RC-Car (KART)

Lecture Summerschool 1 (SS1)

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1 Preparation

1.1 Program the daughterboard

For most tests, the daughterboard should be flashed with the latest **master** program.

For this, plug the daughterboard through USB-C and either:

- Clone the VHDL project, build it through Libero and flash the board through a dedicated programmer.
- Download the latest released SVF files and CommandInterpreter. Install OpenOCD and make it available in your `PATH`. Run the `CommandInterpreter`, click the **OpenOCD** menu and select the SVF files location.
  - For Windows, you need plug the board and run **Zadig** => **Options** => **List all devices** => select **EBS3_Igloo_Serial (Interface 0)** => **Replace driver** before trying to program through OpenOCD.

Once programmed, either power cycle the board or press the **FPGA Reset** button.

2 Baseboards test

2.1 Hardware preparation

Required material:

- Motherboard
- Daughterboard
- Power button
- End of turn switch
- Hall sensor + magnet
- Range finder sensor + flat cable
- DC “charger” cable + power supply
- USB-C cable
- PMOD motor controller boards (2x)
- DC Motor
- Stepper motor

Wire the modules as shown here:

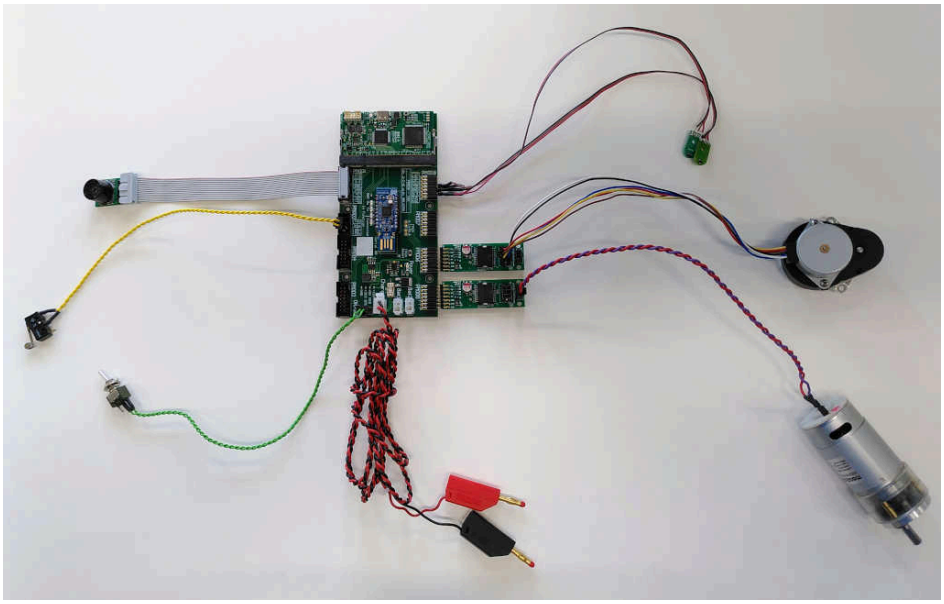

Figure 1: CommandInterpreter program

- End of turn switch: PMOD2 pins 1<->GND
- Hall sensor: PMOD8 pin 4
- Range finder: PMOD1 pin 8
- DC motor: PMOD5
- Stepper motor: PMOD6

Plug the board into a +12V - 1A power supply.

2.2 Software preparation

Open the **CommandInterpreter** program, select **Serial** => **Port** => biggest COM port.

To ensure the board is connected, then click on **Read** and the **Rx** text should be green:

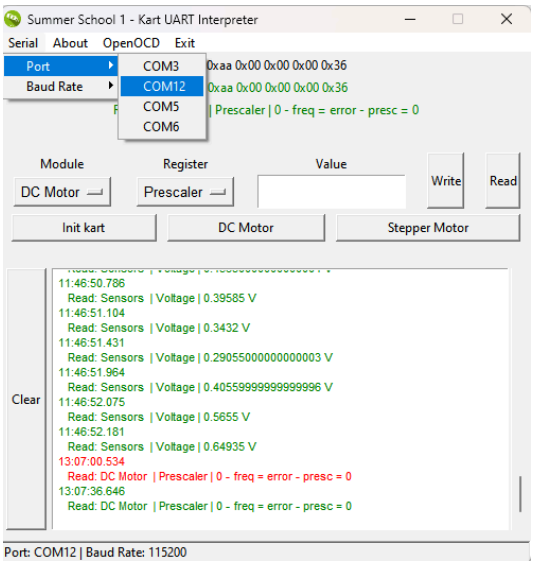

Figure 2: CommandInterpreter program

Else try another port.

2.3 Test

Click the **Init kart** button:

- Answer the questions if the board is mounted in a Kart, else ansqer anything. Do NOT simulate steering end contact.
- The stepper motor should turn until the stepper end switch is pressed.

Click the **DC Motor** button:

- The DC motor turns at full speed (forward).
- The DC motor stops.
- The DC motor turns at full speed (backward).
- The DC motor stops.

Click the **Stepper Motor** button:

- The stepper motor turns to 400 steps.
- The stepper motor turns to 0 steps.

To test the Hall sensor:

- Bring a magnet near the sensor and turn it.
- Messages should show on the app for each detected pole change.

To test the range finder:

- Simply move your hand near and far from the sensor.
- Messages will log the estimated distance from your hand.

3 PMOD-OD2 board test

3.1 Hardware preparation

Required material:

- Motherboard
- Daughterboard
- Power button
- DC “charger” cable + power supply
- USB-C cable
- Servomotor
- PMOD-OD2 board

1. Plug the PMOD-OD2 board into **PMOD5**.
2. Ensure that **Vio** is set to +5V thanks to the dedicated 0Ohms resistor on the back of the board.
3. Wire the servo with:
   - Red to **Vio**
   - Yellow to **Px** (will be tested one after the other)
   - Black to **GND**
   - A **4.7kOhm** resistor between **Px** and **Vio**.
4. Plug the DC cable into the charger port and into a +12V - 200mA power supply.
5. Power the board
6. Plug the USB-C cable into the daughterboard and the computer.

3.2 Software preparation

Open the **CommandInterpreter** program, select **Serial** => **Port** => biggest COM port.

To ensure the board is connected, then click on **Read** and the **Rx** text should be green:

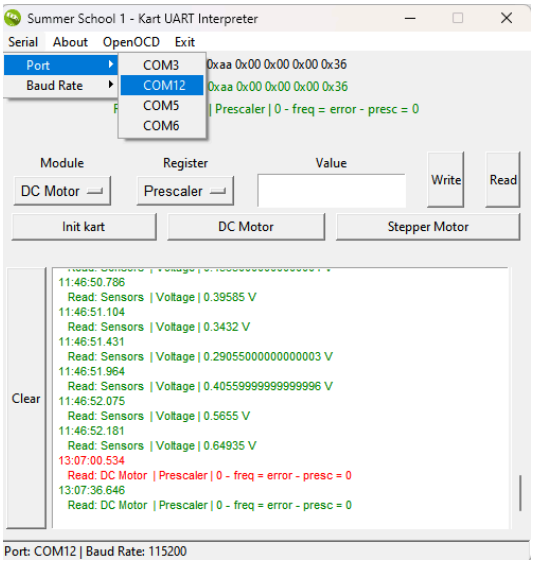

Figure 3: CommandInterpreter program

Else try another port.

Set the **Module** to **Sensors**, and set the following registers:

- LED1: **Value** 11000 => **Write**
- LED2: **Value** 13000 => **Write**
- LED3: **Value** 16000 => **Write**
- LED4: **Value** 19000 => **Write**

The board is now ready to perform tests on the PMOD-OD2 board.

To test multiple boards, simply swap the PMOD-OD2 boards withtout power-cycling the daughterboard.

3.3 Test

With the board ready and the PMOD-OD2 board wired as shown above:

1. Bring the pull-up resistor to **P1**. Then bring the servo command line (yellow) to **P1**.
    - The servo should turn to 18°.
2. Bring the pull-up resistor to **P2**. Then bring the servo command line (yellow) to **P2**.
    - The servo should turn to 54°.
3. Bring the pull-up resistor to **P3**. Then bring the servo command line (yellow) to **P3**.
    - The servo should turn to 108°.
4. Bring the pull-up resistor to **P4**. Then bring the servo command line (yellow) to **P4**.
    - The servo should turn to 162°.