Université Saint-Joseph de Beyrouth
Faculté d'ingénierie
Institut national des télécommunications
et de l'informatique

Firmware Design: 4-Floor Elevator Controller

Patrick Soueid - Jane Abi Saad

Introduction

Project Objective: Design a firmware-based elevator controller for efficient real-time operations.

Core Features: Handles floor requests, motor control, and user inputs using modular programming.

Hardware Integration: Includes ADC-based temperature monitoring and I2C communication with the DS1307 RTC.

User-Centric Design: Ensures seamless elevator operation with responsive inputs and clear feedback systems.

Practical Application: Demonstrates firmware design principles in embedded system development.

System Architectures

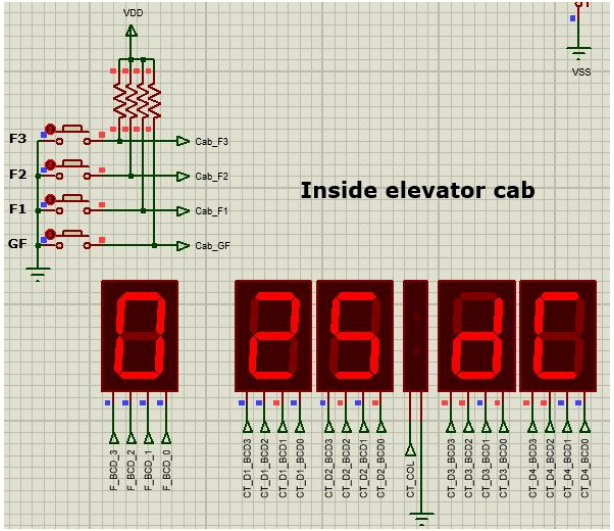
Scheduler: Ensures task prioritization and avoids blocking operations.

•Cabin interior: Processes temp, time and date information.

• Elevator motor: Manages button presses, cabin movement, led activation and stopping logic.

• I2C interface: which we used to communicate with the DS1307 driver.x

Interior Cabin



Temperature (LM35 Sensor):

- Configured the ADC to read analog data from the LM35 sensor.
- Converted the ADC value to voltage and then to temperature in Celsius.
- Displayed the temperature on the shared cabin display.

Time and Date (DS1307 RTC):

- Set up I2C communication to read data from the DS1307 RTC module.
- Retrieved and decoded BCD values for time (hours and minutes) and date (day and month).
- Alternated the display between time and date alongside the temperature.

Display Management:

- Used a switch case with a counter to periodically switch between showing temperature, time, and date.
- Dedicated another display to show the current floor number continuously.

Motor Controller

Initialization:

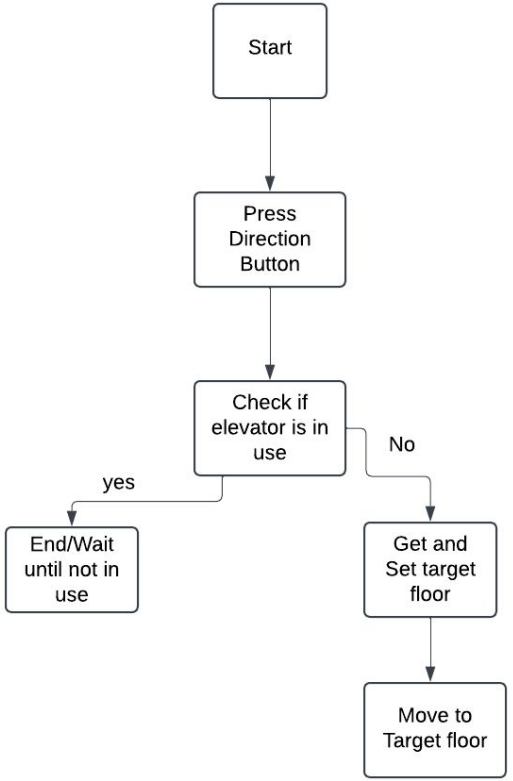
- Motor pins are set to idle, and the elevator starts at the ground floor.

Request Handling:

- If the current floor matches the target, the motor stops.
- If the target is above, the motor moves up; if below, the motor moves down.

Floor Display Update:

- The current floor is shown on the 7-segment display as the elevator moves.



Future Enhancements

- Adding support for more floors by expanding input and output handling.
- Enhancing accessibility through voice-based announcements.
- Integrating a weight sensor to prevent overloading