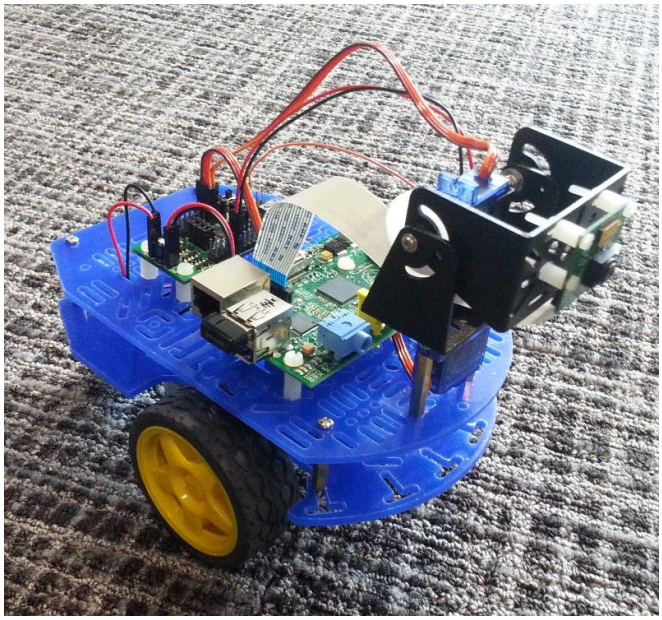
Autonomous Raspberry Pi robot

Introduction

This demo consists of a small autonomous robot identifying and driving to a distinctly coloured target. The robot is a Dagu 2WD skid-steer chassis with a Raspberry Pi and Raspberry Pi Camera installed. The chassis is supplied with a custom Arduino motor controller to drive the motors and camera servos



Parts

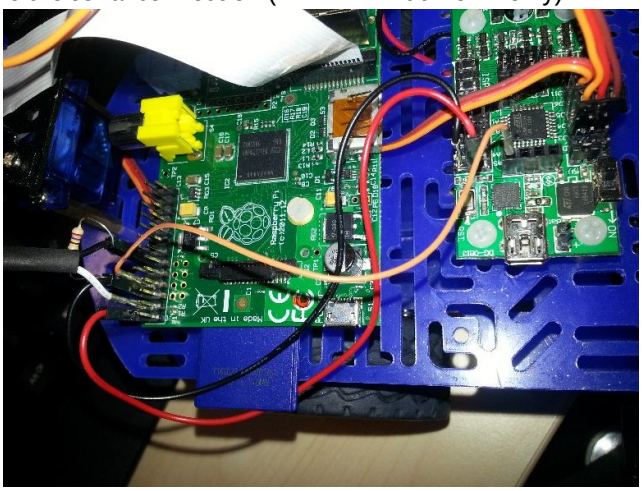
The required parts for this demo are:

- Robot chassis bundle
- Raspberry Pi
- Raspberry Pi Camera
- A supported USB-Wifi adaptor
- 6 High quality (>600mAh) AA-batteries
- A momentary push-to-make switch

Set up

1. Build the robot as per the manufacturer's instructions with the following changes
    a. Do not flash their custom SD card firmware
    b. Do not connect the Arduino motor controller over USB, use the Raspberry Pi serial port instead. This photo shows how they should be wired together, the orange wire

is the serial connection (RPi Tx -> Arduino Rx only)



c. Flash the Arduino motor controller board with this code, selecting the board type **Arduino NG or older w/ ATmega8**
d. Hook up a momentary push to make switch between GPIO18 and 3.3V on the Raspberry Pi (recommend to have a 10k pull-down resistor to ground also, see photo above).

2. Set up the Raspberry Pi firmware as per the doc
3. Disable the serial console on the Raspberry Pi
4. Set up the Raspberry Pi as a wireless access point
5. Enable to Raspberry Pi camera
6. Power the Arduino motor board with 9V, the Raspberry Pi should boot and the servos centralise
7. Connect your laptop to the Raspberry Pi access point

MATLAB Demo

The **identifyTarget.m** script runs through a simple example of connecting MATLAB to the Raspberry Pi to acquire images and interface with the serial port and GPIOs. Once an image has been acquired from the Pi a simple image processing algorithm is developed. Run the demo by stepping through the script.

Simulink Demo

FindTarget.slx is a Simulink/Stateflow demo which detects the presence of a green target, estimates the distance/heading of the robot from it and drives the robot to the target. The localisation is done with a simple EKF, based on this paper. Deploy the model to the robot in External Mode (ensuring the target IP address is correct) to observe the image acquired and the thresholding results. The threshold can be tuned inside the **Image Processing/Image processing/Detect Target** subsystem. The robot does not move until the GPIO switch is pressed, at which point it will search for then drive to the target (see Stateflow chart for details). Upon reaching the target the camera point tilts up and down to “Nod” the camera, acknowledging the target has been found.