Project Work – Elevator

In the project work, the task is to make an elevator system using the Arduino MEGA (ATmega2560) as a master and Arduino UNO (ATmega328p) as a slave. MEGA and UNO boards should be connected to each other using a communication protocol (**SPI or I2C/TWI**).

- Keypad must be connected to MEGA board, and it is used to input the floor numbers (0 – 99).
- LCD must be connected to MEGA board, and it is used to display messages to the user (floor number, door opening, door closes, emergency, etc.).
- Two LEDs are used to indicate the elevator movement and opening the door, respectively. Both of them should be connected to UNO.
- Buzzer is connected to UNO board is used to play a melody.
- External button is connected to MEGA to initiate the emergency.

The project work must fulfil at least all the minimum functionalities.

Minimum functionality of the system:

1. System waits for floor input from the keypad (*Idle*)
   a. LCD displays the idle state (for example showing text “Choose the floor”)
2. Elevator moves to selected floor based on the input from the keypad (*Going up / Going down*)
   a. Movement LED is *ON* until the floor is reached
   b. LCD screen displays the current floor during the movement until the selected floor is reached
   c. System executes the door opening case
3. Door opening and closing is done by one case (*Door opening*)
   a. Door opening LED is *ON* for 5 seconds after the floor is reached
   b. LCD displays that the door is open/closed
   c. System goes back to idle
4. Stopping the elevator in an emergency during movement (*Emergency*). The melody of buzzer must consist of 4 notes at minimum! (Group must choose one of the levels)
   a. Minimum level: When external button is pressed, LCD shows “EMERGENCY”, movement LED blinks 3 times, door opens, melody plays for 1 loop, and then door closes. System goes to idle.
   b. Improved level: When external button is pressed, LCD shows “EMERGENCY”, movement LED blinks 3 times. Button on keypad is pressed to open the door and play the melody for 1 loop. And the door automatically closes. System goes to idle.
   c. Final level: When external button is pressed, LCD shows “EMERGENCY”, movement LED blinks 3 times. Button on keypad is pressed to open the door and play the melody. The melody loop continues infinitely until another button on keypad is pressed. And the door automatically closes. System goes to idle.
5. Fault state initiates if selected floor is the same as current floor (*Fault*)
   a. Movement LED blinks 3 times
   b. System goes to idle

Additional functionalities for the project work (max 5 points):

Improved/Final level of emergency	(1/2 points)
Use ISR in the project	(1 points)
Add your own functionalities	(1 – 2 points)

This project work must be done in Microchip Studio. Only external libraries or header files related to LCD and keypad, available on the Moodle page, are allowed to be used. Additionally, all libraries that come with Microchip Studio, such as <util/delay>, are allowed.

Demo:

Groups will have to demo the project work circuit to the teachers before deadline. The contribution of each group member should be explained during demo. **Demo can only be done in person**. You can demo the work by arranging a suitable time with the teachers.

Report:

Each group submits the **whole commented Microchip Studio project** (including the *main.c*, and other used *.c* or *.h* files) and **brief report of around 5 pages**. The report should include a list of used components, schematic diagram of the circuit (includes pin connections), general explanation of the functionality, and conclusions on how the group's project work could be improved. The report should include the group number, names of the group members, and respective clear contributions of each member.

To create the schematic diagram, you can use for example https://www.cirkitstudio.com/.

The report must be submitted in PDF format!

Grading:

To receive a grade from the course, the group must return their Arduino kits in a proper arrangement. Any broken or missing components should be reported.

You can read the "Project work grading" from Moodle to get an idea of the evaluation criteria.

THE DEADLINE FOR THE DEMO IS 9.5.2025.
THE DEADLINE FOR THE REPORT IS 11.5.2025 AT 23:59.
Every late submission is deducted 2 point/day.