

# Multifunctional Robot For Home Application

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**Abstract-** Many people are busy in their own work, some need an assistant to do their little things, there are elderly, physically challenged people too, they also need some basic help to be done by someone else. So our project is about design a machine or robot which can perform simple tasks by its own (Autonomous) Multifunctional robot for home application.

The basic task is to clean the dust and small particles like a autonomous vacuum cleaning machine which has its own sensor to detect the obstacles on its own with the help of algorithms which is controlled by a microprocessor and a voice assistant which is called chat bot we can speak and have conversation with it and we can command through our voice to control the smart home appliances like fan, coffee machine, heater and lights etc.

**Keywords-** Machine, Clean, Microprocessor and Home appliances.

## I. INTRODUCTION

In present scenario robots play a vital role in day to day life such as in industries, educational purpose, personal and home usage. Most of the robots are automated so that these robots need to be programmed with respective works. Many people need a personal assistant to do their basic works. Elderly people, physically challenged must be some one to help them with small works such as cleaning the dust in the floor, someone who can talk and need help to switch on/off the home appliances like fan, lights, heater and coffee machine etc.

To overcome these problem we design a robot which act as a vacuum cleaner and voice assistant to control the smart home appliances by integration of these two works into a single machine which will be useful for certain people. The basic operation of this robot is Automatic vacuum cleaner which cleans dust and small particles through a suction chamber and it works with certain algorithm and obstacles avoided through ultrasonic sensor. Through voice command an artificial intelligence is been implemented which act as a bridge to control your smart home appliances.

### 1.1 Scope and Objectives

- This robot can help people in cleaning the floor.
- In busy time this machine will be useful to control the smart home appliances.
- A great usage for physically challenged people like voice control access.

our objective is to integrate certain features into a single machine unit as robot, It can perform like automatic vacuum cleaning machine which cleans dust and small particles through a suction chamber and it works with certain algorithm and obstacles avoidance through ultrasonic sensor, control (turn on/off) home appliances through our voice command an artificial intelligence is been implemented which act as a bridge to control your

### 1.2 Existing problem

There are many elderly people, busy working people and physically challenged who lives alone helpless for certain small (their own needs) things like cleaning their house floor, control over the home appliances like light, fan, air conditioner, coffee machines etc.

## II. DESCRIPTION OF COMPONENTS

Construction of Multi-functional robot consist following things:

1. Arduino uno
2. Dc motor (12v, 10 kg torque)
3. Ir (infrared) and ultrasonic sensor.
4. Raspberry pi 3
5. Mic
6. Speaker
7. Battery (12v 7.5ah)
8. Wheels
9. Bolt & Nut
10. Relay
11. Dc-Dc converter
12. Motor driver L298n

### 2.1 Arduino uno

It is a open source micro-controller which works with atmega 328 (32 kb, 8-bit processor) this controllers the

motors and the sensors of the bot . The algorithm is been pre-programmed to execute the task.

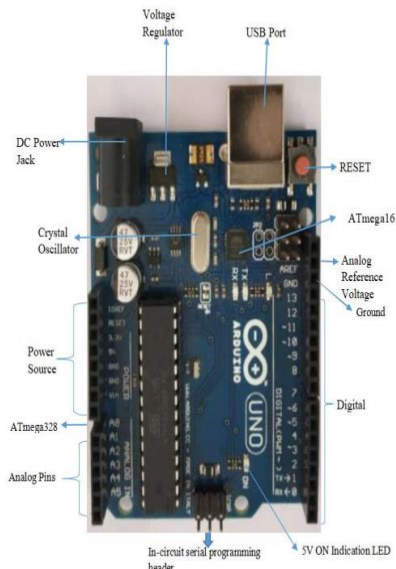


Fig 1- Arduino uno

### 2.2 Raspberry pi

A pocket size computer it can store many program and can execute many tasks ,it has memory, ram,processor ,Gpu etc. Python can be used to write the programs.



Fig 2-Raspberry pi 3

### 2.3 Infrared sensor

Which is used to detect the obstacles in-front of the bot . light emitting diode which emits the light and receives it so that The resistances and these output voltages, change in proportion to the magnitude of the IR light received.



Fig 3- Infrared sensor

### 2.4 Motor driver

Which controls the motors of the robot this works(LN298n) with H-bridge concept we can drive the motor in forward and in reverse direction also and even we can vary the speed of the motor by pwm.The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

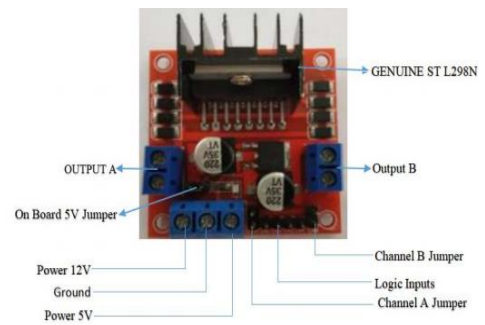


Fig 4- Ln298n motor driver

## III. DESIGN AND CALCULATION

### 3.1 Material selection

We choose general grade Aluminium sheet (4mm) thick , **Aluminium** is well known for its robust properties, especially when exposed to the elements. It is unaffected by UV rays, it will not rot, rust or bend. We need a light weight material and strong also so that this aluminium will best for our fabrication . We gave our fabrication materials for laser cutting process for a good finish in cutting .

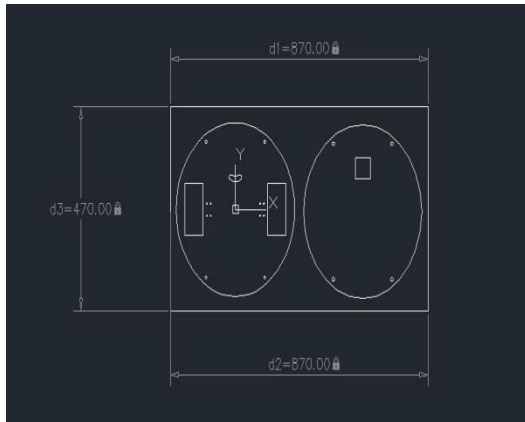


Fig 5-The aluminium sheet configuration

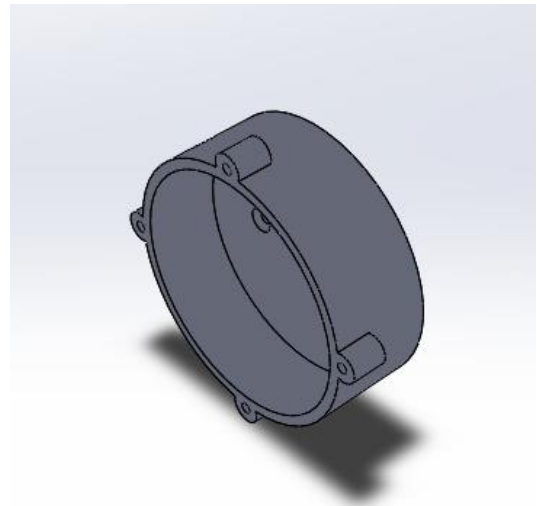


Fig 8- Case of the impeller

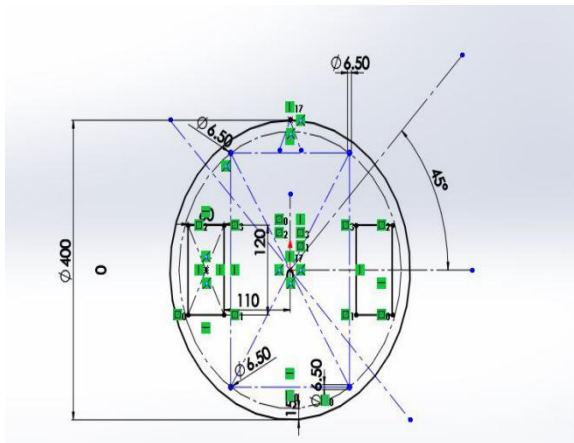


Fig 6-Detailed design of bottom base

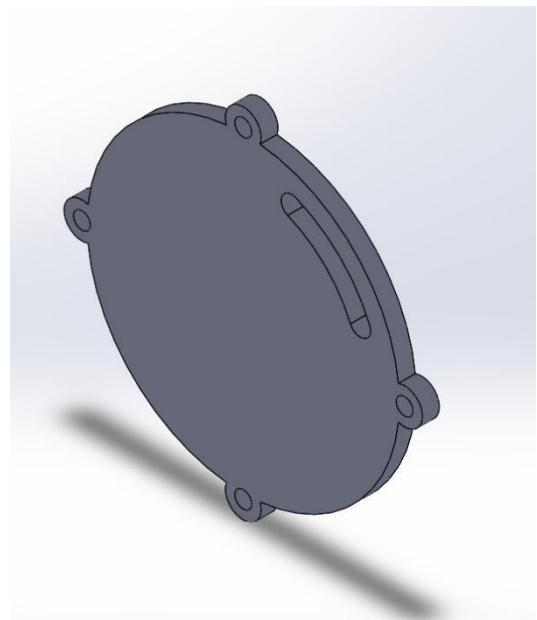


Fig 8- Top plate

### 3.2 Vacuum chamber Design

we design and constructed our own vacuum chamber using 3d printing . This will be up to our requirements for the suction even the vacuum impeller we design accordingly to the motor shaft and speed which has 30,000 RPM.

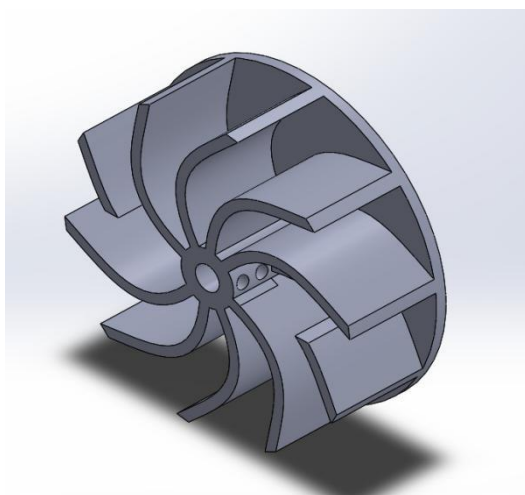


Fig 7- Impeller (Dia =60mm height =25mm)

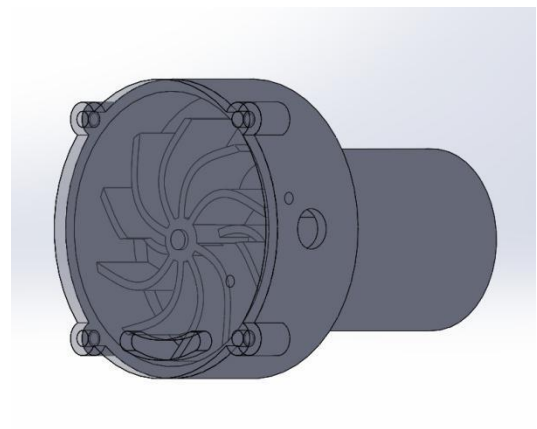


Fig 10- Assembled view

### 3.3 Robot design

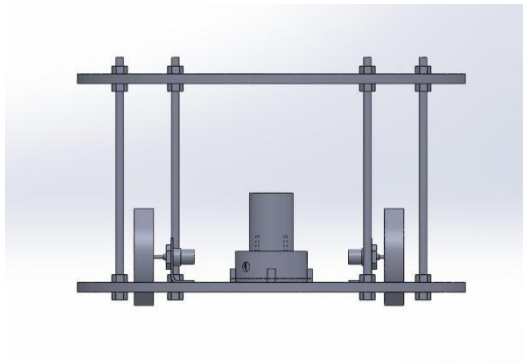


Fig 11- Front view (height = 250mm)

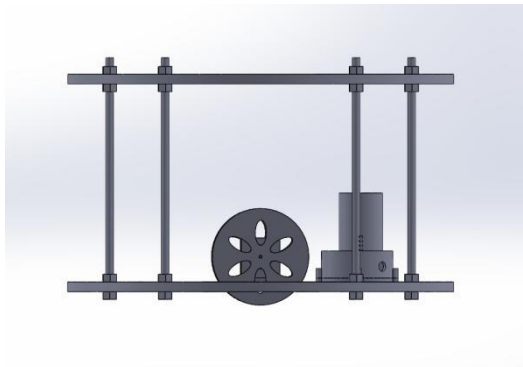


Fig 12- Side view

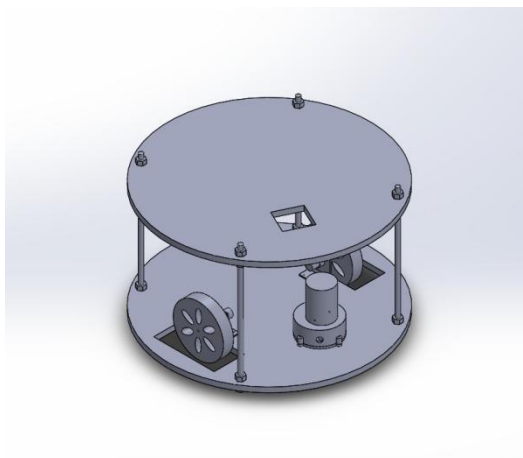


Fig 13 - Isometric view

### 3.4 Motor calculation

Total weight to be carried = 5kgs

Diameter of the wheel = 10cm , radius = 5cm

### TORQUE REQUIRED

$$T = r \times f$$

$$5 \times 5 = 25 \text{ kg-cm}$$

The torque is going to split between the motor .

We are using two motors :  $25/2 = 12.5 \text{ kg-cm}$

Lets assume the speed of the motor as 500 rpm [more efficient to carry good ]

$$\text{Power} = 2 \pi NT/60$$

$$2 \times 3.14 \times 500 \times 12.5 / 60 = 6.54 \text{w}$$

4.58 is the power rating for single motor .

For two motors the power is 13.08w

Where

T = torque in kg-cm

r = radius of the wheel in cm

F = force acting on the body which is mass in kg

P= power in watts

N = speed of the motor in RPM

So we select 12v dc 500 rpm with 15 kg -cm torque .

### 3.5 Power ratings

$$\text{Arduino} = 7 \text{v} \times 42 \text{mA} = 0.29 \text{w}$$

$$\text{Infrared sensor} = 5 \text{v} \times 5 \text{mA} = 0.025 \text{w}$$

$$3 \text{ sensors so } 3 \times 0.025 = 0.075 \text{w}$$

$$\text{Raspberry pi} = 5 \text{v} \times 1.5 \text{A} = 7.5 \text{w}$$

$$\text{Mic} = 5 \text{v} \times 50 \text{ma} = 0.25 \text{w}$$

Motor as calculated is 13.08w

Suction motor 12v x 1.5A = 18w

Total power required = Add these ratings which is 39.91WH  
.The battery selection 12v 4.5ah which is 54WH (lead acid) .

which is more sufficient to run the robot more than 50 min (approx).

## IV. ELECTRICAL DESIGN AND METHODOLOGY

### 4.1 Working of the robot

We control the robot by using Master and slave method so we use raspberry pi as master and arduino uno as slave so if master send signal to the slave it should perform task according to the masters information . The primary task of the robot is to clean the dust particles through vacuum so there are IR sensors which is used to detect the object and sends the information to the micro-controller, It will act according to the command which is been programmed. The software used to program is embedded c and python .



## V. FABRICATION AND EXPERIMENTAL SETUP

The robot frame was constructed with aluminium sheet (4mm), the bottom base and top plate another set of top plate with foam material is placed over it due to the electrical setup which avoids short circuit act as an insulating material. The top plate is lifted and hold by the mild steel rod (8mm dia) with nut and the motors is fixed with L clamp (m4 x6 bolt & nut).

All the electrical components is placed in the top plate and the 3 sensors is fixed in bottom base in (45 , 90 , 135 ) degree and vacuum motor is placed behind the base .

### 5.1 Problems we faced

1. Mainly the weight constrain where a huge problem but some how we managed to distribute the weight accordingly but it affects while battery is low .
2. The chat bot responds slow and throws errors randomly sometimes it crashes .



Fig 18 Machining and 3D printing

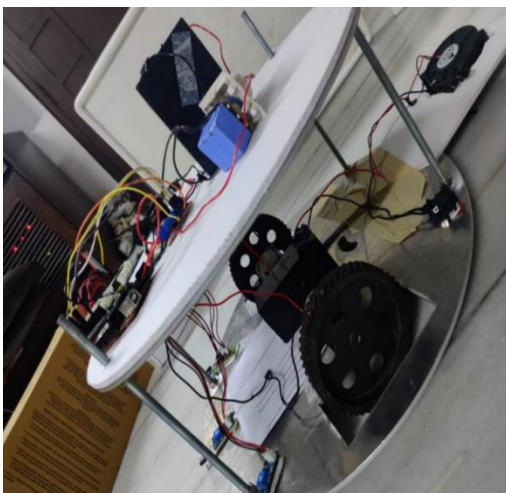


Fig 19- The Final working model

## VI. CONCLUSION

The Multifunctional robot for home application is been designed and tested in real time . The designed robot has been worked fine with the obstacle avoidance algorithm and chat bot responds fine through the voice command . After studying this report we have know that how the general robots will work, and knowing the construction and how mechanism work in the machine. We learn how the theoretical design is possible in practical. This machine is used for home application for physically challenged, elderly people Etc.

## VII. FUTURE SCOPE

The cleaning efficient can be improved by sufficient vacuum chamber and optimized algorithms .

Even all the home appliances can be control by AI power and learn new things .

Our project can be integrated with Image processing systems and can be used for Security surveillance.

It can also be automated completely and be used as an AGV( Automatic Guided Vehicles ) .

## REFERENCES

- [1] Varsha P.H. ;Lavanya V. ;Meghana K. ;Rohan P.S. ;Sneha R.“Sweepy – The Smart Floor Cleaner”2018 International Conference on Design Innovations for 3Cs Compute Communicate Control (ICDI3C).
- [2] Yueguang Li ;Wei Luo ;Lei Wang ;Lizhong Sun“Design and Control Research of Vacuuming Robot Cleaning Mechanism” 2015 International Conference on Computer Science and Mechanical Automation (CSMA).
- [3] Mao Lin ;Ji Xiaoming ;Qin Fei “A Robot Obstacle Avoidance Method Based on Improved Genetic Algorithm” 2018 11th International Conference on Intelligent Computation Technology and Automation (ICICTA).
- [4] Jieming Zhu ;Xuecai Gao ;YucangYang ;Hang Li ;Zhati Ai ;Xiaoyan Cui“Developing a voice control system for ZigBee-based home automation networks” 2010 2nd IEEE InternationalConference on Network Infrastructure and Digital Content.
- [5] Piyush Vashistha ;Juginder Pal Singh ;Pranav Jain ;Jitendra Kumar “Raspberry Pi based voice-operated personal assistant (Neobot)” 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA).