

Application Notes

Team8 AgBOT

Yanqi Wang

A45712478

Content

Introduction

Raspberry Pi

Motor Driver

Sensors

Speed Control

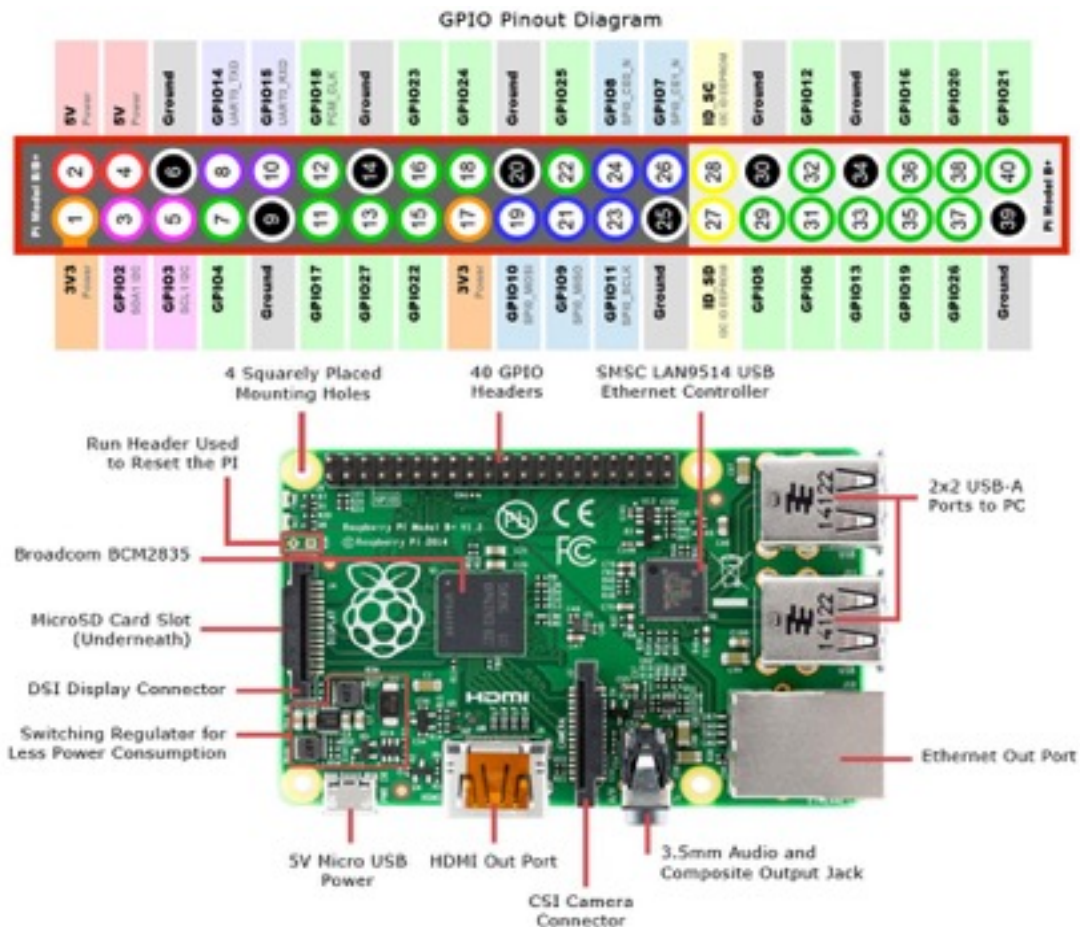
Final connections

Introduction

The AgBOT project contains an RC model car, a raspberry pi, two motor drivers, gyroscope & magnetometer and a GPS module. It is essential to get all these part work together as a whole robot system. Since raspberry pi works as a central processor of the system, every component needs to be connected with it to receive inputs or send outputs. A general research of every component and the pins of raspberry pi is necessary.

Raspberry pi

Raspberry pi is a microprocessor which is similar to a computer. It is able to process different software from several programming languages such as c, c++ or python. There are 40 pins on the raspberry pi board which can be directly connected to some external circuit. These pins can also take in inputs from different kind of sensors.



This picture shows a brief description of the 40 pins on raspberry pi board. All the pins in green color are defined as simple GPIO (general purpose input & output) pins. They can both read and output either a high or low signal which is digital. The low signal is a zero voltage as usual and the high signal is defined as a 3.3V here for the raspberry pi. The pins can be controlled by a software called wiring pi. It is a straight forward software which has two simple functions: setting pins to input/output direction and giving a pin a high or low signal.

```
Echo 2 > sys/class/gpio/export
```

```
Echo out > sys/class/gpio/gpio2/direction
```

```
Echo 1 > sys/class/gpio/gpio2/value
```

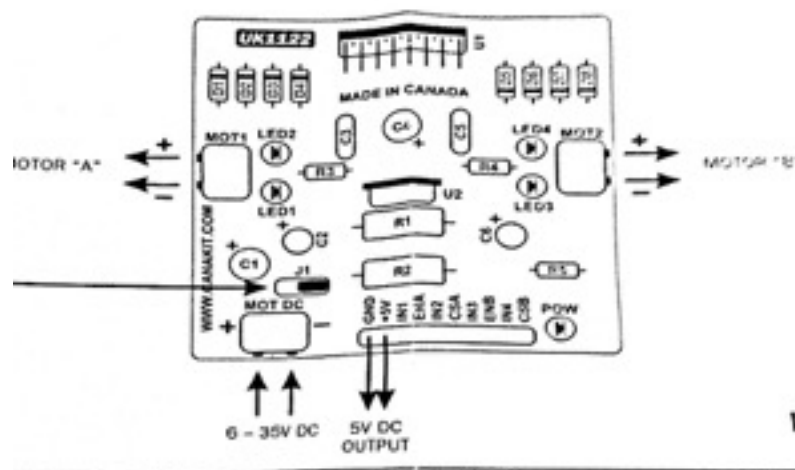
This is an example code of the wiring Pi. It means to set pin2 as an output

and its value to 1 which is also 3.3V.

There are other pins than GPIO on raspberry pi. Except the 3.3V, 5V and ground, pin2&3 as well pin 8&10 will be used. They are the I2C and UART pins and they are both transmission methods. These kind of pins allow raspberry pi to take in inputs from some specific sensors other than a high or low voltage from a circuit.

Motor Drivers

The RC model car has three motors which are pretty straight forward to use. Two of them are responsible for going forward and backward. Each of them controls the front and back two wheels. The other motor controls the back two wheels as well for turning the car. However, motor drivers must be connected between the real motor and raspberry pi in order to control the current and voltage allowed to the motors.



This is pinout graph of the motor driver. It should be supplied with a 9V DC voltage and it can output an optional 5V DC voltage. The pins on the right hand side of the 5V output is what really controls the motor. En1/2 are like switches of the motors. En1 controls motor A and En2 controls motor B. Only by setting the enable pin to '1' can turn the motor on. The LED2/4 will be on to indicate the motor is working. In1/2 belongs to motor A and In3/4 belongs to motor B. A high voltage for a input pin will drive the specified motor to one direction. Here is a truth table for a whole motor driver.

En1	In1	In2	En2	In3	In4		Motor A	Motor B
0	x	x	0	x	x		not working	not working
1	0	0					stop	
1	0	1					backward	
1	1	0					forward	
1	1	1					stop	
			1	0	0			stop
			1	0	1			backward
			1	1	0			forward
			1	1	1			stop

This table also shows the two motors connected to one motor driver can be controlled separately.

Sensors

The robot needs several sensors on it to get information about the environment while it is working. The primary goal of the project is to navigate the car. A GPS module and a gyroscope & magnetometer chip are used as the sensors. Both of them receive analog signal from the environment. Following the datasheet of both devices, the GPS module requires UART transmission and gyroscope & magnetometer requires I2C transmission. They will be connected to those pins on the raspberry pi so the required data can be transmitted and displayed on the raspberry pi.

Speed Control

A simple speed controller is needed when the car is making a turn or approaching the destination. Two GPIO pins on the raspberry pi will be used to construct a 4:1 digital to analog MUX. The two pins are able to give 00, 01, 10, 11 these 4 choices which can lead to four connections with external circuit.

Final pin connections are as following:

