

Booting Otto

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- 1) Boot Otto by pressing its power button. Gumstix needs about 45 seconds to boot. At the completion of the boot process, a yellow LED (labeled "LED1") on gumstix's WIFI card (top of the Gumstix stack) will blink rapidly for a few seconds and then remain on.

If using the CMUCam, remove the lens cap from its lens.

Starting and Stopping Player Server

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- 1) Once gumstix has booted, SSH to it as root. To do this from a Linux shell use this command:

```
ssh root@gumstix
```

The root password is

```
RunOtto!
```

- 2) In root's home directory, you'll currently find two Player server configuration files:

```
roomba.conf --- Only runs the roomba driver
```

```
roombaCmucam.conf --- Runs both the roomba and CMUCam drivers
```

- 3) To start Player server running on gumstix, run the following from root's home directory:

```
./player player_conf_file
```

replacing `player_conf_file` with the name of a valid Player server configuration file. Note that Otto's LEDs and/or one of the CMUCam's LEDs will extinguish when Player server starts running. This is normal.

- 4) To stop the running Player server, type a ^C.

Halting Otto

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- 1) Shutdown gumstix by running:

```
halt;exit
```

Wait 30 seconds for gumstix to complete its shutdown procedures and then press Otto's power button. Not waiting a full 30 seconds may render gumstix unusable. The LEDs on gumstix and the CMUCam should be extinguished once you've pressed Otto's power button. Replace the lens cap over the CMUCam's lens.

Recharging Otto

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- 1) If Otto is not already powered-off, halt Otto.
- 2) CAREFULLY disconnect the gray DB25 connector at the front of Otto's cargo bay.

- 3) Connect the charger to Otto.
- 4) Connect the charger to a surge-protected outlet. Wait a few hours for the charge indication LED to glow green.
- 5) Disconnect the charger from the outlet.
- 6) Disconnect the charger from Otto.
- 7) CAREFULLY reconnect the gray DB25 connector to Otto.

Recording Color Blob Information for Object Tracking

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- 1) The CMUCam will need to be connected directly to the Linux workstation in order to capture the RGB values necessary for tracking an object.

Note carefully AND RECORD the orientation of the two cables connected to the CMUCam from gumstix. The two-wire cable is power. The red-striped wire on this cable is +5V (labeled "Main" on the circuit board). The four-wire cable is the serial cable. The red-striped wire on this cable is ground.

- 2) Carefully disconnect the two cables. Do NOT pull on the wires.
- 3) Connect the wall transformer to the CMUCam board. The red lead should be connected to the +5V Main pin. Connect the serial converter cable to the CMUCam's serial port. The black wire should be connected to the ground pin.
- 4) Using the USB cable attached to the workstation, connect the serial converter cable to the workstation. Ensure that the CMUCam's power switch is in the "On" position. Plug-in the wall transformer to a surge-protected outlet. Two green LEDs should light on the CMUCam board. Remove the lens cap from the CMUCam's lens.
- 5) From a shell prompt, run the command

```
cmucam
```

and follow the instructions printed by the program to correctly specify the serial port to be used for communications. The CMUCam2 GUI will begin running.

- 6) If it is not already selected, select the GUI's "Camera View" tab. Click the "Grab Frame" button in order to grab a frame from the camera. If necessary, refocus the lens by turning it clockwise or counterclockwise on its screw mount and grabbing another frame. Repeat as necessary until the image is reasonably sharp.
- 7) Place the object to be tracked within view of the camera. The color of this object should be fairly unique relative to other colors in the scene. Lighting should be adjusted so that it matches the lighting that will be used while tracking the object. Grab a frame containing the object to be tracked.
- 8) In the frame you just grabbed, click the object to be tracked. It will become highlighted.
- 9) Click the GUI's "Color" tab. At the bottom of this tab you will see six color values. These are the three min RGB values and three max RGB values to be used for tracking the object. These are eight-bit values. Record the six values in this format:

```
min_red max_red min_green max_green min_blue max_blue
```

If you want, you can track the object from the GUI by clicking the "Track Color" button and moving the object around in the camera's field of view. The GUI may lose communications with the camera. Don't worry --- that appears to be normal.

- 10) Exit from the GUI.
- 11) Disconnect the wall transformer from the surge suppressor. Disconnect the serial converter from the workstation. Disconnect the two cables from the CMUCam. Again, be careful to NOT pull on the wires.
- 12) Carefully reconnect the two cables from gumstix to the CMUCam, in the same orientation you had originally observed and recorded.
- 13) Now, we transfer the six RGB values you just recorded into a Player server configuration file on gumstix.

Follow the instructions elsewhere for booting Otto and gumstix.

- 14) Once gumstix has booted, SSH to it as root. To do this from a Linux shell use this command:

```
ssh root@gumstix
```

The root password is

```
RunOtto!
```

- 15) In root's home directory, you'll find the Player server configuration file `roombaCmucam.conf`. The color blob information is stored in this file. Open it for editing using `vi`.

Here's a quick summary of the important `vi` commands:

- o Cursor motion: use arrow keys.
- o Change a number: move cursor to the number's first digit; type "cw" (no quotes); type the replacement number; press the Esc key.
- o Save file and quit: type `":wq"` (no quotes); press the Enter key.

- 16) Near the end of the file, you'll find a line that looks like this:

```
color0 [ 215 255 215 255 31 81 ]
```

Documentation above this line in the file will remind you of the format for entering the six RGB values you recorded earlier. Enter your six RGB values, save the file, and exit `vi`.

- 17) To start Player server running on gumstix, refer to the specific instructions elsewhere. You'll want to use the `roombaCmucam.conf` configuration file.
- 18) The CMUCam's upper LED will blink rapidly when it has acquired the tracking object. This is a good sign that things are working well.
- 19) Run your Player client program and interact with Otto. For instance:

```
playerv -h gumstix
```
- 20) Follow the instructions elsewhere for stopping Player server and halting Otto.

Client Utilities Provided with Player

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Player server must be running in order for these Player clients to work.

- 1) playerv --- visualization tool for data from Player server devices

Starting:

```
playerv -h gumstix
```

Devices supported and usable from this tool: blobfinder, position2d, and power.

- 2) playerprint --- print sensor data from Player server devices

Starting:

```
playerprint -h gumstix device
```

where device is a supported device.

Devices supported and usable from this tool: blobfinder, bumper, position2d, and power.

Removing/Replacing the Sensor Platform

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- 1) CAREFULLY disconnect the two cables from the CMUCam, noting and recording their orientation.
- 2) CAREFULLY remove the CMUCam from the sensor platform (it's attached with two strips of Velcro).
- 3) Unscrew the four screws attaching the sensor platform to Otto.
- 4) CAREFULLY remove the sensor platform from Otto, CAREFULLY pushing the WIFI antenna from above through the platform. (The WIFI antenna is on a very short, delicate cable.)
- 5) To replace the sensor platform, reverse instructions 1--4.

Removing/Replacing the Gumstix Platform

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- 1) Remove/replace the sensor platform, following the instructions elsewhere.
- 2) CAREFULLY disconnect the DB25 connector. Note that two short, delicate wires are connected to it. Do NOT stress these wires.
- 3) CAREFULLY disconnect the DIN connector between gumstix and Otto from Otto.
- 4) Unscrew the two screws holding the gumstix platform in the cargo bay. Nuts are used as spacers beneath the platform, so DON'T try to pull the screws out of the platform.
- 5) CAREFULLY remove the platform from Otto, being CAREFUL to not stress any of the cables or wires. The piece of doubled-over tape at the back of the platform may be used to help get the platform out of the bottom

of the cargo bay.

Loosely re-tighten the two nuts on the underside of the platform.

6) To replace the Gumstix platform, reverse instructions 1--5.