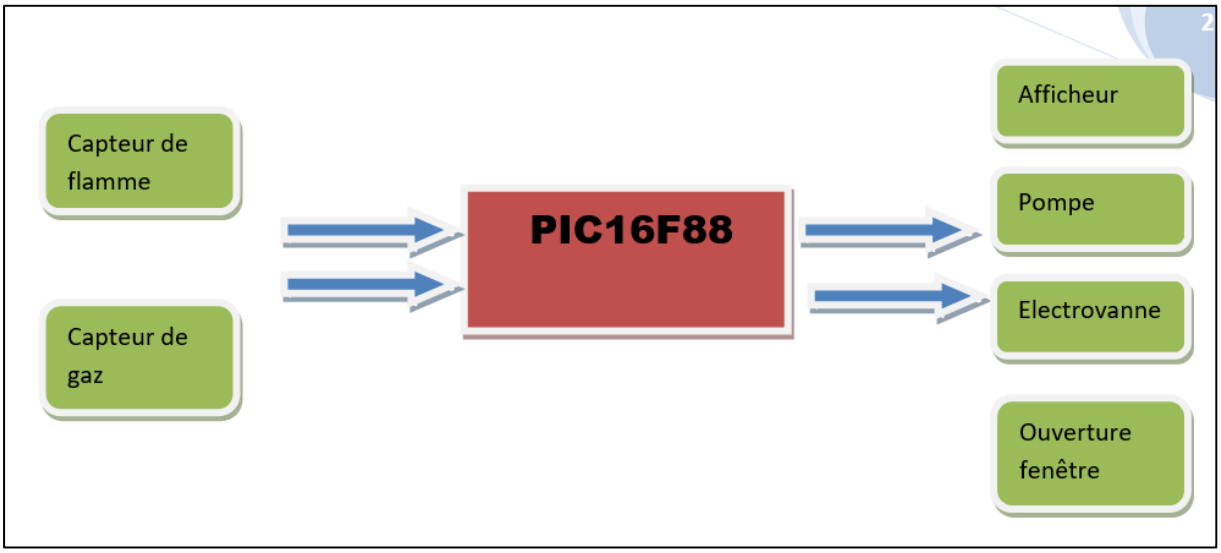
1. Introduction

This project focuses on designing and implementing a **smart home automation system** that integrates IoT to enhance energy efficiency, safety, and user comfort. The goal was to modernize home management by automating climate regulation, hazard detection, and intrusion prevention.

2. Technical Overview:

2.1 Embedded System Design

- **Controllers**: PIC16F88 and PIC16F877 microcontrollers for centralized and decentralized control.



- **Development Tools**:
  - **Simulation**: Proteus software for validating the design.
  - **PCB Design**: Eagle software for creating the circuit layout.

2.2 Energy Management

- **Temperature Sensing**:
  - LM335 temperature sensor with an accuracy of ±1°C.
  - Automated actions:
    - Activate heating below 17°C.

        - Trigger air conditioning above 23°C.
- **Power Regulation**: Voltage regulators (7805 and 7812) ensure stable operation for sensors and controllers.

2.3 Safety Features

- **Motion Detection**: Passive Infrared (PIR) sensors for intrusion alerts.
- **Gas and Flame Detection**: Sensors trigger alarms and automated responses such as power shutoff and window opening during hazards.

2.4 IoT Integration

- **Data Visualization**: Real-time monitoring on LCD displays.
- **Remote Access**: Future potential for cloud integration and smartphone control.

3. Results and Impact

- **Energy Efficiency**: Automated climate control reduced unnecessary energy consumption.
- **Enhanced Safety**: Reliable hazard detection and mitigation.
- **User-Friendly Interface**: Simplified interaction through displays and remote control options.

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4. System Functionality Summary

The developed system operates as follows:

1. **Initialization**:
    - The microcontrollers are initialized with pre-configured parameters.
    - Sensors (temperature, gas, flame, and motion) are activated to monitor the environment continuously.
2. **Climate Control**:
    - The LM335 temperature sensor monitors the ambient temperature.
    - Based on the temperature readings:
        - Heating is activated if the temperature drops below 17°C.
        - Air conditioning is triggered if the temperature exceeds 23°C.

3. **Safety Mechanisms**:
    - PIR sensors detect movement and activate intrusion alarms.
    - Gas and flame sensors monitor hazardous conditions and trigger:
        - Alarm notifications.
        - Automatic shutdown of power sources.
        - Opening of windows for ventilation.
4. **User Interaction**:
    - The system provides real-time data on an LCD display.
    - Users can control functions remotely through future IoT-enabled devices or locally using buttons.
5. **Power Regulation**:
    - Voltage regulators ensure consistent power supply to all system components, preventing interruptions.

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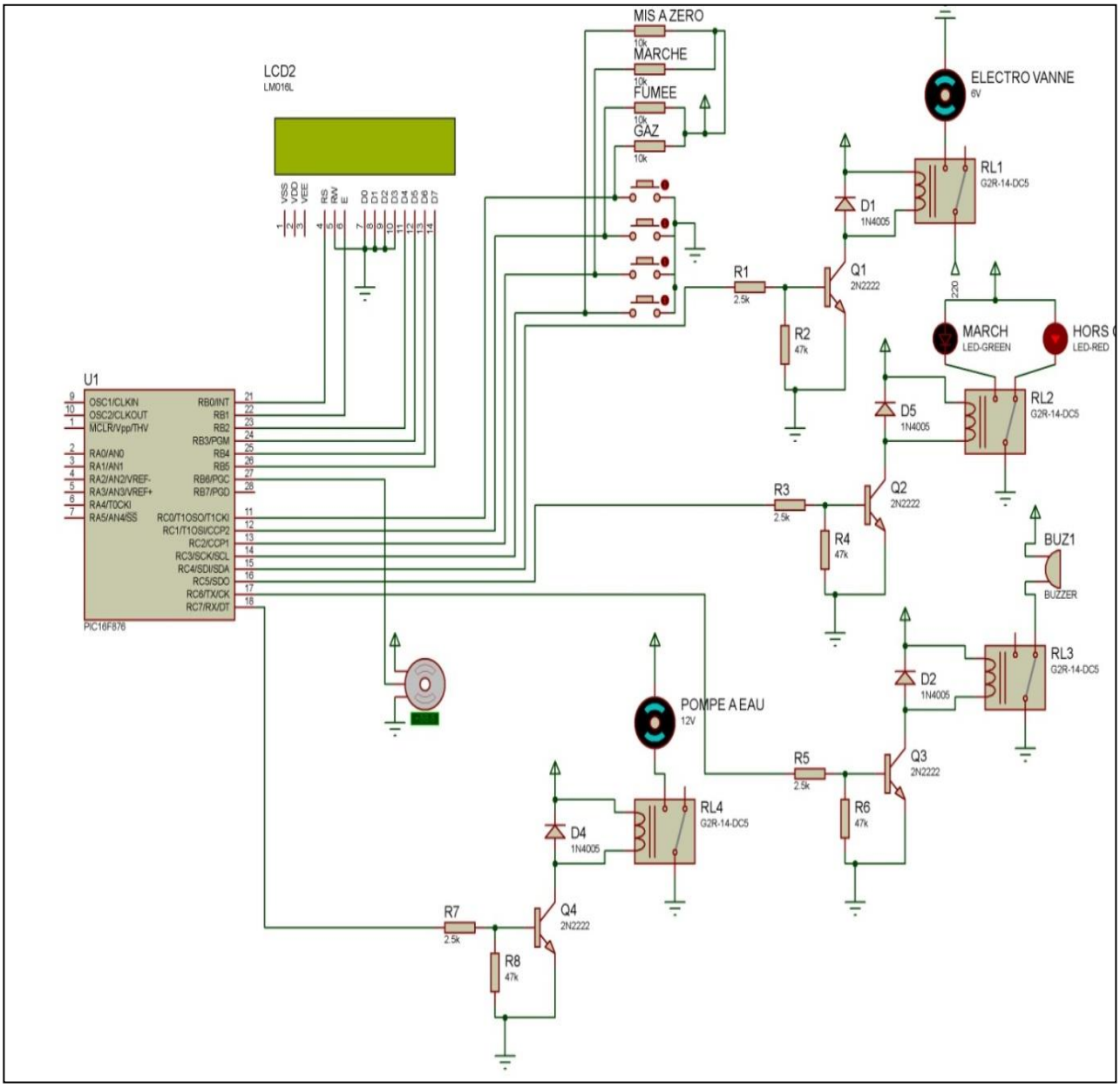
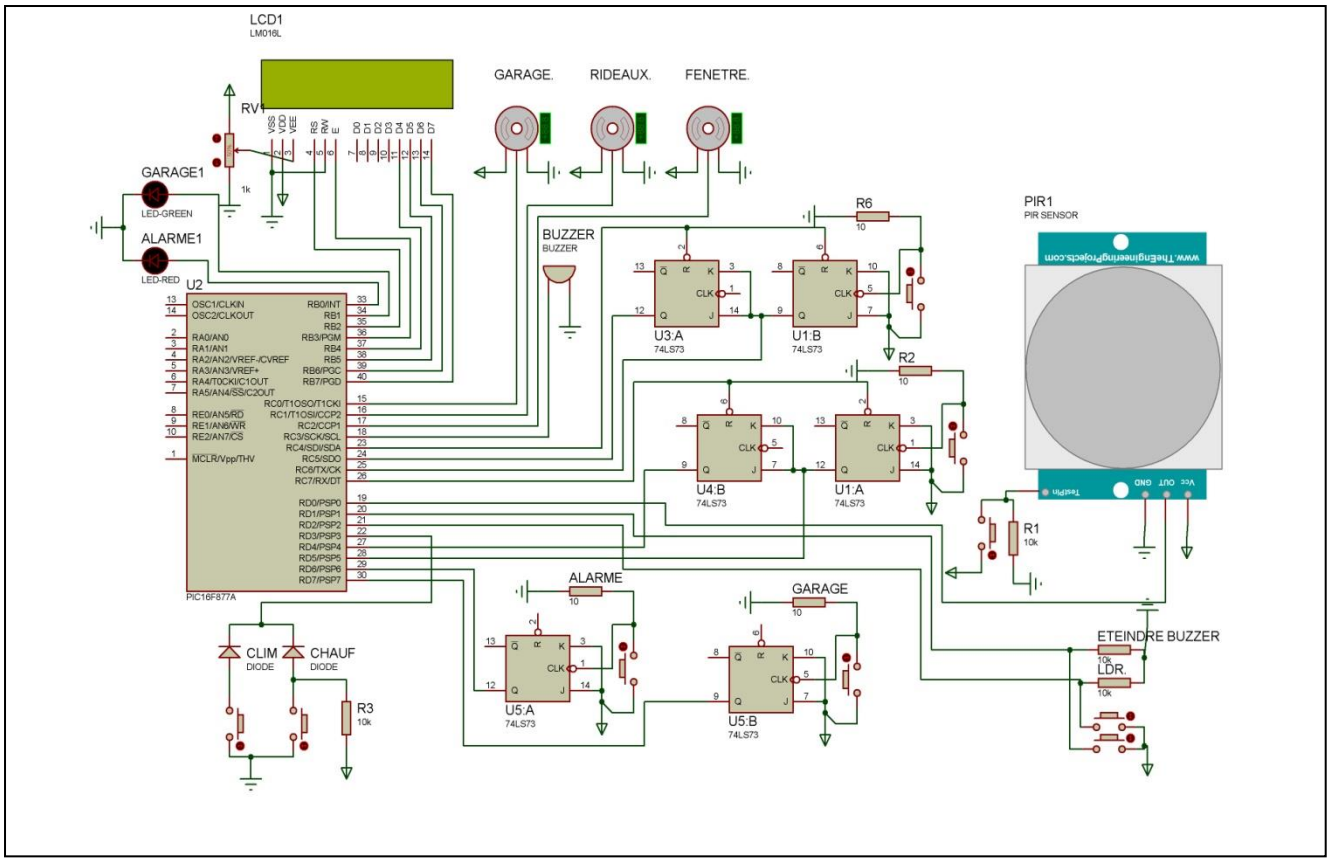
6. Visuals

- **System Schematic**: Showing connections between microcontrollers, sensors, and actuators.



Wiring diagrams based on **pic 16F876**

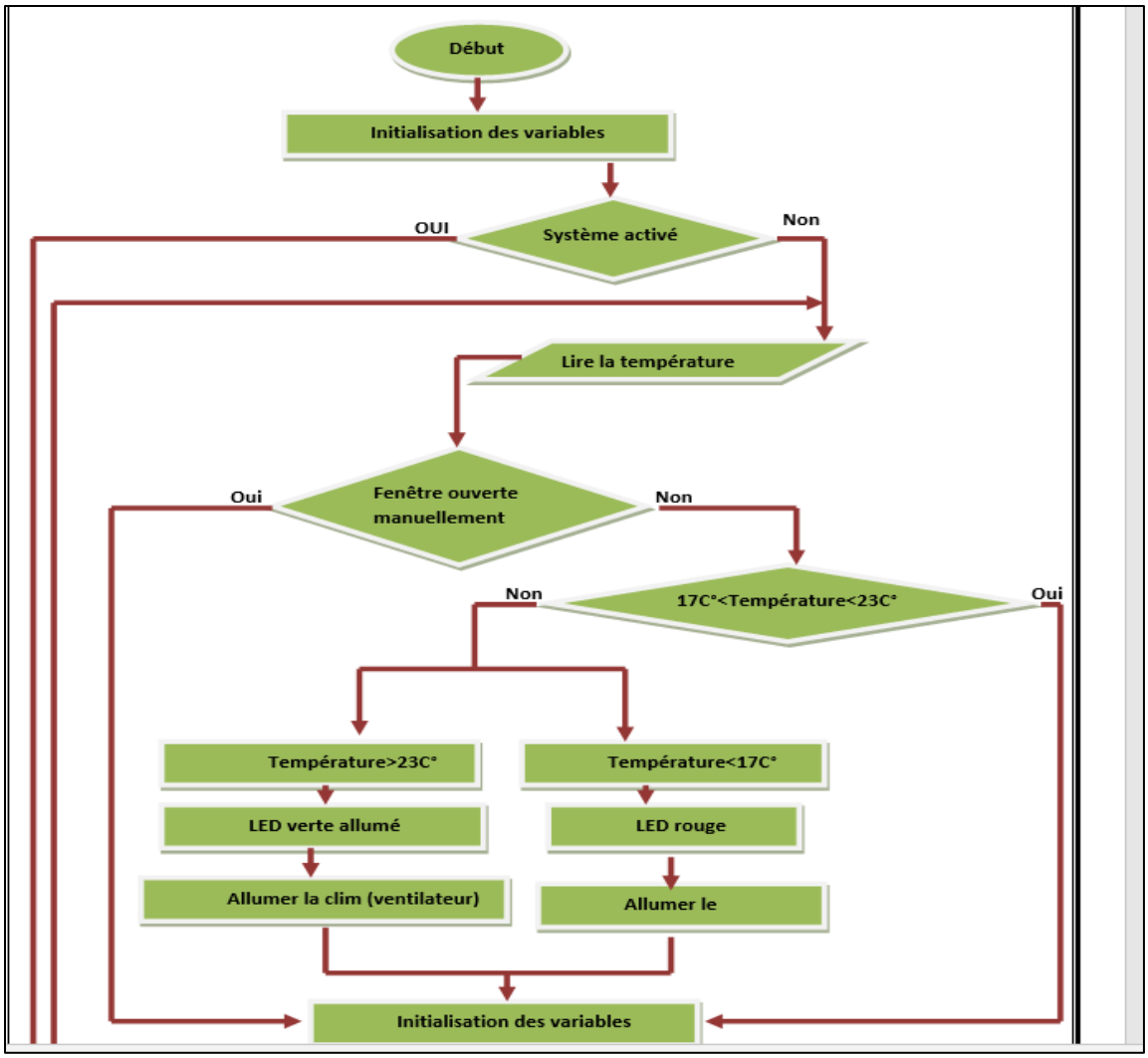


Wiring diagrams based on **pic 16F877A**

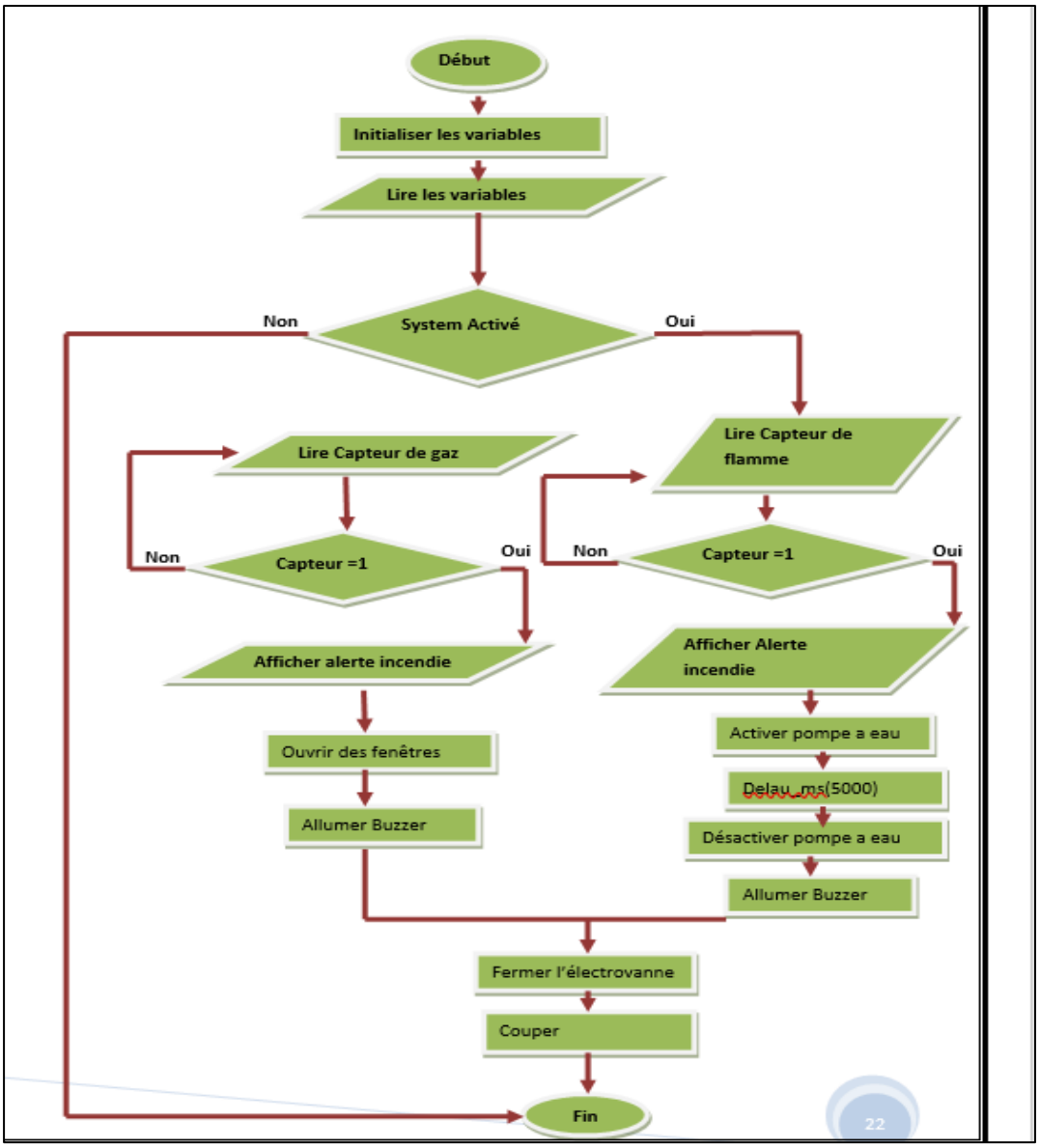
Microcontrollers programming :

Here I present a few diagrams explaining the reasoning behind the code :

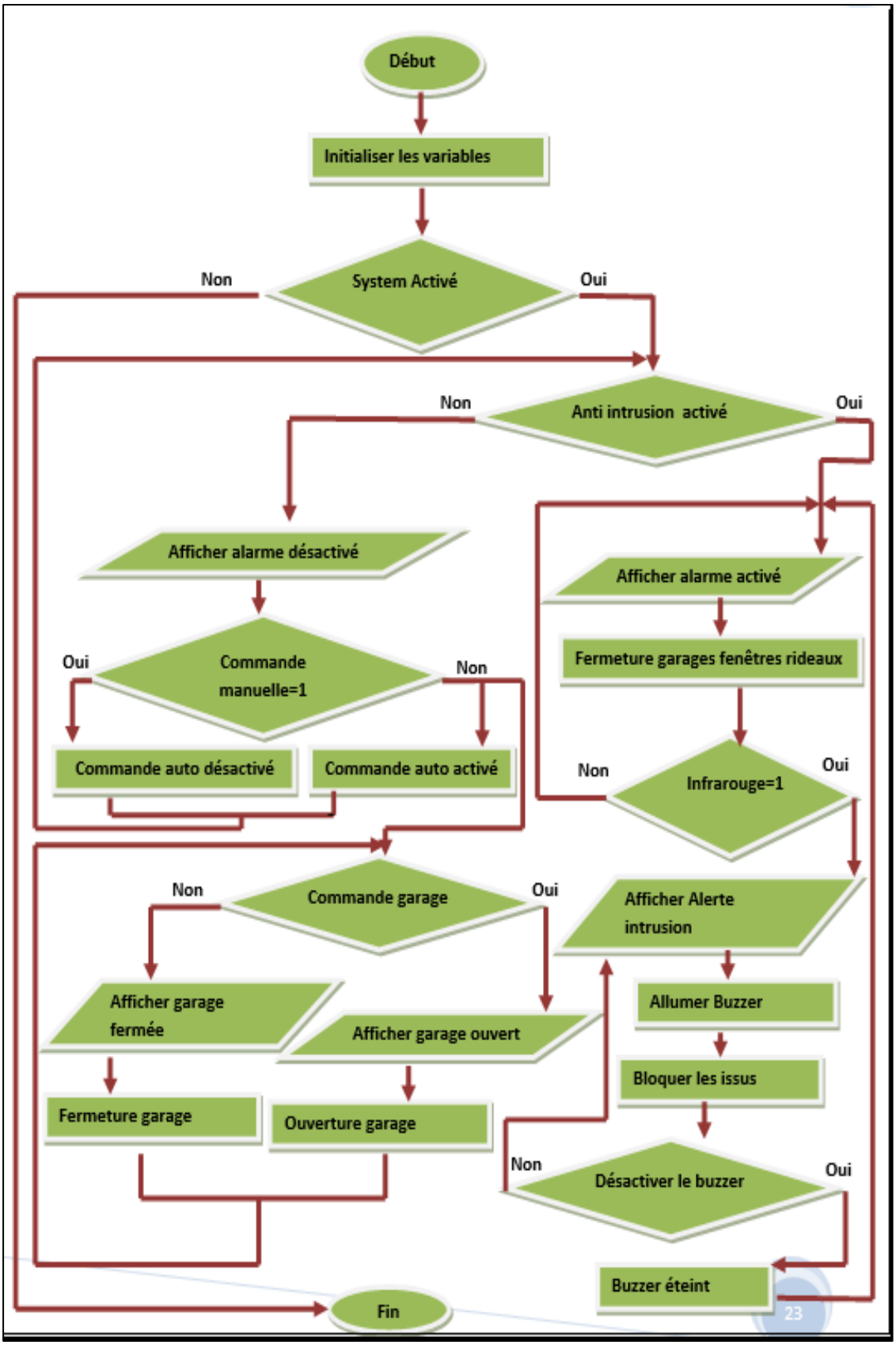
Ps : the diagrammes are in French , as the project was done in french .



1-Climat control

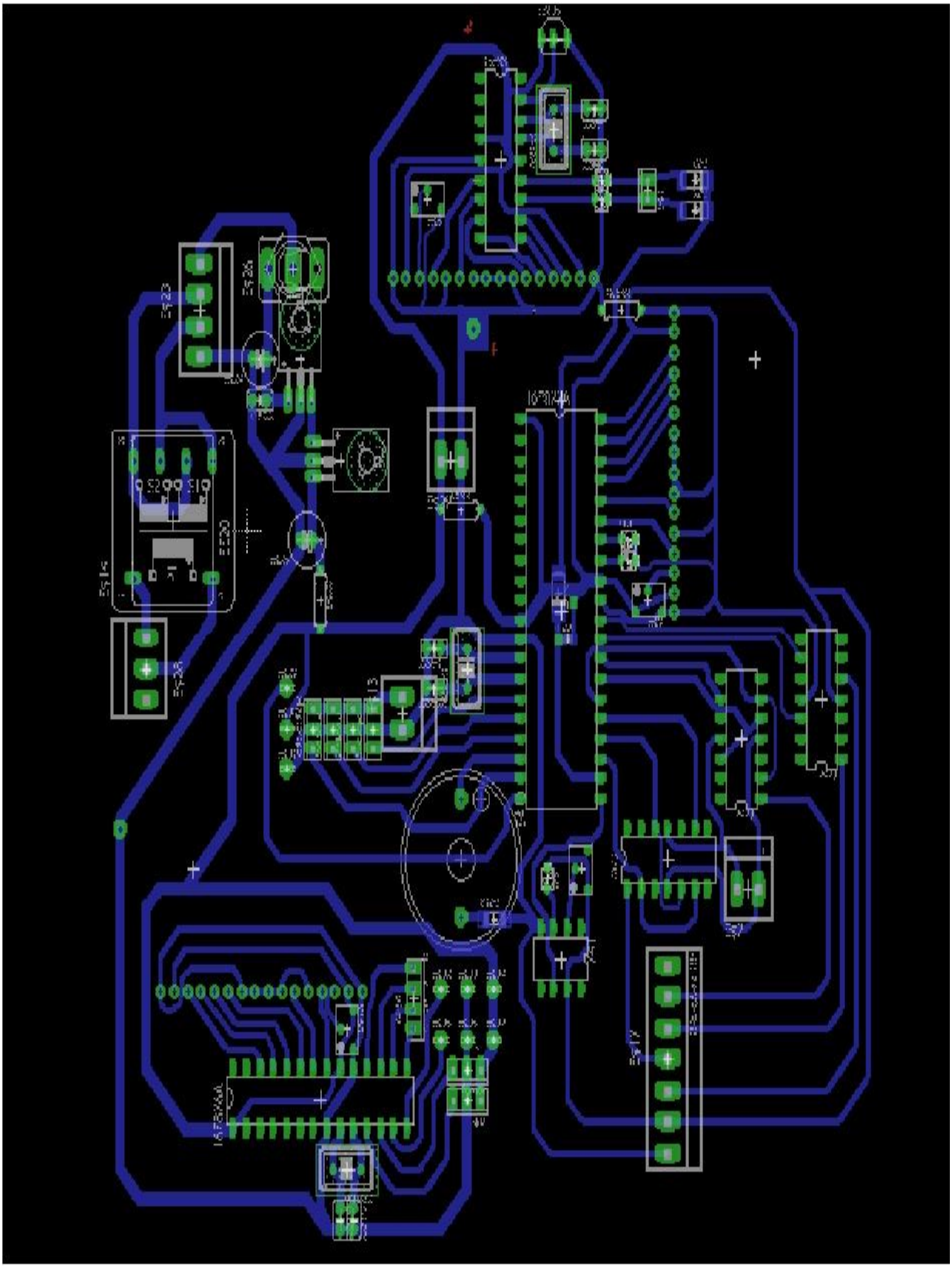


2-gas and flame sensors

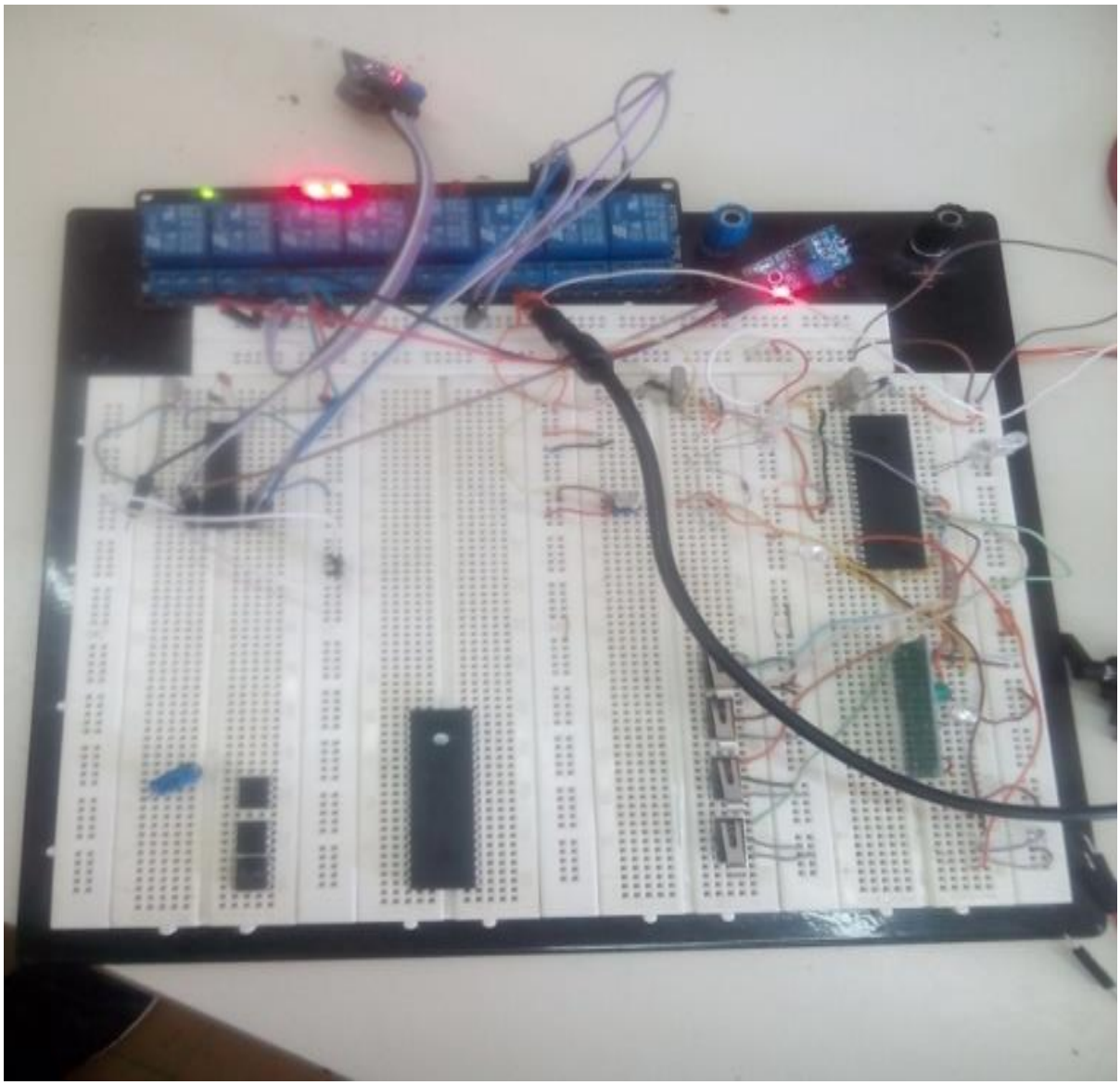


3-Safety mechanisms :

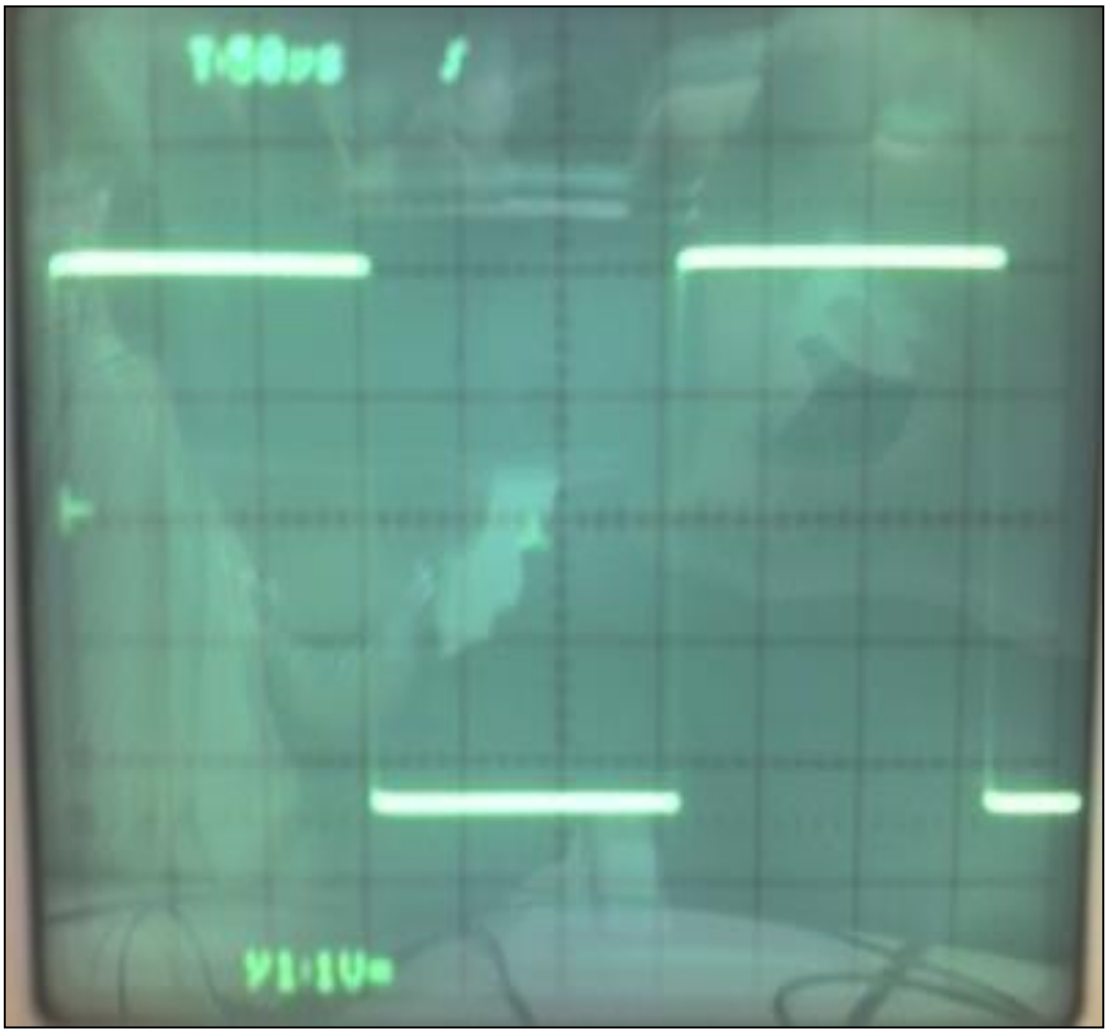
- **PCB Design**: Annotated layout of the implemented circuit.



- **Setup Photos**: Images of the working prototype or lab tests.

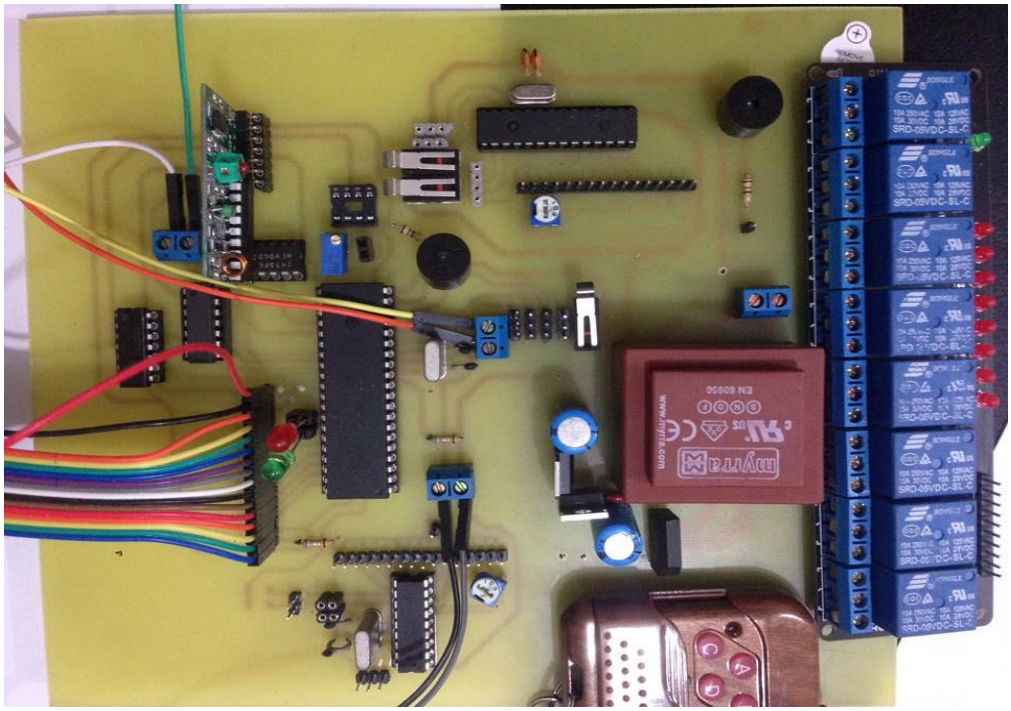


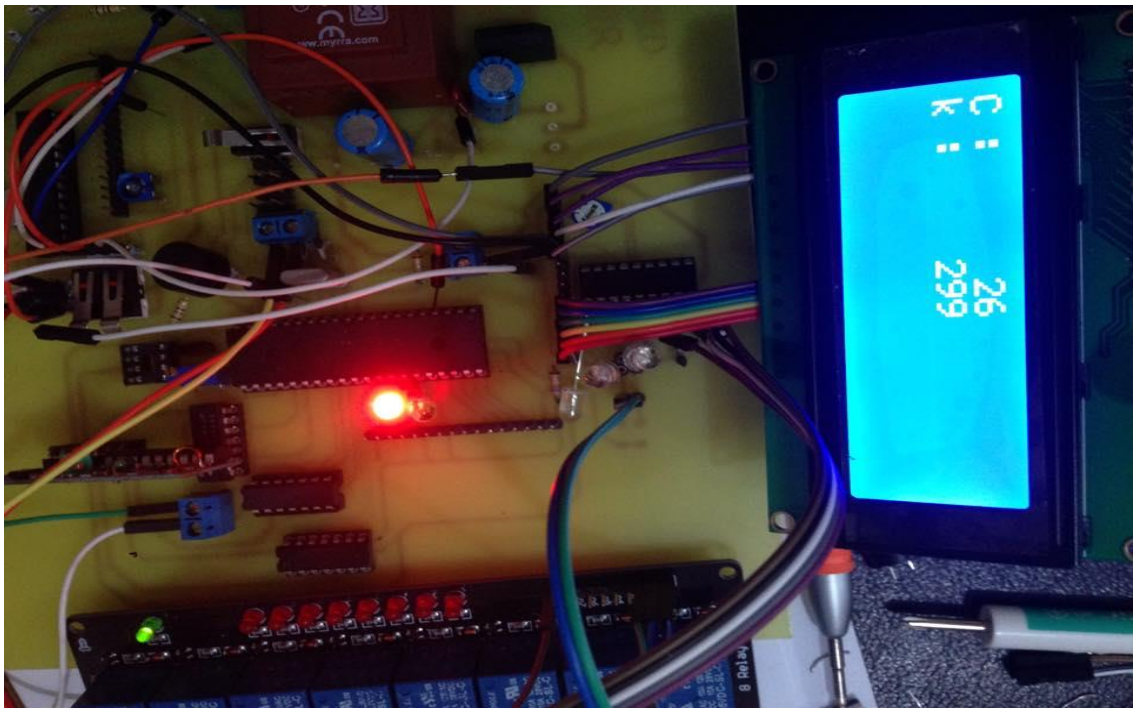
Testing the components on a bread board



Electrical signals visualations using an oscilloscope

The circuit with the components soldered on :





6. Conclusion

This project demonstrates expertise in embedded systems, IoT technologies, and energy optimization. The successful integration of advanced sensors, microcontrollers, and automation highlights practical problem-solving skills applicable to energy-efficient and sustainable solutions.

7-Why This Project Makes Me Perfect for the Internship :

This project directly aligns with the requirements for an electrical engineering internship, showcasing my ability to design, implement, and optimize embedded systems. The following attributes make me an ideal candidate:

1. **Hands-On Experience**:
    - I developed a fully functional IoT-based system that integrates sensors, actuators, and microcontrollers.
    - Practical skills in simulation and PCB design using industry-standard tools like Proteus and Eagle.
2. **Problem-Solving Skills**:
    - I addressed real-world challenges in energy management, safety systems, and automation.
    - Designed efficient control algorithms for temperature regulation and hazard mitigation.
3. **IoT and Embedded Systems Expertise**:
    - My ability to create smart systems with IoT integration highlights my understanding of modern technologies and their applications.
    - Experience with data visualization and system optimization for enhanced usability.
4. **Relevance to the Internship**:
    - This project demonstrates skills that are essential for developing innovative and energy-efficient solutions, which aligns with the goals of your organization.

Final note :

Thank you so much for taking the time to read this and I hope this has giving a positive impression of me and my abilities and if you have any questions please feel free to reach out

WALID ATMANE