An-Najah National University

Faculty of Engineering

Computer Engineering Department

Graduation Project 2

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Contents

Figures:

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Disclaimer:

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Abstract:

This project proposes a monitoring and control system for pharmaceutical refrigerators. The system aims to address the growing need for effective temperature management in medication storage, as deviations from optimal conditions can lead to medication spoilage and compromised health. By utilizing a network of sensors and monitoring devices connected to an internet-enabled intermediary, the system allows for real-time monitoring and remote control functionalities. This technology reduces reliance on human presence, facilitates remote management, and enhances the safety and efficiency of pharmaceutical storage facilities.

Chapter 1: Introduction 1.1

Statement of the problem:

All hospitals have dedicated rooms for storing medications, where the medicines are kept inside refrigerators at appropriate temperatures. These rooms house valuable medications, and access to them is restricted to authorized personnel only, with no constant presence of staff. Hence, there is a clear need for an intelligent system to control and monitor these valuable refrigerators. This is what we aim to achieve a comprehensive system that provides the necessary control.

The issue of medication spoilage due to temperature deviations becomes evident only when it's too late, and damage has already occurred. In our project, we strive to incorporate a smart detection feature to monitor the condition of medications in our system.

1.2 Description

In this project, we prioritize the safety and security of all medicines stored in the refrigerator. We have implemented an automated and manual temperature control system, an internal alarm system, and phone/email notification alerts. At the hardware level, we have a comprehensive security system with password requirements to add or remove medications, as well as a sensor mechanism to detect the presence of a medication.

On the software side, we've developed an admin dashboard to monitor and control the system, along with email and notification services to keep participants informed and engaged. We will delve into these details in the next report.

During this project, we gained valuable experience and knowledge in the field of hardware implementation. We have successfully applied many of the concepts we learned during our learning journey, which we will discuss in detail later in this report. In addition, we have faced and overcome many challenges and limitations, which we will address in due course.

1.3 Report Organization:

The following chapter will discuss the limitations and challenges we encountered in the development of our project, as well as the previous coursework.

In the methodology chapter, we will explain the development process, the physical tools we utilized in building this project, the results obtained, and the outcomes of this project. The conclusion and future work chapter will provide the final conclusion of this project, along with recommendations and future endeavors.

Chapter 2: Problems and Constraints

In this chapter, we will outline the primary limitations that were encountered throughout this project. Additionally, we will explore various courses and subjects that proved beneficial during the project's execution.

2.1 Constraints :

- Refrigerator: We faced difficulties in obtaining a refrigerator of suitable size and containing a glass door so that we could see the medicines from the outside, as all refrigerators were very expensive

- Disk: Where it is difficult to find a round disk that carries medicines of a certain size, and that these medicines may fall out of it, so a cardboard box was removed to prevent this.

- Bar Code Reader: We had a hard time coming across this sensor

- Finding a suitable place to work, as the project contains a lot of equipment, and we had difficulty moving it from one place to another

2.2 Standards, Codes, and Hardware Modules

-Hardware Modules

We used the following hardware components in our system:

DHT Sensor: The DHT sensor was used to measure the temperature inside the refrigerator and work to keep medicines at a suitable temperature to keep medicines.

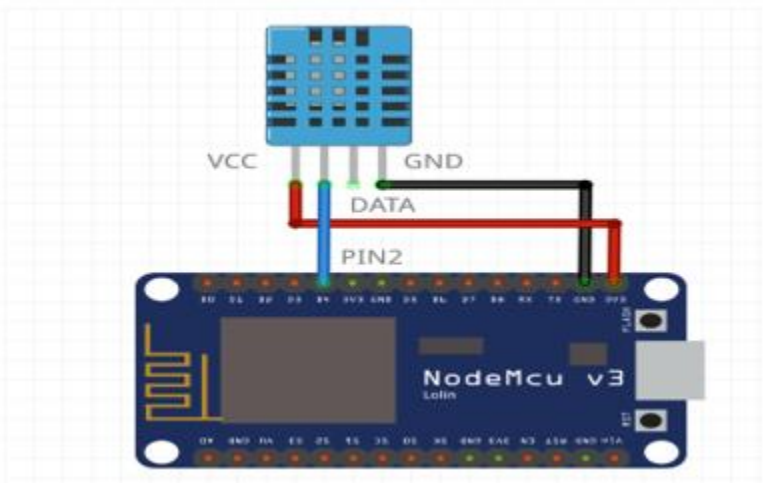

Figure 2.2.1

The IR Sensor: through which the places in the disk are checked and the empty places are found in it.

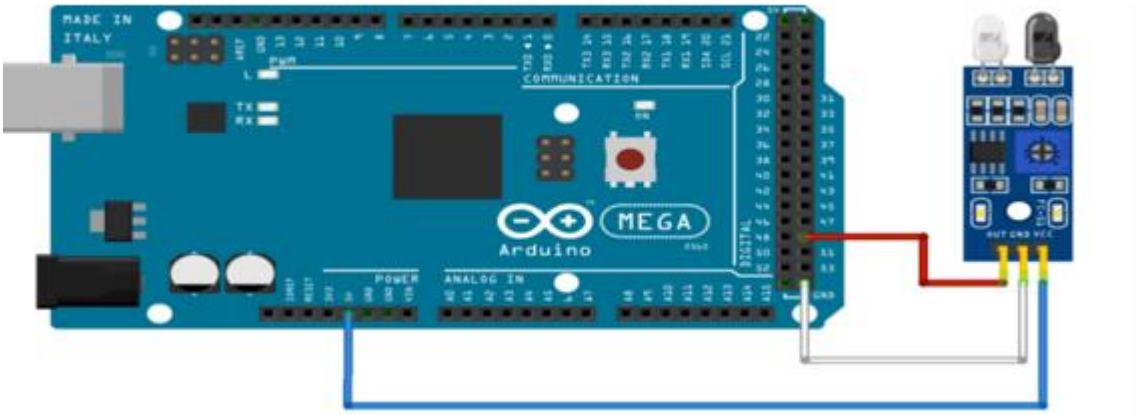

Figure 2.2.2

Electromagnetic Lock: It was used for the purpose of protection and to prevent the refrigerator door from being opened by an unqualified person.

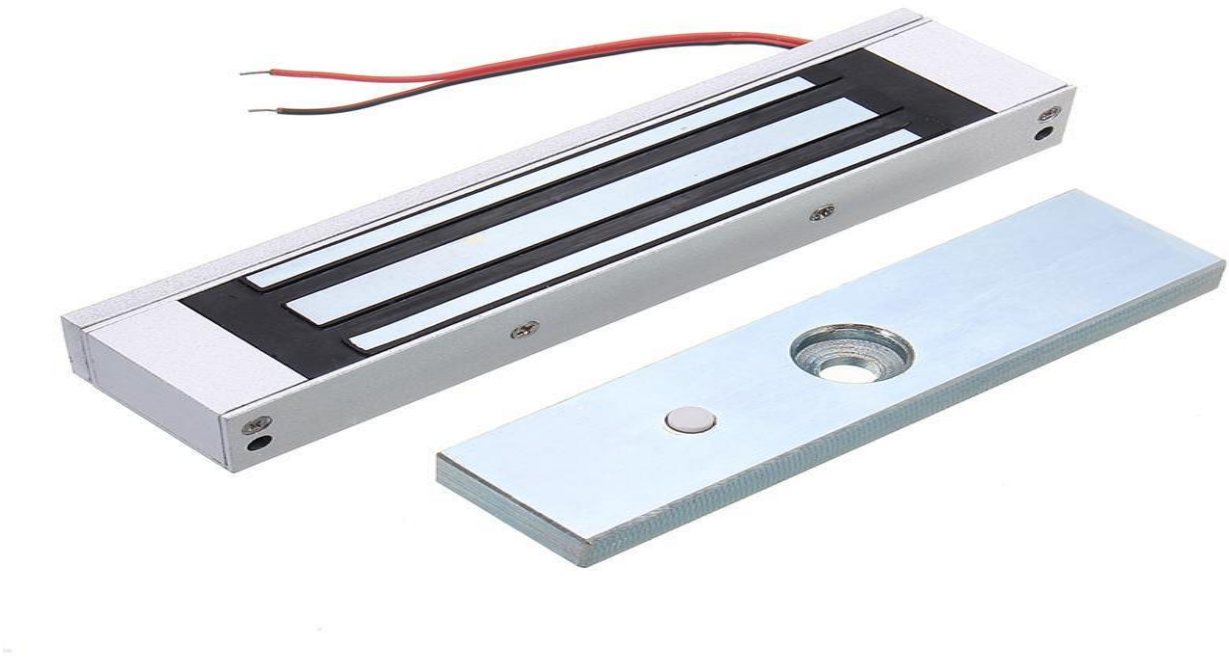

Figure 2.2.3

Driver hy-div268n-5a: To achieve precise positioning, the pulse signals from the controller are converted into motor motion.

Figure 2.2.4

Stepper motor: It is used to control the disc and rotate it at a certain angle to transport medications from one place to another.

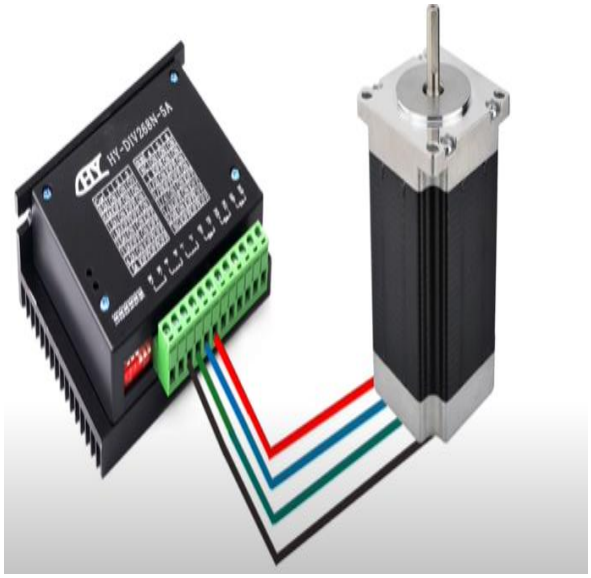

Figure 2.2.5

TFT Screen: This screen is used to display the names of the medicines contained in the refrigerator.

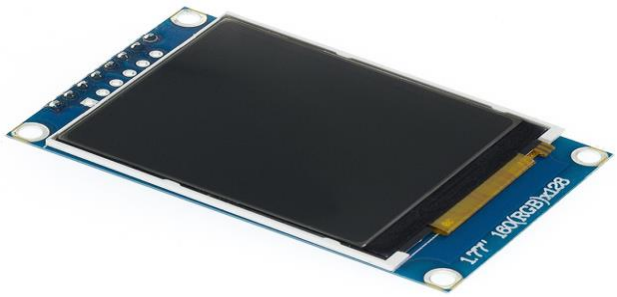

Figure 2.2.6

Peltier: It is used for cooling in the event of a specific event in the refrigerator to maintain the appropriate temperature for medicines, and it is provided with a heat sink, fan and a new piece to obtain the appropriate cooling in the event that the refrigerator developer breaks down

Figure 2.2.7

Keypad: The keypad is used to enter the correct password, thus opening the door when entered, and thus for the purpose of protection.

Figure 2.2.8

Barcode Scanner: This sensor is used to recognize the barcode of each drug and enter it into the system

Figure 2.2.9

Buzzer: It is used to sound an alarm in the event that the temperature rises from the appropriate temperature for storing medicines

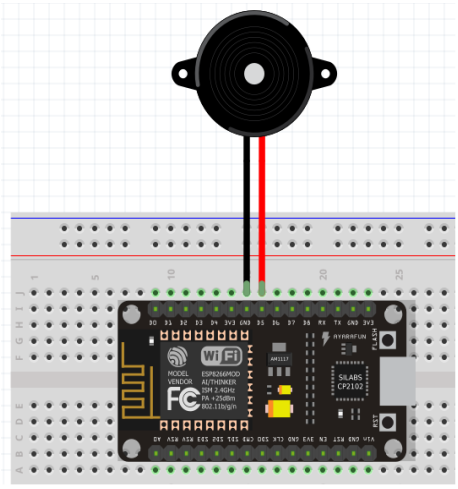

Figure 2.2.10

Arduino Mega: through which the system is fully managed by Arduino IDE

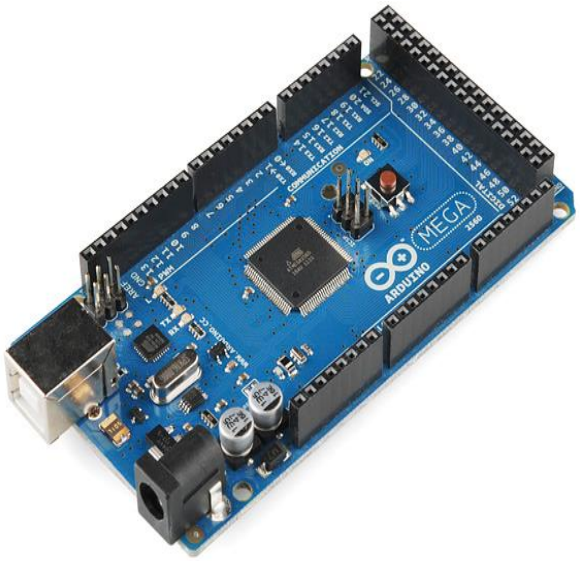

Figure 2.2.11

NodeMCU ESP8266:

Figure 2.2.12

By linking it to the Blynk application, temperature readings are monitored and their graphic representation is tracked during a certain period of time. It also contains drug names with additional information.

2.3 Earlier Coursework:

During our time in the Computer Engineering Department, we covered a variety of courses that played a crucial role in our education and contributed to the successful completion of this project. Here are a few examples:

1.Arduino course: This course familiarized us with the Arduino IDE, even though we didn't directly employ Arduino in our project.

2.Wireless course: We benefited from this course by gaining an understanding of wireless communication principles, which proved essential in facilitating communication between different nodes in our project.

3.Microcontrollers and its lab: This course equipped us with the necessary skills to work with microchips, including their configuration and utilization of various features.

Chapter 3: Literature Review:

The purpose of this project is to develop a complete system that ensures the effectiveness and safety of medications by utilizing the ESP8266 microcontroller. This system enables the monitoring and control of potential risks. Upon investigating the condition of medication storage refrigerators in hospitals, we discovered a notable deficiency in their features. Unlike our system, these refrigerators did not incorporate remote control capabilities. but, by incorporating the Arduino Mega and taking advantage of its additional functionalities, our system outperforms other projects in the field of medication preservation in terms of efficiency.

Chapter 4: Methodology:

In this section, we will provide an overview of the development process and discuss the hardware tools and techniques employed during the project construction.

4.1 Data collection:

We had conceived the idea of preserving the quality of medications due to the potential danger they pose to humanity when they spoil. However, we wanted to identify the specific areas that needed development. Therefore, we visited Al-Najah Hospital to observe their smart medication storage system, which guided us on the areas that required improvement in this field. We also visited Nablus Specialized Hospital to gain further knowledge and explore multiple medication preservation systems. Both hospitals provided us with valuable guidance, advice, and useful information that helped us enhance the smart medication storage system.

4.2 System development and building:

Initially, we conducted research to identify the necessary tools and devices that should be available, and we envisioned how we would build them inside the refrigerator. Then, we experimented with the individual tools without connecting them together. Next, we proceeded to the system building stage and integrated it with the Blynk application and website. We then connected the tools to each other and envisioned multiple scenarios that helped us improve specific aspects of the system.

The following is a chart that explains the mechanism of the system's operation:

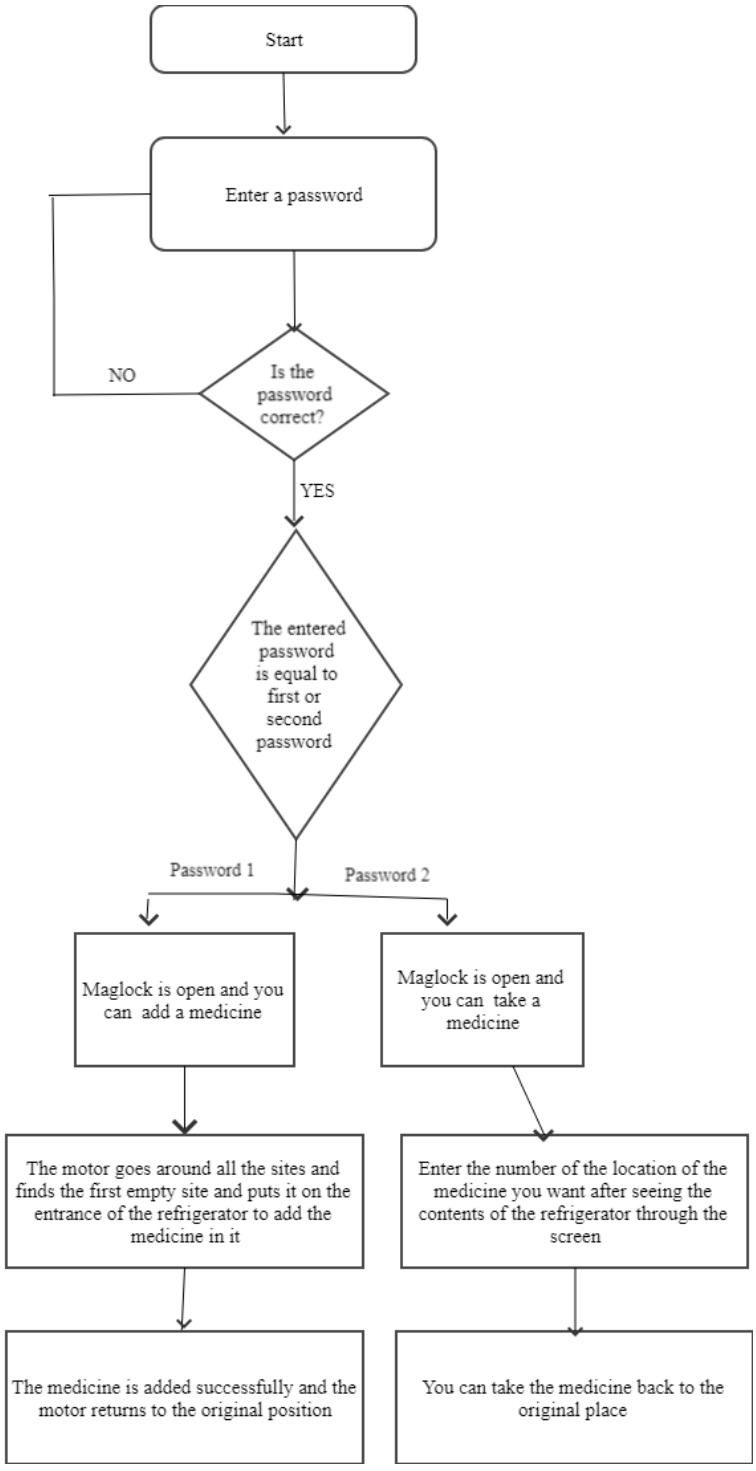

Figure 4.2.1

Blynk flow chart :

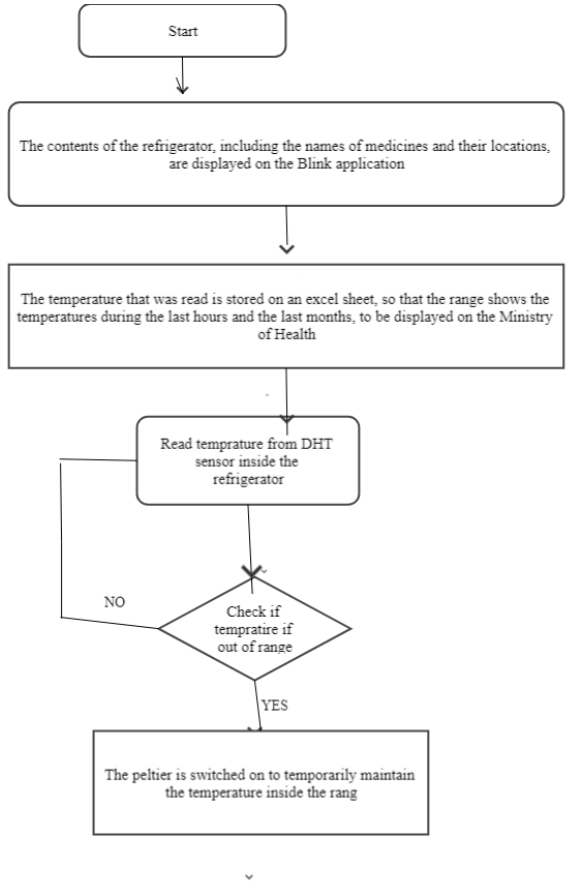

Figure 4.2.2

And in the following is the initial form of the project shown in the pictures below:

Figure 4.2.3

Figure 4.2.4

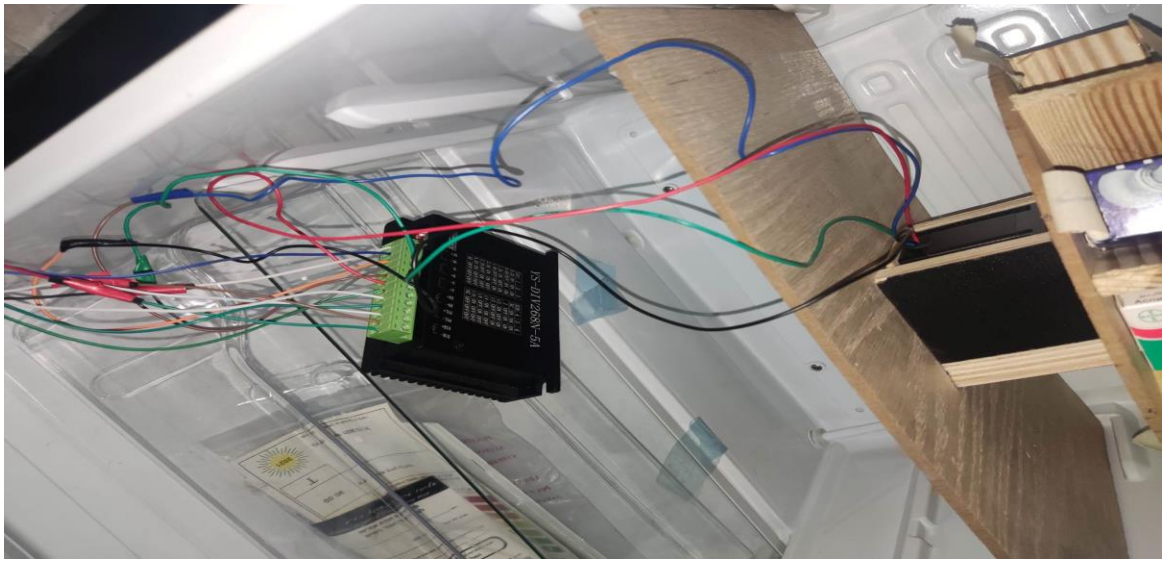

Figure 4.2.5


ميزيل
لعلاج التهابات
الجلد الفطرية
رناز
CARDIO
100 mg
coated tablets

Figure 4.2.6

Figure 4.2.7

Figure 4.2.8

Figure 4.2.9

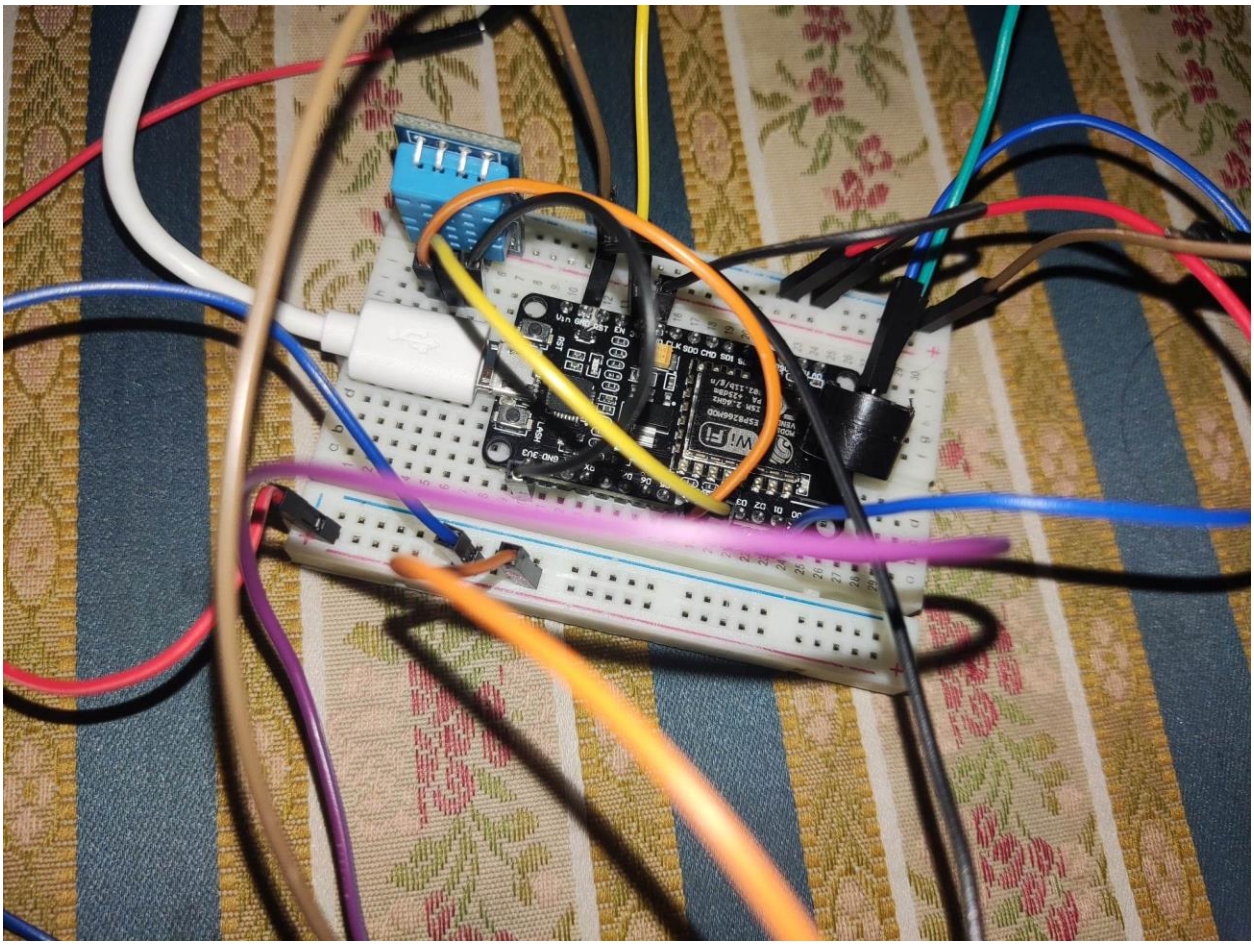

Figure 4.2.10

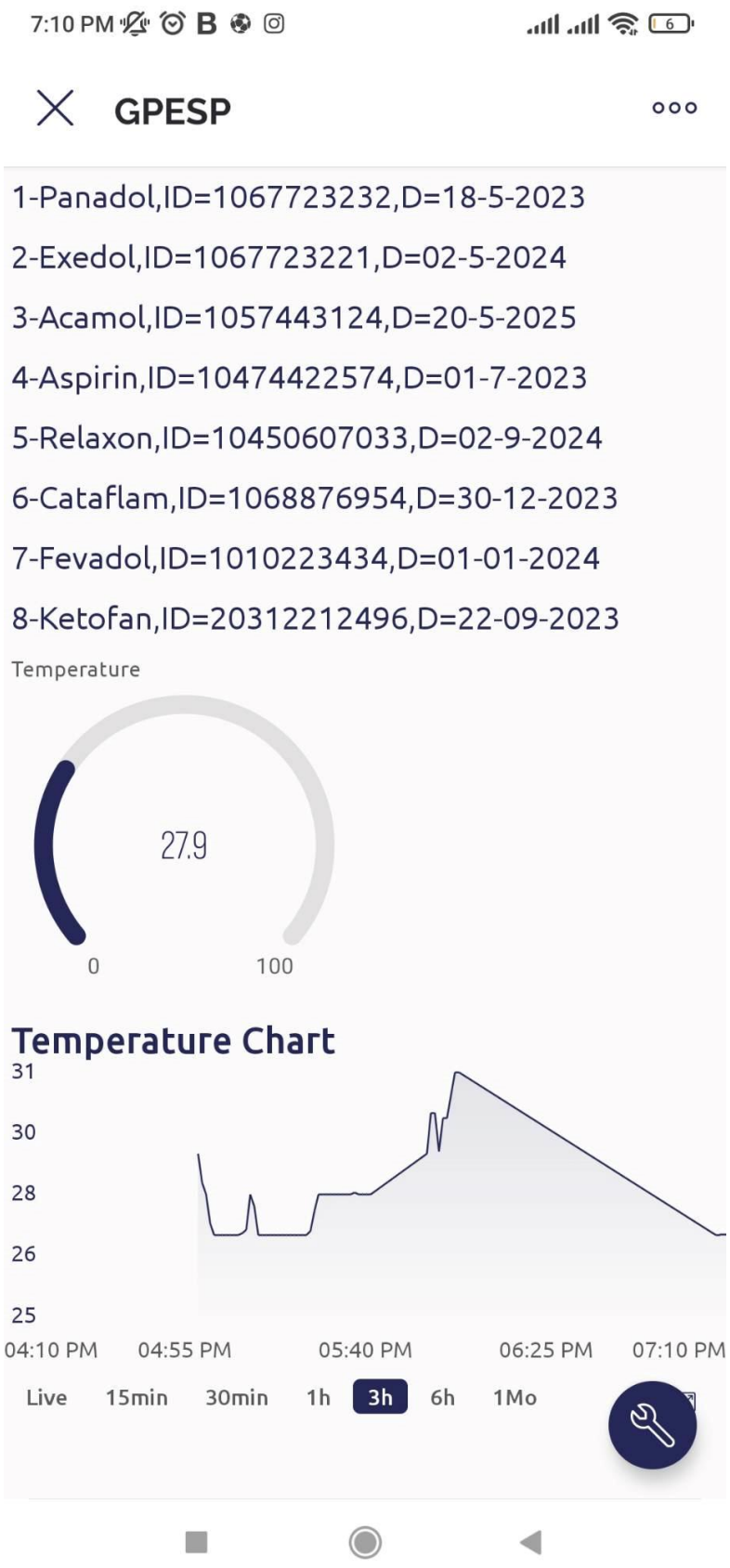
7:10 PM
GPESP
1-Panadol,ID=1067723232,D=18-5-2023
2-Exedol,ID=1067723221,D=02-5-2024
3-Acamol,ID=1057443124,D=20-5-2025
4-Aspirin,ID=10474422574,D=01-7-2023
5-Relaxon,ID=10450607033,D=02-9-2024
6-Cataflam,ID=1068876954,D=30-12-2023
7-Fevadol,ID=1010223434,D=01-01-2024
8-Ketofan,ID=20312212496,D=22-09-2023
Temperature
27.9
0
100
Temperature Chart
31
30
28
26
25
04:10 PM
04:55 PM
05:40 PM
06:25 PM
07:10 PM
Live
15min
30min
1h
3h
6h
1Mo

Figure 4.2.11

4.3 Results and Discussion:

The project has been successfully completed, achieving all the expected and desired outcomes. We tested various scenarios, including adding and removing medications, and the results were as anticipated. We have taken this project to another level by integrating it into the realm of technological advancement and incorporating electrical components. The expected results and benefits when implementing this project in hospitals are as follows:

- Enhanced security system.
- User-friendly interface and ease of use.
- Ensuring the safety and preservation of medications.
- Continuous monitoring at all times.
- Alert system in case of emergencies.
- Reduction in monitoring and control costs and efforts.

Chapter 5: Conclusion and Future Work:

In the end, after building the system, testing various scenarios, and conducting thorough evaluations, our project presents a complete system for specialized nurses to access the refrigerator. We achieved this by utilizing hardware tools, internet connectivity, and sensor devices in our system. Throughout the construction process and the completion of the system, we gained valuable knowledge and insights. One crucial lesson was the importance of having a clear and comprehensive vision of what you want to accomplish and the necessary components to achieve it. This helps in avoiding unnecessary purchases or acquiring items that are beyond the required specifications, thereby reducing costs.

As for future work, we aspire to develop several aspects, such as:

- Expanding the system to accommodate more medication locations.
- Enhancing security by replacing password authentication with fingerprint recognition for authorized personnel.
- Implementing location detection of vacant spaces for medications using a camera instead of an IR sensor.

These advancements aim to further improve the system's functionality, enhance security measures, and optimize the medication management process.

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