Remote control for CPG based robots

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Current way to remote control the robots at Biorob

Gamepad + PC + Radio interface
Goal of the project

Gamepad + PC + Radio interface
Goal of the project: Hardware

- The device has to be as autonomous as possible

Controls + Battery + Radio interface
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. »
Task description

• Task-list:

1. Review of the existent remote control using a PC and a radio interface. This radio interface is then included in the current project.

2. Definition of the components needed to achieve interaction between the user and the robot.

3. The PIC18F2580 development kit and a radio interface are available for test purpose.
Parts of the project

- **Hardware**
  - User interface
  - Battery management

- **Software**
  - User interface’s PIC18F2580

- **Housing and mechanical integration of the hardware**
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Hardware : User Interface

• Control the locomotion parameters
  – Joystick
Hardware: User interface

- Control the locomotion parameters
  - Joystick
- Control other parameters
  - 4 Buttons: "Enter", "Cancel", "+", "-"
- Visual feedback
  - LEDs
  - LCD (2x16 characters, 3.3V, I2C)
Hardware : User interface
Hardware: Battery management

- **Battery charger**
  LT1571-5:
  Input 8.2 - 26V (typ. 24V at Biorob)

- **Battery monitor and protection**
  DS2764:
  Monitoring through I2C (voltage, temperature)

- **DC/DC Converter**
  LTC3240:
  Battery voltage to 3.3V
Hardware: Dev. version Board

- First result: PCB
Parts of the project

- **Hardware**
  - User interface
  - Battery management

- **Software**
  - User interface’s PIC18F2580

- **Housing and mechanical integration of the hardware**

  (Dev. Version)

  In progress…
Software: getters and setters

- Register length: 1 byte - 32 bytes
  - `get_reg_b` / `set_reg_b` 1 byte
  - `get_reg_w` / `set_reg_w` 2 byte
  - `get_reg_dw` / `set_reg_dw` 4 byte
  - `get_reg_mb` / `set_reg_mb` variable

- `int1 get_reg_b` (int16 address, int8* value)
Software : scan function

- Selection of the robot by the user
  - Scan the channels to identify all the available robots
  - The user selects the one he wants to control
- The function must be transparent for the robots

```
channel = 0

read remote channel

false

channel = channel + 1

true

Display a description of the robot on the LCD

false

true

User selects the robot

false

true
```
Software : first program

• RTCC (timer0) interrupt with prescaler

\[ T_{\text{int}} = \frac{1}{2.5\text{MHz}} \cdot 4 \cdot 2^{16} \approx 105\text{ms} \]

• Analog to digital converter (8 bits) on pin A0 and A1 ("output" of the joystick)

\[
\begin{align*}
\text{set_adc_channel}(1) & \rightarrow \text{value} = \text{adc_read()} \rightarrow \text{speed} = f(\text{value}) \\
\text{set_adc_channel}(0) & \rightarrow \text{value} = \text{adc_read()} \rightarrow \text{set_turn} = f(\text{value})
\end{align*}
\]
Software : first complete program

- Goal: to control the speed and direction of the Salamandra with the joystick

```c
void set_turn(float turn_front, float turn_rear){
    set_reg_b(INTERNAL_REGB_TURN, (from_turn(turn_front) << 4) |
        (from_turn(turn_rear)));
}
```

Amplification formula:
- $ampl_b = 33.333333 + 2.666667 \times spd$
- $ampl_l = ab$
- $freq_b = 0.5 + 0.08 \times spd$
- $freq_l = 0.2 + 0.08 \times s$
Parts of the project

• Hardware
  • User interface
  • Battery management

• Software
  • User interface’s PIC18F2580

• Housing and mechanical integration of the hardware

✔ (Dev. Version)

⇒ In progress…
Up-coming steps

• **Software** : LCD + Battery monitoring + Interface + compatibility with all the robots

• **Housing and mechanical integration** : choice of case + new PCB + integration
Up-coming steps: Housing
Up-coming steps: Housing
Questions

Thank you for your attention