



An Najah National University
Faculty of Engineering and Information Technology
Department of Computer Engineering

Hardware Graduation Project

Grass Cutting Robot

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Disclaimer

This report was written by Haneen Yaqoub and Rana Mara'beh at the Computer Engineering Department, Faculty of Engineering, An-Najah National University. It has not been altered or corrected, other than editorial corrections, as a result of assessment and it may contain language as well as content errors. The views expressed in it together with any outcomes and recommendations are solely those of the student(s). An-Najah National University accepts no responsibility or liability for the consequences of this report being used for a purpose other than the purpose for which it was commissioned.

Abstract

With the increase in green spaces in the world, people need to take care of them, but we do not deny that they require a lot of time and effort, which sometimes a person does not have the space for.

From this standpoint, we thought to find a solution that could help in the process of caring for plants and save time and effort for humans, so we started our idea by working on a robot that cuts green grass when it reaches a certain length in the garden and with work on the idea of making its movement logical and suitable for the work that will be done by this robot.

For the movement, it begins with the ability of this robot to cover all the existing space in addition to its ability to move away from the obstacles that appear in front of it. In addition, to make it easier for the user, two modes of movement are provided, either automatically or by the user controlling his movement.

In addition, to facilitate the movement process, this robot cuts the grass only when it has reached a certain length, and this saves energy on the robot instead of constantly cutting, and to take care of the garden in all respects, we have added the feature of watering the crops when a low level of moisture is reached in the soil.

This is done wirelessly by sending a notification to the robot from the soil sensor, then the robot pumps water to increase the moisture level in the soil.

Chapter 1

Introduction and Motivation

1.1 Motivation

Green gardens constitute a high percentage in the world, and no house is devoid of a home garden, and the issue of taking care of it requires a lot of time and effort, so we have created an idea that combines garden care and maintaining the soil moisture content, this saving effort and time.

There are a lot of projects and applications that perform the work of garden care, but in this robot we have added the feature of maintaining the percentage of soil moisture wirelessly, in addition to providing two movement systems, either automatically or through user control.

1.2 Problem Statement

The project aims to facilitate the Plant care process by solving some of the problems that occur when The farmer moves away from the plant,for example, the process of cutting grass, which can take time from the farmer, in addition to constantly irrigating the crops when the water level decreases.

1.3 Objective

In this project, we aim to facilitate the process of cutting grass for farmers and everyone who has green spaces in their home so it is cut when it reaches a specific length, this thing saves time and effort, and it can move either automatically or remotely by the user.

We also aim to collect more than one work that the robot might do in the absence of someone from the plant, for example, measuring the humidity and spraying water when it decreases, and this helps the plant to survive and not need water.

1.4 Background

This project includes many features that we made,In the beginning, this robot cuts the grass when it is long only by a sensor, and it can move automatically so that it covers all the required space, or until the user can move it in the four directions according to his need.

In addition, it can measure the moisture content in the soil wirelessly, and send a notification to the robot to spray water to increase the humidity.

The movement in this robot is regular and covers the whole place if it is automatic, in addition to moving away from the obstacles that are in front of it, but if the user moves it, he will be responsible for it and can stop if it finds obstacles.

1.5 Organization of the report

Our report divides into chapters, each of them provides a specific information about the project.

The first chapter [Introduction] which provides a background about the project. Then, the second chapter [Constraints and Earlier Coursework] which shows the limitations and challenges that we faced and the previous courses that we have studied and helped us in this work. After that, there is chapter three [Literature Review] which include a brief features about this project and some similar ones. The next chapter [Methodology] which includes the plan to ending our work such as hardware and software tools. There is then the fifth chapter [Results, Analysis and Discussion] which summarizes our results and gives an explanation of these results. Finally, there is the Conclusion and future work chapter which collects what are the benefits that we that we took from implementing this project and also this chapter shows our ideas for the future to improve our robot.

Chapter 2

Constraints and Earlier course work

2.1 Constraints

In the beginning, we faced some problems and challenges with how to start in the project, and how to give the components that we need, there is a lot of events that happened in nablus and make it not easy to give the components.

We also had difficulty dealing with new components and assembling the elements together, especially at the beginning of the project.

Some things in the project required more time than others, especially because we encountered a problem with damage to some pieces and wires.

2.2 Earlier coursework

- **Critical Thinking and Scientific Research:** Helped us accomplish this project by helping to make searching and writing paper much easier for us and gave us an experience in how to write in editor.
- **CPU Lap:** Helped us in wiring and dealing with hardware components and debugging them.
- **Micro-controllers Lap:** Helped us to deal with arduino and programming it also helped to use the serial communications and motors.
- **Wireless:** Helped us on dealing with bluetooth HC-05 and make the two modules connecting with each other slave one and master one.

Chapter 3

Literature Review

This project is not completely different from other robots and tools that take care of the garden, but through it we tried to collect the most things that the farmer needs to take care of his garden in his absence or even to save his time and effort.

It gives you all the options that make it easier for you and save you the effort of the process of taking care of the plants, and it can work in the event of your presence or even automatically in the absence of you, and its movement is regular and away from the obstacles that exist in front of it.

This project combines several different ideas, all of which serve the user in the best way and provide the most suitable in all respects, in addition to providing what is needed to take care of the plant.

This is what distinguishes this grass cutter from others, it not only cuts the grass, but also takes care of the moisture level in the soil, and this means providing water for the plant in the event that the water level decreases, and cutting the grass when it is long and distinguishable.

As for its movement, the user can use it in two cases, either by moving it through a mobile application according to what the user wants, or by running its movement automatically so that it can cover the required area and move away from all the obstacles in front of it that impede its movement.

Chapter 4

Methodology

In this chapter, we will talk about the robot design, its components to accomplish it and show the process that we follow to develop our robot.

4.1 Overview

In this research, we developed a grass cutting robot for gardens care. In order to achieve the results we use Arduino as a controller to control the robot.

Hardware and Software were needed to get the final project. We aimed to reduce the burden that falls on the gardener.

4.2 Equipment and Components

4.2.1 Arduino car

We use this car to be the base of our robot. It includes three wheels and DC motors connected with each wheel in order to make it move.

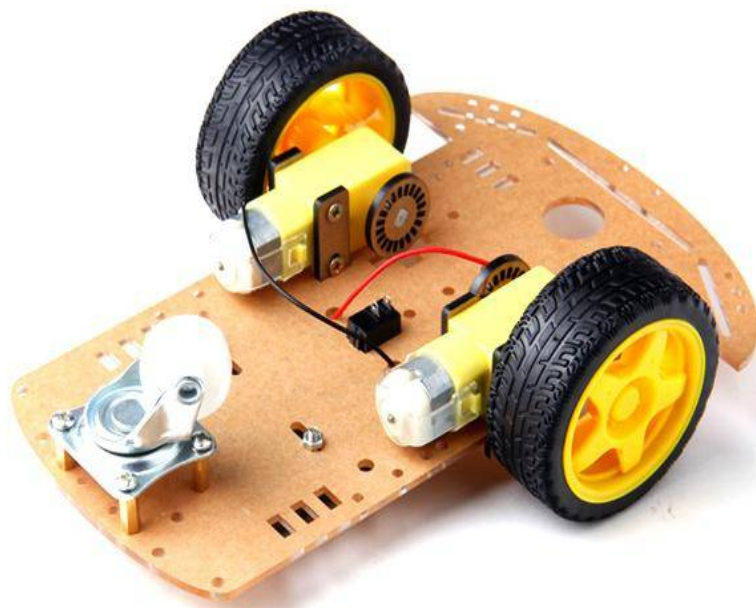


Figure 4.1: Arduino car

4.2.2 Arduino Uno

This is the most important tool in our project. It acts like a micro-controller board based on the Microchip ATmega328P that control every side in our project. It has 14 digital I/O pins, 6 analog I/O pins, and is programmable with the Arduino IDE using the usb cable.

We use it in our project to connect all tools with each others and make them work in an integrated manner.

We use two arduino uno in our project, one of them for the circuit that measures soil moisture and the other for the remaining features such as controlling the robot movement and the cutter movement .



Figure 4.2: Arduino Uno

4.2.3 L298N Driver

The L298N is a dual H-Bridge motor driver enables simultaneous speed and direction control of two DC motors.

We use two L298N Drivers in our project, one to control the DC motors that connected with wheels in order to control the movement and the other to control the DC motors that connected with the cutter and the pump.

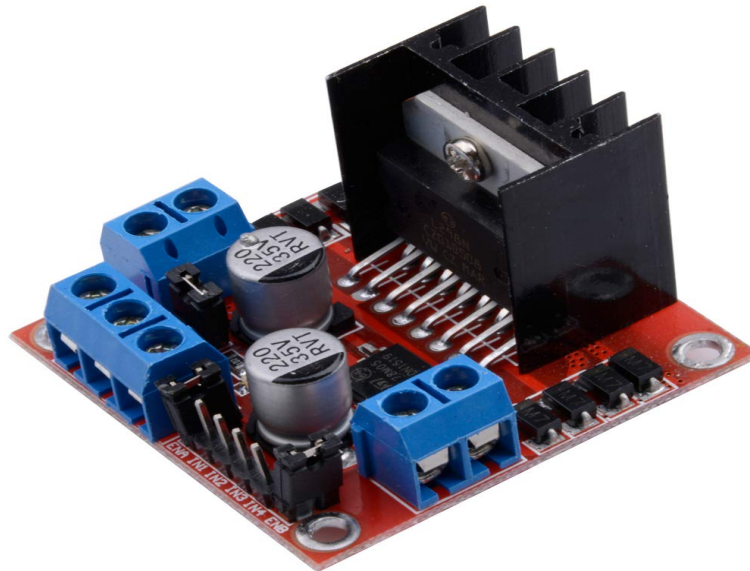


Figure 4.3: L298N Driver

4.2.4 DC Motor

DC motor is an electrical motor that converts the direct current electrical energy into mechanical energy.

In our project we use it as a driving power that connected with L298N driver to control the movement of the robot and the cutting process.



Figure 4.4: DC Motor

4.2.5 Servo Motor

The ultrasonic was moved by the servo motor so that the robot could be moved by scanning the surrounding area and skipping the barriers. By sending a PWM signal to the servo motor, the rotation angle of the device is managed.



Figure 4.5: Servo Motor

4.2.6 Ultrasonic Sensor

In order to direct the robot to move and avoid obstacles, ultrasonic distance measurements are made around it.



Figure 4.6: Ultrasonic Sensor

4.2.7 Water Pump

Connected to our tank so that the robot can pump water onto the garden if the soil moisture is less than the minimum limit.



Figure 4.7: Water Pump

4.2.8 Bluetooth module HC-05

HC-05 bluetooth module designed for wireless connection. It used in our project to connect the robot with mobile that control the robot, also we used it to connect the two arduino uno with each other to know when the pump must start pumping the water.

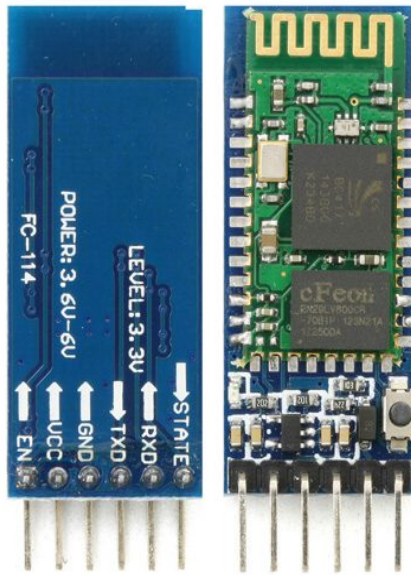


Figure 4.8: Bluetooth module HC-05

4.2.9 Soil moisture sensor

This sensor is important for agricultural applications to help farmers knowing the exact soil moisture conditions in order to use less water to grow a crop.

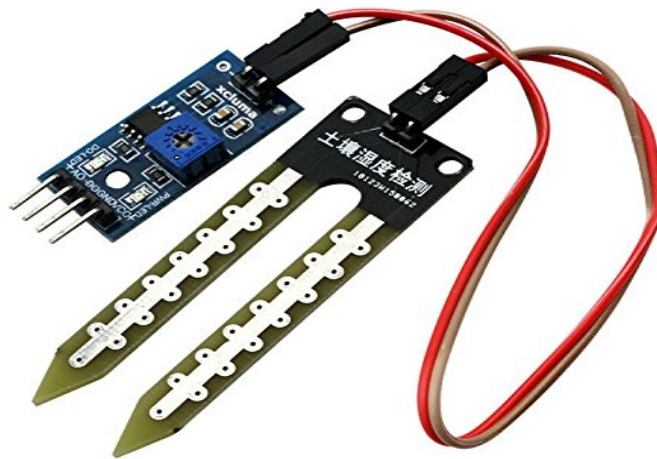


Figure 4.9: Soil moisture sensor

4.3 Software

To control the robot we used Bluetooth RC Controller App. We used the arrows to control the direction of the movement and for automatic movement we used the buzzer button on the app.

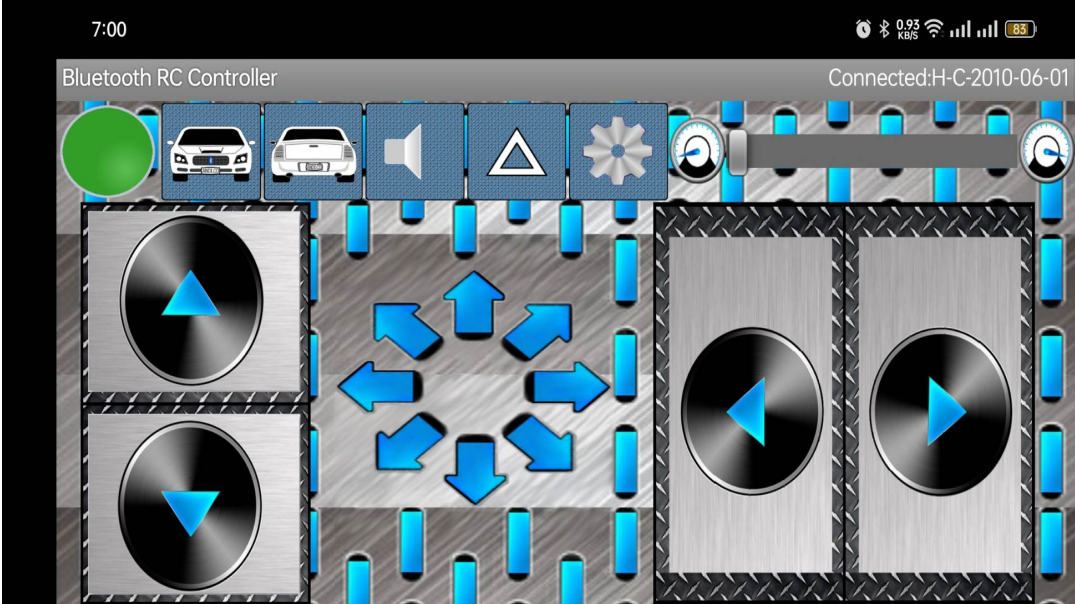


Figure 4.10: Bluetooth RC Controller App

To program the Arduino, we use the Arduino IDE windows app to write the code then upload it to arduino.



Figure 4.11: Arduino IDE

Chapter 5

Results and Analysis

Technology has developed a lot in people's lives and it includes many aspects and helps them in all their affairs, such as health, academic, agricultural and many other matters, and people's dependence on it has become greater than their dependence on themselves in carrying out tasks.

There are many projects that help people with agricultural matters and that include one task that you focus on, but we tried through our project to include more than one aspect to take care of plants in a way that is easy for the user and can always be used.

From our point of view, we have reached a good stage of plant care with this robot, and many other elements can be added that can also help with this. This robot mainly serves the farmer, and its use is easy and its movement is good and commensurate with the existing place.

With the development of other services, there are many things that can be added to the project so that it is comprehensive in all aspects and can take care of the plant completely and in all respects.

All of these things will increase the number of users, because it will save them a long process of caring for plants.

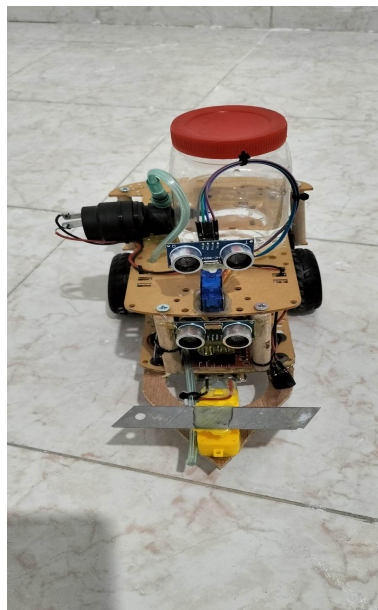


Figure 5.1: the Robot

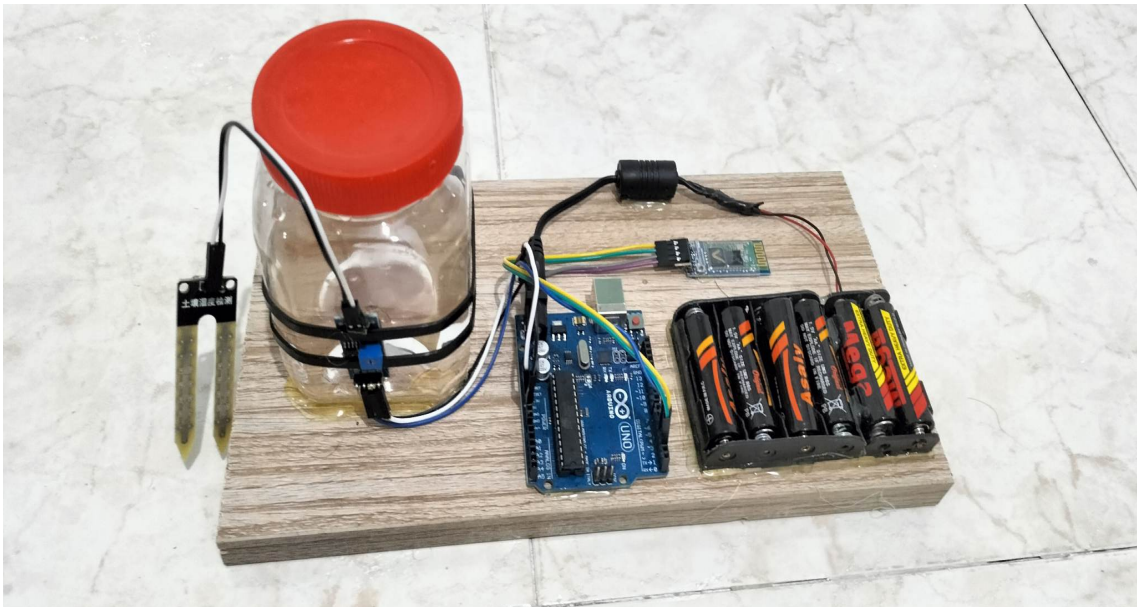


Figure 5.2: The Soil moisture part

Chapter 6

Conclusion and Future Work

At the end of this project , we learned many things that improved our skills in using the hardware tools and equipments. We learned how to use the Arduino tool and programming it to control our robot. Also, we understood how to use the servo motor and control its movement angle. On the other hand, we dealt with the bluetooth HC-05 module and connect two modules with each other slave and master. We used the soil moisture sensor and the ultrasonic sensor.

For the future work it will include replacing energy sources with solar energy. In addition, we will improve our app to make the user able to specify an area for the robot to cover it.

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