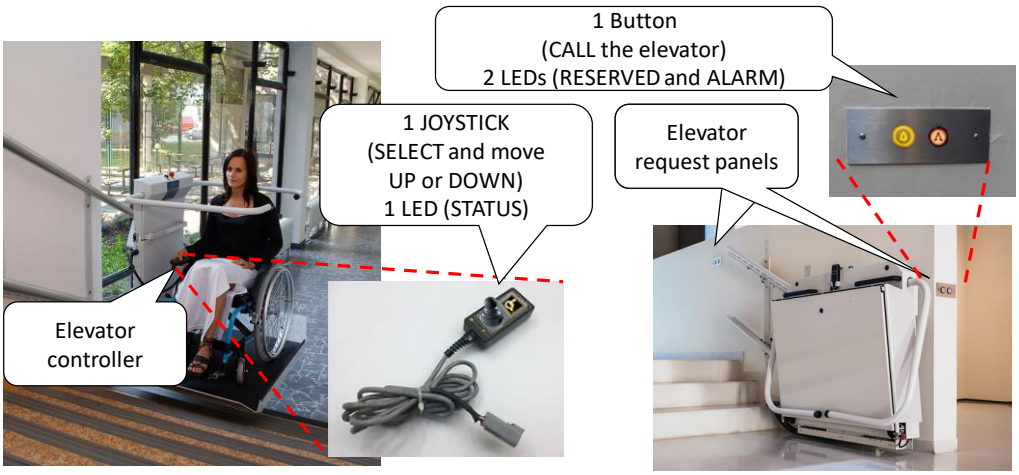


Figure 1. General view of the scenario

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)**

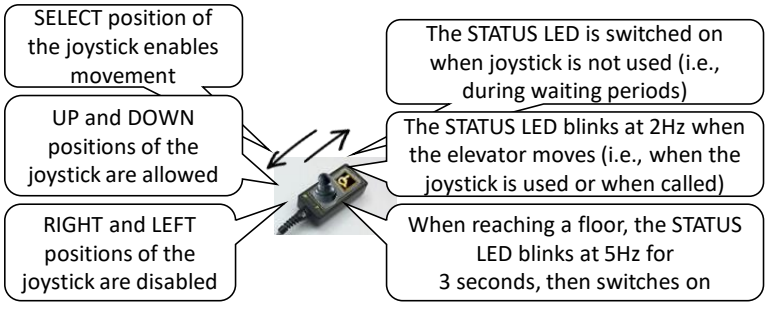


Fig. 2 Elevator controller

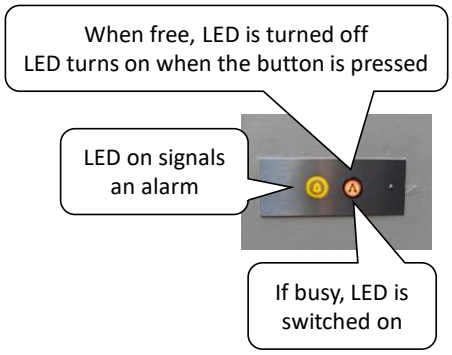


Fig.3 Request panel

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:
    a. the joystick is operated by a user or;
    b. 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.

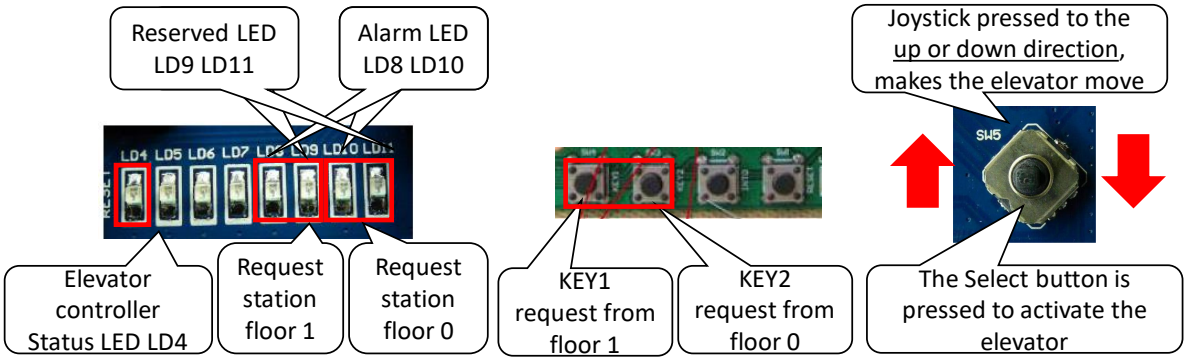
REQUEST PANEL: when the user approaches the elevator request station, the elevator may be at the corresponding floor or at the opposite one. In the latter case, a request acts on the elevator and makes it move to the right floor (i.e., the one from which the user is requesting the elevator). The speed 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**:

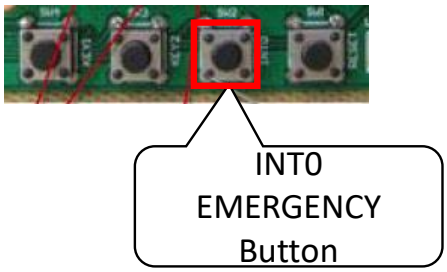
- if the elevator is free (when not reserved, not moving and stopped at one of the two floors) the LED is off;
- if the elevator is busy (after having pressed the reserve button, when moving or when it has been stopped between the floors), the LED is on;
- in the case the elevator reached the target 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);

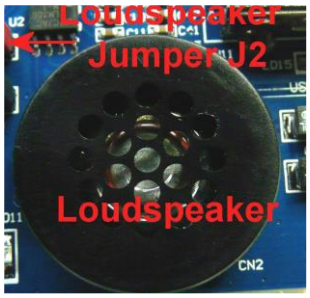
Use the available LEDS, BUTTONS and JOYSTICK to reproduce the various components of the elevator for limited mobility persons, as indicated below.



A) Button INT0 is used to implement an **EMERGENCY BUTTON** included in the Elevator Controller, that can be pressed when the transported person is in difficulty and requires assistance. The button activates the following rescue measures:



1) As soon as pressed, **Status LED** blinks at a 4Hz frequency.
2) As soon as pressed, the loudspeaker alternates two tones (please see point B for more specifications) synchronously with the flashing frequency of the Status LED; **volume have to be limited to the 30% of the maximum amplitude**.
3) **Alarm LEDs** at both request panels are switched on.



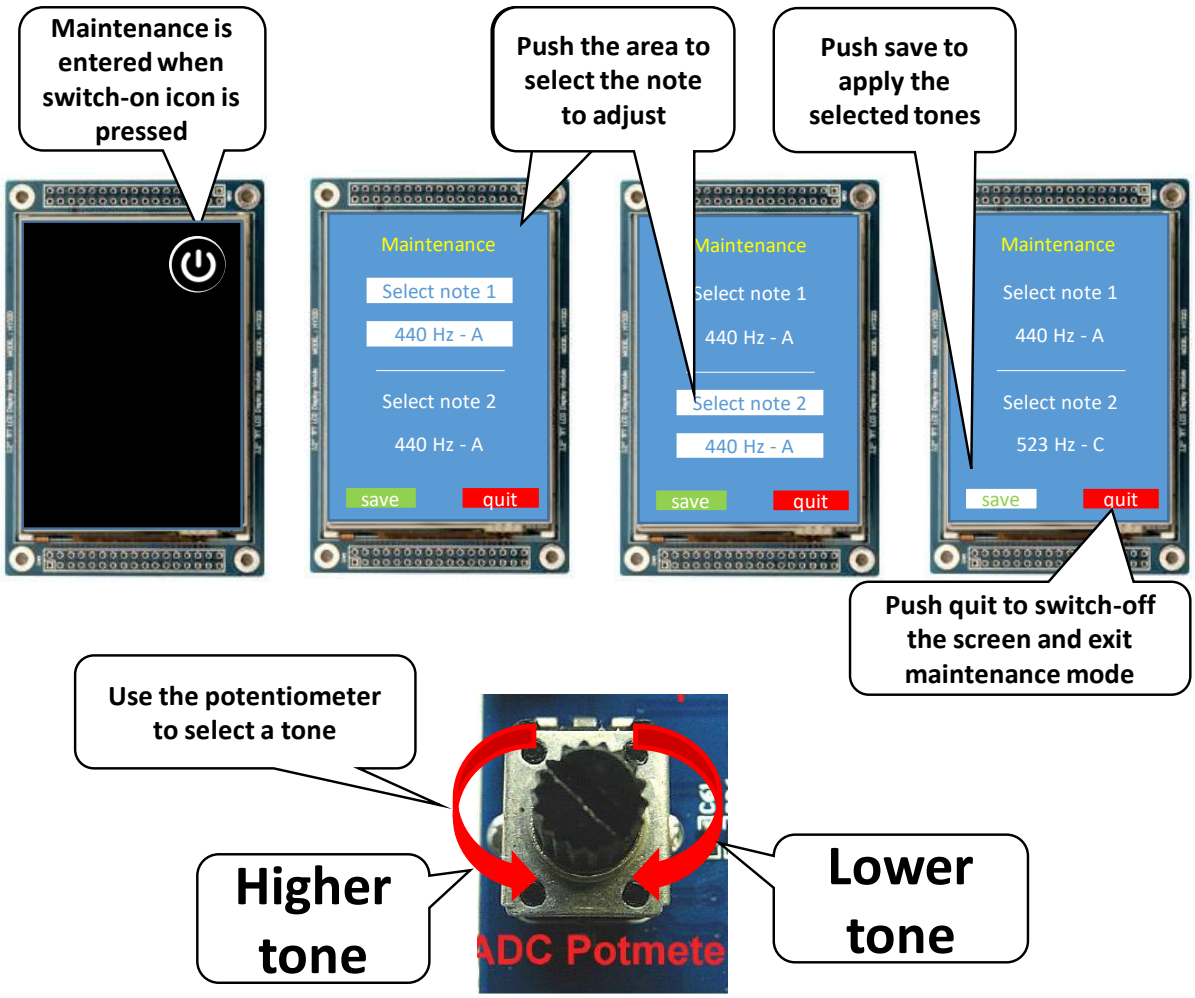
Since the Emergency Button can be also pressed accidentally:

4) If intentionally pressed (i.e., for at least 2 seconds),
   i. It makes the elevator stop at any point during the transportation.
   ii. The Status LED, the Alarm LED and the loudspeaker hold the emergency behaviour if the button is released.
   iii. The elevator moves again when it is called from a Request panel, meaning that someone is rushing to the rescue
      - The elevator moves in direction of the floor from which it was requested.
      - Loudspeaker stops emit sounds
      - LED works according to the usual behaviour when the elevator is normally requested.
5) If accidentally, two scenarios are possible. If pressed while in **EMERGENCY MODE** the behaviours A.1, A.2, A.3 are suddenly interrupted and the normal one is resumed. Instead, if pressed during the normal operation for a period less than 2 seconds it must be ignored by the system.

IMPORTANT: in the equipment upgrade, the manufacturer decided to use/adapt the rescue protocol described above (A.1 to A.4) also for the regular Alarm triggered by 1-minute inactivity (as described in the extra-point track 1).

B) The renovated elevator is now also including a TfT (touch panel screen) and a potentiometer. The screen and the potentiometer are close each other and simply cached in the elevator structure (not to be used by impaired persons, but by a specialized operator).

The specialized operator can enter a **MAINTENANCE MODE** to setup the notes emitted by the loudspeaker when an emergency situation occurs. Maintenance mode can be entered only when the elevator is not used and waiting for a request; after entering into the maintenance mode, all LEDs of the elevator are switched off and all transportation functionalities suspended.



The visual information displayed in the example is just representative of the desired behaviour. The Graphical User Interface should permit to select a functionality by touching the panel.

Once a selected note functionality is entered, the operator can select a tone by turning the potentiometer wheel right (to go lower) or left (to get higher notes). Default notes at power on of the system are both middle A tones (440 Hz). Volume must not be changed from the default 30% amplitude required in the specification A.2).