An-Najah National University
Faculty of Engineering information technology
Department of computer Engineering

Roadway Artist

Done by
Yahia Mansour, Omar Quzmar

Supervisor
Dr.Aladdin Masri & Dr.Haya samaana

September 3, 2023

Acknowledgements

"First of all, we would like to thank our supervisor, Dr.Aladdin Masri & Dr.Haya samaana, for thay consis-tent efforts throughout the semester, and for being completely prepared to assist us with scientific support. We would also want to thank all of the academics in the Department of Computer Engineering assisted us when we inquired, and last but not least, we thank our friends and family. Those who gave us their undivided attention and believed in our ability. "

Disclaimer

Yahia Mansour and Ahmad Omar Quzmar have written this report as requirements for Bachelor's degree in Computer Engineering Department. No one modifies or corrects it because it will be evaluated by professors at An-Najah National University. It is worth mentioning that An-Najah National University does not have any responsibility for any word in this report.

Contents

List of Figures

Abstract

When making a new street, the opening of the street is usually delayed because of the time spent planning the street and the warnings on the street floor, So we made (Roadway Artist) the painter's car that automatically draws drawings on the street floors.

Chapter 1

Introduction

Large road projects are often delayed in opening the road to cars, for many reasons, including that it is not ready for use, as no drawings are showing the road, which may lead to many traffic accidents. So we needed a device that would automatically map streets very quickly so that roads could be opened quickly.

1.1 Problem Statement

Delay in opening roads may lead to suffocating congestion and road disruption, Therefore, the (Roadway Artist) project aims to speed up the process of planning streets and make it more accurate and easy.

1.2 Objectives

Accelerate the drawing and planning process and make it more accurate and less expensive.

1.3 Scope of the work

1. **Remote control wireless:** images are transmitted remotely by wifi.
2. **Paint tank sensitivity alarm:** audible alarm when the amount of paint allotted for painting is finished.
3. **Motion sensor:** it's stops when there is an obstacle in front of the machine.

1.4 Significance

To complete the long paths that need time in drawing and the places that need accuracy in drawing as an alternative to manual drawing and to avoid human errors.

Chapter 2

Constraints and Earlier Coursework

2.1 Constraints Limitations

We faced many restrictions in this project, the first and most important of which is the lack of time as we are in the summer semester and we have other subjects to study and because of the repeated closures of the city of Nablus and the difficulty of reaching the university. Also, the workplace was an obstacle for us because each of us is from a region far from the other. In addition to the difficulty of finding people. Some of the electronic parts that we needed in the project. Some of the details took us time because we were dealing with them for the first time, so we needed a longer time to get to know their details well.

2.2 Earlier Coursework

- Arduino Course for Beginners - Open-Source Electronics Platform:
  This course gave us a comprehensive and accurate overview of Arduino and how to deal with it and its pins.
- Introduction to ESP32 Board:
  This course helped us learn about ESP, how to connect it to the Arduino, define it, and the transmission process through it.
- Electrical Engineering Basics course :
  We needed some videos from this course to verify some of the electrical connections and calculations for motors and other parts.
- GRBL Panel Review:
  This video gave us a comprehensive overview of the GRBL program and how to deal with it, as this program is important and we used it to give it an image so that it can be converted to G-code, which is one of the most famous and best programs used to deal with projects that contain CNC.

Chapter 3

Literature Review

Street planning is very important as it is indispensable for the traffic process to proceed correctly, safely and safely for people and drivers. Many accidents may occur due to lack of proper planning or a defect in the process of planning streets. After research, it was found that in our country the drawing is done manually, which takes more time and effort, and from here the idea of our project appeared. In our project, streets can be planned more easily and completely comfortably, as all you need is to send a picture of the drawing to be drawn on the ground without the need except for a number of workers or drawing templates, but the nature of the drawing must be in one direction and we seek to develop our project to be in More than one direction and more than one color at the same time.

3.1 What enhancements did Roadway Artist bring?

What distinguishes our project is speeds up and facilitates the drawing process to complete drawings quickly and accurately without the need for direct human intervention. It is easy to use and the job it does is important.

Chapter 4

Methodology

4.1 System Architecture

4.1.1 Wooden Body

We designed a 120cm*40cm*45cm wooden body :

Figure 4.1: Initial Design for wooden body

4.1.2 Rail and parts holder

We added a light metal bridge connecting the two ends of the body, and placed a box consisting of two pieces of wood with open sides on top of it, in order to put the battery and the circuit connection inside it.

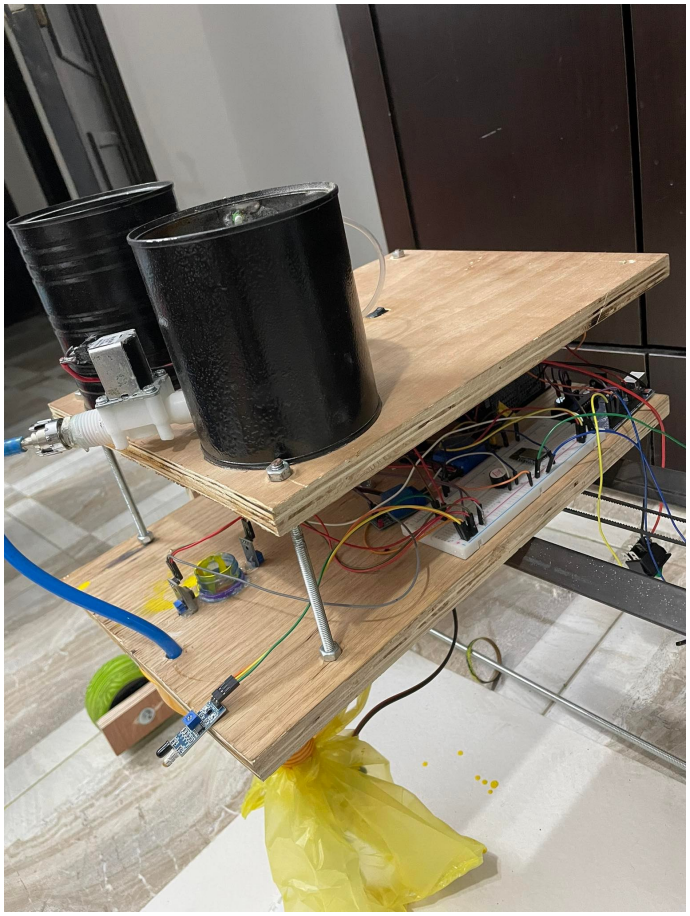

Figure 4.2: Final Result for the Rail and parts holder

4.1.3 Drawing mechanism:

The drawing mechanism will be in two dimensions, as the body will move based on the G code of the given drawing or shape, and the paint will be applied at the appropriate moment to obtain the desired shape.

4.2 Processing Units and Used Devices

4.2.1 Arduino uno

The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal oscillator, a USB connection, a power jack, and an ICSP header. It contains everything needed to support the microcontroller.

The Arduino Uno is a popular choice for many projects due to its simplicity and versatility.

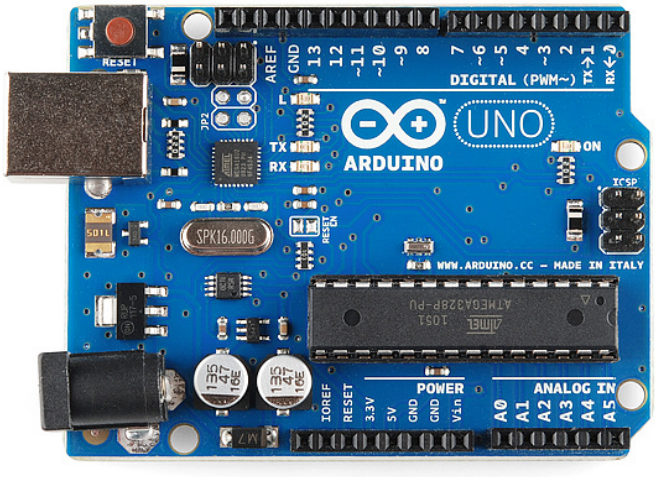

Figure 4.3

4.2.2 ESP8266 NodeMCU

The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds. We utilized ESP8266 as the main chip to commuincate with the internet, and also to control the pulse oximetry sensor along with controlling the Arduino UNO.

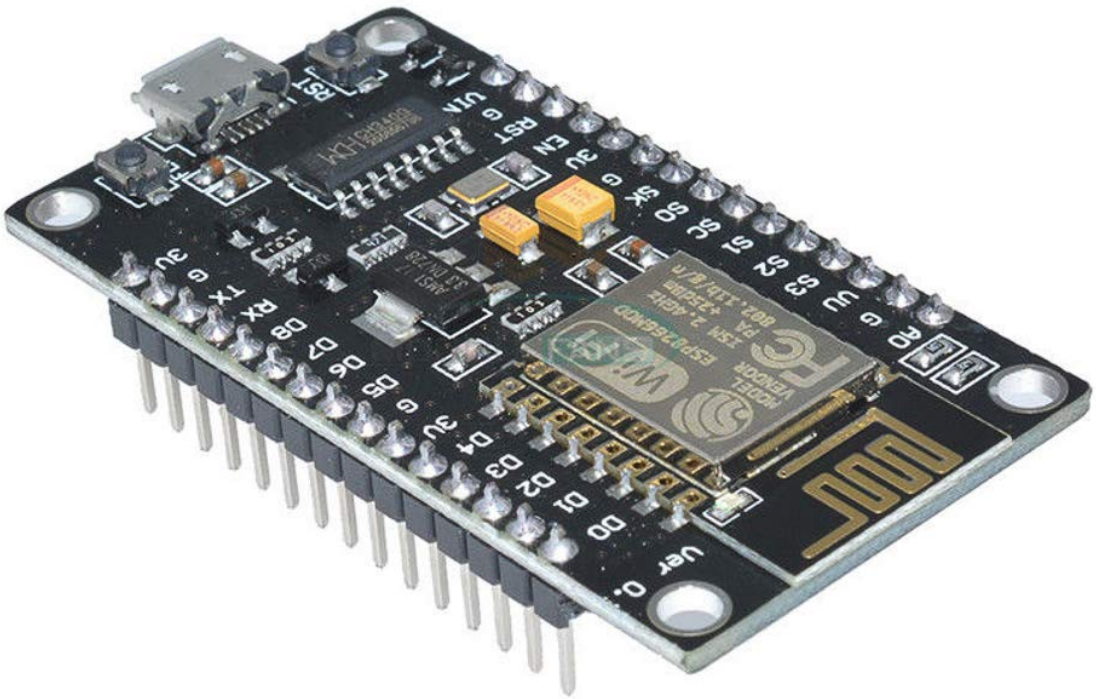

Figure 4.4

4.2.3 YUASA BETTERY

The Yuasa 12V 7Ah battery is a sealed lead-acid (SLA) battery known for its reliability and versatility. With a voltage of 12 volts and a capacity of 7 ampere-hours (Ah), it provides a stable power source for various applications, such as backup power supplies, security systems, and medical equipment. These batteries are maintenance-free, rechargeable, and designed with safety features like overcharge and discharge protection. They come in different sizes and weights depending on the specific model, making them a popular choice for a wide range of electronic devices and systems.

Figure 4.5

4.2.4 TB6600 DRIVER

The TB6600 is a commonly used stepper motor driver module known for its compatibility with a wide range of stepper motors. It provides precise control over the motor's movement by converting digital signals into the required current levels for each stepper motor coil. This driver supports various stepping modes, microstepping, and adjustable current settings, allowing for fine-tuned control and smoother motion. The TB6600 is frequently used in CNC machines, 3D printers, and robotic applications due to its reliability and ability to handle higher current requirements. It's essential to understand the datasheet and configure the driver correctly for optimal motor performance in your specific application.

Figure 4.6

4.2.5 IR SENSOR

An IR (Infrared) sensor is a type of electronic device that detects and responds to infrared radiation. These sensors are commonly used for proximity detection, object tracking, and motion sensing applications. They work by emitting an infrared light beam and measuring the reflection or interruption of this beam to detect the presence or movement of objects. IR sensors are widely used in various fields, including automation, security systems, and consumer electronics, where they enable functions like touchless control, automatic lighting, and obstacle avoidance. They are known for their reliability and cost-effectiveness in many practical applications.

Figure 4.7

4.2.6 NEMA 23 stepper motor

The NEMA 23 stepper motor is highly regarded for its robust performance and versatility, often chosen for applications requiring more substantial torque. It operates with a standard step angle of 1.8 degrees per step, requiring 200 steps to complete a full revolution, the NEMA 23 stepper motor typically features larger dimensions and can handle higher currents, often in the range of 2 to 5 amperes, depending on the specific model. It accommodates voltage inputs ranging from 12 to 48 volts, making it suitable for various industrial and automation applications that demand greater power and precision. Its role in our project was to control the wheels and move them, as well as move the cutting holder on the rail.

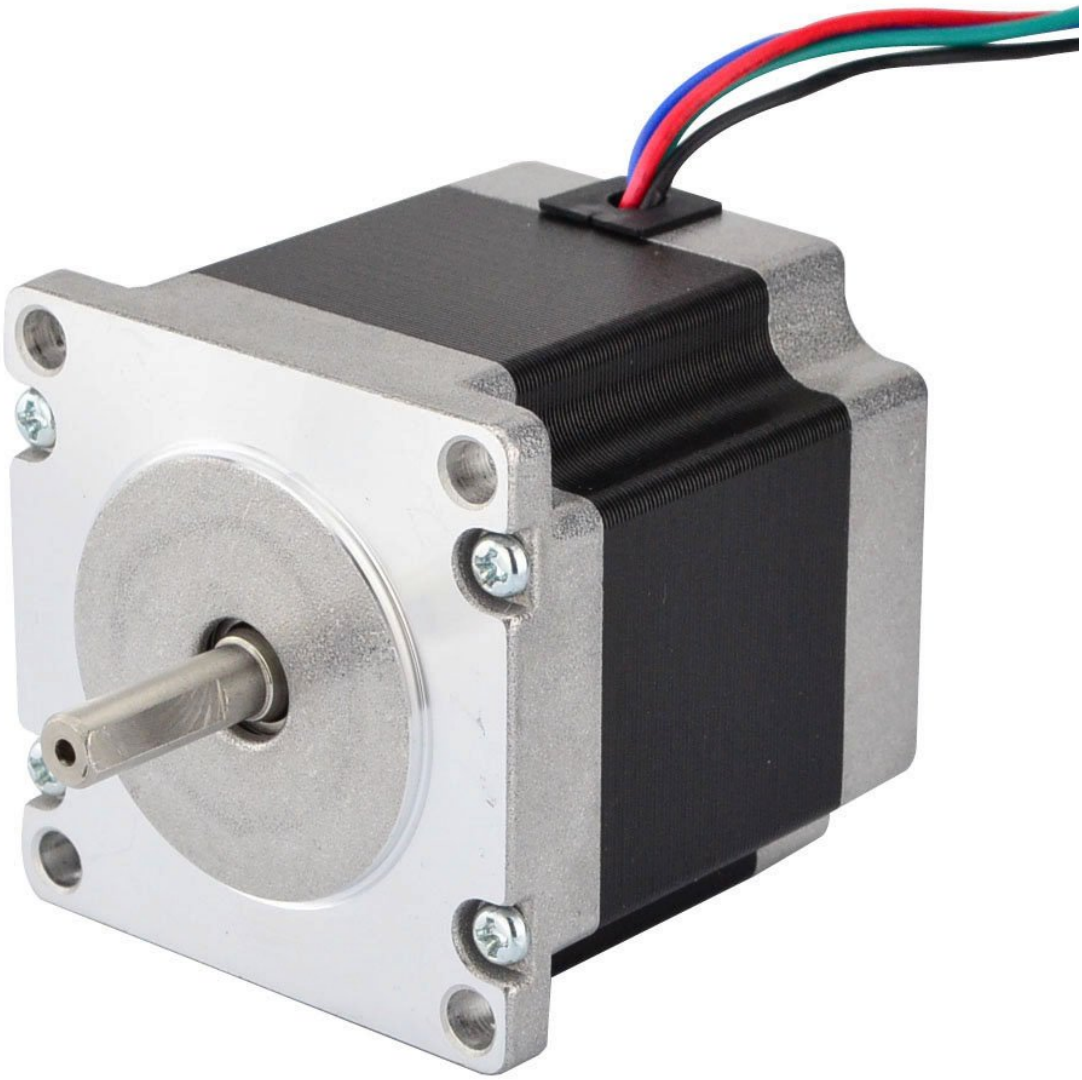

Figure 4.8

4.2.7 SOLENOID VALVE

A solenoid valve is an electromechanical device commonly used in fluid control systems to regulate the flow of liquids or gases. It operates by using an electrical current to actuate a solenoid, which, in turn, controls the valve's opening and closing. Solenoid valves are known for their quick response times and precise control, making them essential in a wide range of applications such as irrigation systems, industrial automation, automotive systems, and more. They come in various types, including normally closed (NC) and normally open (NO), each serving specific purposes in controlling the flow of fluids. Solenoid valves are valued for their reliability and ease of integration into various systems, enhancing efficiency and automation in numerous industries.

Figure 4.9

4.2.8 GT2 and GT3 open timing belts

GT2 and GT3 open timing belts are types of toothed belts used for precise motion control applications. These belts feature a toothed design, which engages with corresponding pulleys or gears to ensure accurate positioning and timing of mechanical components. GT2 belts have a 2mm pitch, while GT3 belts have a 3mm pitch, indicating the distance between teeth. The "open" design means that these belts are not closed-loop, making them easier to install and adjust. They are commonly used in 3D printers, CNC machines, and other automation systems to transmit rotational motion accurately. The choice between GT2 and GT3 depends on the specific requirements of the application, with GT3 offering slightly higher torque transmission capabilities due to its larger pitch.

Figure 4.10

4.2.9 RELAY

A single-channel relay is an electromechanical device used for switching or controlling electrical circuits. It typically consists of a coil, an armature, and a set of contacts. When an electrical current is applied to the coil, it generates a magnetic field, which attracts the armature and closes or opens the contacts. This action allows the single-channel relay to control the flow of electricity to a connected device or circuit. Single-channel relays are commonly used in a variety of applications, such as home automation, industrial control systems, and automotive electronics, to enable remote or automated control of electrical loads, such as lights, motors, or heaters. They are known for their simplicity, reliability, and versatility in providing an isolated switch for electrical circuits.

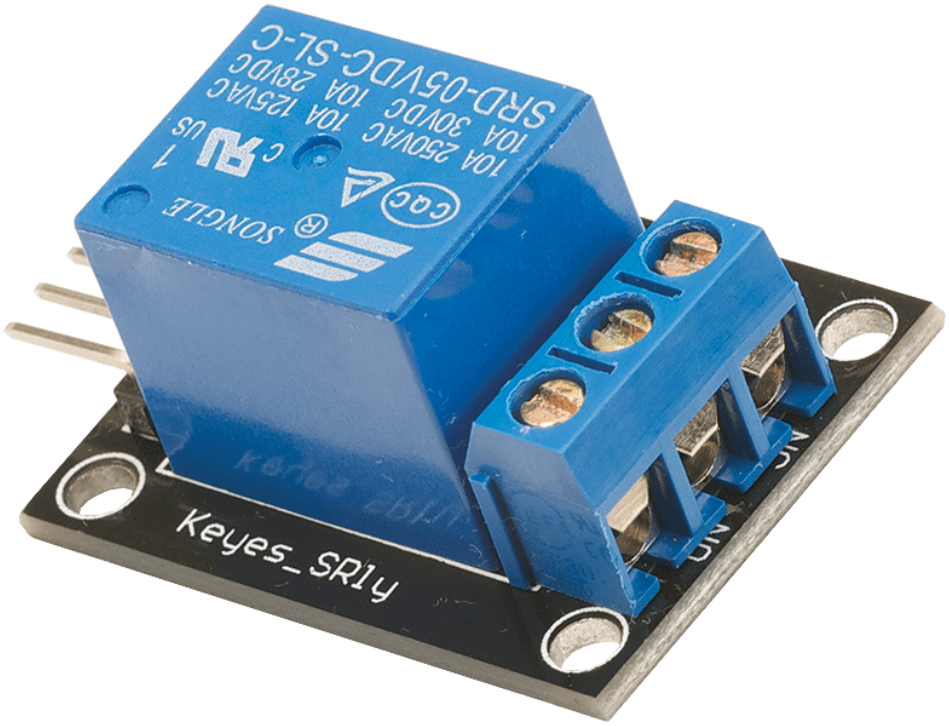
SRD-05VDC-SL-C
10A 250VAC 10A 125VAC
10A 30VDC 10A 28VDC
SONGLE
Keyes_SR1y

Figure 4.11

4.3 All Project

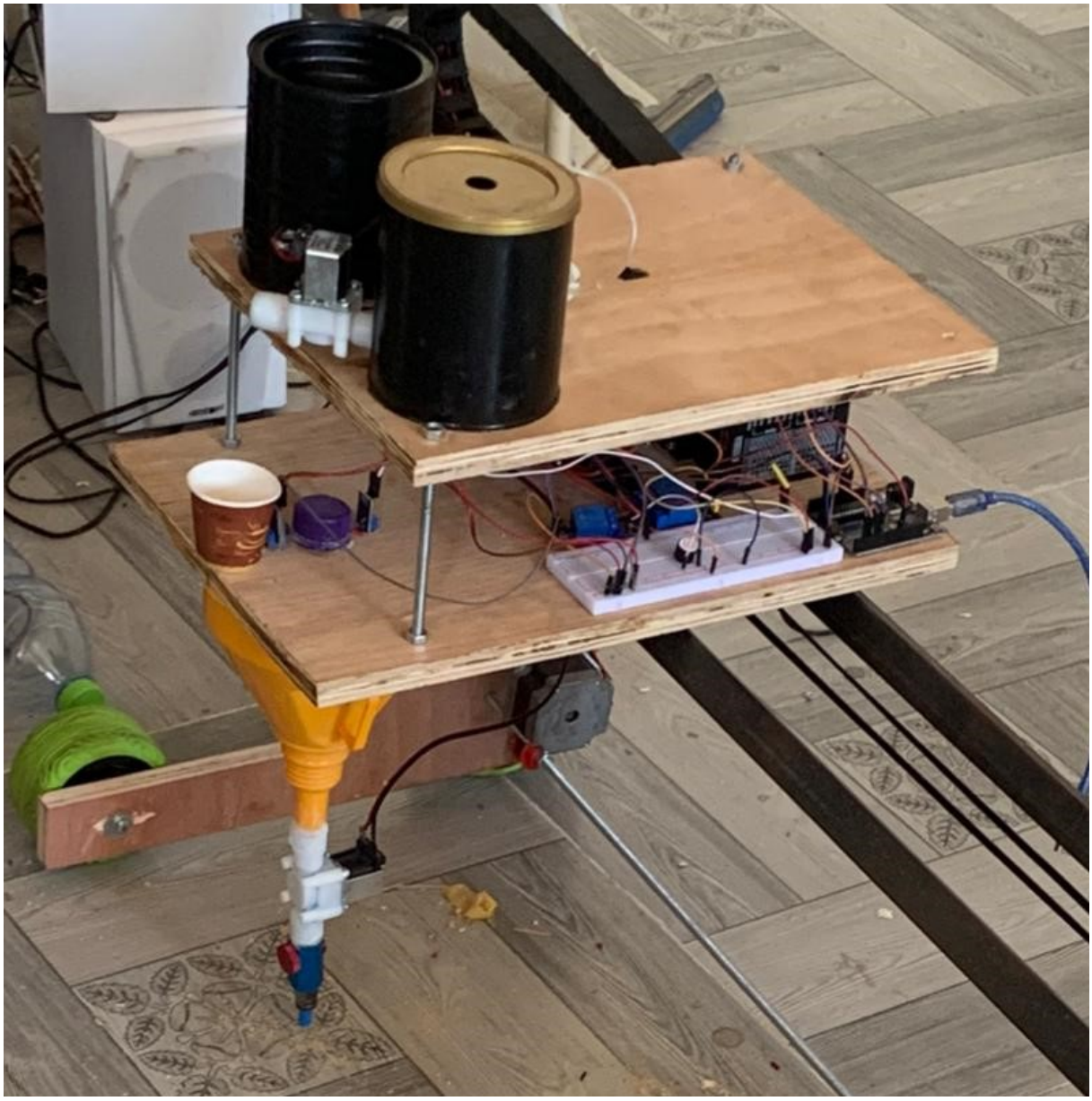

Figure 4.12

Chapter 5

Results & Discussion

5.1 Results

Roadway Artist It is a project that relies on drawing on the street floor in an automated that allows users to perform the following:

1. Control it remotely.
2. Sensor to pay attention to the object in front of it.
3. Paint quantity sensor.
4. Giving remote graphics.

5.2 Discussion

Roadway Artist most likely supplied the following:

1. Speed of work, achievement and accuracy of drawing.
2. Reliability in getting the job done.

Chapter 6

Conclusion & Future Work

6.1 Conclusion

Cleverly is a project for drawing on floors automatically and remotely, and it facilitates many tasks requiring accuracy and time in work.

We had hoped to incorporate a modest set of minor features into the project, It can be modified in the future to be more suitable for different floors and different sizes.

6.2 Future Work

There are various areas that Roadway Artist might improve, including:

1. Add other colors.
2. Ability to rotate the wheels.