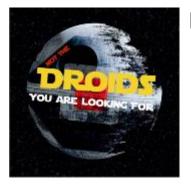
Bonus EV3 Programming Lessons



LEGO MINDSTORMS and Raspberry Pi IR Light controller



By Droids Robotics

Objectives

- Program a Raspberry Pi to control a string of LED lights using an IR sensor
- Learn how to make the EV3 communicate with a Raspberry Pi
- Learn to use an IR sensor and IR LED to emulate remote signals

Prerequisites:

- Must have basic Python programming knowledge
- Must be comfortable using a Raspberry Pi (Unix/Linux commands & GPIO)
- Must be familiar with EV3 Bluetooth Messaging
- Must have done EV3 Raspberry PI Communicator lesson on EV3Lessons.com

Materials

- Raspberry Pi (Tested on Model B Edition 1 using Raspbian)
- EV3 brick
- USB Bluetooth (for the Raspberry Pi)
- IR Sensor (for the Raspberry Pi)
- IR LED (for the Raspberry Pi)
- LED Strip with IR receiver and remote
- E.g. Intertek flexible lighting strips
- GPIO compatible wires (for Raspberry Pi)
- Breadboard (optional)



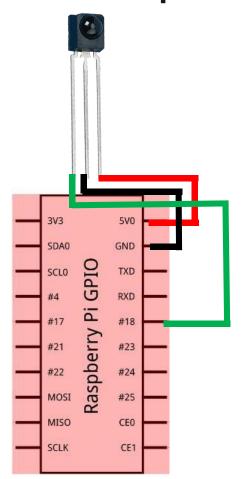


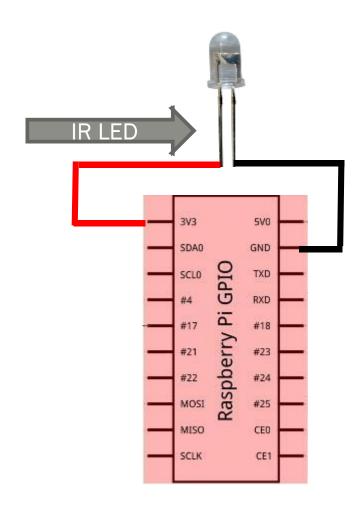


Step 1: Pi Setup

- Setup the IR sensor and IR LED on the GPIO (see next slide).
- Make sure you arrange the wires correctly based on the sensor you own.
 (You can use a volt meter to arrange the wires correctly to identify ground, voltage and ground)
- Install packages on the Raspberry Pi
- sudo apt-get update
- sudo apt-get upgrade
- sudo reboot
- sudo apt-get install lirc
- Make sure you have completed all the steps in the EV3-RPi Communicator Lesson

GPIO Setup





Configuration based on IR sensor available on Adafruit (Product link)

Step 2: Edit System Files

- sudo nano/etc/modules
- add these lines at the end to make LIRC start up on boot and set the IR sensor pin to Pin-18 and IR LED pin(for later) to Pin-17:
- lirc_dev
- lirc_rpi gpio_in_pin=18 gpio_out_pin=17
- Now we need to edit the LIRC hardware configuration file. Open it using: sudo nano /etc/lirc/hardware.conf
- Change the following lines:
- DRIVER="default"
- DEVICE="/dev/lirc0"
- MODULES="lirc rpi"
- sudo nano /boot/config.txt
- add the following line to the file:
- dtoverlay=lircrpi,gpio_in_pin=18,gpio_out_pin=17,gpio_in_pull=up
- Reboot: sudo reboot

Step 3: Record All Remote Buttons

- Stop LIRC: sudo /etc/init.d/lirc stop
- To make sure you setup the IR sensor correctly, use: mode2 d / dev/lirc0 (press buttons on a remote to get the readings)
- Record all the buttons to the raspberry pi: $irrecord n d / dev/lirc0 \sim /lircd.conf$ It will take you through some detailed instructions.
- sudo nano lircd.conf Find the line that says "name /home/pi/lircd.conf" and change it to "name remote"
- Copy the new configuration sudo cp lircd.conf /etc/lirc/lircd.conf
- Start LIRC: sudo /etc/init.d/lirc start
- Reboot: sudo reboot
- To test the configuration run the commmand i rw
- Every time you press a button on the remote, you will get the name of the button.

Step 4: Send IR signals with Pi

- Connect the IR Led to the GPIO (See image on right)
- To send an IR signal use
- irsend SEND ONCE remote ONE OF THE BUTTONS NAME
- We use SEND_ONCE to only sent the light signal once
- Now in python you can send a signal using
- import os
- os.system("irsend SEND_ONCE remote ONE_OF_THE_BUTTONS_NAME")
- Replace ONE_OF_THE_BUTTONS_NAME with one of the names you assigned to a button in step 3
- In a terminal you can use
- irsend SEND_ONCE remote ONE_OF_THE_BUTTONS_NAME

Step 5: Bluetooth EV3 to Pi (If you are not already connected)

- Run hcitool scan to find the mac address of EV3 (will look something like this: 00:16:53:3F:2F:C3)
- **Run** bluetooth-agent 1234 &:proxy for entering passcode for ev3
- Run sudo rfcomm connect /dev/rfcomm0 MAC_ADDRESS & :to connect the ev3 (press enter if any message(s) appears on the screen)
- If you are not returned to a terminal, try pressing "Return/Enter". If that did not work you probably forgot the & symbol.

Step 6: Base Code

- Open RPi code you made in the EV3-RPi Communicator Lesson
- Open EV3 code you made in the EV3-RPi Communicator Lesson

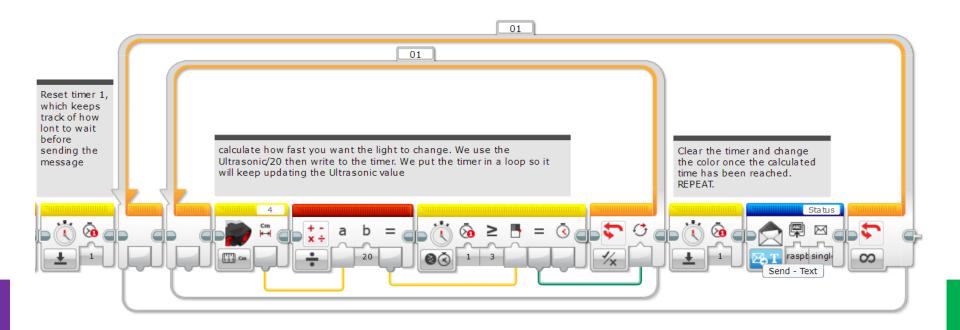
Challenge 1: Change the LED's Color Using the EV3

- Make the LED strip change color/change mode when the EV3 sends "color_change"
- You will need to use os.system("irsend SEND_ONCE remote ONE OF THE BUTTONS NAME") in python
- Download solution code from EV3Lessons.com

Challenge 2: Change the LED's Colors At Different Rates Using the Ultrasonic Sensor

- Make the LED strip change color/change mode when the EV3 sends "color_change"
- Download solution code from EV3Lessons.com

Challenge 2 Solution



CREDITS

- This tutorial was created by Sanjay Seshan and Arvind Seshan from Droids Robotics.
- More lessons are available at www.ev3lessons.com
- Author's Email: <u>team@droidsrobotics.org</u>
- Credits: <u>Antzy Carmasaic for the IR remote recoder</u> & <u>gipprojects</u> for the code to connect a Raspberry Pi to an EV3



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