An-Najah National University

Faculty of Engineering & Information Technology

Department of Computer Engineering

Hardware Graduation Project

Noo-Noo
Cleaner Robot

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Presented in partial fulfilment of the requirements

for **Bachelor Degree in Computer Engineering**

Acknowledgment

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Disclaimer

Both of “Mohammad Saleh” Issam Dwikat and Ala’ Kamal Mashaqi wrote and edited this report and we would like to point to that this report has not been reviewed and audited by any expert, and therefore it may contain spelling or linguistic mistakes or as well as informational mistakes.

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Abstract

Cleanliness and a healthy environment are the basis for individuals' health, their distance from diseases, and their psychological happiness in life.
People naturally tend to be clean, and seeing clean things comfort them psychologically. The problem they deal with is the effort to clean places, whether it is a house, land, or otherwise. One of the most common cleaning processes that people do on a daily basis is cleaning the floor of the house or carpets, as a result of its exposure to continuous and continuous use, which makes it in need of continuous cleaning, and the manual cleaning process. The body overwork because it requires muscular effort, whether by using a vacuum cleaner to clean the carpet or by using scrapers to scrape the floor.

Noo-Noo is a solution to help people to clean floors and carpets without any effort just by launching it and then it will clean everything alone in an easy effective way.
This would make it easy for everyone to have well-cleaned places and give them healthy and happy lives.

Chapter 1

Introduction

Dirt is put in as a health hazard because diseases and dirt are co-exit [1]. Some types of dangerous bacteria live in many conditions in which there are dirt and unclean surfaces and they are adapted to living in them. This endangers the health of individuals by being exposed to any of these bacteria that come from different places for example the soil, which stick to shoes when leaving the house and coming back or any other way to enter living or working places, which leads to dirty floors, carpets and surfaces. Many of these bacterial diseases are transmitted directly through infection, such as direct pollination or contamination of food or through the air and transmission of infection through the nose. This can cause various diseases related to the digestive system, respiratory system or skin [2].

The above shows the necessity to pay attention to hygiene, cleaning and maintaining the cleanliness of the house, workplace or residence. When we talk about the cleaning process, the predominant processes in the world are manual cleaning operations, whether using scrapers or brooms, which are used on a daily basis in all places around the world. But despite the use of manual methods in cleaning to a large extent, it has many drawbacks that affect the people, which people do not pay attention to because they considered it the only methods of cleaning, so they did not pay attention to its negative aspects, which are many.

When we say manual cleaning process whether it is in the house, on work, cleaning floors, or cleaning carpets we can't not mention the efforts it takes to clean and finish the cleaning process. As it’s known, the cleaning process requires manual and muscular effort, which exhausts the muscles and the person in every cleaning process. The wrong movement or cleaning incorrectly can negatively affect the correctness of the assignment and cause joint, back, skin and other diseases which require people to use and buy protection equipment during the cleaning process, such as gloves or masks, which itself also represents an increase in the cost and extra effort of the cleaning process.
In addition to that, a lot of cleaning equipment and protection equipment that are not

permanent and harmful to the environment is used extensively and daily, it is used in many numbers and is ineffective and accumulates to end up in garbage containers, which it is not known where it will end up whether badly or well. We also can’t not mention the cost of all of these equipment.

Noo-Noo Robot came to solve these issues and to make life easier. Noo-Noo is a cleaning Robot built to clean places’ floors and carpets by itself without any effort from the users just by turning it on and putting it on the start path to clean it starts cleaning directly, it has a scraper and a broom for cleaning it has also a pump that pumps water to wipe it up with the scraper.

Mainly Noo-Noo has two modes wiping up with the scrapper and sweeping with the broom you can control the mode you want whether you want to wipe up or sweep. The scrapper built in an efficient way to wipe up directly and easily in all conditions as well as the broom. Noo-Noo has an optimized design and is user friendly.

With Noo-Noo you won’t make an effort. It will keep you comfortable and rest also you don’t always need to buy a scrapper or a broom as its’ mentioned the scrapper and the broom in the robot are efficient enough. Regarding the protection equipment because you no longer need to swipe manually so there is no fear from the cleaning process and you don’t need to to buy protection equipment.

Chapter 2

Literature Review

There are many cleaning robots built to clean in different ways, IRobot Roomba Vacuum is one of the most famous Robots used to clean using broom. It has a mobile application provided to control the cleaning operation and a powerful design implemented in a modern and user friendly way to help [3].

Another robot built specially for washing is Shine bot W400 it also uses a mobile application for controlling the path and the operation of cleaning and it has components separated from each other in a way to separate the clean and the dirty water [4].

Neato D7 is an Intelligent robot that uses laser to detect objects and it goes far distances that make it able to clean the house in different areas[5].

The main feature of the Noo-Noo robot is that it is used for sweeping and for scraping or wiping together, as it basically has these two properties and this is what distinguishes it here, as most of the robots spread in the world are either for the purpose of sweeping alone or for the purpose of scraping alone, while the Noo-Noo robot is designed for both, it is also equipped with a water pump that spray a spray of water to be wiped or scraped off by the skimmer and it is attached in an effective and easy way to use.

The other feature of the robot Noo-Noo is that it works automatically, it has special sensors and motors to work automatically and this is what distinguishes it from others, most other robots are controlled manually, either through a phone application or through a wired or wireless control device that is custom built for this robot, while the Noo-Noo robot is attached to it automatically by simply placing it at the beginning of the path designated for it, it moves on its own and moves on the carpet as well and is committed to its presence within the perimeter and edges of the carpet, and this in itself distinguishes Noo-Noo robot from other cleaning robots.

Noo-Noo robot is not only works automatically at the request of the user, but it has been modified and set a special mobile application to be controlled manually when needed if the person is forced to do so or in the event of a malfunction in the automatic operating system, and this makes the robot Nuno work with two systems. Manual and automatic system. Thus,

to it and incorporated these features in addition to adding new useful and effective Noo-Noo robot has included most of the features and features found in cleaning robots similar features and features that facilitate the cleaning process further, increase productivity, and ensure clean floors or carpets.

Chapter 3

Methodology

3.1 Overview

After reviewing the data and reading about latest cleaner robot and as it's mentioned in the literature review it was obvious the advantages that Noo-Noo robot functionalities has, how much it would add to the concept of cleaning and for sure how much using Noo-Noo robot would make life through cleaning much easier, healthier and help people a lot.
The process of building Noo-Noo robot is divided into two main steps: Collecting and building the hardware and the second step is building the software for the hardware.

3.2 Collecting and building the hardware

First the tools and the equipments that we used in building Noo-Noo Robot which were all based from current and local stores and suppliers in our country

3.2.1 Hardware tools and components

- Arduino uno

  Arduino uno is the Microcontroller that we used in our robot which is connected to Arduino Software IDE it is the most used bored of all Arduino boards and that's because it has a rich documentation[6], all requirements and lots of components it has a 14 digital (input and output) pins you can use 6 of them as pulse width modulation it has an input that you connect it with usb wire to your pc when you want to download the code on it, also it has a power input so that you can use it without connecting it to pc just with source power like batteries.
  A reset button to reset the process of the code,

a 16 header and 6 analog inputs it also has VCC(3.3 volt and 5 volt) and GND. The reason of using it with our robot is that it has a sufficient number of inputs and outputs that can be connected with our robot components, it is also one of the most robust boards in the arduino family and as mentioned it has a very rich documentation and the Software IDE for it is simple and also easy to use which makes it easy to connect the hardware withe the software in building the robot. Arduino uno is also used because it is available in the market so it is easier to reach than other microcontrollers that might take a lot of time to reach them and if any mistake or fault happened to the Arduino we can provide directly another one.

Figure 3.1: Arduino uno microcontroller

- Servo Motors

  We used Servo Motors with type MG996R and we choose this type specially because it has a high speed with high Torque strength because we need to depend on them with holding up the scrapper and the broom and controlling them so we needed a strong Servo Motor for that and the MG996R achieved the this purpose. MG996R is High Torque Metal Gear Dual Ball Bearing Servo[7] and it has a suitable weight of neally 54 g and a suitable size that can be placed in an efficient

place and position without disturbing or affecting other components.
MG996R Servo Motor has 3 pins for VCC, GND and the last one is for signal which hen you connect them and then we can control the signal and the angle from the code for the amount e we want it to turn to pick up or pick down the scrapper and the broom.
We used 3 Servo Motors, one of them to control the scrapper and two of them to control the broom.

*Figure 3.2:*MG996R *Servo Motor*

- DC Motors

  For dc motors we used two main Dc Motors connected to two wheels, these Two Dc motor are Hennkwell Dc Gear motors which they have more Torque strength than the normal or default Dc Motor and we used them because we wanted to connect them with wheels connected to sprockets, so because of the sprockets we needed a higher strength to handle and adapt the movement of these sprockets which they are connected to the wheels.

Also because of the weight of the robot it needed a strong moving base that can handle it and move freely and efficiently.

Figure 3.3: Hennkwell Dc Gear Motor

- H-Bridge

  We used L298N Dual H-Bridge Module and we used two H-Bridge modules one of them to control the two DC Motors that are connected to the wheels to control the direction and the movement of the robot and the other H-Bridge is connected to the scrapper and the broom to control the modes weather it scrapping or brooming.
  To control the direction of the Dc motors we Just need t o inverse the current on the motor that we want to change the direction for it and that's how H-Bridge helps us, In H-Bridge we have 4 switching components transistors or Mosfets and the main motor in the center that made circuit looks like H and the inversing direction process works be turning on two switching components and turn off the other which will let the motor work in a specific directions and inversing the process by turning on the other two motors and turning off the current working ones will invert the direction.

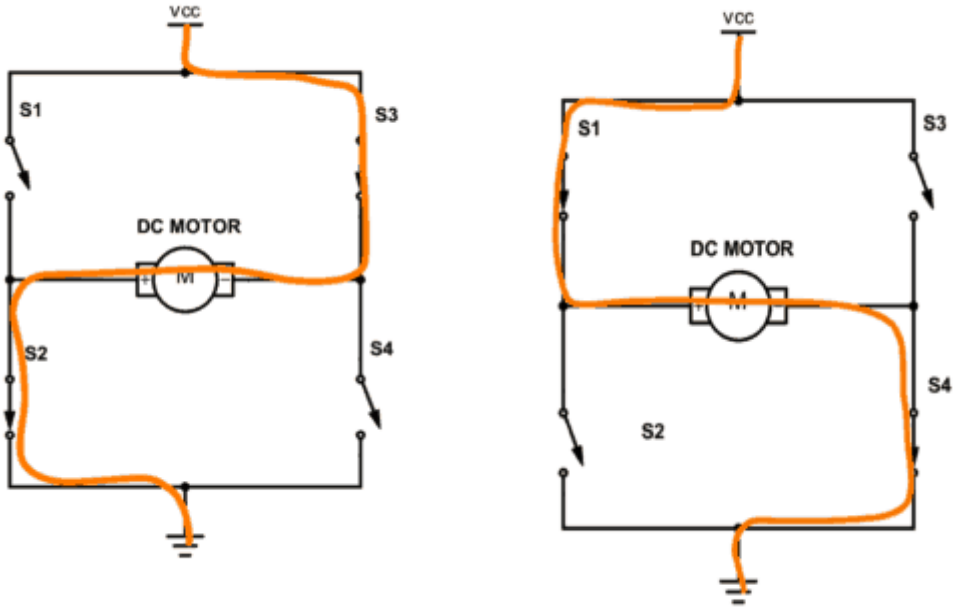

Figure 3.4:H-Bridge Process of work

H-Bridge has 4 pins for each motor you want to connect it, also it has 12 Volt, GND and 5 volt pins to connect

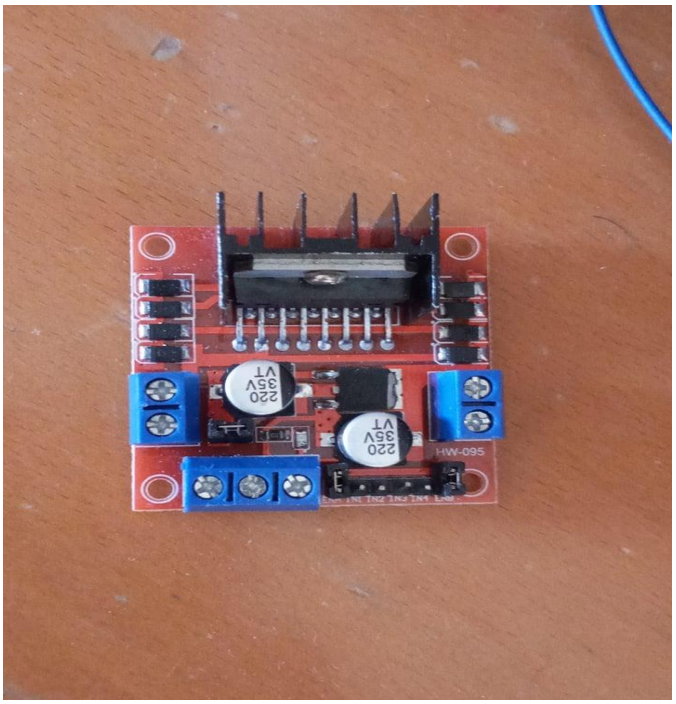

Figure 3.5:L298N Dual H-Bridge

- Ultrasonic Sensors

  The concept of ultrasonic sensors is that they measure the distance that an obstacle or an object is away from it and that happens by sending ultrasonic waves and then a sound reflection will be back and the ultrasonic will convert it to electrical signal[8].

  Three main Ultrasonic sensors were used to detect obstacles in the front, left and in the right this would make the process of detecting obstacles and moving very efficient, the algorithm for detecting built to check on all cases whether there are any obstacles on any side or not.

Figure 3.6:UltraSonic Sensor

- GyroScope GY-271

  GY-271 (hmc5883l) is a module for detection the direction when the robot is going to right or to left to and this came by the bending of the moduly it measures the angle and in this case every angle has a specific value for it and when moving to the left it increases also when moving to the right it decreases so you can control the turning operations of the robot.

Figure 3.7:GY-271 hmc58831

- Bluetooth module

  We used the HC-05 Bluetooth module which is a mould used to connect two microcontrollers together which in our case are the Arduino and the Mobile Phone. It works on the concept of sending serial data communication from sender to receiver.

  The HC-05 module has VCC which is preferable to be connected on 3.3 volt also it has a GND, RXD and TXD which both depend on the Universal Asynchronous Receiver and Transmitter (UART).

  So this module used to control all of the components like the sensors , scrapper, broom, robot movements.

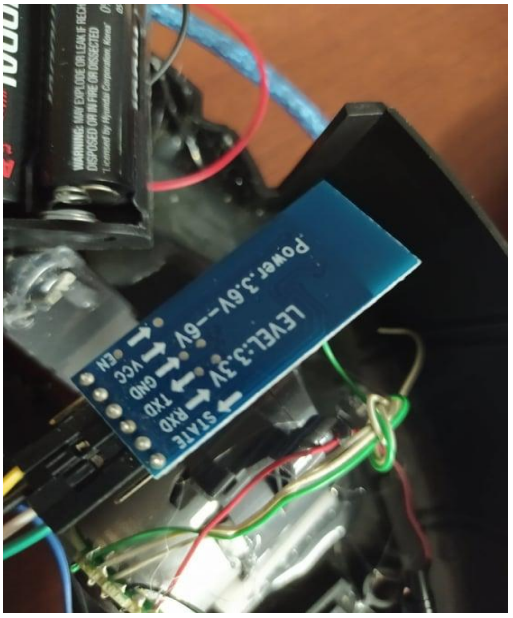

Figure 3.8:HC-05

- Pumb

  In the process of cleaning before the scrapper swipes the floor it needs the floor to have some water on it to make the process of swiping efficient so a Pump was provided to spray water before the swiping process and it has a container to fill it with water as wanted.

  The Pump was put next to the Robot because it has a strong carrying base and it was provided with a strong base to carry the body of the Pump itself and a hosepipe was connected to it and extends to the front of the robot in this way the robot will be kept protected from the water because of the position of the Pumb and the hosepipe are away from its external components.

Figure 3.9: Pumb

- IR Temperature Sensor

  We used module MLX90614. The reason for using it is to detect the edges of the carpet when the robot is moving on it so that it doesn't go out of the boundaries of this carpet and that was by measuring the Temperature of the surfaces and the difference between them.

  The concept that MLX90614 Temperature Sensor works on in this case is that at first it measures the temperature of the room and surroundings and then any object was put in front of it it measures its temperature and when the robot is moving on the carpet it measures the temperature of the carpet if the temperature sensor escapes the edges it will measure the temperature of the floor which will be different than the carpet and in this case the robot will escaped the carpet so it will be redirected on the path to make it stay on it.

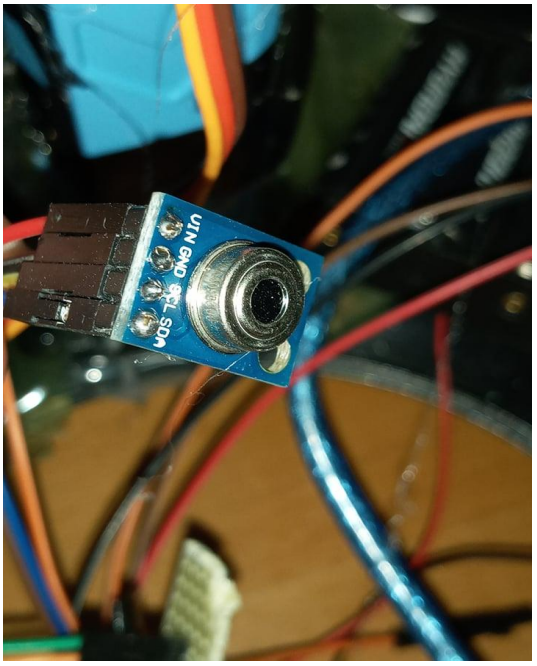

Figure 3.10: IR Temperature Sensor

- Relays

  We used Relay to pass higher voltage to the pump

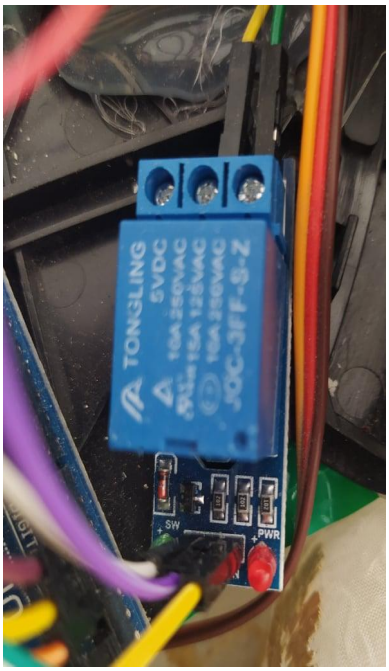

Figure 3.11: Relay

3.2.2 Building the hardware

The process of building the hardware was a combination of hardware and software because the core of the process was building the robot component by component separately and each component was tested on the Arduino Software IDE if it works and then trying its principles if they are applicable.

- Building the Base

  The base of the robot was made by collecting old parts and equipment, re-designed and reconfigured to be the base of the robot, and it was re-designed in a circular way. A strong plastic type was chosen so that all the components of the robot would be based on it, so it was necessary to be strong in order to handle and take care of all the components above it. Two holes for the main wheel were made, a hole for the right wheel connected to its own DC Motor, as well as a slot for the left wheel that was also connected to its own DC Motor, as well as a slot for the front wheel.

Also, a special area has been built for the broom, which will be at the bottom of the robot to use the space.Thus, the robot has a robust, strong base that utilizes space in a reasonable size and is suitable for use.

- Connecting wheels

  The main wheels with the direction of front and back were connected to the robot for moving operation before connecting them. The wheels were tested by testing them with the DC Motors then testing them with the H-Bridge after that it was shown that they were working fine and then they were connected to the base of the robot.

  A wheel that moves in all directions was connected to the front of the robot and this would make the robot flexible in movement.

- Connect Bluetooth module HC-05

  The bluetooth module was connected to test the wheels and its work wirelessly. It was connected to Mobile Application and the Mobile was configured with specific buttons to control the robot

- Connecting and testing sensors

  Three ultrasonic sensors were connected in addition to the Temperature sensor and also GY 271 was connected for direction detection.

- Connecting the scraper

  A technique was followed to connect the scrapper in an efficient way, a circular piece of hard plastic was wrapped with a special piece for scraping and wiping, and then they were fixed tightly together. They were connected with the robot using a single servo motor through its head with ropes that depend on the force of lifting and lowering, and a special balance was made for the ropes in order to hold them in a steady manner and for the process of dropping the clamp to be effective so that it covered all sides of the scraper on the ground and the servo motor is made to wind at a certain angle, suitable and effective.

- Connecting the broom

  The broom is placed in the middle of the robot from the bottom so that the entire available space in the robot is used and so that it is suitable for the design, shape and composition of the robot so that location was appropriate in terms of design and utilization of the available space.

  Two Servo Motors were connected to the broom from the front and the other was from the back, the two servo motors worked to raise and lower the broom according to a certain angle.

- Connecting the Pump

  The pump was placed next to the robot away and separated from its components so no conflict or damage could happen between the water and the robot's components and a water pipe was extended from the pump to the front of the robot through the scraper.

3.3 Building the software

The software was built using Arduino IDE and was on steps

- Initializing variables

  First of all libraries used are <VarSpeedServo.h> which was used to handle the Servo Motors, the <Wire.h> library is used for , the <Adafruit_MLX90614.h> is used for. The used variables were initialized at first for the used pins like the Motors, the sensors and objects.

```
#include <VarSpeedServo.h>
#include <Wire.h>
#include <Adafruit_MLX90614.h>

//Motors PIN
int IN1 = 4; //Motor1 Wheel 1
int IN2 = 5; //Motor1 Wheel l
int IN3 = 6; //Motor2 Wheel 2
int IN4 = 7; //Motor2 Wheel 2

//UltraSonic sensor 1
int commonTrig = 9;
int eco1 = 8;

//Utrsonic sensor 2
int eco2 = 11;

//Utrsonic sensor 3
int eco3 = 10;
int trig3 = 13;

// Readed char from Mobile APP
char c = 1;

//Pins for servo motors
int servoScraperPin = A2;
int servoBroomPin = A3;

// Objects to control the servos motors
VarSpeedServo servoScraper;
VarSpeedServo servoBroom;

//IR temperature Sensor object
Adafruit_MLX90614 mlx = Adafruit_MLX90614();

//Relay's Input to enable Water Bumb
```

- Setting up Modes

  The second part was for setting up Modes (Inputs/Outputs) and then giving the Servo Motors the angle that needed to be used then starting typing the functions.

```
//Relay's Input to enable Water Bumb
int relayBumb = 12;

void setup()
{
  Serial.begin(9600);
  pinMode(eco1, INPUT);
  pinMode(commonTrig, OUTPUT);
  pinMode(trig3, OUTPUT);
  pinMode(eco2, INPUT);
  pinMode(eco3, INPUT);
  pinMode(IN1, OUTPUT);
  pinMode(IN2, OUTPUT);
  pinMode(IN3, OUTPUT);
  pinMode(IN4, OUTPUT);
  pinMode(relayBumb, OUTPUT);
  pinMode(servoScraperPin, INPUT);
  servoScraper.attach(servoScraperPin);
  servoScraper.write(0,120, true);
  pinMode(servoBroomPin, INPUT);
  servoBroom.attach(servoBroomPin);
  servoBroom.write(130,255, true);
  digitalWrite(relayBumb, HIGH);
  mlx.begin();
}

void shotWater(){
    digitalWrite(relayBumb, LOW);
    delay(800);
    digitalWrite(relayBumb, HIGH);
}

void turnOffSystem(){
    stopMovment();
    turnOffBroom();
    turnOffScarper();
}
```

- Writing functions

  To work in an Object Oriented structure every operation needed was put into a function to handle it.

```
74  float getAmbientTemperature(){
75    return mlx.readAmbientTempC();
76  }
77
78  float getObjectTemperature(){
79    return mlx.readObjectTempC();
80  }
81
82  void turnOnScarper(){
83    servoScraper.write(180,100, false);
84  }
85
86  void turnOffScarper(){
87    servoScraper.write(0,255, false);
88  }
89
90  void turnOnBroom(){
91    servoBroom.write(180,100, false);
92  }
93
94  void turnOffBroom(){
95    servoBroom.write(130,255, false);
96  }
97
98  void moveBack(){
99    digitalWrite(IN1, HIGH);
100   digitalWrite(IN2, LOW);
101   digitalWrite(IN3, HIGH);
102   digitalWrite(IN4, LOW);
103 }
104
105 void moveFront(){
106   digitalWrite(IN1, LOW);
107   digitalWrite(IN2, HIGH);
108   digitalWrite(IN3, LOW);
109   digitalWrite(IN4, HIGH);
```

- GyroScope Configuration GY -271 for rotation Direction

```
//get co-ordinates
int getCoordinates(){
    compass.read();
    int coordinates[3];
    coordinates[0] = compass.getX();
    coordinates[1] = compass.getY();
    coordinates[2] = compass.getZ();
    Serial.print(coordinates[0]);
    Serial.print(" ");
    Serial.print(coordinates[1]);
    Serial.print(" ");
    Serial.println(coordinates[2]);

    return coordinates[0];
}
void autoScarper(){
  moveFront();
  shotWater();
  bool flag = getDistanceLeft() < 20;
  int xCor = getCoordinates();
  int counter = 0;
  int i = 0;

  while(true){
    Serial.println("Front");
    int f = getDistanceFront();
    if(f < 20 && f != 0){
      if(!flag){
```

- Configuring buttons with Mobile App

  A mobile Application was used to control the robot manually and it was (Arduino Bluetooth Controller) on the Mobile Application the buttons were configured and in the Arduino Software IDE also.

- Algorithms used

  ZigZag algorithm which has the concept of starting from a start point and when reaching an obstacle rotate to the other side and move again as shown in the figure below.

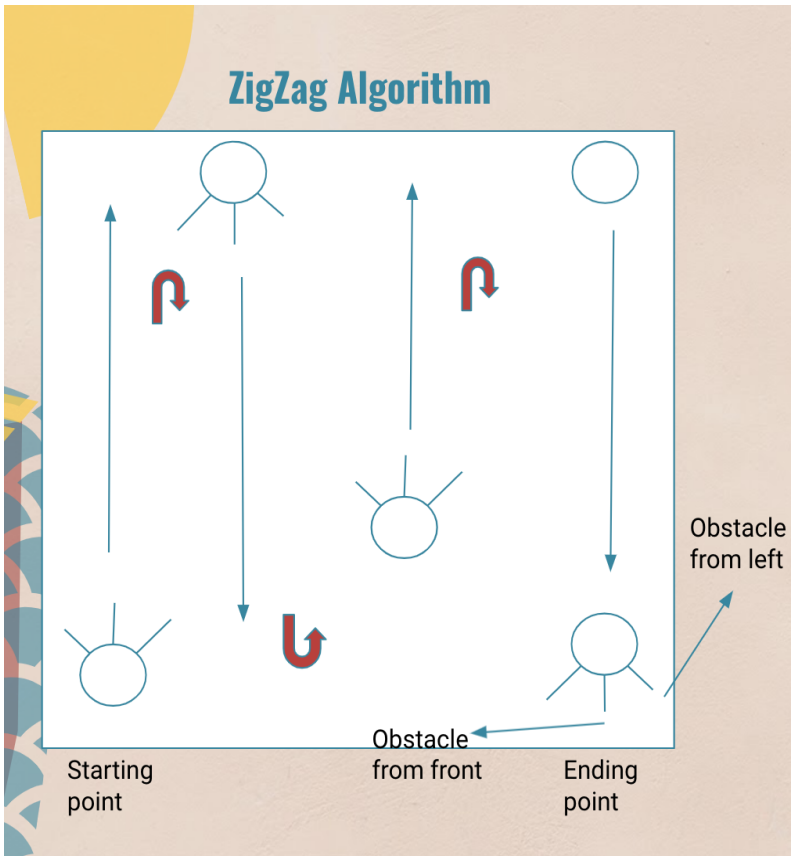

Figure 5.1: ZigZag Algorithm

```
void autoBroom(){
  moveFront();
  bool flag = getDistanceLeft() < 15;
  int *x ;
  x = getCoordinates();
  int xCor = x[0];
  float temp = getObjectTemperature();
  while(true){
    if(getDistanceFront() < 15 || temp + 2 >  getObjectTemperature()){
      if(!flag){
        if(getDistanceLeft() < 15 || temp + 2 >  getObjectTemperature()){
          stopMovment();
        }
        else{
          moveLeft();
          while (xCor + 1000 >= x[0]){
            x = getCoordinates();
          }
          moveFront();
          flag = true;
        }
      }else{
         if(getDistanceRight() < 15 || temp + 2 >  getObjectTemperature()){
          stopMovment();
          break;
        }
        else{
          moveRight();
          while (xCor + 1000 >= x[0]){
            x = getCoordinates();
          }
          moveFront();
          flag = false;
        }
      }
    }
  }
}
```

```
  shotWater();
  bool flag = getDistanceLeft() < 20;
  int *x ;
  x = getCoordinates();
  int xCor = x[0];
  while(true){
    if(getDistanceFront() < 15){
      if(flag){
        if(getDistanceRight() < 15){
          stopMovment();
        }
        else{
          moveRight();
          while (xCor + 1000 >= x[0]){
            x = getCoordinates();
          }
          moveFront();
          flag = false;
        }
      }else{
         if(getDistanceLeft() < 15){
          stopMovment();
          break;
        }
        else{
          moveLeft();
          while (xCor + 1000 >= x[0]){
            x = getCoordinates();
          }
          moveFront();
          flag = false;
        }
      }
    }
    x = getCoordinates();
    if(xCor + 1000 < x[0]){
      xCor = x[0];
      shotWater();
    }
  }
```

NOO-NOO Algorithm This algorithm came from the traditional way of cleaning which depends on repeating on some fields that wanted to clean and going to this algorithm was related to the not exact accurate readings from the sensors and especially the ultrasonic sensor and the GY-271.

So the Robot moves to the area it wants to clean and if it reaches an obstacle it turns and does an iteration and it keeps doing that until it reaches the maximum number of iterations.

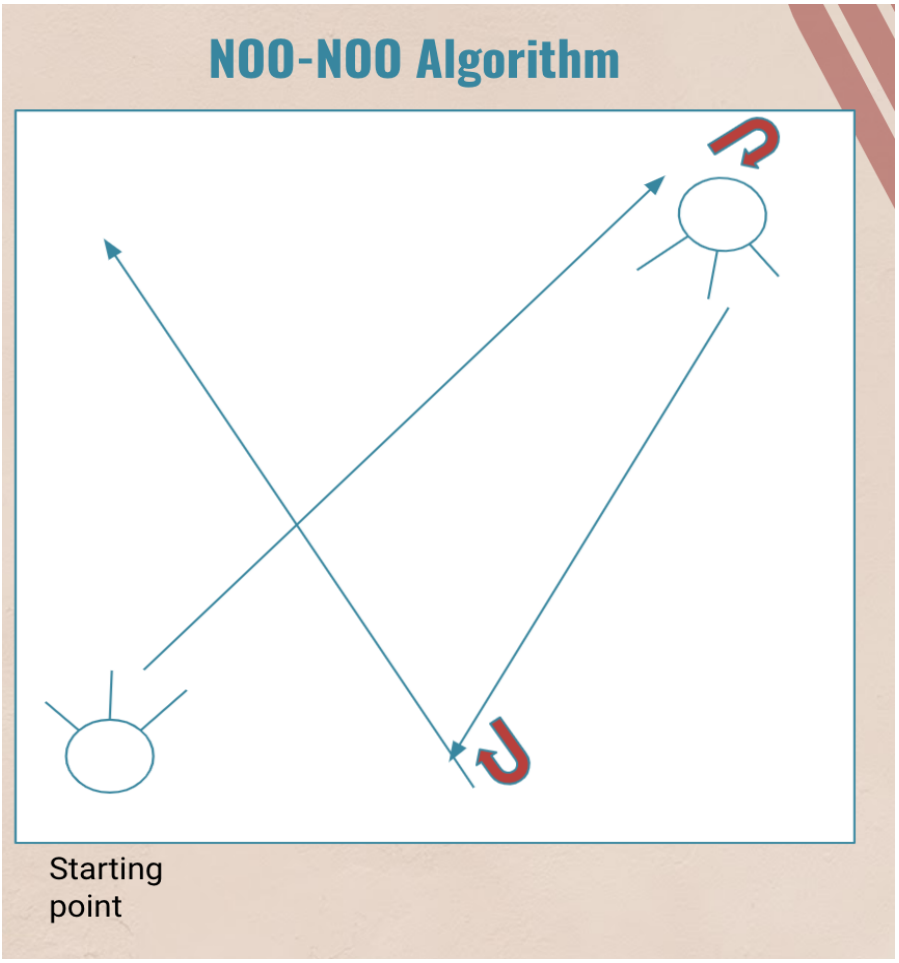

Figure 5.1: NOO-NOO Algorithm

```
void autoScarper(){
  moveFront();
  shotWater();
  bool flag = false;
  int x = getCoordinates();
  int xCor = x[0];
  int counter = 0;
  int i = 0;

  while(true){
    if(i == 20){
      stopMovment();
      break;
    }
    if(getDistanceFront() <= 15 && getDistanceFront != 0){
      if(flag){
        moveLeft();
        i++;
        while (xCor + 1000 >= x[0]){
          x = getCoordinates();
        }
        flag = false;
        moveFront();
      }else{
        i++;
        moveRight();
        while (xCor + 1000 >= x[0]){
          x = getCoordinates();
        }
        moveFront();
        flag = true;
        moveFront();
      }
    }

    if(counter == 900){
      shotWater();
      counter = 0;
    }

    counter++;
  }
}
```

```
void autoBroom(){
  moveFront();
  bool flag = false;
  int x = getCoordinates();
  int xCor = x[0];
  int counter = 0;
  int i = 0;
  float temp = getObjectTemperature();

  while(true){
    if(i == 20){
      stopMovment();
      break;
    }
    if(getDistanceFront() <= 15 && getDistanceFront != 0 || temp + 2 >=  getObjectTemperature()){
      if(flag){
        moveLeft();
        i++;
        while (xCor + 1000 >= x[0]){
          x = getCoordinates();
        }
        flag = false;
        moveFront();
      }else{
        i++;
        moveRight();
        while (xCor + 1000 >= x[0]){
          x = getCoordinates();
        }
        moveFront();
        flag = true;
        moveFront();
      }
    }
  }
}
```

Chapter 4
Constrains

- Weight

  We were constrained by the actual weight because we needed it to be handled by the user, especially if they wanted to take it with them or for example fly in a plane with it because the weights of traveling luggage are so restricted.
  So to make that possible we handled the weights in a special way for example optimizing the batteries and cascades also the wires and connecting.

- Design

  We took in our consideration the users because we needed the Robot to be user friendly as much as possible and we needed to have a very good user experience.
  To achieve these goals we built the robot in a rounded optimized shape so the user will not need to act or handle the wires and the internal components.

- Algorithm

  We took in our consideration the users because we needed the Robot to be user friendly as much as possible and we needed to have a very good user experience.
  To achieve these goals we built the robot in a rounded optimized shape so the user will not need to act or handle the wires and the internal components.

- Memory

  We had limitations in the arduino uno and the memory so we needed the code to be optimized as much as possible to do that. We used functional programming and software engineering principles so we wrote functions for each functionality and we didn't repeat code and removed unnecessary code.

Chapter 5

Challenges

For sure, the first obstacle is the quarantine and lockdowns that occurred recently due to Covid-19, which has affected on our work together, as this project requires the presence of the two partners together physically in order to cooperate in the work and also requires going to

stores to buy tools and supplies and the fact that the pandemic has caused the limitation of movement Thus, it would be the biggest obstacle.

The second obstacle that limited the method of work is the lack of hardware pieces and tools available in the country as most of the available pieces were basics in the devices, and this affected the way of thinking about the project, as we planned it and thought about it in light of the available capabilities of pieces, tools and supplies in the country.

When we say obstacles we should truly mention the distance between us which was so far whenever we wanted to go to any of our houses to work on the project we needed to travel nearly 1hr - 1hr and half so that is going and the same when coming back which also took some of our efforts.

We were able to adapt to work in the circumstances of the pandemic by intensifying working hours in the days of the meetings and spending a long time trying to complete the largest possible amount of the project at an early date. We were able to adapt to this issue to a certain extent, but the lockdowns and sanitary quarantines came intermittently and unaccounted for times, but at last when the vaccens came to our country it started to become easier to see each other and work with each other.

Regarding the lack of pieces and tools in the country, we were able to recommend some pieces that were harmful to them through the owners of cutting shops, which took some time until they reached us. We also adapted to the existing cat and used it to achieve the goal or purpose of the project.
According to the long distance we were able to divide the time once at each house to divide the effort on each one of us

Chapter 6

Conclusion

6.1 Summary

We managed to build a cleaner Robot which is able to clean the floor using a scraper that wipes the floor and a pump which sprays some water on the floor to wipe it. Also a broom for cleaning the floor which cleans it directly and both functionalities are using manual control and automatic control.

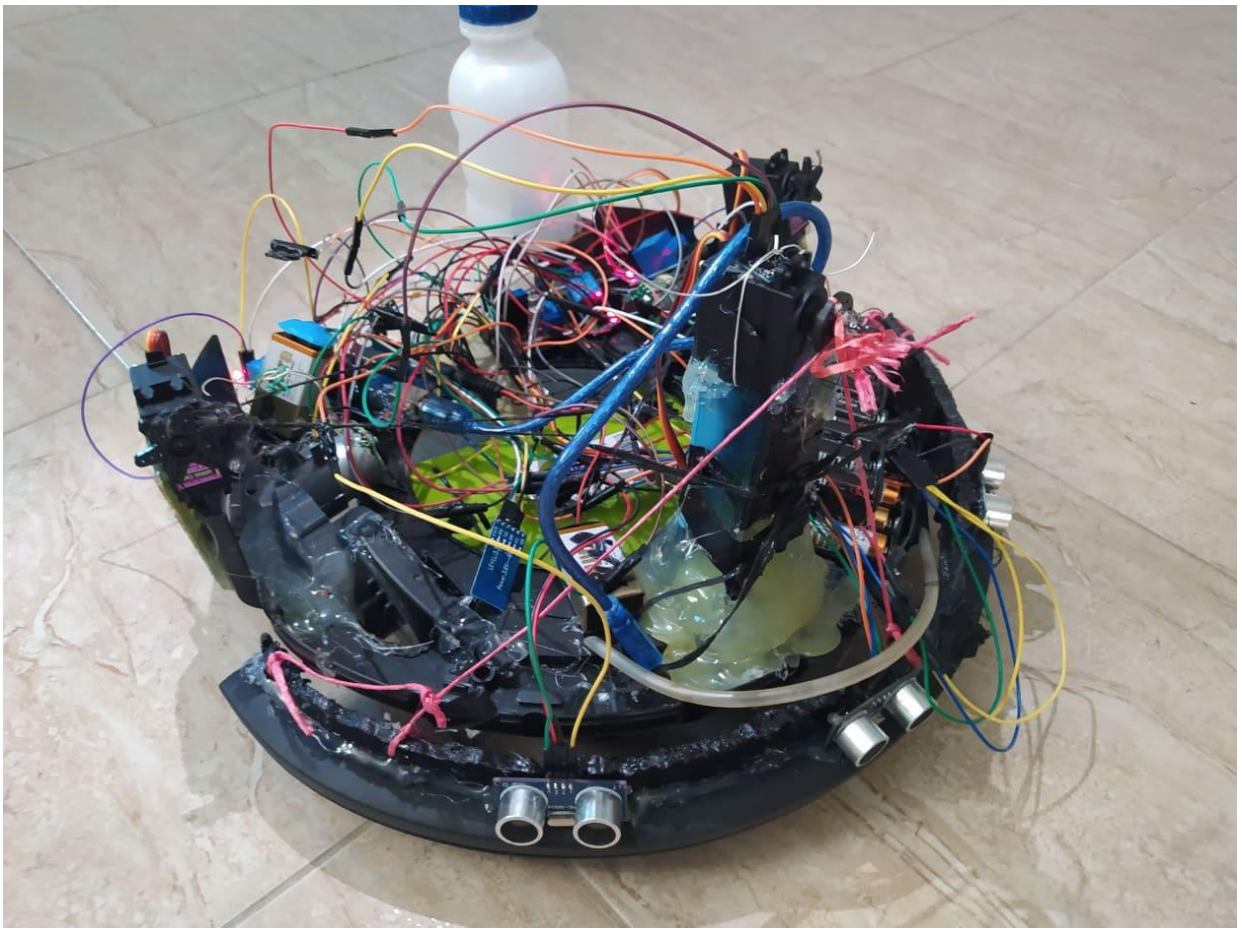

Figure 6.1: NOO-NOO Robot

6.2 Learned Subjects

- Arduino Software IDE and programming on Arduino uno
- Handling Hardware and Discovering New Hardware Components and how they work.

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