AN-Najah National University
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Vacuum cleaner

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Disclaimer:

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Abstract:

Nowadays, the world is facing an evolution in technology to make their lives easier and save time.

Since cleaning the house is essential and approached every day in people's lives.The project aims

to facilitate the cleaning of the house without the need for a human being and to save time.

The idea of the project is a vacuum cleaner that cleans by suctioning dirt. This broom is easy to use

and can clean in two ways. The first method is by itself without human

intervention with regular movement. It also bypasses obstacles and walks on

the

borders of the place until it finishes the cleaning process.. The second method

That the person controls its movement through a phone application connected to

the Internet and see the movement of the broom through an equipped camera that

transmits images to the user to see the movement of the broom and its location.

1. Introduction

1.1 Statement of the problem:

In the modern era, large buildings and large and wide facilities have become important elements indicative of development and with the rapid

lifestyle and with the spread of the use of technology and computerized techniques and their increasing importance and dependence on them, we came to the idea of establishing a vacuum cleaner from its advantages: saving time, effort and number of employees that can be applied in Palestine in companies and universities and huge buildings and houses.

1.2 Objectives:

The vacuum cleaner aims to save time and effort for the user, where the concerned area is cleaned without the need to supervise the place, as it is placed in the concerned area and follows the boundaries of the area without exceeding it and avoids obstacles without collision as it reduces the possibility of damage to the broom and cleaning can be done through Wi-Fi without the need to be in the same place The room is through a camera that transmits the image via Wi-Fi, which increases the speed of completing the work.

1.3 Significance of the work:

The vacuum cleaner is intended for large buildings, companies, and shopping centers that are Characterized by large areas. This will help save time, manpower, and effort.it also help in homes for people with disabilities who find it difficult to clean without the need for movement, as it cleans by itself.

1.4 Organization

This report has organized as follows: We explained about the idea, its importance and scope of work. Then the constraints we faced during our work including equipment, tools we used and earlier course work. In addition to finding similar systems to our project with different features, you can read about them to get a background on the project.We also explained the methodology of our work in addition to discussing the results we obtained.Ending it up with the conclusion of the whole work and what is our vision for the future to improve our work.

2. Constraints Standards/ Codes and Earlier course work

2.1 Constraints:

In general, the equipment was not as good as we needed. In the beginning, we faced the problem of friction of the wheels with the floor due to the heavy weight of the broom, which reduces its balance relatively, and we faced the problem of the camera needing a large number of pins, so the problem was solved by using another controller, and the problem of the IR sensor being affected by th lighting, so a sensor was used that distinguishes between only two colors, which are white And black.

2.2 Earlier coursework

Working on our project requires knowledge from some of the

courses we took in the computer engineering program, including:

Microcontroller: In the Microcontroller course, we learned basic information about a PIC microcontroller and how to program

hardware components. Also, in the PIC lab we learned how to

download the code to the PIC microcontroller and understand

each

pin and every feature in it. As a result, this course helped us

understand how to deal with the ESP32 in the project, so this

contributed mainly to help us start working on the project.

Electronic circuits :This course helped us to understand electrical circuits and how to deal with them and to identify the connections of these circuits .

2.3 Literature Review:

Cleaning large buildings and homes requires quite a bit of effort

and time for individuals, especially the working class, so it was

used to save time and effort The vacuum cleaner contains a sensor that distinguishes between two colors, black and white and is used to know the borders of the carpet. The fan is turned on when you manually press the operating button to start suctioning dirt, and it moves automatically using an ultra

sonic to avoid obstacles and move smoothly. The third mode is via local wifi. The camera is used to transfer the image connected to the ESP32. It contains a web page, video streaming is done, and the camera

communicates serial (UART) with the other esp32 to control the movement of the wheels to move according to the instructions

given by the esp32 camera forward, backward, right, left, or stop .

2.4 Standards/ Codes:

The following list contains the hardware components that have been used in our project

Ultrasonic:

Ultrasonic devices are used to detect objects and measure distances. by emitting ultrasonic sound waves.

Figure 1: Ultrasonic sensor.

DC Motor:

Plastic DC Gear Motor to move wheels.

Figure 2: DC

ESP32cam:

This ESP32-CAM module can be widely used in various IoT applications. It can be used as a face detection system in offices, schools and other private areas and can also be used as wireless monitoring, QR wireless identification, and many other IoT applications.

Figure 3: ESP32 cam

ESP32 wroom:

ESP-WROOM-32 is a Wi-Fi module equipped with a chip called ESP32 provided by Espressif Systems and capable of Wi-Fi and Bluetooth (BLE) communication. It is slightly larger than ESP-WROOM-02, but it still is small. The module also has the advantage that Arduino programs can be written (that is, the module can be used as part of Arduino), Wi-Fi communication is supported, and the cost is lower.

Figure 4: ESP32 vroom

Relay:

Use to employment fan

Figure 5: Relay

Suction fan12v 70mmx15mm 2pin:

The fan is used to suck out dust and dirt.

Figure 6: fan

Buck Convertor:

DC-DC converters or choppers are power electronic circuits which convert a fixed DC input to a variable DC at the output. The Buck converter is a form of a DC-DC converter which steps down the level of supply voltage and provides it at the output. To understand how a Buck converter works.

Figure 7: Buck convertor

Wires:

Using Male-Female and Male-Male:

Figure 9: Male-male wires. Figure 8: Male-female wires.

Driver L298n:

L298N module is a high voltage, high current dual full-bridge motor driver module for controlling DC motor and stepper motor. It can control both the speed and rotation direction of two DC motors. This module consists of an L298 dual-channel H-Bridge motor driver IC. This module uses two techniques for the control speed and rotation direction of the DC motors. These are PWM – For controlling the speed and H-Bridge – For controlling

rotation direction. These modules can control two DC motor or one stepper motor at the same time.

Figure 10:Driver L298n

IR sensor:

The sensor is used to distinguish between the color of the carpet and the color of the tiles.

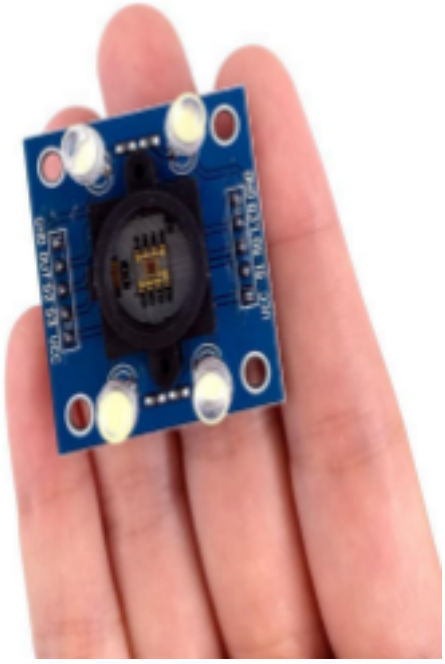


Figure 11: IR sensor

Wheels&Motors:

Figure 12:wheels &Motors

Lithium Batteries:

Each one 3.7 volt.

Figure 13: Lithium batteries.

3. Methodology

This is a report on a project in which a vacuum cleaner was implemented that performs cleaning and tasks with an advanced system that uses a smart phone to control the machine and its movement connected to the Internet. So, this project includes two parts

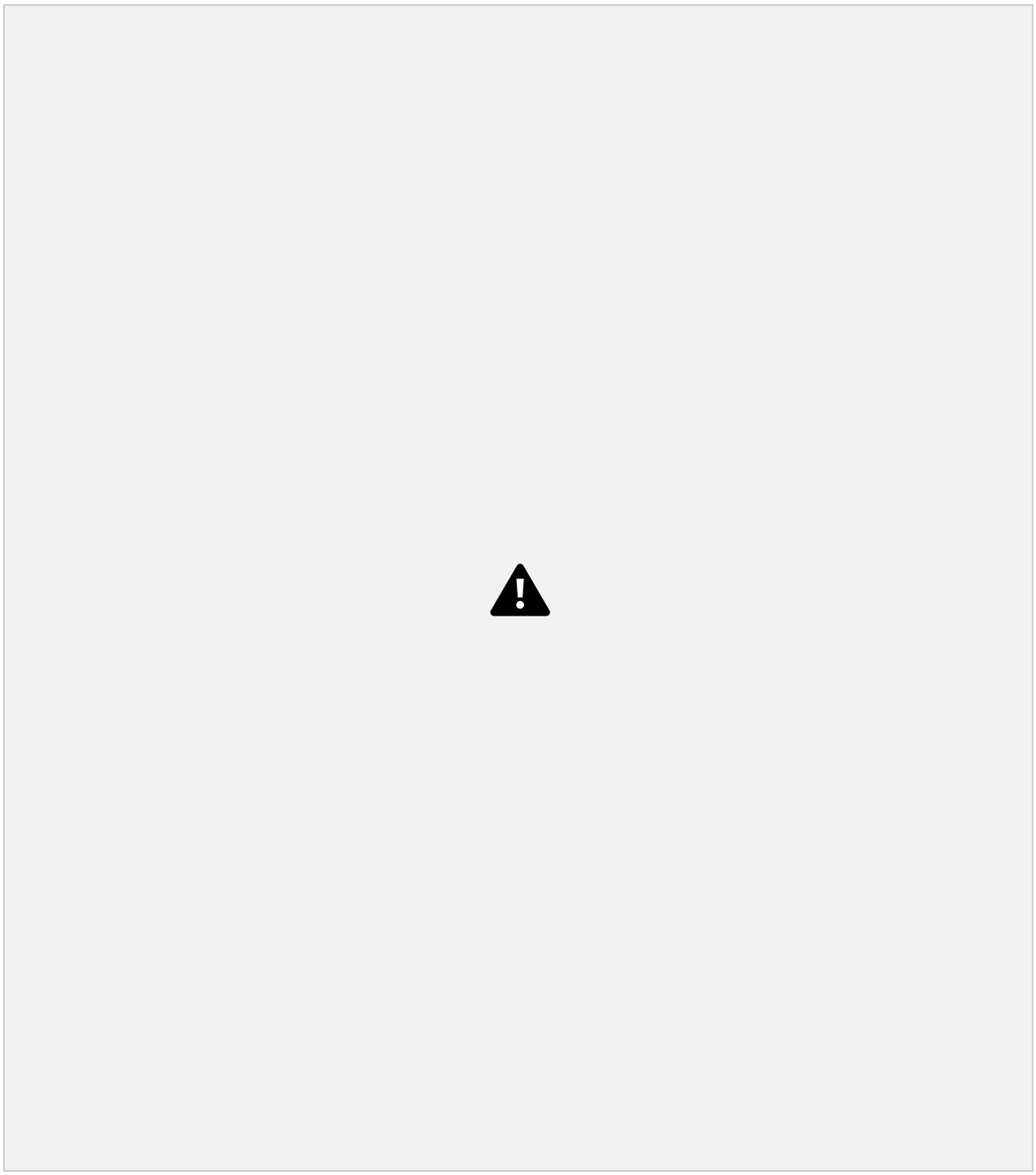
3.1 TheVacuum cleaner

This is a report on a project in which a vacuum cleaner was implemented that performs cleaning and tasks with an advanced system that uses a smart phone to
control the machine and its movement connected to the Internet.

So, this project includes two parts:

4.1 Vacuum Cleaner

Figure 14: Design the car.



Used component:

1. 4 DC- motor + 4 Wheels
2. 3 ultrasonic sensors
3. IR sensor detection color light and dark color.
4. Wi-Fi – esp8266 using mobile application to control the robot using

switch ON-OFF 5-fan and relay to employment fan
6-ESP32cam
7-ESP32wroom
8-Driver L298n
9-Ultrasonic sensor holder
10-Buck convertor

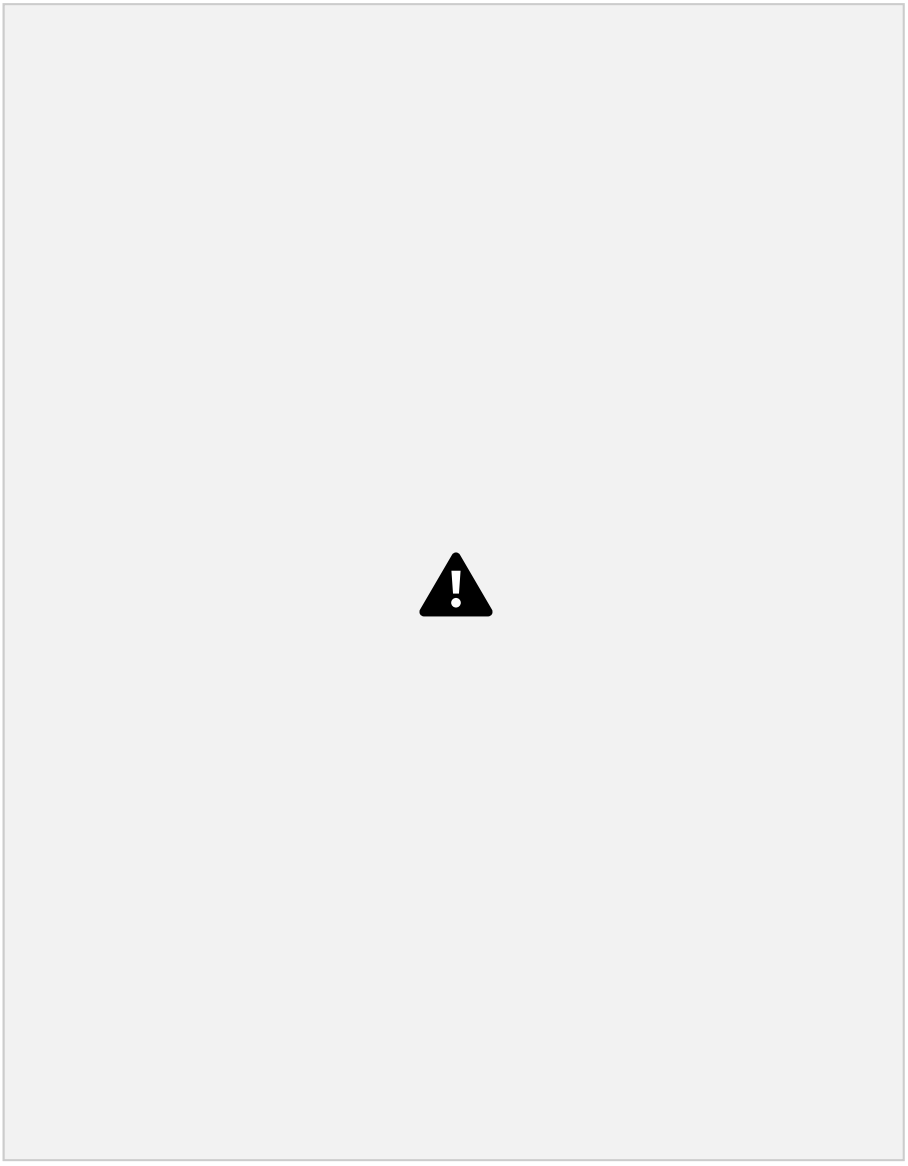


Figure 15: web application.

4.1.2 Implementation

Hardware Development

To build this project, we went through the following steps:

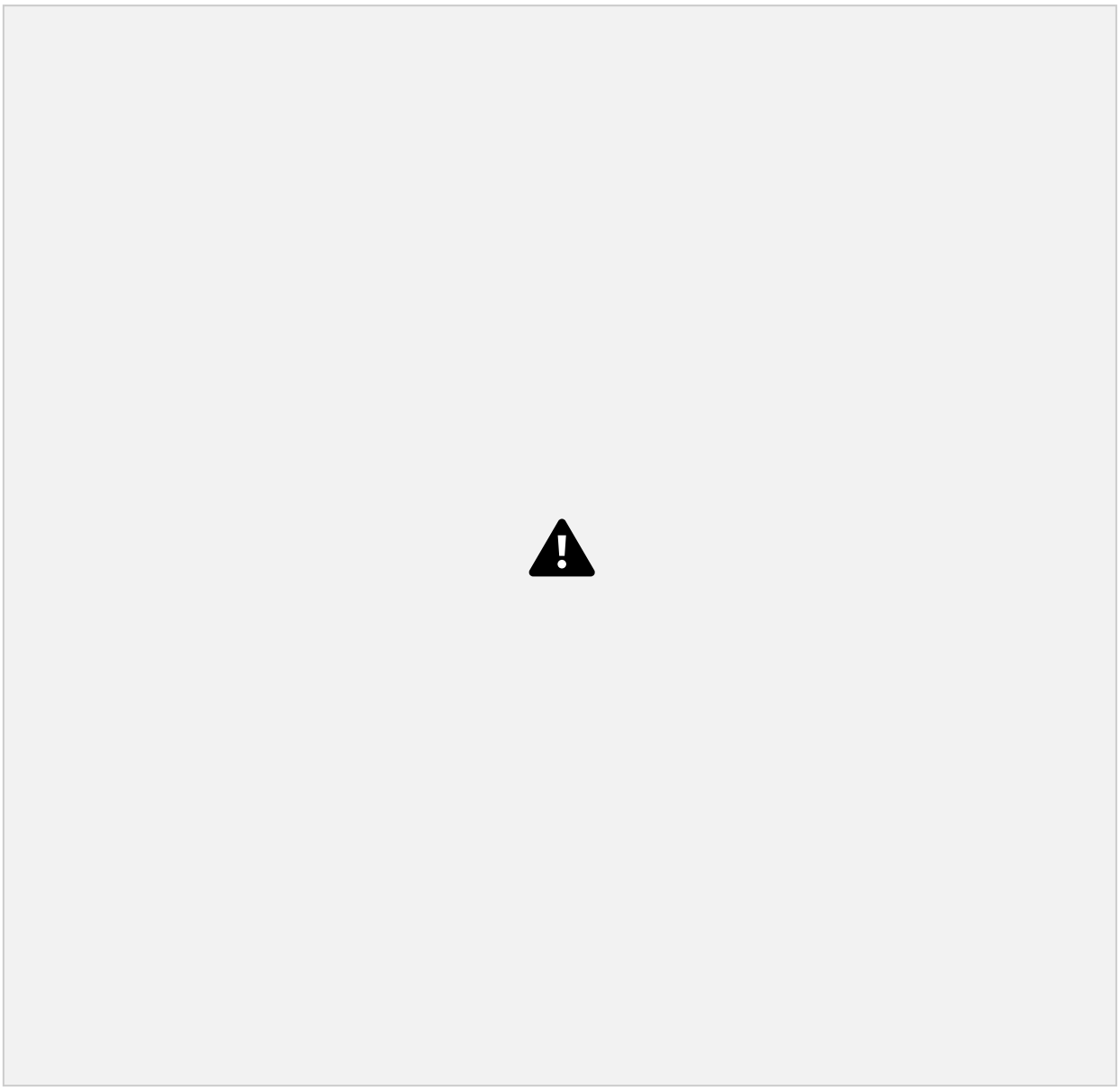


Figure 17 :Cart Design

The libraries we used:

```
#include "esp_wifi.h"
#include "esp_camera.h"
#include <WiFi.h>
#include <HardwareSerial.h>
```

definitions on the code:

For control to wi-fi and serial and speed of motors add to flashing

```
HardwareSerial EspSerial(2);

/* Wifi Crdentials */

 const char* ssid = "iphone";

 const char* password = "12345678";

#define CAMERA_MODEL_AI_THINKER

#define PWDN_GPIO_NUM 32

#define RESET_GPIO_NUM -1

#define XCLK_GPIO_NUM 0

 ****************************************************

 {


//

void initFlash() {

  ledcSetup(7, 5000, 8); /* 5000 hz PWM, 8-bit resolution and range from 0 to 255 */

  ledcAttachPin(FlashPin, 7);

  /* Connecting to WiFi */

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {

    delay(500);

    Serial.print(".");

  Serial.println("' to connect");
```

```
/* Flash led */
 for (int i = 0; i < 5; i++) {
  ledcWrite(7, 10);
  delay(50);
  ledcWrite(7, 0);
  delay(50);
 }
```

For RTC:

```
//-----------------------------------------------------control the wheels and direction mode left or right or front or back

#include <HardwareSerial.h>

#include <NewPing.h>

#define SONAR_NUM 3 // Number of sensors.
#define MAX_DISTANCE 200 // Maximum distance (in cm) to ping.



}

    ***** goForward();

     timer = millis();

      sensorReading = digitalRead(IRpin);
```

```
    while (sensorReading == 0 ) {
      sensorReading = digitalRead(IRpin);
      if (millis() - timer > 3000) {


      }
      }
******
    turn180degRight();
    delay(1000);
    sensorReading = digitalRead(IRpin);
    if (sensorReading == 1) {
      Serial.println("finish");
      goto finish;
    }
******
    goto Start;
finish:
    finishFlag = 1;
    digitalWrite(FanPin, 0);
  }
 }
```

```
if (digitalRead(switchPin) == 0) {//manual mode

 if (TestSerial.available()) {

  buff = TestSerial.readString();

  Serial.println("--------");

  Serial.println(buff);

  Serial.println("--------");



  if (buff.indexOf("speed") >= 0) {

   speed = (buff.substring(buff.indexOf("speed") + 5, buff.indexOf("#"))).toInt();

   Serial.println("speed:" + String(speed));

  }



  }

  else if (buff.indexOf("Turn Left") >= 0) {

   Serial.println("Turn Left");
   /* Controlling the motor with PWM */

   /* ledcWrite(Channel, Dutycycle) */

   ledcWrite(3, speed);

   ledcWrite(4, 0);

   ledcWrite(5, speed);

   ledcWrite(6, 0);
```

```
    }


        }



void goBackward() {
  Serial.println("Backward");
  /* Controlling the motor with PWM */
  void turn180degLift() {
  Serial.println("turn180degLift"); /*
  Controlling the motor with PWM */ /*
  ledcWrite(Channel, Dutycycle) */


void turnRight90deg() {
  Serial.println("turnRight90deg");
  ledcWrite(3, 0);
  ledcWrite(4, Autospeed);
  ledcWrite(5, 0);
  ledcWrite(6, Autospeed);
  delay(turnRight90degDelay);
  stopMotors();
```

```
}


}


void AvoidObstacleOnBackward() {
  turnRight90deg();
  leftReading = sonar[leftSensor].ping_cm();
  Serial.println("leftReading:" + String(leftReading));
  while (leftReading < 15 && leftReading > 2) { }
  delay(500);
  stopMotors();
}
```

5. Discussion:

We have created a prototype for the vacuum cleaner, which performs cleaning in a modern and developed way, and one of its most important characteristics was distinguishing between the borders of the carpet and the floor alone without human intervention, in addition to that it is equipped with a camera that broadcasts to the user live pictures of the movement of the robot and the space in which it is, which facilitates the user's monitoring of that Broom without staying alone through the local internet.

In addition, that is, when the puller is finished, it stops by itself and avoids the obstacles that it encounters on its way.. and they faced problems in dealing with the robot and with the motors and wheels used and the irregular movement of the robot as a result of installing the wheels, as it requires accuracy Also, there were problems

in the process of transferring images via the Internet, which blocked your imagination due to the inaccuracy of the image in the transfer and its dependence on your Internet speed in each area, which made it difficult to perform tasks.

6. Conclusions and Future work:

At the end of the project, we were able to build a prototype of the vacuum cleaners that will help clean the dirt, as it is based on saving time and effort through its own movement for cleaning and knowing its limits without the need for human intervention, in addition to the possibility of controlling it remotely via the camera and the smartphone application that facilitates the use of This broom.
For future work, we can improve our project by making this vacuum cleaner self-charging. When it runs out of charge, it can move to its charging point. It is possible to add a feature when the machine bag is full of dirt to go and empty the bag in the trash or in a place designated for emptying it.

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