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| **Architetture dei Sistemi di Elaborazione 02GOLOV [AA-LZ]** | Delivery date:  Thursday 9/1/2019 |
| **Extra-points Project**  **Part 1** | Expected delivery of **extrapoint\_01.zip** must include:   * The zipped folder of your project * A 4 minutes video with audio (.mp4 or .avi) explaining how the project works; the video has to show a software debug session with all significant peripheral windows opened; the audio must be a voice recording of you describing (in Italian or English) the behavior of the running system. |

Purpose of Part 1: to acquire full confidence in the usage of the KEIL **software debug** environment to emulate the behaviour of the LPC1768 and the LANDTIGER Board.

This part is evaluated to assign a maximum of 2 extra-points for qualified students taking the exam with a mark >= 18

Starting from the 09\_sample\_BUTTON\_LED\_NVIC\_PCON\_TIMER\_RIT\_bouncing\_buttons\_joystick project, develop the controller of an elevator for persons with limited mobility; an example is given in figure 1.



Figure 1. General view of the scenario

You are asked to write a program for the LandTiger Board that permits to reproduce the behaviour of the elevator. As shown in figure 1, there are two main components:

1. An elevator controller: it is used by the impaired person to drive the elevator.
2. Two elevator request panels (one for each floor), to request the elevator to reach the floor associated with the request panel.

The elevator controller is composed of:

* **A joystick** used to manoeuvre the elevator.
* A **Status LED**, for providing visual feedback about the elevator status.

Each of the two request panels is composed of:

* 1 **reserve button**, to be pressed to reserve (i.e., call) the elevator.
* 2 LEDs:
  + The first one is located behind the reserve button, and it is switched on when the elevator is either busy or successfully reserved **(Reserved LED)**.
  + The other one is used to light on an alarm signal **(Alarm LED)**

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Fig. 2 Elevator controller Fig.3 Request panel

**ELEVATOR CONTROLLER**: Once on the elevator, the user handles the controller.

The joystick should be activated exclusively after having pressed the reserve button and after that the elevator is stopped at the same floor of the user. Then, once the wheel chair is placed on the platform, the **joystick** SELECT button should be pressed before starting the movement to activate the elevator. After activation, through the joystick UP and DOWN commands, the user can decide the direction to give to the elevator. The movement can be *suspended and resumed at every time* during the transportation. Moreover, the direction can be changed instantaneously. By acting on the joystick, the elevator can be moved with a constant speed of 4km/h. In our case, it is assumed that the elevator is intended for connecting the ground floor or floor 0 with the first floor of a private house. The distance that the elevator has to cover is 8m.

The **STATUS LED** shows the status of the elevator:

1. ON - When the elevator is stopped during the normal operation for any reason but the target floor is not reached the LED remains on. This is the case when the user released the joystick during the transportation but the target floor is still not reached.
2. 2 Hz blinking - when moving. This happens when:
   1. the joystick is operated by a user or;
   2. when the user requests the elevator from a given floor, and the elevator is moving from the opposite floor towards the user.
3. When the elevator reaches the requested floor, the LED blinks for 3 seconds at 5Hz frequency (i.e., when it arrives to the requested floor, or when the user has driven successfully up to the destination floor), and then, the status LED should be Off.
4. OFF – when the elevator is not in use, or it has reach the targeted floor as described in 3.

**REQUEST PANEL:** when theuser approaches the elevator request station, the elevator may be at the corresponding floor or at the opposite one. In the latter case, a request acts on the elevator and makes it move to the right floor (i.e., the one from which the user is requesting the elevator). The speed is the same as with the user on board. Instead, if the elevator is at the same floor of the user, the request makes the elevator busy. Successively, the user can act on the joystick to control the elevator movements.

The button is used to call and reserve the elevator; this button is associated with a **Reserved LED**:

* if the elevator is free (when not reserved, not moving and stopped at one of the two floors) the LED is off;
* if the elevator is busy (after having pressed the reserve button, when moving or when it has been stopped between the floors), the LED is on;
* in the case the elevator reached the target floor but after 1 minute the joystick select button has not been pressed, the reserved led should be turned off, as well as the STATUS led in the elevator controller.

The **alarm LED** switches on in case the elevator is stopped without moving between the floors for more than 1 minute (i.e., it signals an alarm in case the user was unable to operate the joystick for a large amount of time);

Use the available LEDS, BUTTONS and JOYSTICK to reproduce the various components of the elevator for limited mobility persons, as indicated below.

