Mini Project: RedBot

Sung Yeul Park

Dept. Electrical & Computer Engineering
University of Connecticut
April 8, 2019
Email: sung_yeul.park@uconn.edu

Mini Project Description

Title	AVR Functions	Additional H/W	S/W Scenario
Line Follower	ADC, PWM, GPIO, USART	IR sensor, H-bridge driver	Based on IR sensor input, RedBot need to adjust motor speed and move along the line

Requirement

- Two students will form a team and share one RedBot.
- Requirement: Task based programming – no delays!!
- Prove your understanding of AVR design capability
- Approaches:

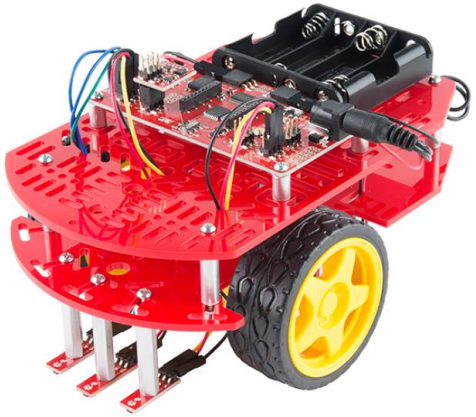
- Basic function development
- Algorithm development
- Lab demo and competition

Mini Project: Line Follower

Description

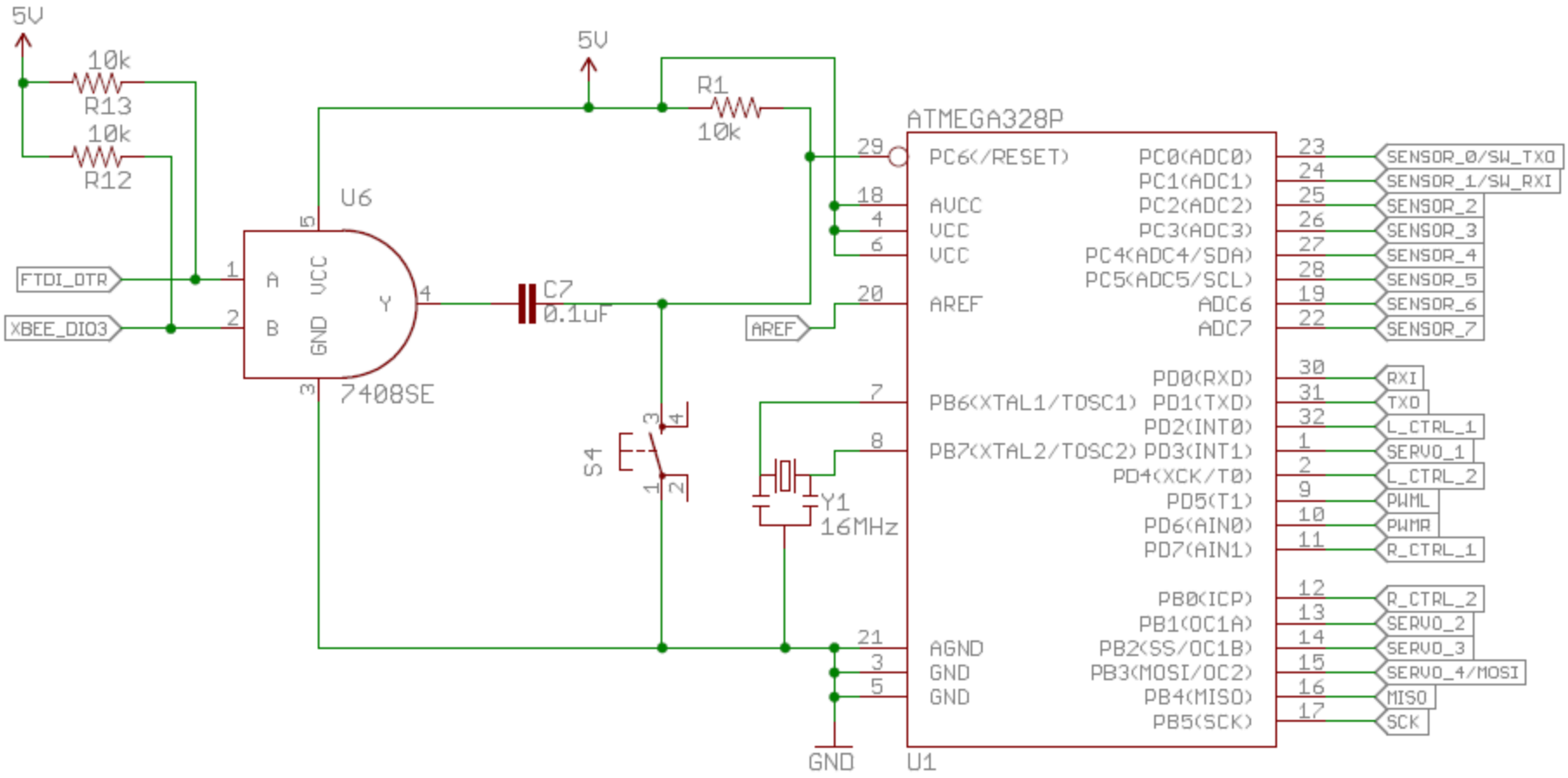
- Using Sparkfun's RedBot Line Follower kit, you will implement a small robot that follows a line of electrical tape.
- Infrared Sensors are used to sample the desired path in reference to the robot's trajectory.
- Movement is actuated by two PWM controlled H-bridge modules.

https://www.sparkfun.com/products/12649

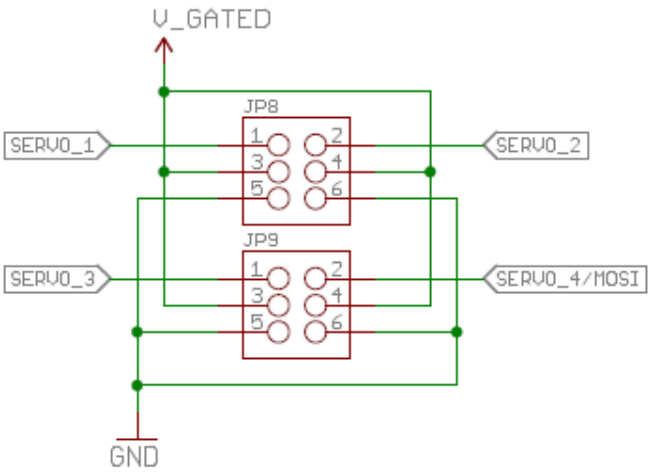


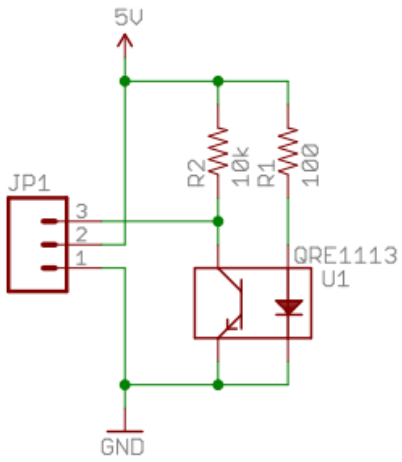
https://www.sparkfun.com/products/12697

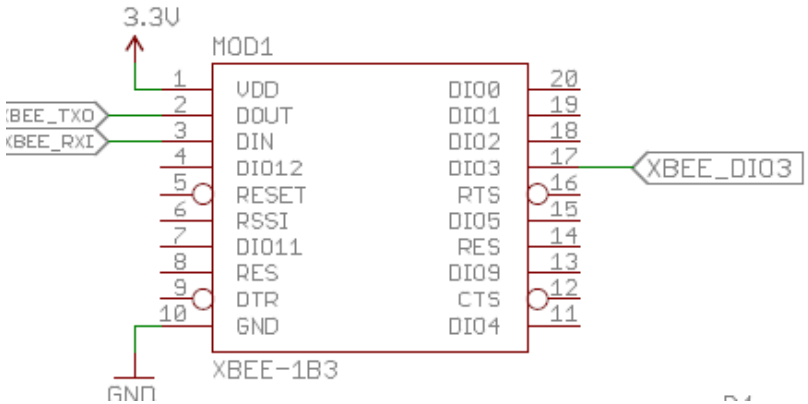
RedBot Schematic (1/2)

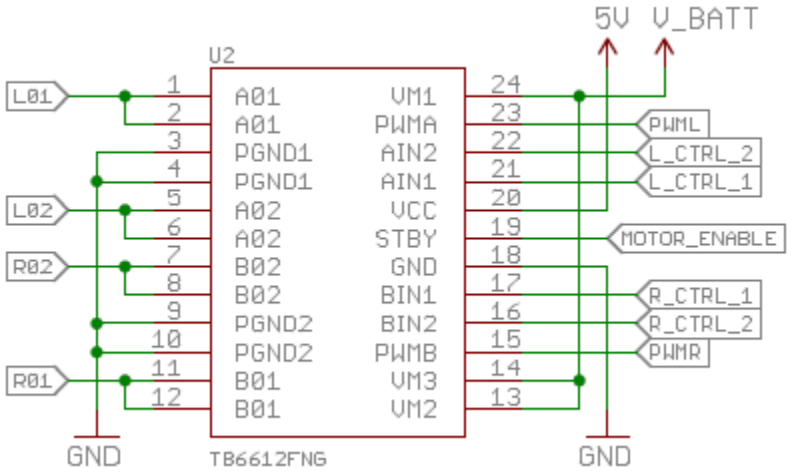


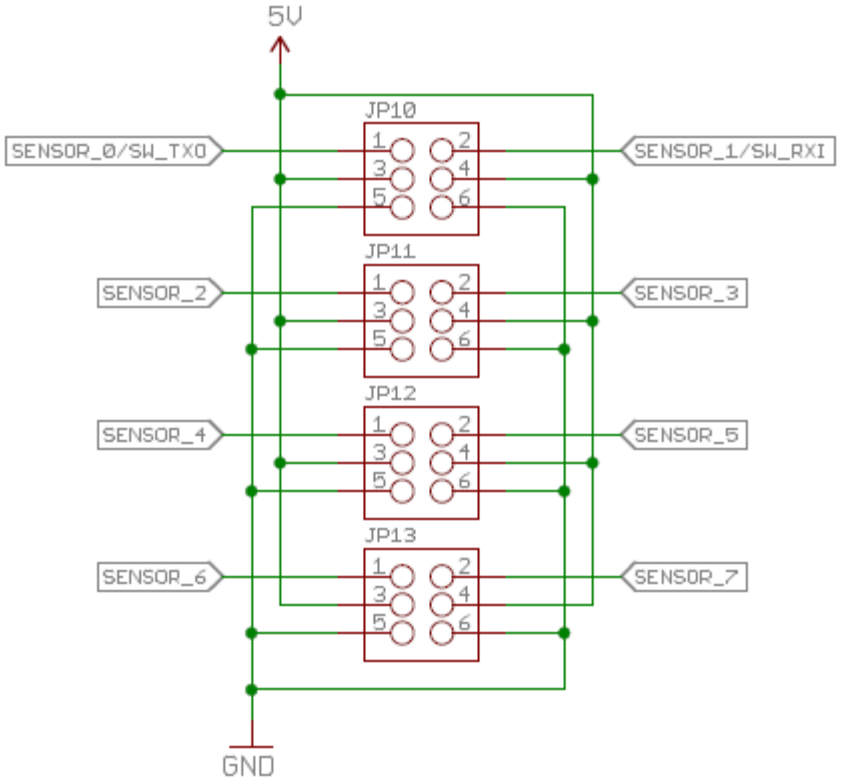
RedBot Schematic (2/2)



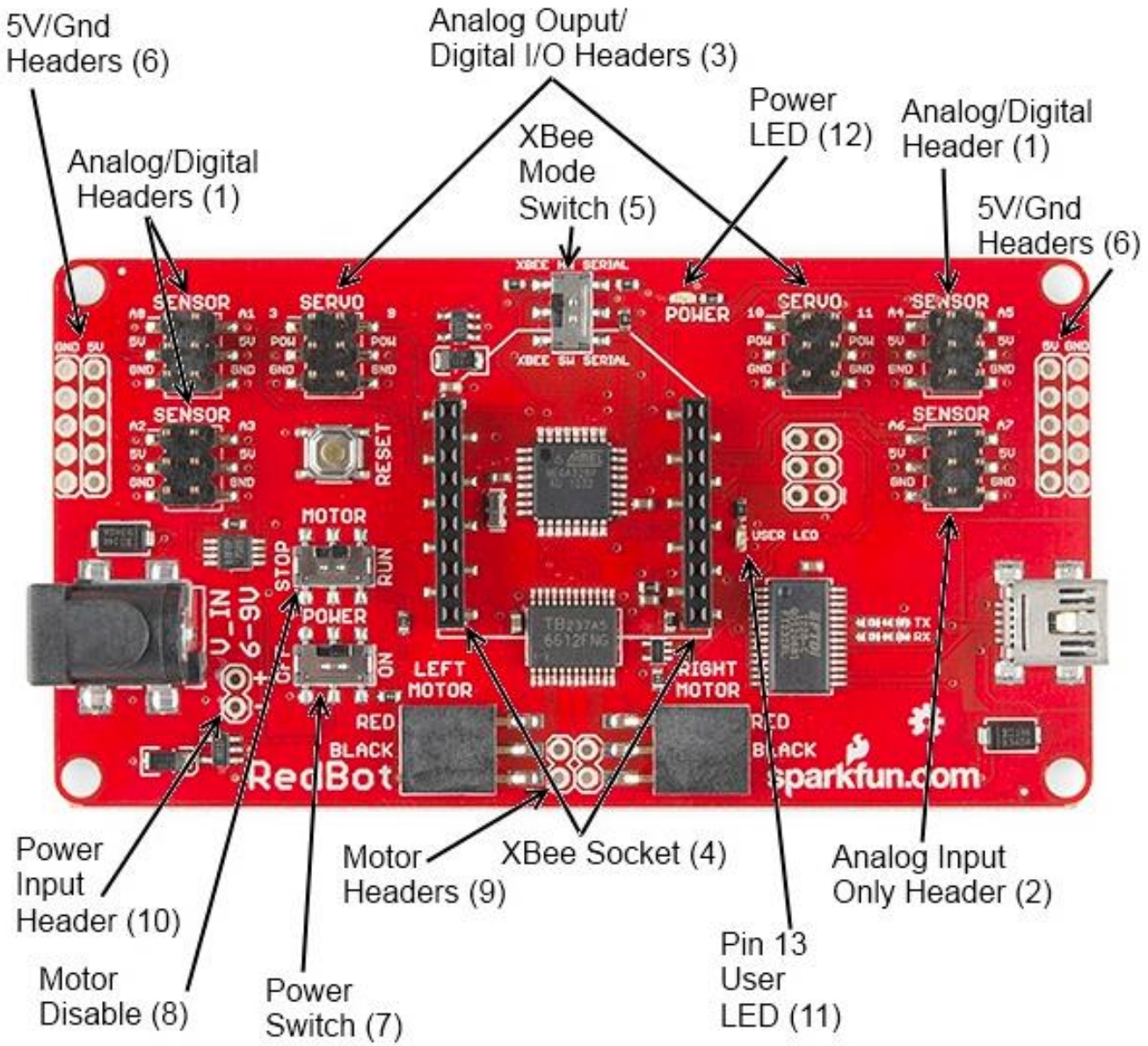




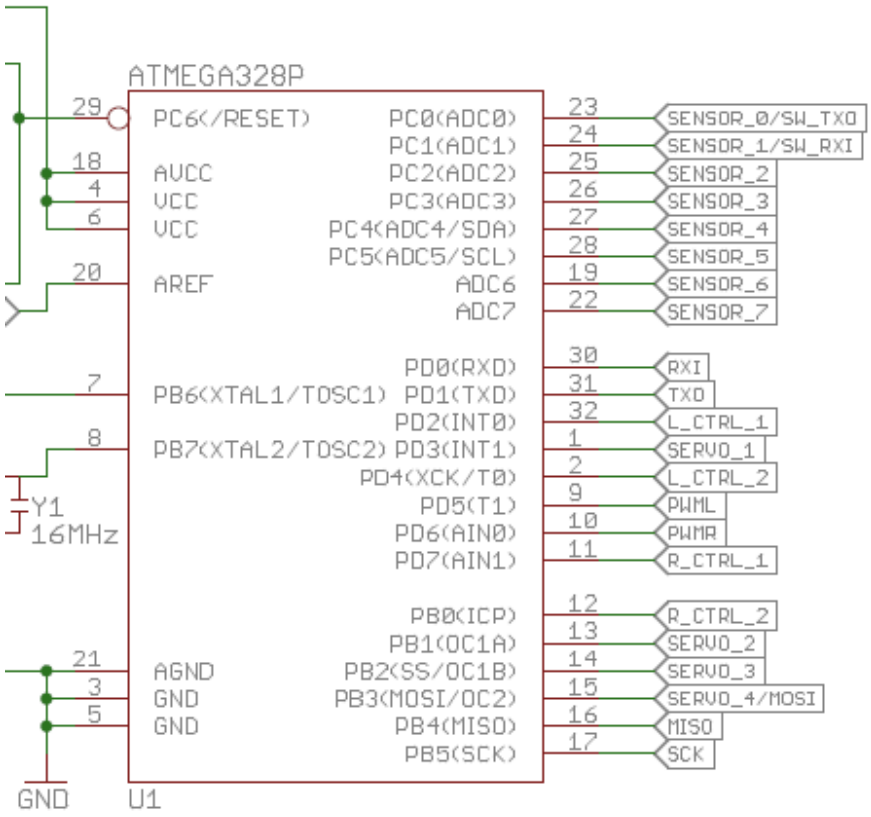




RedBot Mainboard

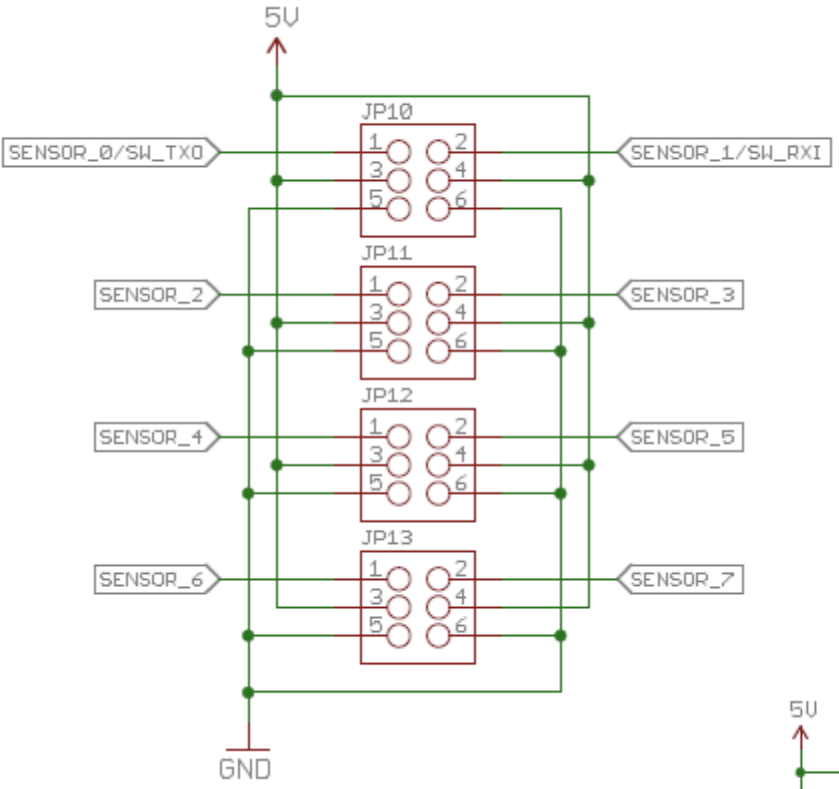


Atmega328P Pin Assignment for RedBot



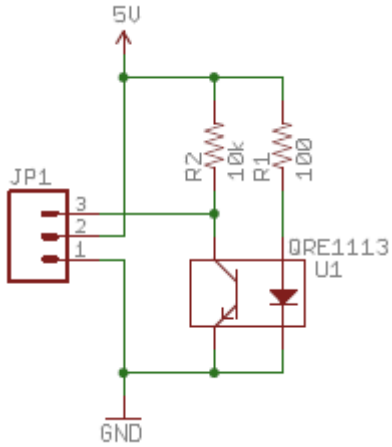
Pin#	Pin Name	Port Name	Ext Circuit
19, 22~28	ADC	PC0 ~ 5	ADC Input
30, 31	USART	PD0, PD1	XBEE
32, 2	L_CTRL_1/2	PD2, PD4	Left Motor
1, 13~15	SERVO_1/2/3/4	PD3, PB1, PB2, PB3	
9~10	PWML/R	PD5, PD6	
11~12	R_CTRL_1/2	PD7, PB0	Right Motor
29	/RESET	PC6	
7, 8	CLK	PB6, PB7	
18,4,6	AVCC,VCC		
21,3,5	AGND, GND		
20	AREF		
16,17	MISO, SCK	PB4, PB5	6PIN ISP

Line sensing mechanism



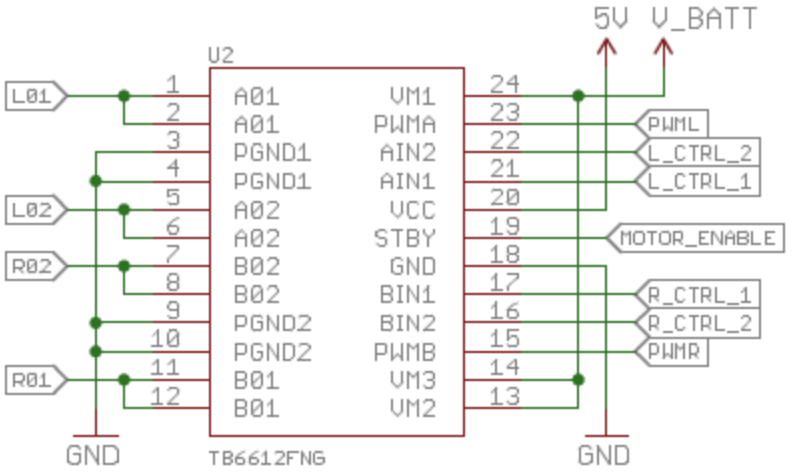
Pin#	Pin Name
1	Sensor Output #1
3	VCC: 5V
5	GND

Pin#	Pin Name
2	Sensor Output #2
4	VCC: 5V
6	GND



- QRE1113: Miniature Reflective Object Sensor
- The sensor works by detecting reflected light coming from its own infrared LED.
- By measuring the amount of reflected infrared light, it can detect transitions from light to dark (lines) or even objects directly in front of it.

Motor control mechanism



- TB6612FNG: Dual DC motor driver IC
- Four modes: CW, CCW, Short brake, and stop
- Speed control: PWM duty ratio
- Input1, 2: determine/control Mode
- STBY: motor enable pin

Input				Output		
IN1	IN2	PWM	STBY	OUT1	OUT2	Mode
H	H	H/L	H	L	L	Short brake
L	H	H	H	L	H	CCW
		L	H	L	L	Short brake
H	L	H	H	H	L	CW
		L	H	L	L	Short brake
L	L	H	H	OFF (High impedance)		Stop
H/L	H/L	H/L	L	OFF (High impedance)		Standby

Using Atmel Studio to Program Arduino Board

- Since the board on RedBot is an Arduino Board, we are not able to directly use Atmel Studio to program it. We need to setup an external programmer in Atmel Studio for programming this board.
- Please follow the following steps to setup the external programmer.

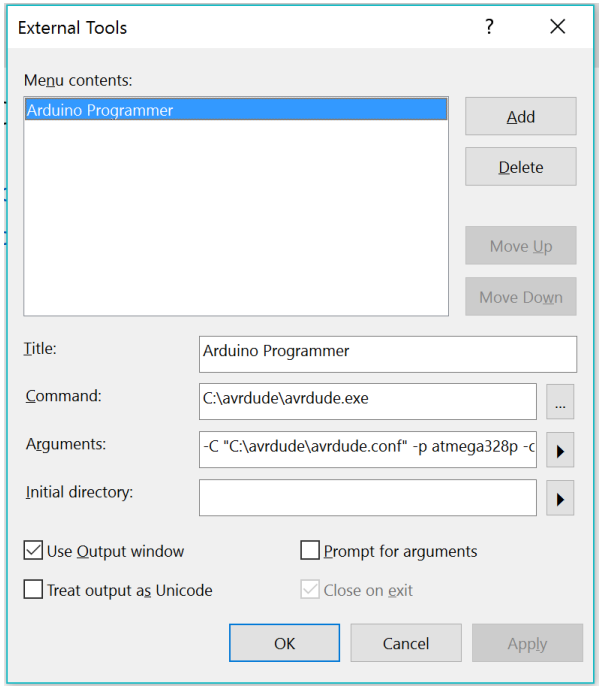
1. Download Avrdude from http://mirror.rackdc.com/savannah//avrdude/avrdude-5.11-Patch7610-win32.zip
2. Unzip the downloaded file, rename the directory to ***avrdude***, and copy it into your ***C*** drive
3. Connect your board to your computer, open Device Manager, check the **COM** port.
4. Open Atmel Studio, go to Tools -> External Tools

Setup External Programmer

5. Fill the dialog box like this:
6. The Arguments field in the dialog box is

```
-C "C:\avrdude\avrdude.conf" -p atmega328p -c
arduino -P COM9 -b 115200 -U
flash:w:"$(ProjectDir)Debug\$(TargetName).hex":i
```

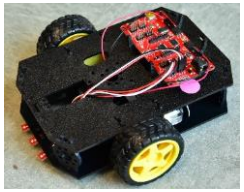
for most of



The Arguments field in the dialog box is

```
-C "C:\avrdude\avrdude.conf" -p atmega328p -c
arduino -P COM9 -b 57600 -U
flash:w:"$(ProjectDir)Debug\$(TargetName).hex":i
```

for most of



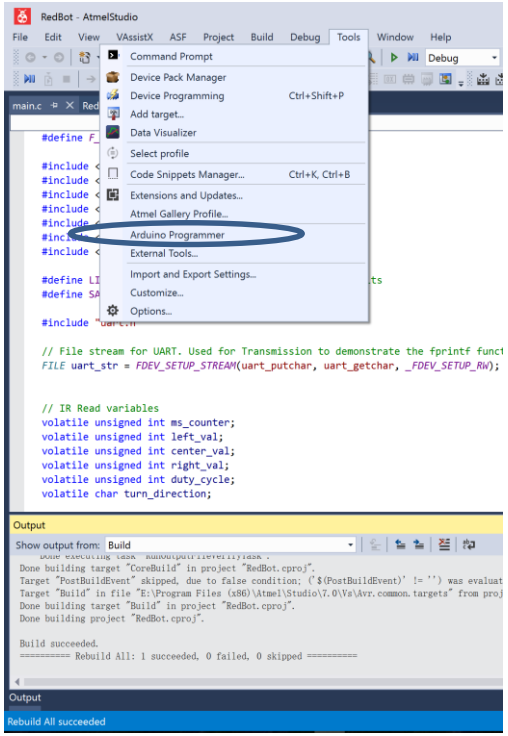
Note: Update your COM number accordingly. If your programmer does not work after setup, change to the other argument. It must be one of these two.

Use External Programmer

Since the MCU on this board is also ATMega 328P, you just need to create the project and program as usual.

Then first build the project, and click Tools-> Arduino Programmer to program your board.

Notice: This Arduino Programmer can only be used to program the board (not to build the solution), so you should always rebuild your solution before you program it.



Mini project approach

How do we start?

- Read carefully all available resources including datasheets.
- Converter or build individual function test program
- Check the individual functions: ADC, PWM, USART, Encoder, motor control, and so on.
- Build up a modular program
- Combine modular programs for line follower program
- Test and debug