing at 60.9%, by males compared to females at 46.3% in 2024 Q1. Similarly, the EPR of adults is relatively higher, standing at 57.4%, compared to that of the youth aged 16-30 years old, standing at 47.7%.

Figures from the computer and from the internet: We can get several information like the following: Unemployment rate of Rwanda goes down by 4.3 p.p. in Q1 2024, By The Fifth Rwanda Population and Housing Census 2022 : Proportion of the population who never attended school decreased to 16.4% if we take into consideration the population aged 3 years and above .

3.3.1 Research population

3.3.1 Electrical machines and electronic machines

Sample size, Experimental vacuum cleaner machine, 7.82 watt DC motor, 10 cm2 Fan blade 70 cm3 Cylindrical plastic 15 cm Flexible pipe. The purpose of making this sample machine was to clean small pieces of paper. As the machine cleans the small pieces of paper it is able to clean highly denser particles as its power is increased.

3.4 Sampling procedures

In sampling we will be using Two sampling procedures, which are convenient and purposive sampling procedures.As well known convenient sampling procedure is non-probability sampling procedure where the researcher gathers the data from nearby sources of information exerting minimal effort.

We choose it because it is easy to conduct information from the internet with computers these days, our computers accounts can be found in every computer and wherever we are. This procedure helped to read free cheap books, documents and reports such as "The invention of the vacuum cleaner, from horse-drawn to high tech". Science and NISR, Rwanda’s Unemployment rate drops by 4.3 p.p. in Q1 2024. It is time saving and portable. We are able to use the internet whenever and wherever you are, like in a bus, home and at the office.

The purposive sampling procedure was also chosen because we took Rwandan demography as sample for a purpose such as: It is easy to access government published trustworthy information and It is the region of the research.

3.4 Research instrument

3.4.1 Choice of the research instrument

The first choice of the research instrument is the existing dataset research instrument which is a secondary data type where the data is conducted from the internet. And the second Choice was the observation research instrument. It is conducted by observing the working experiment vacuum cleaner. The purpose is to observe its proper system working and the mass of debris it is able to clean up.

3.4.2 Validity and Reliability of the Instrument

The existing dataset research instruments used are valuable and reliable because they are published by legal and even governmental websites such www.statistics.gov.rw, wikipedia, and so on. The second choice observation research instrument is the primary data type because the data acquired are first hand and are viewed by naked eyes, so they are trustworthy.

3.5 Data Gathering Procedures

Computer internet: Internet is a world network that is used by most of the computer and other electronic devices. With the help of the internet, we are able to access almost all information and its communication is world wide.

In case, we have been able to access the information that has led us to the problem that needs engineering solutions. By analyzing the data accessed we have realized that cleanness and time are very important parameters to be managed and maintained. By analyzing statistical data from government institutions in charge such as NISR of Rwanda

After having mixed qualitative and quantitative knowledge from different websites such as wikipedia, https://www.sciencemuseum.org.uk and so on, we have been able to carry out **the** experiment of a new theoretical machine into a practical machine. The experiment gave us the trust of the machine and its electrical power matching to suction power. The experimental machine has been able to clean up small parts of the paper due to its low power of 7.82 watt . The materials used are DC motor, fan, filter, housing of plastic battle, switch, power supply cable and connecting wires.

3.6 Data Analysis and interpretation

Descriptively Diagnostic, and Predictively Apart from the time being left behind, We have analyzed that human beings are getting knowledgeable and skilled, which is and will continue to make man powers few and expensive in the next few years. As seen in 2024 Q1, the EPR increased to 53.1%, showcasing a significant rise from the 47.7% recorded in 2023 Q1. This increase of approximately 5 percentage points holds true for both males and females, indicating broad-based employment growth. It shows as time goes up it equalizes itself, to fit up as real money for many people. And casual works such as cleaning are getting expensive to afford and even their presence requires special machines to facilitate them, such as Automatic dustbin ,vacuum cleaners.

Prescriptively Analyzed, For that reason of the problem stated, as engineers, we have thought about the invention of a new machine that is going to minimize time and energy wasted by people doing these daily chores, which are cleaning and dumping. With experiment done we have realized that, with help of a small DC motor, fan and cover bottle with Nozzle, It has been able to create suction power. It means we are able to increase the air watt as suction and airflow as the variables in charge are increased such as speed of motor, efficiency and specific orifice area.

3.7 Ethical considerations

This research is limited to harm to human beings like private personal data used, harmful chemical components are limited to be used , no non published information used or without permission and every electrical component used is well insulated and grounded. The measurement of consumption is calculated and corrected.

Touchless operation: auto dustbins promote less or no contact at all, which will reduce the chances of the spread of germs and bacteria.

3.8 Limitations of the study

This research is limited because it should be with many different systems so as to be almost fully automated and extremely important. The followings are system that should be in the research of the project but limited by financial and time factors:

Mobility system of vacuum clean : the machine should be able to move around the cleaning house and move around the obstacles due to sensors and robotic tyres. Self blocking system of automatic

dustbin : the dustbin would not be opened automatically once the dustbin is full of wastes. Drying system of wet surface for the wish of the user : If water is dropped down willingly or unwillingly the machine should be able to remove it by evaporation method. Cooling system : System of the machine should be improved so as to not burn easily or provide no chance to heat up quickly.

CHAPTER 4: DESIGN AND IMPLEMENTATION OF AUTOMATIC DUSTBIN, VACUUM CLEANER

4.0 Introduction

Automatic dustbin, vacuum cleaner is a robotic machine of 10 watt and 1 kg and 165.801 cm^3 volume. Vacuum cleaner Cleaning ability is measured with the help of "air watts" which is equal to suction multiplied by air flow CFM(cubic feet per minute)

Suction is force created by pressure difference; it can be measured in inches of water lift or Kilopascals(kpa) ; it is not a movement.

Air flow is the speed of a volume of air. It can be measured in CFM(cubic feet per minutes) or L/min(litres per minute) . It is a movement. Air watt is a product of suction multiplied by airflow(CFM) and the result is divided by 8.5 for specific areas. The suction power of a vacuum cleaner is measured by a manometer. The Air flow is measured by an anemometer. This system follows the Bernoulli's principle

4.1 Drawings

4.1.0 Machine block diagram

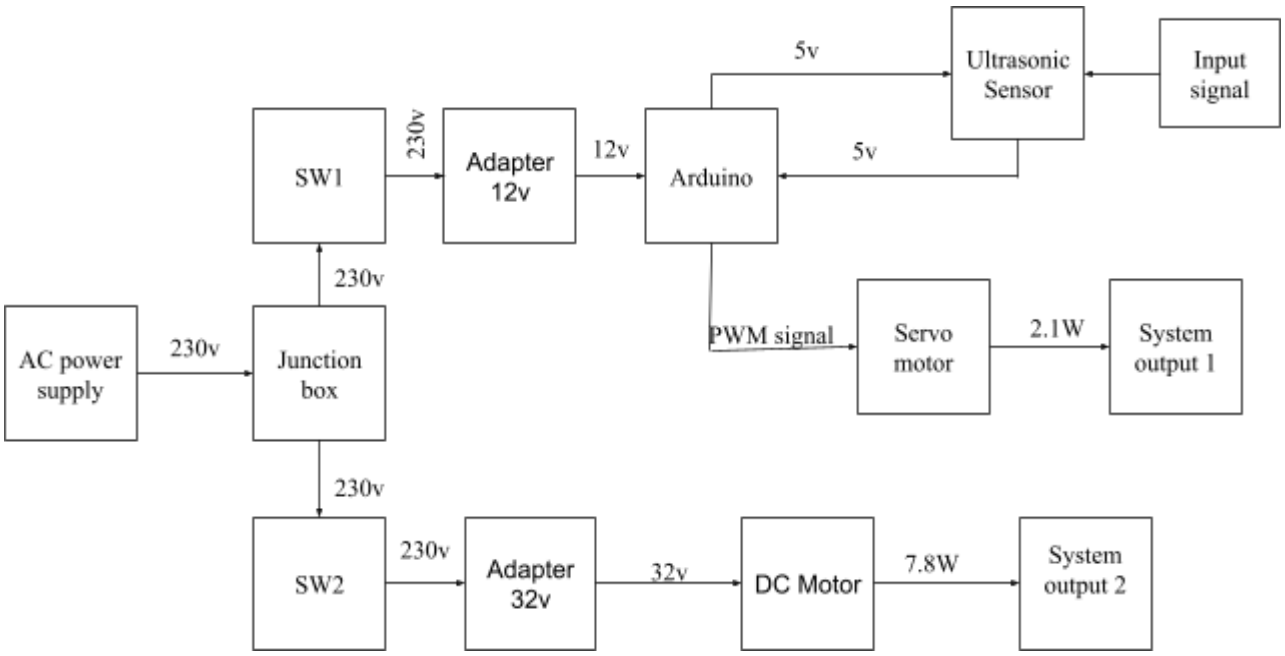
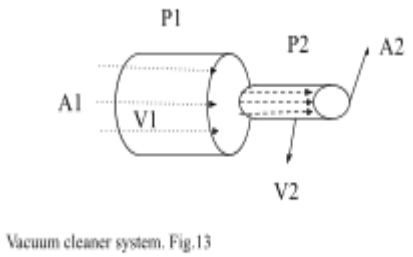


Figure 14**. Machine Block diagram**

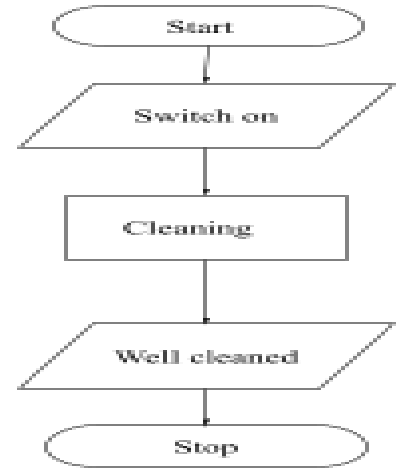
4.1.1 Vacuum cleaner system



Vacuum cleaner system. Fig.13

Figure 15. **Vacuum cleaner system**

4.1.2 system flow chart



Vacuum cleaner flow chart. Fig.14

Figure 16**. system flow chart**

V1: Volume one, V2: Volume two, A1: Area one, A2 Area two, P1: pressure one, and P2: Pressure two

4.1.3 Automatic dustbin system

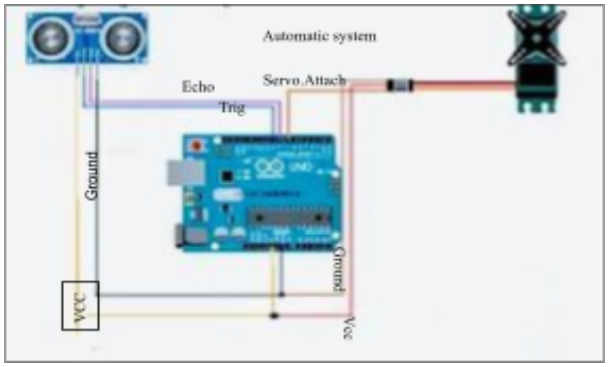


Figure 17. **Automatic dustbin system**

4.1.4 System flow chart

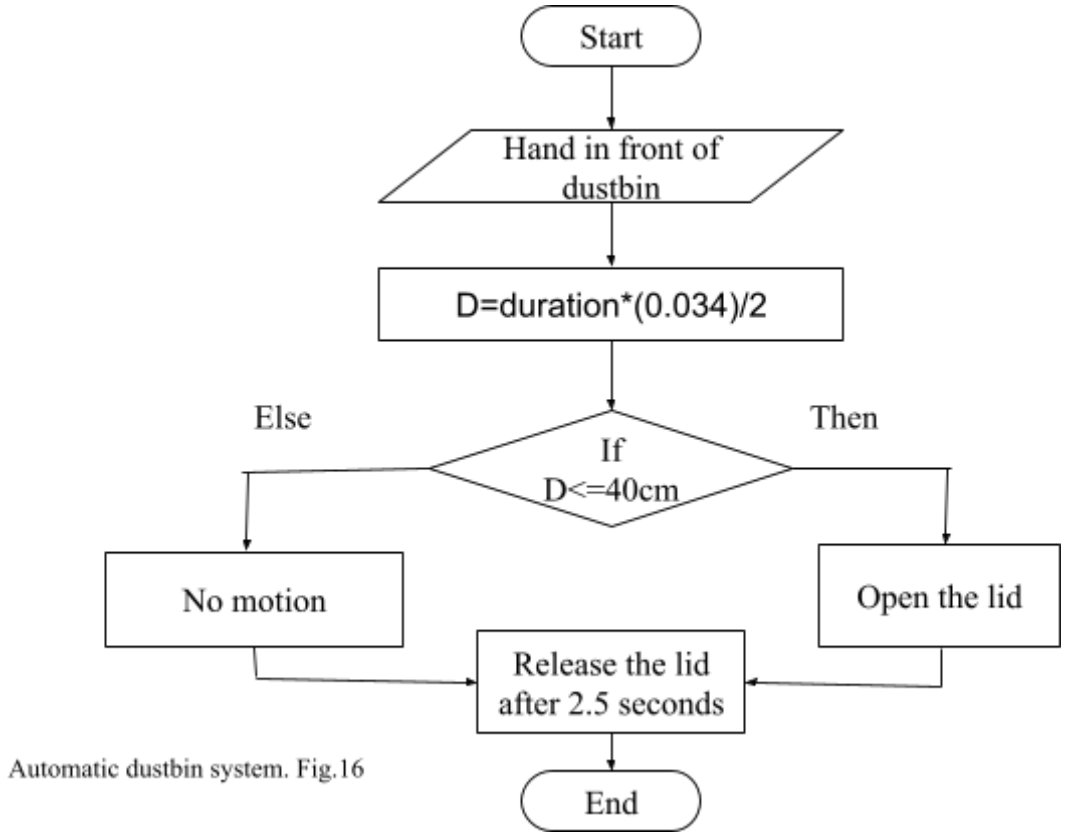


Figure 18**. System flow chart 2**

4.2 Calculations

$P_s + \frac{1}{2}\rho V^2$= Constant

$\Delta PE = \rho g \Delta h$

$P_s + \frac{1}{2}\rho V^2 + \rho g \Delta h$=Constant(4.1.1)

The volume and Density of a machine(2.2) and (3.0)

It is conical cylinder

R=22cm⇒ 0.22 m

r=19.5 cm⇒0.195 m

h=23.5 cm ⇒0.235 m

V: volume ,R: Radius of big circle, r: Radius of small circle, h: Height of machine

V=$\frac{\pi h}{3} \times \left(R^2 + Rr + r^2\right)$

V=24.6091424531 × (11^2 + 9.25 × 11 + 9.25^2)

V=7587.30623258 cm^3

V=0.03182577347 m^3

Density is equal to $\frac{1}{0.03182577347}$

ρ_1=31.4210745171 kg/m^3

Formulas(4.0),and (4.1.1)

A: area, and V: Velocity P: Pressure in fluid

A*V is Constant

Let's consider air flow in unequal cross section areas, but constant velocity.

V1=V2

There is V1 and V2; and A1 and A2

A1V1=A2V2

What changed is Pressure

P1≠P2, P1<P2

So the particles move from high pressure to low pressure.

(Air Flow * suction)/8.5 = Air Watts

4.3 Specification

The project is manufactured through a multi-step process. It consists of two systems: an automatic dustbin and a vacuum cleaner. It's made up of many components. Following are the specifications of the project.

Materials Used: There are a lot of different materials I will be using in this project, and some are hand-made. The materials used and their specifications are stated in the table below:

Number	Materials	Specifications
1.	Carbon Brushes DC-motor:RS-445PA/PD	output : 3.0W~55W (APPROX) Typical Applications Office Automation Equipment : Carbon-brush motors WEIGHT : 127g (APPROX) voltage model operating range nominal no load speed is 6600 r/min, current is 0.060 at a maximum efficiency current is 0.30 a torque is 13.6 mN·m at 139 g·cm output 7.82 W and wih81.6 mN·m stall torque at 832 g·cm with a current of 1.5 A. RS-445PA-14230.

2.	Servo Motor	Operating Voltage is +5V typical, Current is 2.5A, Stall Torque is 9.4kg/cm, Maximum Stall Torque: 11 kg/cm, operating speed is 0.17 s/60°, Gear Type: Metal, Rotation : 0°-180°, Weight of motor : 55gm, and Package includes gear horns and screws This motor will pull and release the lid when the signal is sensed.
3.	Filter	It is 7.5 centimeters in diameter for the small holes sheet.
4.	Flexible pipe	This narrowed 2 cm diameter and 50 cm length, plastic of pipe to make suction power by creating pressure difference in system
5.	Plastic housing	this 11 centimeter of cross diameter and 23 centimeter as height. Cylindrical medium pipe.
6.	Arduino uno R3	This is a microcontroller having VIN MAX. VIN pad to 20 V maximum input voltage, VUSB MAX. USB connector maximum input voltage is 5.5 V. Processor: ATMega 328P, Memory: AVR CPU 16 MHz, Flash: 32KB, SRAM: 2KB, EEPROM: 1 KB.

7.	Connecting wires	These are 0.5 mm insulated signal wires to transfer signals from one component to the other.
8.	Adapters	This material is needed because in the system to be controlled it requires low voltage, Direct current(DC). That means it will reduce the voltage and change it from alternating current(AC) into direct current (DC). The adapter will receive 230 V, AC and provide below 12 V and 32 V DC .
9.	Switch	Manually hand-operated of medium current switching system is required, so as to control vacuum clean systems
10.	Supply cable	This cable is 1.5 mm, 3 in 1 insulated core will feed all power towards the system.
11.	Dustbin	A 0.03182577347 m3 volume.
12.	Ultrasonic sensor	It is a Power Supply: DC 5V, Working Current: 15mA Working Frequency: 40Hz, Ranging Distance : 2 cm – 400 cm/4m, Resolution : 0.3 cm, Measuring Angle: 15 degree, Trigger Input Pulse width: 10uS, Dimension: 45mm x 20mm x 15mm.

13.	Fan	4 cm metallic fan

Table 1. Material specifications

4.4 Cost estimation

The project will require funding for materials, sensors, and prototype development. A timeline will be established for each phase of the project, including design, development, testing, and evaluation.

Table 2. Cost estimation

Budget and Timeline:			
Activities	**Materials**	**price**	**Period**
vacuum cleaner implementation	Carbon brush DC-motor,RS445PA14233R	15,000	6 hours around
	Fan	2,000	
	nosal	1,000	
	Housing	2,000	
	Filter	1,500	
	switching system	1,000	
	Supply cables	5,000	
Implementation of Automatic Lid open and close dustbin:	Dustbin	15,000	
	Servo motor, MG 996R	10,500	
	Arduino Uno R3	15,000	
	Ultrasonic sensor	4,000	
	Connecting cable and supply	5,000	

Combination	Total	77,000	
This budget and timeline can vary according to different factors such time, place, number of pieces bought etc. the time period counted is only to connect march and fix available materials. Transportation, choosing and buying of materials their time period is highly varied by many different factors that is why are not included.			

Table 2. Cost estimation Table 1. Material specifications

4.5 Implementation (Optional depending on the project)

Figure 21. 1 Automatic dustbin vacuum cleaner and Figure 20. 2 Automatic dustbin vacuum cleaner

Circuit diagram

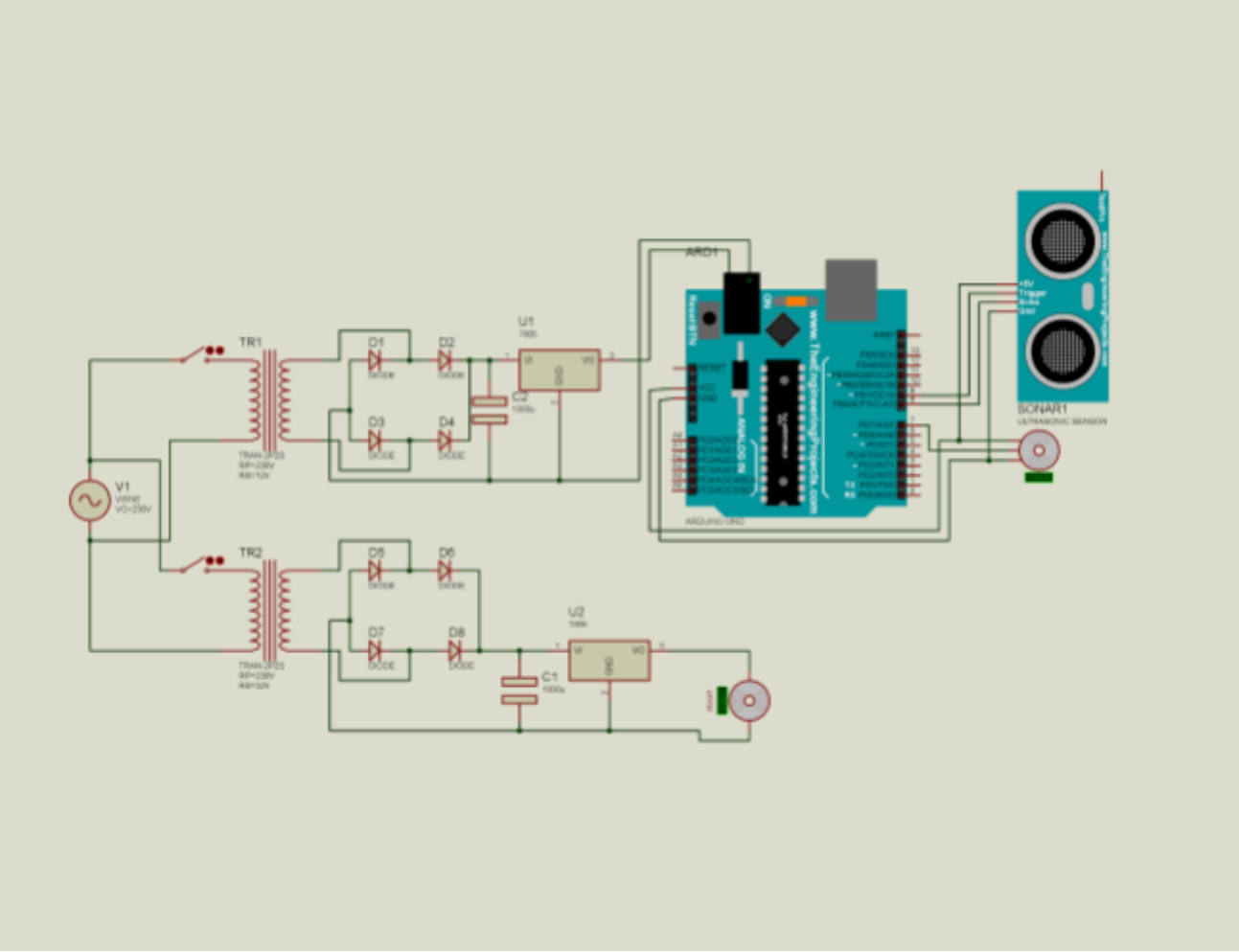


Figure 19.**Circuit diagram**

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The outcome is a functioning prototype of automatic dustbin, vacuum cleaner, Improved waste management efficiency, with timely waste disposal and automated lid opening and closing. Increased convenience for users, reducing the time and effort required for household cleaning tasks. The integration of smart dustbin technology with vacuum cleaner functionality represents a promising avenue for enhancing household efficiency. By automating waste management and cleaning tasks, this system can simplify daily chores and improve overall quality of life. Through this research, we aim to contribute to the advancement of smart home technologies and promote sustainable living practices.

5.2 Recommendation

I recommend that all technical and science schools should provide practical knowledge with case studies and that will enhance our home made, industrial development, creativity, innovation and job opportunities on our land. The theory and practice have to be in the case study and practice in the schools. Where a small vacuum cleaner can be made from home trash.

5.3 Suggestion for further study

The next study will automate integrating vacuum cleaners and improve its functionality. Drying system and mobility system as robots will be found in the next machine.

Figure cross references

Figure 2. DC motor . Figure 3. Servo motor. Figure 4. Fan Figure 5. Filter Figure 6. Plastic housing Figure 8. Arduino uno board Figure 9. Ultrasonic sensor Figure 7. Flexible Pipe Figure 13. Adapter Figure 12. Dustbin Figure 11. Supply cable Figure 15. Vacuum cleaner system Figure 16. System Flow Chart Figure 17. Automatic dustbin System Figure 18. System flow chart 2 Figure 21. 1 Automatic dustbin vacuum cleaner Figure 20. 2 Automatic dustbin vacuum cleaner Figure 14. Machine block diagram Figure 19.Circuit diagram

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APPENDIX

Code of automatic dustbin

```
#include <Servo.h>

// Define pins to be wired in
const int trigPin = 9;
const int echoPin = 8;
const int servoPin = 7;

// Create servo object name
Servo myServo;

// Variables to store distance and servo position
long duration;
int distance;
```

```
int servoPosition = 0;  // Start at 0 degrees

void setup() {
  // Start serial communication
  Serial.begin(9600);

  // Set up the ultrasonic sensor pins
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);

  // Attach the servo to its pin
  myServo.attach(servoPin);

  // Initialize the servo position
  myServo.write(servoPosition);
}

void loop() {
  // Clear the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);

  // Set the trigPin high for 10 microseconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Read the echoPin
  duration = pulseIn(echoPin, HIGH);

  // Calculate the distance
  distance = duration * (0.0344 / 2);

  // Print distance for debugging
  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // Check if distance is less than or equal to 15 cm
  if (distance < 20) {
      myServo.write(90);
        delay(2500);
```

```
  }
else {
  // If hand is removed, move the servo back to 0 degrees after 2 seconds
  myServo.write(servoPosition);
}
delay(2000);
}
```