

Not a Demo Replicating:

“Realtime Edge Based Visual Inertial Odometry (REBVO) for
MAV Teleoperation in Indoor Environments

Juan Jose Tarrio · Sol Pedre”

Joshua McCready

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Stated goals in project proposal:

Use monocular visual odometry that focused on addressing the constraints of real time operation on mobile robotics with limited computational resources:

1. Replicate runtime environment for REBVO on the Picar and required dependencies so the source code can compile on the Picar and run the benchmark

EuRoC dataset. – **Skid right to a halt here**

2. Use the "Custom Camera" REBVO class to interface with images gathered by the usbcam ros package.

3. Configure the system with gathered camera parameters from previous Camera Calibration and other required parameters.

4. Try to use the built in ROS support for the application to transmit depth maps that could be used by a PID controller to show proof of concept.

XKCD: Cautionary



Into the rabbit hole:

Realtime Edge Based Visual Inertial
Odometry for MAV Teleoperation in Indoor
Environments code base can be found here:

<https://github.com/JuanTarrio/rebvo>

Includes an application to simulate a
dataset with no hardware or a video and
imu data feed. Importantly it also has a ros
implementation that I hoped to use.

Top Left: Original image + Edgemap compression data rate
Top Right: Surface fitting Bottom Left: Full Edgemap Bottom
Right: Compressed edgemap @ 4FPS

Too far into the rabbit hole

After a long hunt to install all package dependencies, the project built but...

I screwed something up quite badly and broke the `rqt_XXX` commands necessary for ros debugging. I think it was reinstalled Qt (?) or something else I thought I needed.

After many attempts to remedy the issues, I am re-imaging on a new SD card and starting over...

- **System requirements**

In ubuntu and most linux dist this libraries can be downloaded directly from the repos, except for TooN.

- C++11
- Linux, X11, v4l2
- OpenGL development libraries (GL, GLU, glut)
- TooN 2.2 mathematical library (<http://www.edwardrosten.com/cvd/toon.html> - ZIP provided in the repo)
- Lapack (for advanced TooN functions)
- LibAV (Video Codecs)
- LibGD (Image management)
- Optionally NE10 for ARM Neon optimizations

Also need an IMU

It was easy to find a IMU that will work easily with raspberry pi that doesn't interfere with Sunfounder Hat.

Dedicated python library:

<https://pypi.org/project/sense-hat/>

Starting point ROS Node:

https://github.com/mirkodcomparetti/ros_sensehat

Raspberry Pi Sense HAT

Version 17

Created by [joeman](#) on Aug 11, 2015 1:53 PM. Last modified by [jwatson](#) on Aug 24, 2016 11:26 AM.

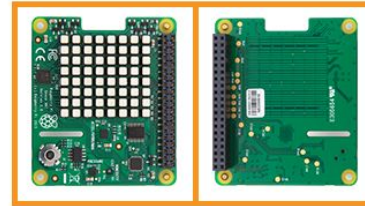


Raspberry Pi Sense HAT

Official Sense HAT from the Raspberry Pi Foundation.

[Buy Now](#)

[See other Pi Accessories](#)



Technical Specification:

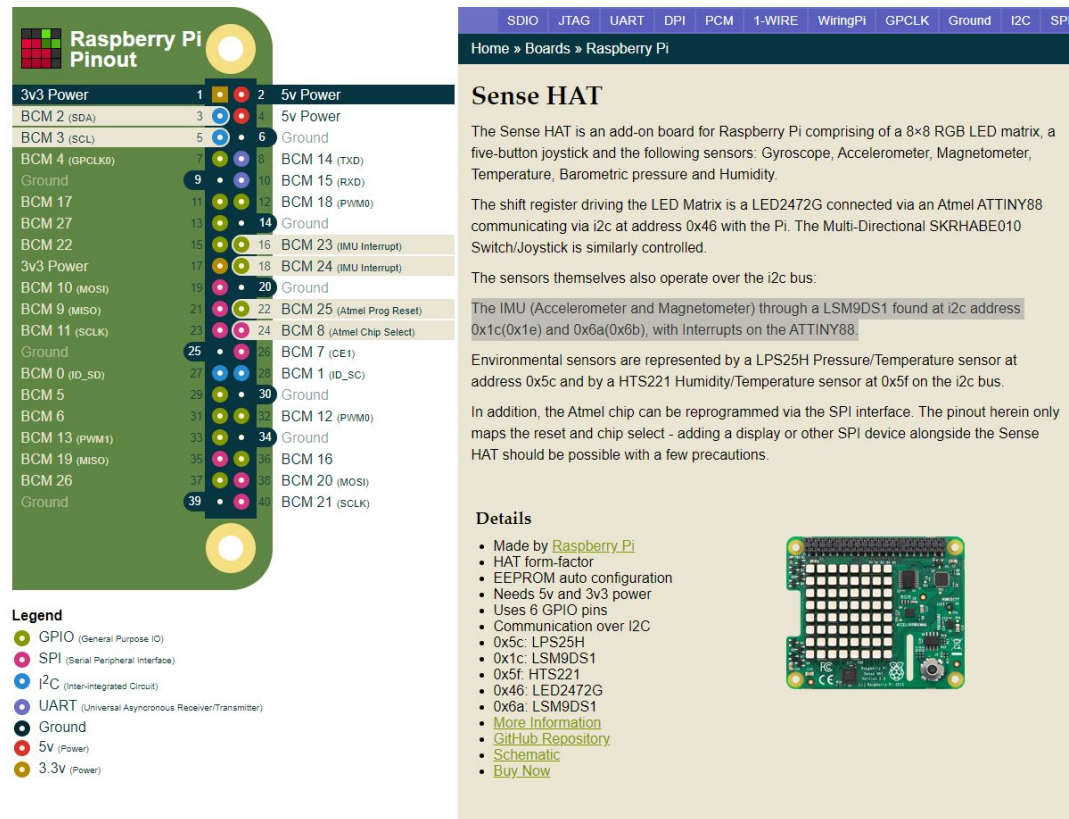
- Official Sense HAT from the [Raspberry Pi Foundation](#)
- 8x8 LED matrix display
- Accelerometer, gyroscope and magnetometer
- Air pressure sensor
- Temperature and humidity sensor
- Small joystick

Compatible With:

- Raspberry Pi 3 Model B
- Raspberry Pi 2 Model B
- Raspberry Pi Model B+
- Raspberry Pi Model A+

*To mount the Sense HAT securely it is advisable to use a set of standoffs and mounting screws

Here's an IMU – will it work...? Probably



The image displays two side-by-side resources. On the left is the official Raspberry Pi Pinout diagram, which maps 40 pins to their functions: 3V3 Power, BCM 2 (SDA), BCM 3 (SCL), BCM 4 (GPIO), Ground, BCM 17, BCM 27, BCM 22, 3V3 Power, BCM 10 (MOSI), BCM 9 (MISO), BCM 11 (SCLK), Ground, BCM 0 (ID_SD), BCM 5, BCM 6, BCM 13 (PWM1), BCM 19 (MISO), BCM 26, and Ground. On the right is the Sense HAT product page from the Raspberry Pi website. The page title is 'Sense HAT' and it describes the board as an add-on for Raspberry Pi with an 8x8 RGB LED matrix, a joystick, and various sensors including a Gyroscope, Accelerometer, Magnetometer, Temperature, Barometric pressure, and Humidity. It also mentions the IMU (Accelerometer and Magnetometer) through a LSM9DS1 and environmental sensors like LPS25H and HTS221. A 'Details' section lists features such as being made by Raspberry Pi, HAT form-factor, EEPROM auto configuration, needing 5v and 3v3 power, using 6 GPIO pins, and communication over I2C. It lists specific components: 0x5c: LPS25H, 0x1c: LSM9DS1, 0x5f: HTS221, 0x46: LED2472G, and 0x6a: LSM9DS1. Links for 'More Information', 'GitHub Repository', 'Schematic', and 'Buy Now' are provided. A small image of the Sense HAT board is shown at the bottom right of the page.

Raspberry Pi Pinout

Pin	Function
1	3V3 Power
2	BCM 2 (SDA)
3	BCM 3 (SCL)
4	BCM 4 (GPIO)
5	Ground
6	BCM 17
7	BCM 27
8	BCM 22
9	3V3 Power
10	BCM 10 (MOSI)
11	BCM 9 (MISO)
12	BCM 11 (SCLK)
13	Ground
14	BCM 0 (ID_SD)
15	BCM 5
16	BCM 6
17	BCM 13 (PWM1)
18	BCM 19 (MISO)
19	BCM 26
20	Ground
21	3V3 Power
22	BCM 2
23	BCM 3
24	BCM 4
25	Ground
26	BCM 17
27	BCM 27
28	BCM 22
29	3V3 Power
30	BCM 10 (MOSI)
31	BCM 9 (MISO)
32	BCM 11 (SCLK)
33	Ground
34	BCM 0 (ID_SD)
35	BCM 5
36	BCM 6
37	BCM 13 (PWM1)
38	BCM 19 (MISO)
39	BCM 26
40	Ground

Sense HAT

The Sense HAT is an add-on board for Raspberry Pi comprising of a 8x8 RGB LED matrix, a five-button joystick and the following sensors: Gyroscope, Accelerometer, Magnetometer, Temperature, Barometric pressure and Humidity.

The shift register driving the LED Matrix is a LED2472G connected via an Atmel ATTINY88 communicating via I2C at address 0x46 with the Pi. The Multi-Directional SKRHABE010 Switch/Joystick is similarly controlled.

The sensors themselves also operate over the I2C bus:

The IMU (Accelerometer and Magnetometer) through a LSM9DS1 found at I2C address 0x1c(0x1e) and 0x6a(0x6b), with Interrupts on the ATTINY88.

Environmental sensors are represented by a LPS25H Pressure/Temperature sensor at address 0x5c and by a HTS221 Humidity/Temperature sensor at 0x5f on the I2C bus.

In addition, the Atmel chip can be reprogrammed via the SPI interface. The pinout herein only maps the reset and chip select - adding a display or other SPI device alongside the Sense HAT should be possible with a few precautions.

Details

- Made by [Raspberry Pi](#)
- HAT form-factor
- EEPROM auto configuration
- Needs 5v and 3v3 power
- Uses 6 GPIO pins
- Communication over I2C
- 0x5c: LPS25H
- 0x1c: LSM9DS1
- 0x5f: HTS221
- 0x46: LED2472G
- 0x6a: LSM9DS1
- [More Information](#)
- [GitHub Repository](#)
- [Schematic](#)
- [Buy Now](#)

Picar hat: Robot HATS uses:

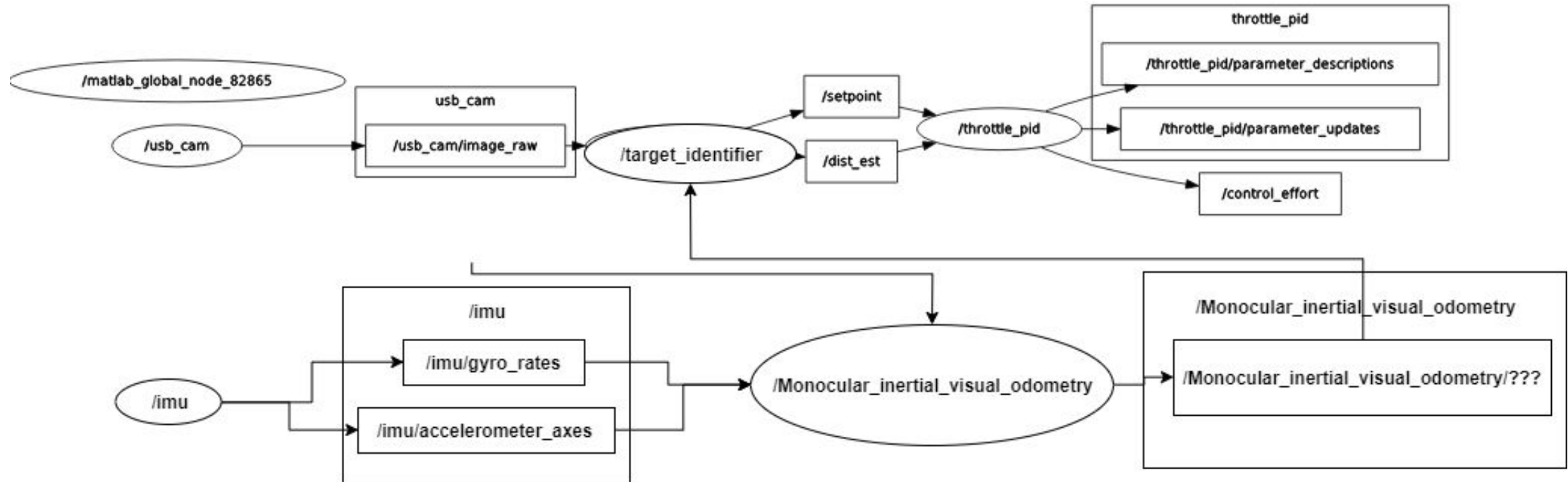
I2C: PCF8591 is used as the ADC chip, with I2C communication, and the address 0x48

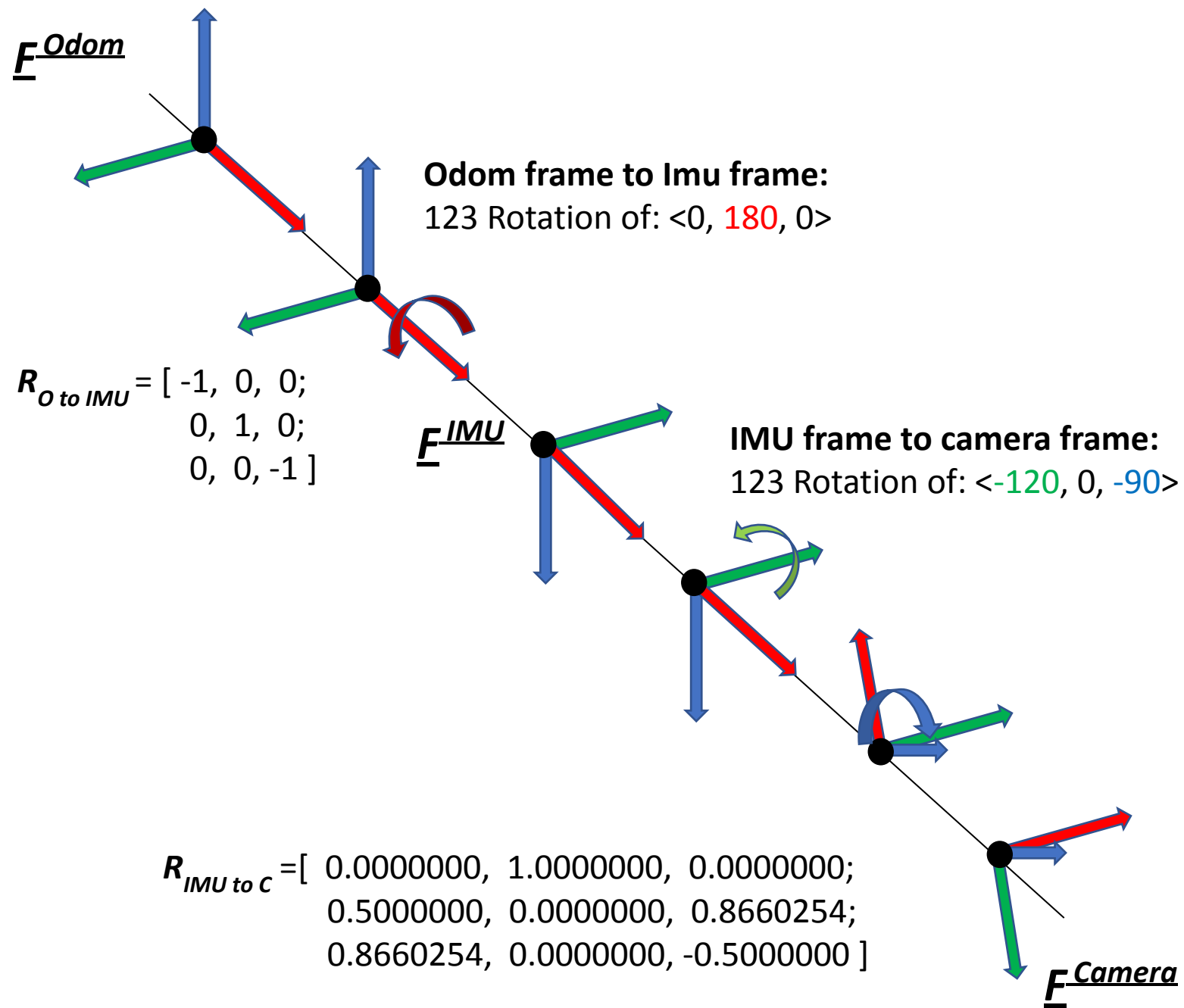
TB6612 motor control ports: includes 3.3V for the TB6612 chip, 5V for motors, and direction control of motors MA and MB; working with SunFounder TB6612 Motor driver

If I interpret the silkscreening right then the only other concern is B27 and B17 which I believe are not used by the Pi Sense Hat.

Unable to find a pinout so I will “give it a try...”

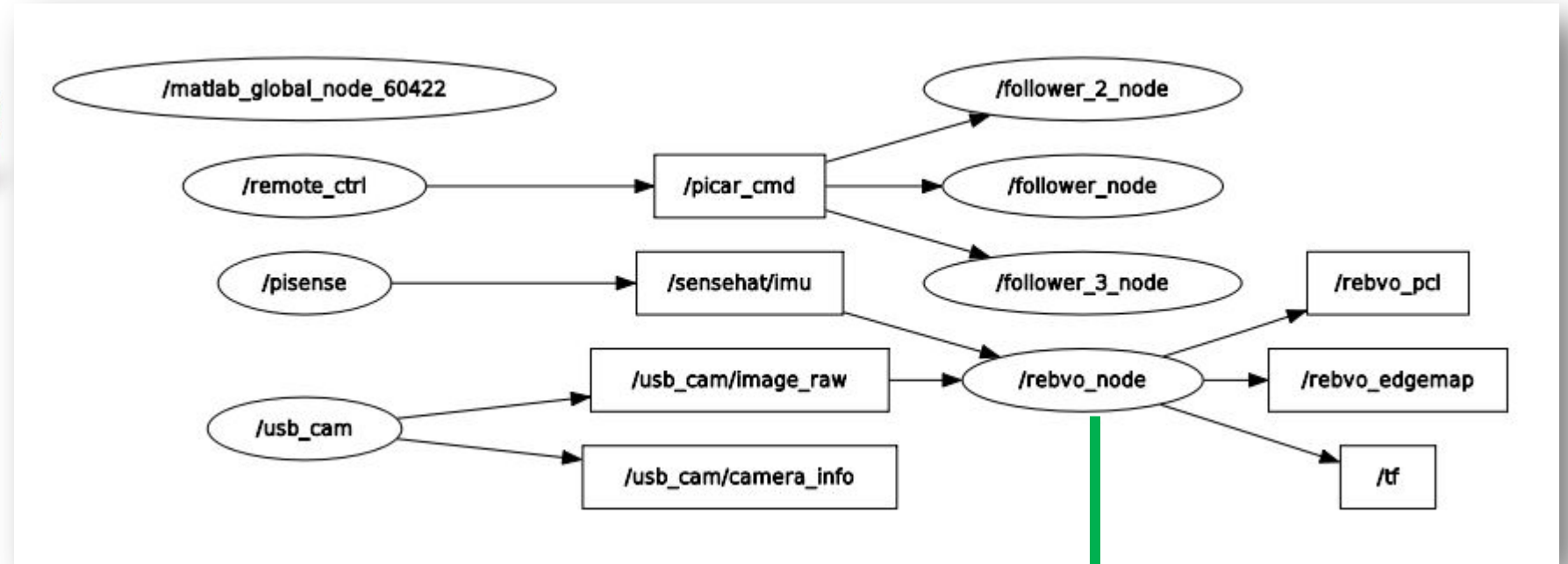
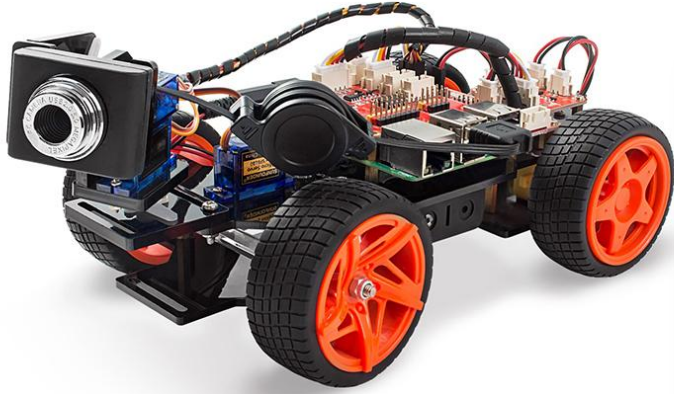
Promised Land: Rqt_graph mock up





Raspberrypi: 192.168.1.84:2708

Picar robot and REBVO



raspberrypi_viewer: 192.168.1.71:2708

Remote visualization of REBVO output

