CS 491/691X – Topics: Introduction to Robotics

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Lab 2 – Handout

1. Create the support chassis for the HandyBoard

- Remove the 1x10 plate from the robot's front
- Remove the 2 1x12 beams from the robot's sides
- Remove the 2 1x8 plates from the robot's sides

Use the following pieces for the HandyBoard mount:

- 2x10 plate: 1
- 2x8 plate: 2
- 1x16 beam: 2
- 1x8 beam: 4
- 1x8 plate: 4
- 1x6 beam: 1
- 1x4 beam: 1
- connector pegs (long, black): 4

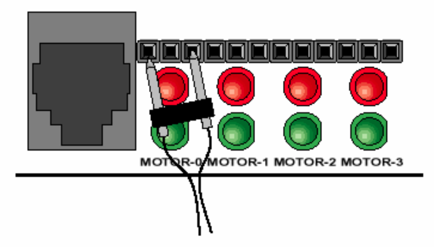
Connect these pieces as shown in the demo robot.

2. Start using the HandyBoard

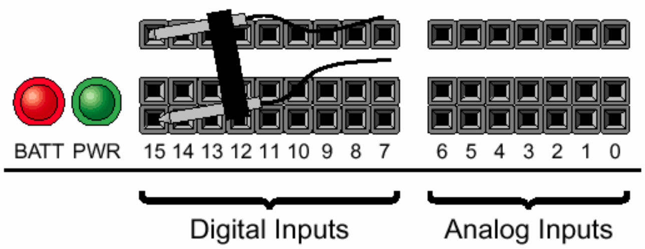
a) Make sure that the HandyBoard is **OFF** and connected to the serial port of your computer, using the Serial Interface board. The Serial Interface board connects to the computer using a standard modem cable; the HandyBoard connects to the Serial Interface using a standard 4-wire telephone cable. Plug in the charger for the Serial Interface board.

ATTENTION!!!
Do not leave the HandyBoard charging in ZAP mode for more than 3 hours. Use NORMAL mode for charging the HandyBoard.

b) **Connect the motors** to the HandyBoard, using the modified LEGO adapter cables. Connect one motor to port 1 and the other to port 3.
c) **Connect the sensors** to the HandyBoard, using the modified LEGO adapter cables. Handy Board has inputs for 9 digital (switch-type) sensors and 7 analog (continuously varying) sensors. Connect your touch sensors to digital inputs 10 and 11 (make sure you know which one is which).



HandyBoard motor board



HandyBoard sensor board

d) Start Interactive C on your computer.

- In the first window select Handyboard (with expansion).
- In the Port Selection Window select Connect Later
- From the Tools Menu select “Download Firmware” and follow the instructions
- Your HandyBoard should be ready to use

3. Test your HandyBoard

In the command line of your IC application, test the following instructions:

a) **2 + 2:** the HandyBoard will compute the answer and will print the answer on its display
b) **{beep(); sleep(2.0); beep();}**
c) Load the first program: in your IC window, select “Open” and load the file called hello.ic. Download it to the Handyboard using the IC icons and then select Run Main. Your Handyboard will display your message to the world!!

4. Overview of relevant functions

a) Beeper (Appendix E, pp. 418 & 419)
   - **beep(); -** Causes the HandyBoard to beep
   - **tone(frequency, length)** – produces a tone at pitch “frequency” Hertz for length seconds.

b) DC Motors (Appendix E, pp. 415)
   - **fd(0); -** Motor 0 output port turns on, green LED on, motor spins
   - **bk(0); -** motor spins in opposite direction
   - **off(0); -** motor turns off
   - **motor(0,50); -** turns motor port 0 on in the “fd” direction with a power level of 50% (port can be 0, 1, 2, 3) (power level ranges from -100 to +100; 0 is off, +100 is full on in the “fd” direction)

c) Digital Input (Appendix E, pp. 417)
   - **digital(15);** Handy Board returns True/1/switch closed or False/0/switch open.
   - **if (digital(15)) {beep();}** Tests the state of the sensor.

5. Write your first program

· **Beeper program**:

Write a program to sound the beeper for 3 seconds with 500 Hz frequency, then be silent for 1 second, and then sound the beeper for 3 seconds with 100 HZ frequency, be silent for 1 second and finally sound the beeper for 2 seconds with 1000 Hz frequency.

- **Motor program**

First check that your fd() command actually make the robot drive forward. In the IC command line type {fd(1); fd(3);}. If the robot is not driving straight ahead, unplug the motor that is running backwards, turn it 180° and plug it back in.

Write a program to turn on the motor connected to port No. 1 with 50% power, work for 3 seconds, sound the beeper, reverse the motor with 50% power for 2 seconds, sound the beeper, turn off the motor for 2 seconds, then turn it on with full power for working 3 seconds, sound the beeper and turn it off.

- **Sensor program**

Write a program for your robot so that when one of its touch sensors is triggered, it will start rotating around itself until the same touch sensor is triggered for the second time.

- **Obstacle avoidance**

Implement the "obstacle avoidance" program described in Section 2.3.2, and extend the program so that both touch sensors are active.

Submit all your programs through e-mail before midnight on Friday (only one copy per team). These will constitute a part of your evaluation for this lab.

- **Assignment for Lab 3:**

See Assignment #1 and Lab 3 handout.