Remote control for CPG based robots

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EPFL Biorobotics Laboratory

Plan

- 20’ Presentation
- 10’ Questions
- 10’ Demo, using the robot

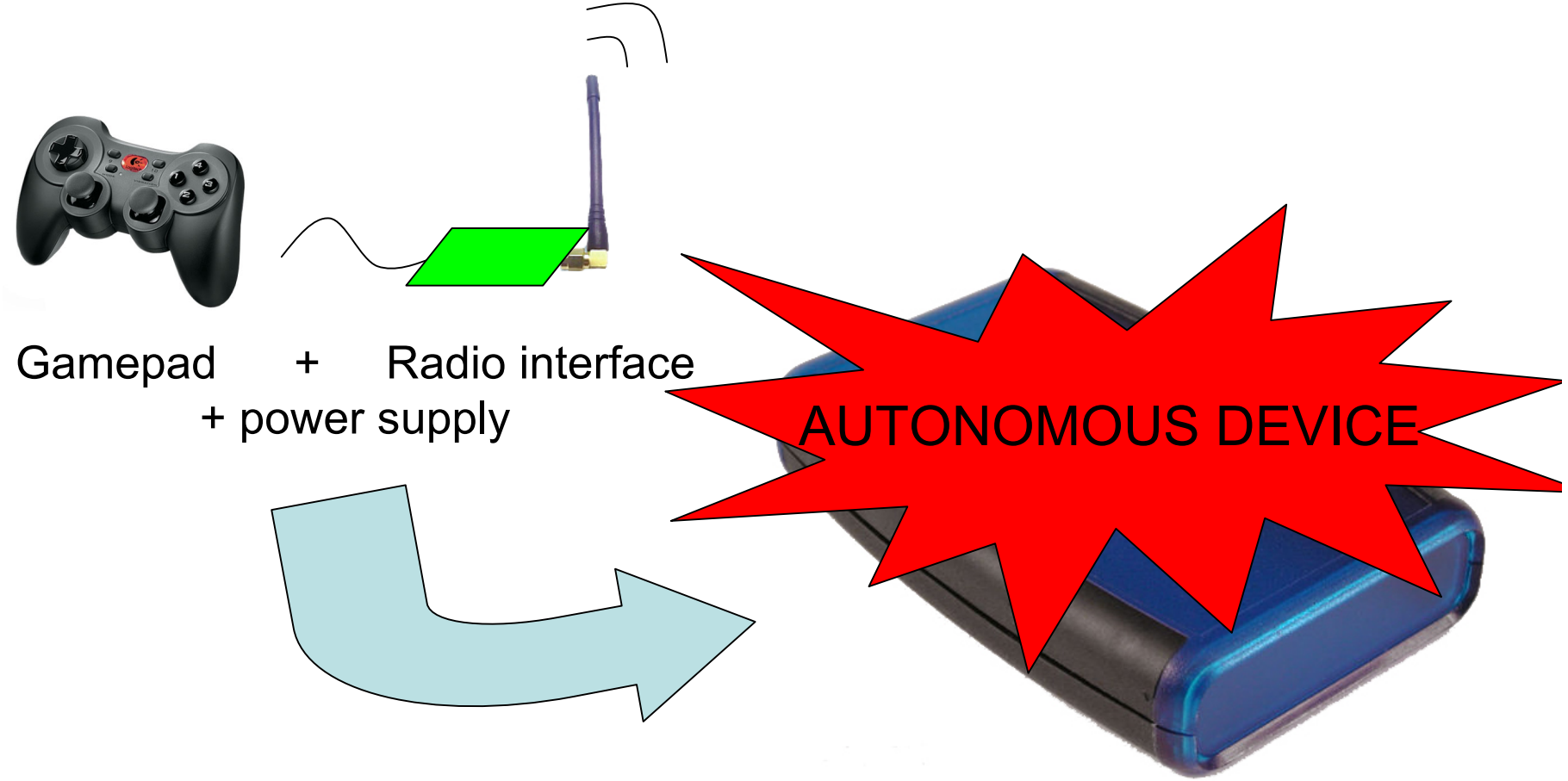
Task description

« *The goal of this project is to develop a wireless remote control that communicates with a robot, which is controlled by a CPG . The electronics for the RF part aren't part of that project, since they are already designed. The remote control is able to configure a small number of locomotion parameters on the robot. It allows a user to interactively remote control the robot without needing a PC.* »

Goal of the project

Gamepad + PC + Radio interface

Goal of the project



Parts of the project

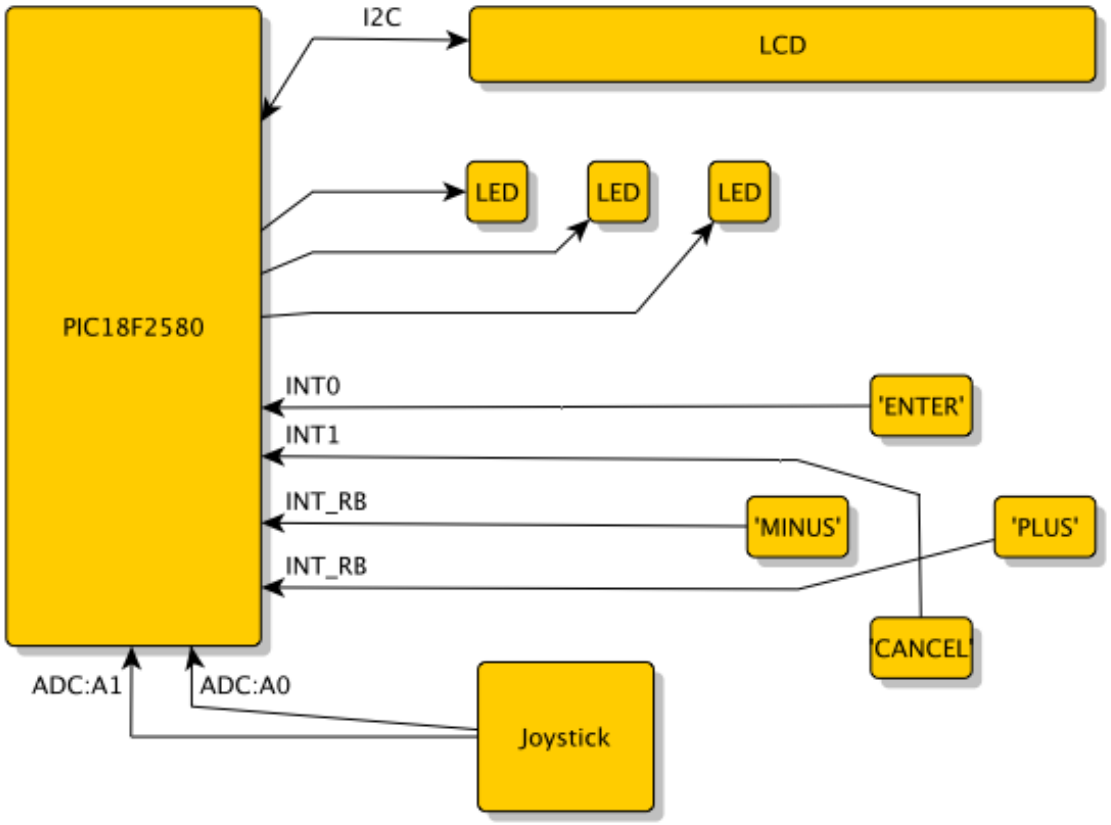
(state at mid-term presentation)

- Hardware ✓ Dev. Version
  - User interface
  - Battery management
- Software ➠ In progress…
  - User interface's PIC18F2580
- Housing and mechanical integration of the hardware

Hardware *(reminder)*

- Battery protection, charger and 3.3V DC/DC converter
- Radio interface (developped by A. Crespi)
- User interface

User interface



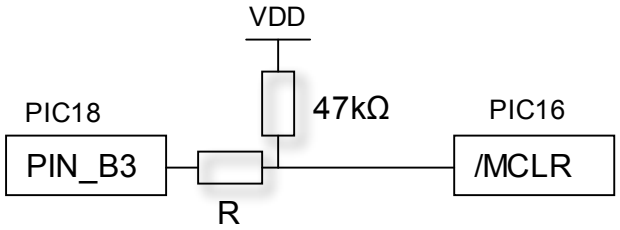
Parts of the project

- Hardware
  - User interface
  - Battery management
- Software
  - User interface's PIC18F2580
- Housing and mechanical integration of the hardware

✓Dev. Version
✓Final version

Final ver. *vs* Development ver.

- Possibility of a supplementary button
- Removal of the on-off LED
- Reset of the radio interface by software



$$U_{\max} = 0.2 \cdot V_{DD} = V_{DD} \cdot \frac{R_{\max}}{47 \cdot 10^3 + R_{\max}}$$

$$R_{\max} = \frac{0.2 \cdot 47 \cdot 10^3}{1 - 0.2} = 11750\Omega$$

Parts of the project

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✓Dev. Version

✓Final version

✓Functions.c / .h

✓RemoteControl_GC.c / .h

Functions (functions.c / .h)

- Registers operations
  - Getters and setters of various length

Functions (functions.c / .h)

- Registers operations
- Display functions
  - Operations on the LCD (I^2C)

Functions (functions.c / .h)

- Registers operations
- Display functions
- Battery management
  - Getters for the battery voltage, temperature and current (I^2C)

Functions (functions.c / .h)

- Registers operations
- Display functions
- Battery management
- Robots locomotion
    - Start, stop and update functions for each kind of robot

Functions (functions.c / .h)

- Registers operations
- Display functions
- Battery management
- Robots locomotion
- User interface
  - *press_button(char button), display_menus(), …*

Functions (functions.c / .h)

- Registers operations
- Display functions
- Battery management
- Robots locomotion
- User interface
- Misc
    - *sync(), err(), scan()*

Functions (functions.c / .h)

- Registers operations
- Display functions
- Battery management
- Robots locomotion
- User interface
- Misc
- Menu functions
    - Functions to fill the menu table: void *function*(void)

Menu

- INFOS RC
  - Battery voltage
  - Radio interface version
  - Reset radio interface microcontroller (PIC16F)
  - Reset user interface microcontroller (PIC18F)

Menu

- SELECT ROBOT
  - Favorites
  - Enter channel number
  - Scan (improved function)
- ROBOT
  - Start robot
  - Stop robot
  - Start charging
  - Stop charging

RemoteControl_GC.c / .h

- Interrupts routines
  - INT_RTCC : timer during robot control
    - call to *update* function every 104ms
  - INT_EXT : ‘enter’ button
  - INT_EXT1 : ‘cancel’ button
  - INT_RB : ‘plus’ and ‘minus’ buttons
    - call to *press_button(*char button*)*
- void *main()*

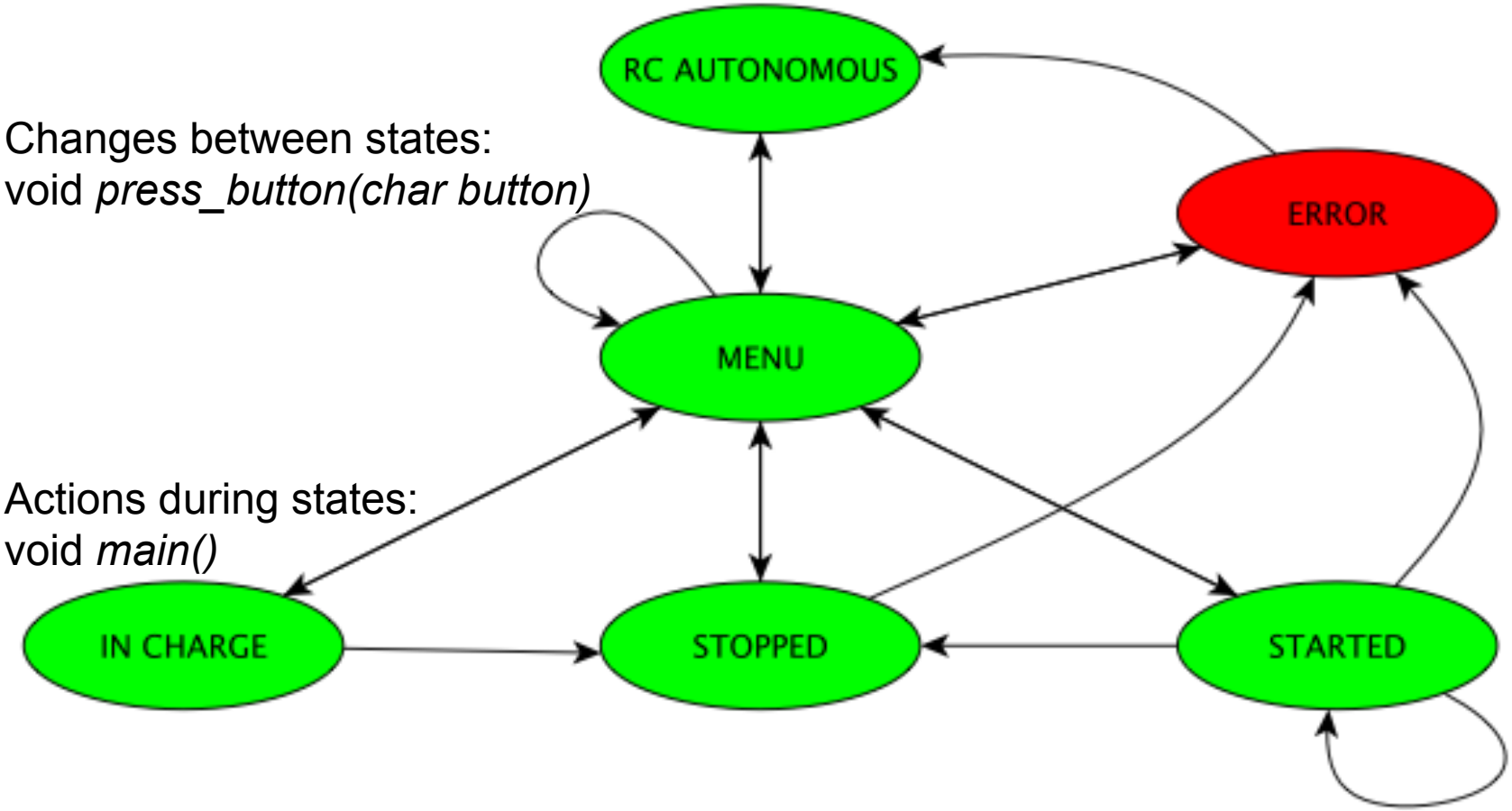
void *main()*

- Initialization sequence
  - Initialisation of the display
  - Synchronisation with the radio : *sync()*
  - Calibration of the joystick
  - Setting of the previous and current states
  - Enabling of the interrupts for the buttons
- Implementation of the state machine
  - Update the display according to the current state **if necessary**.

State machine

Changes between states:
void *press_button(char button)*

Actions during states:
void *main()*



Test for display update

« Update the display if the current state is different from the previous state, except if the current state is MENU and the display did not change »

(current state ≠ previous state)

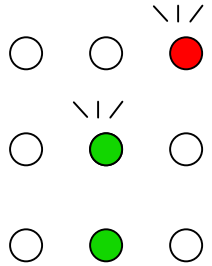
XOR

[(current state = menu) AND (*display_changed* = 0)]

Indication of charge (RC)

- Software implementation of the remote control charge indication using LEDs
- Indication only in RC_AUTONOMOUS state:
  current state = previous state = RC_AUTONOMOUS
- Current measurement (DS2764) :
  signed 12 bits value

50 mA < I
30 mA < I < 51 mA
0 mA < I < 31 mA



Parts of the project

- Hardware ✓Dev. Version
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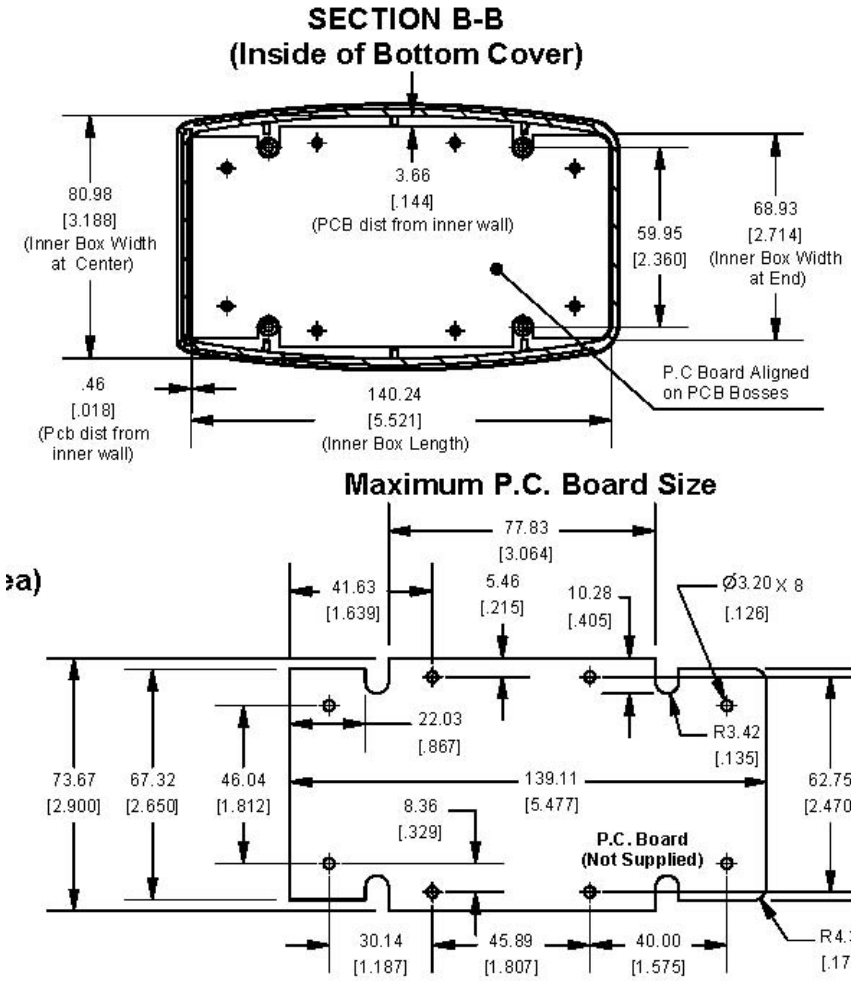
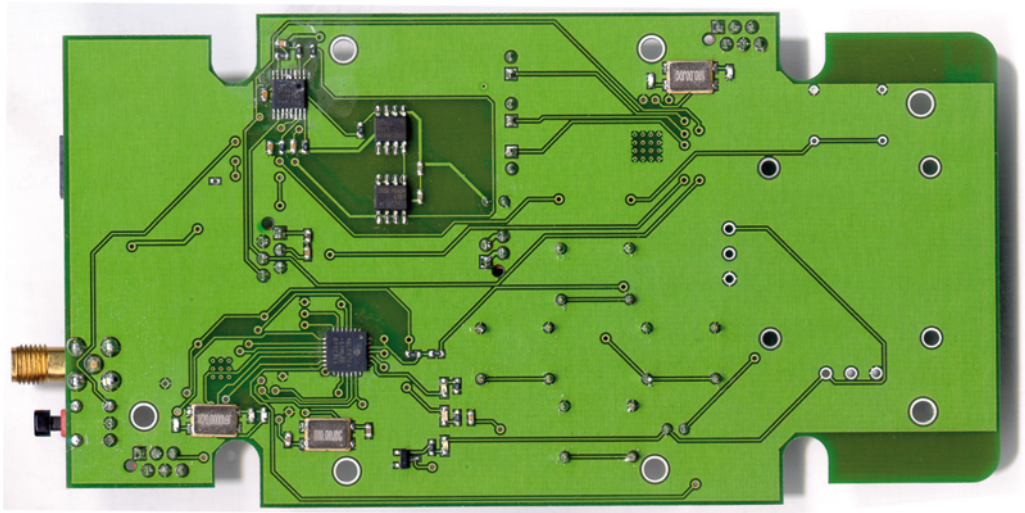
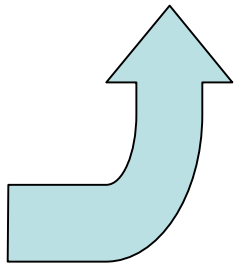
  - Battery management
- Software ✓Functions.c / .h
  - User interface's PIC18F2580 ✓RemoteControl_GC.c / .h
- Housing and mechanical integration of the hardware ✓

Integration of the PCB

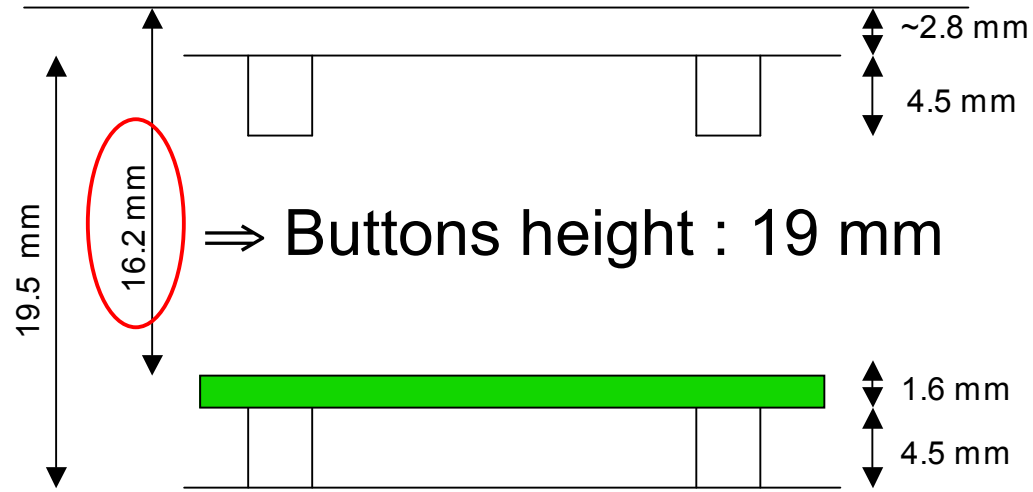






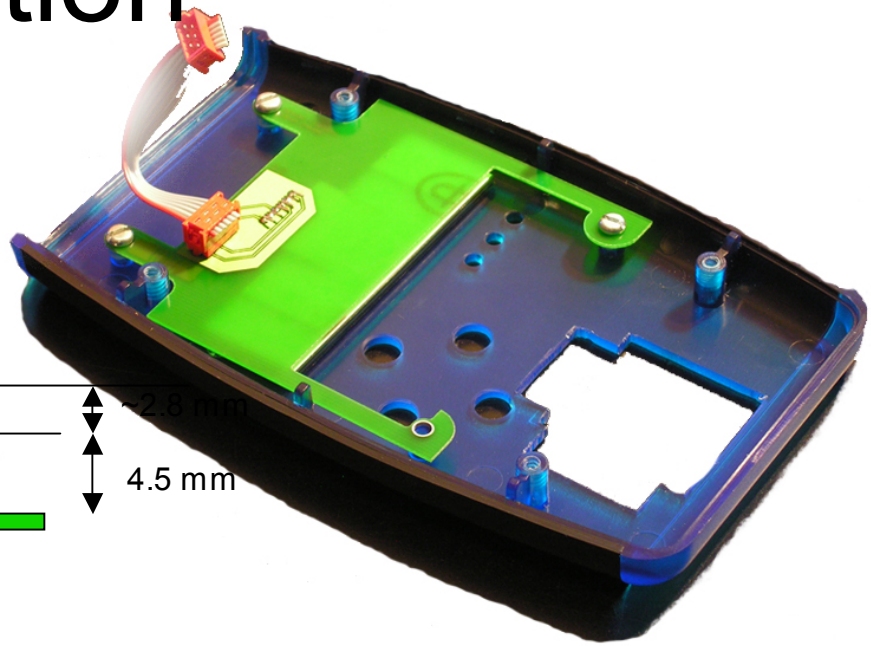
Elevation

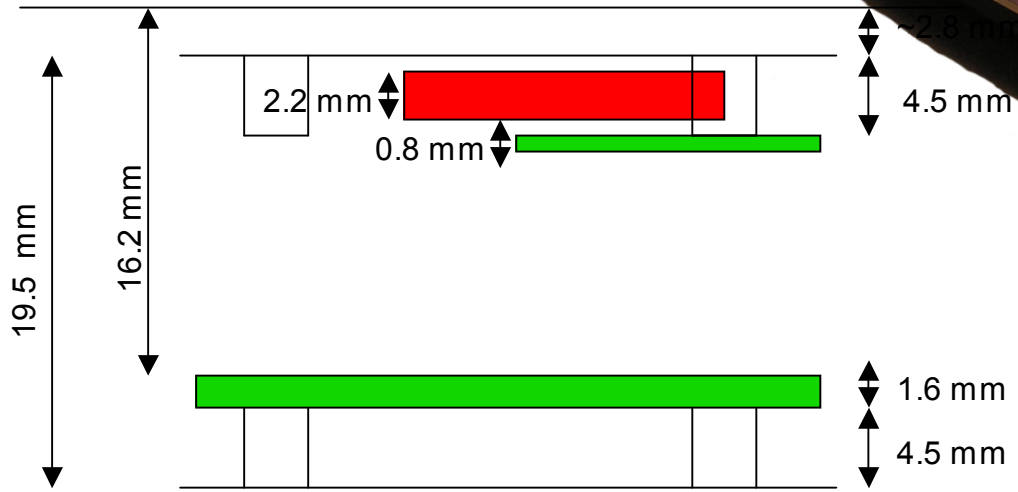
- Choice of the buttons



Elevation

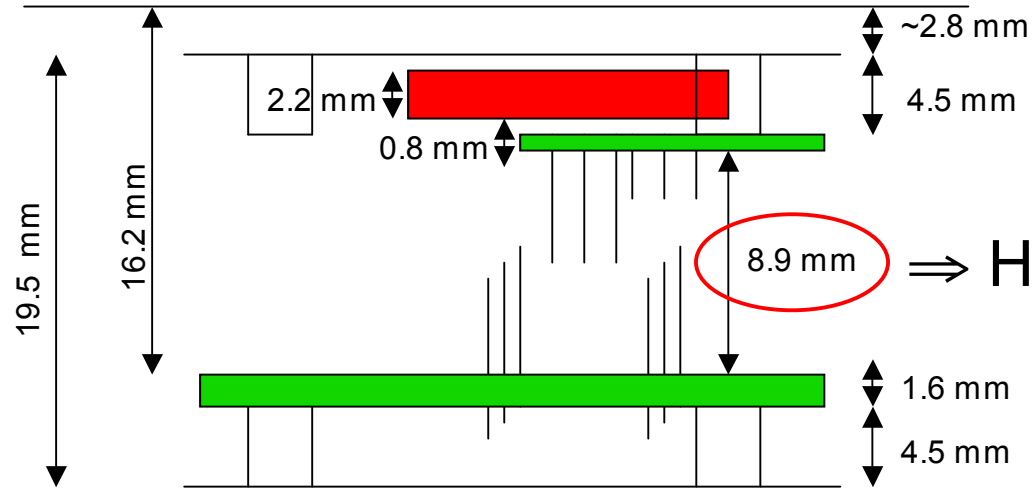
- Choice of the buttons,
- Integration of the LCD





Elevation

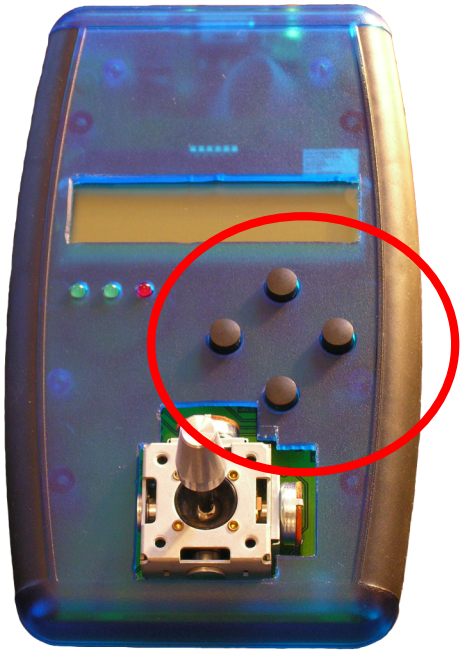
- Choice of the buttons,
- Integration of the LCD and the battery



$\Rightarrow$ Height of the battery: ~8 mm

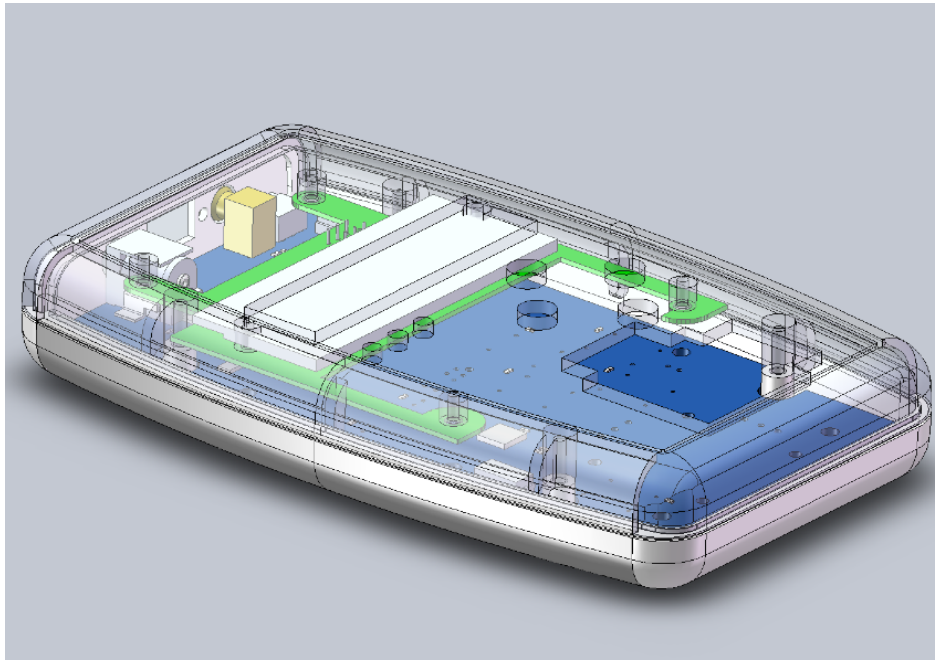
Ergonomics of the user interface

- Inspiration from the Logitech gamepad

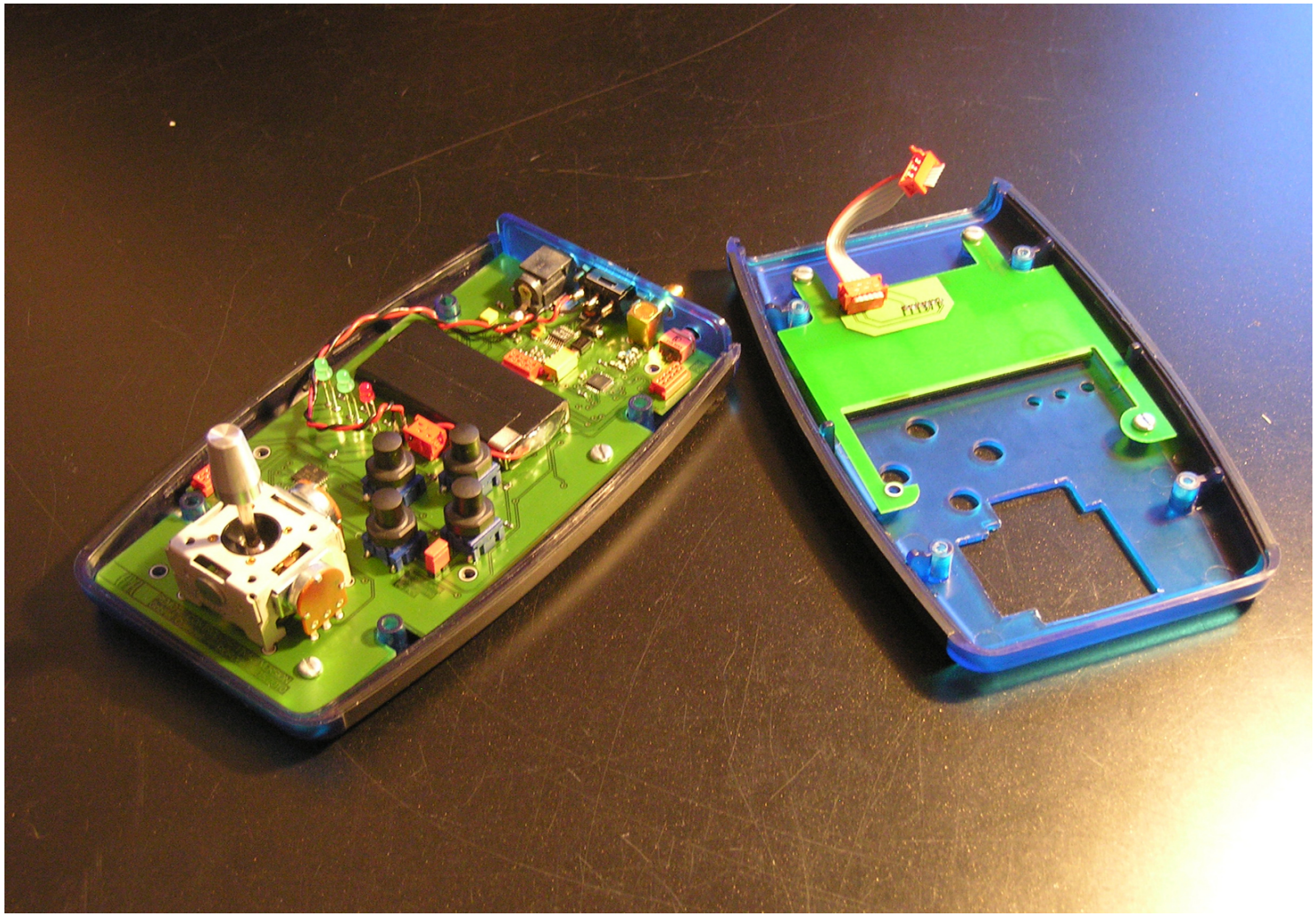


Method

- Use of « Solidworks » for modelling
- Mechanical drawings of the two panels which were drilled (cf. report)



Result



Acknowledgements

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Questions

Thank you for your attention

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