Mini Project: RedBot

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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 move along the line

Requirement

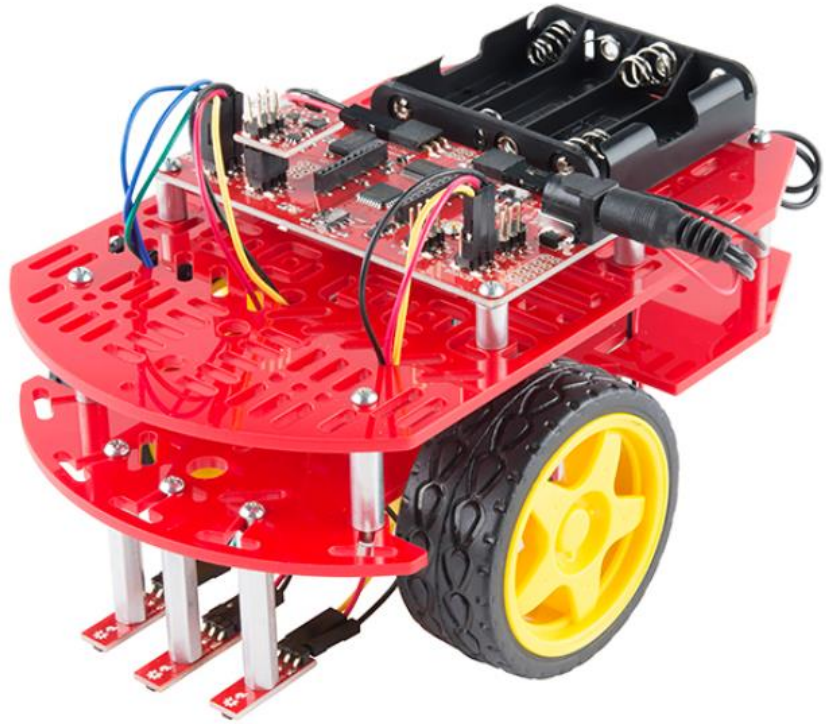
- Two students will form a team and share one RedBot.
- Requirement: Task base programming!!
- Prove your understanding AVR design capability
- Schedule:

- Basic function test(2/28-3/7) - Algorithm test (3/12-14)
- Lab demo and competition (3/19)

Mini Project: Line Follower

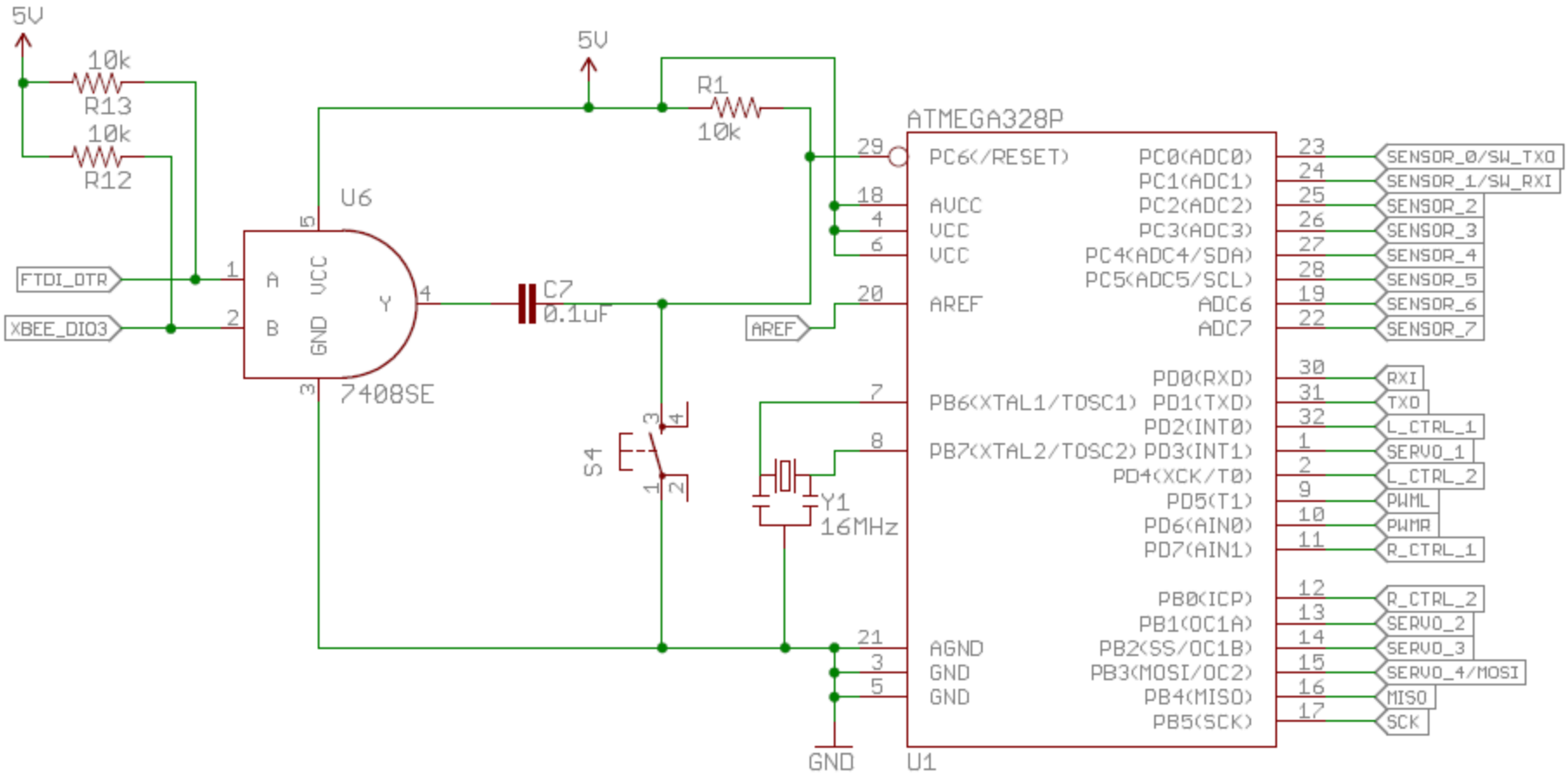
Description

- 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.

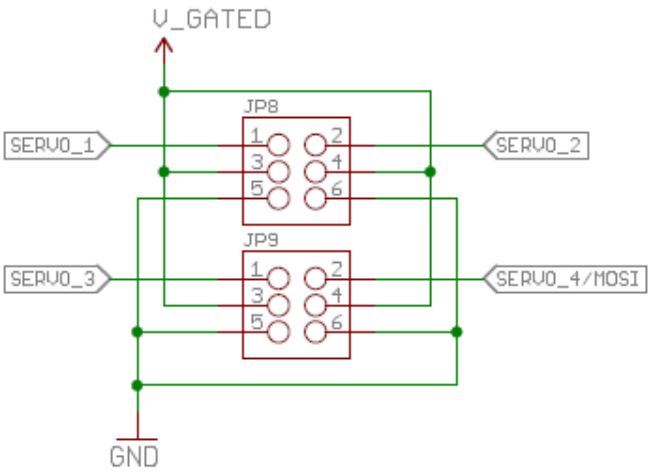


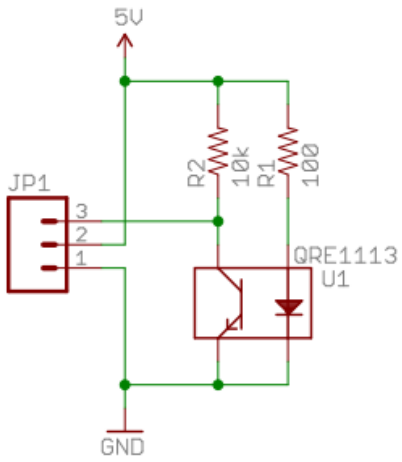
https://www.sparkfun.com/products/12697

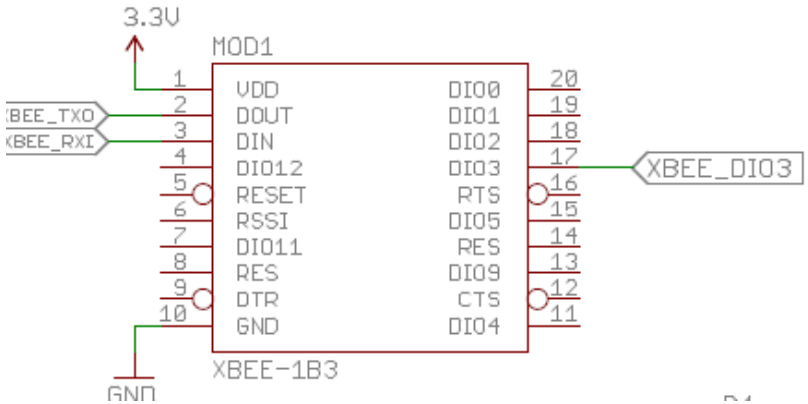
RedBot Schematic (1/2)

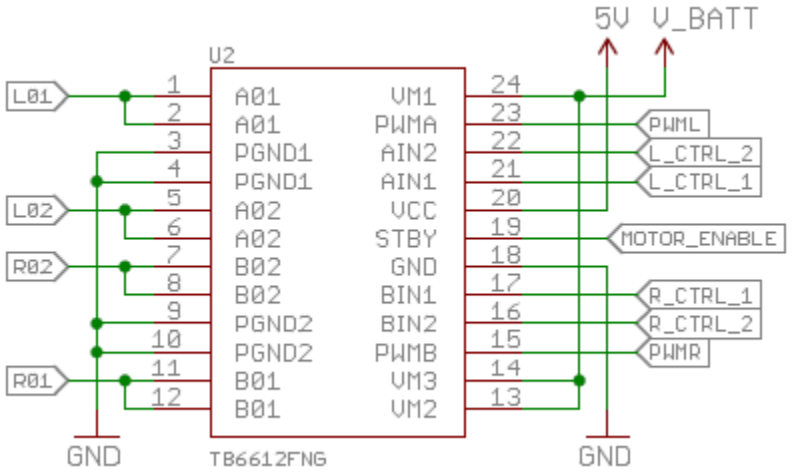


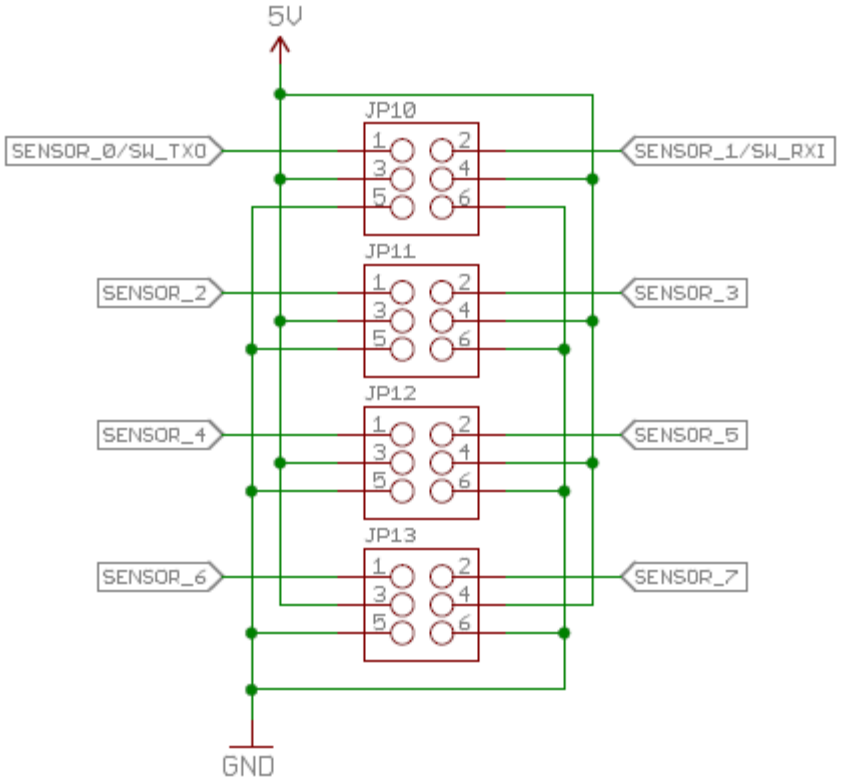
RedBot Schematic (2/2)



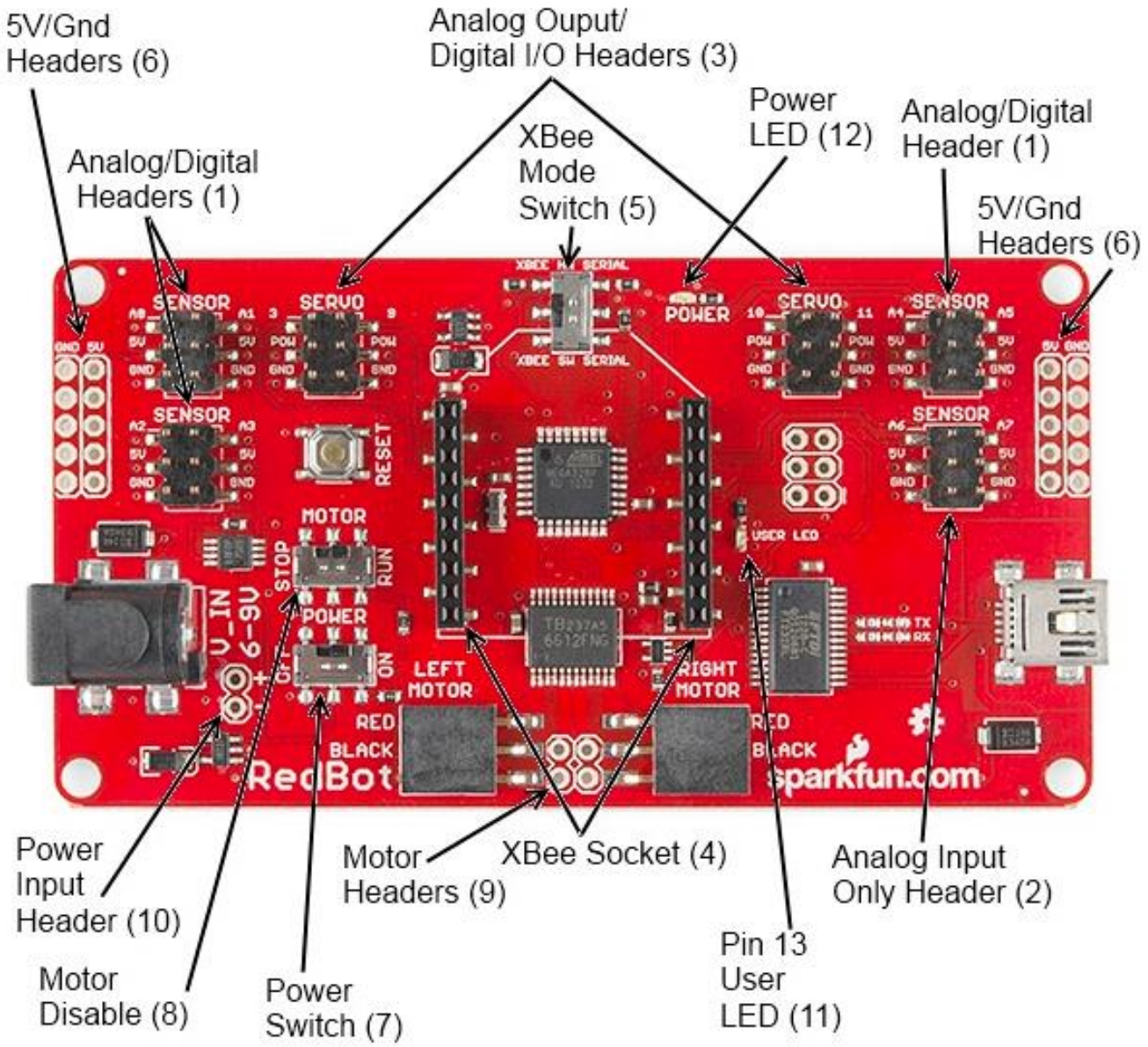




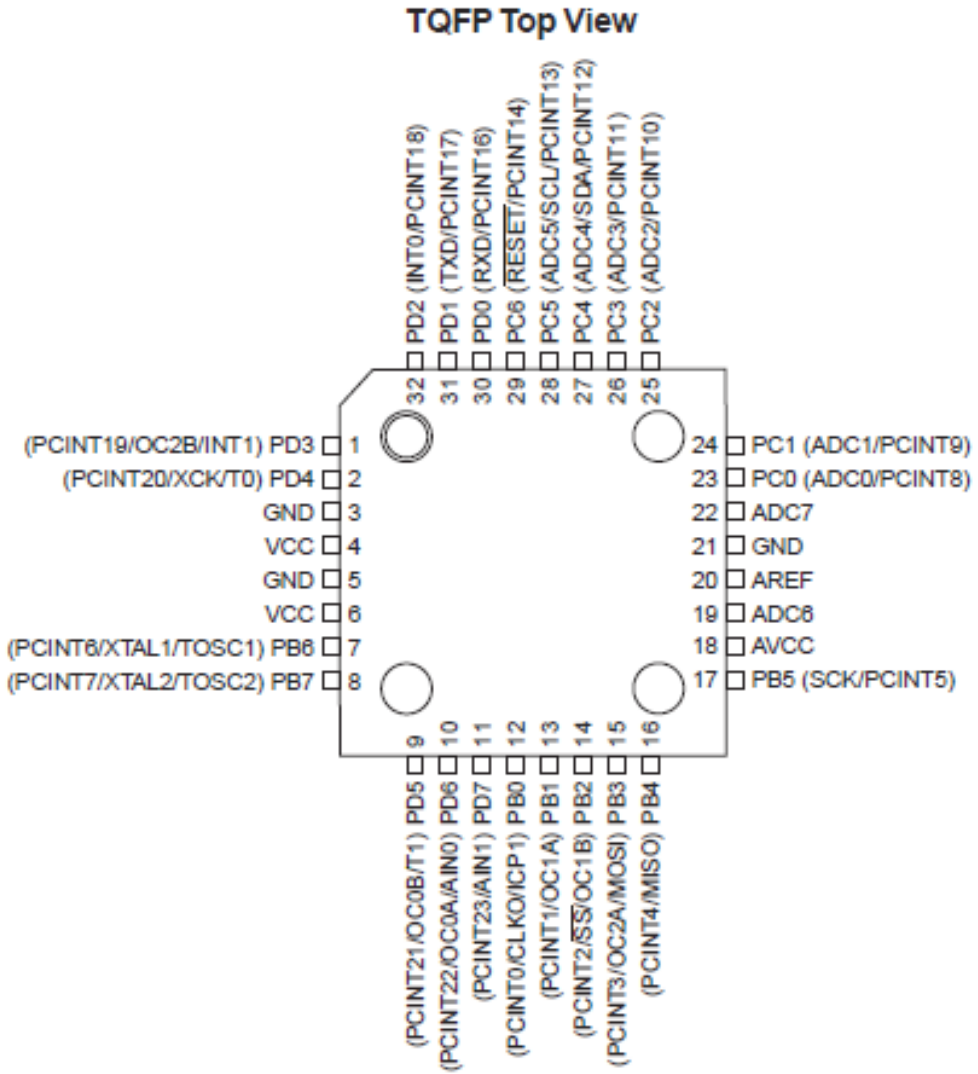




RedBot Mainboard

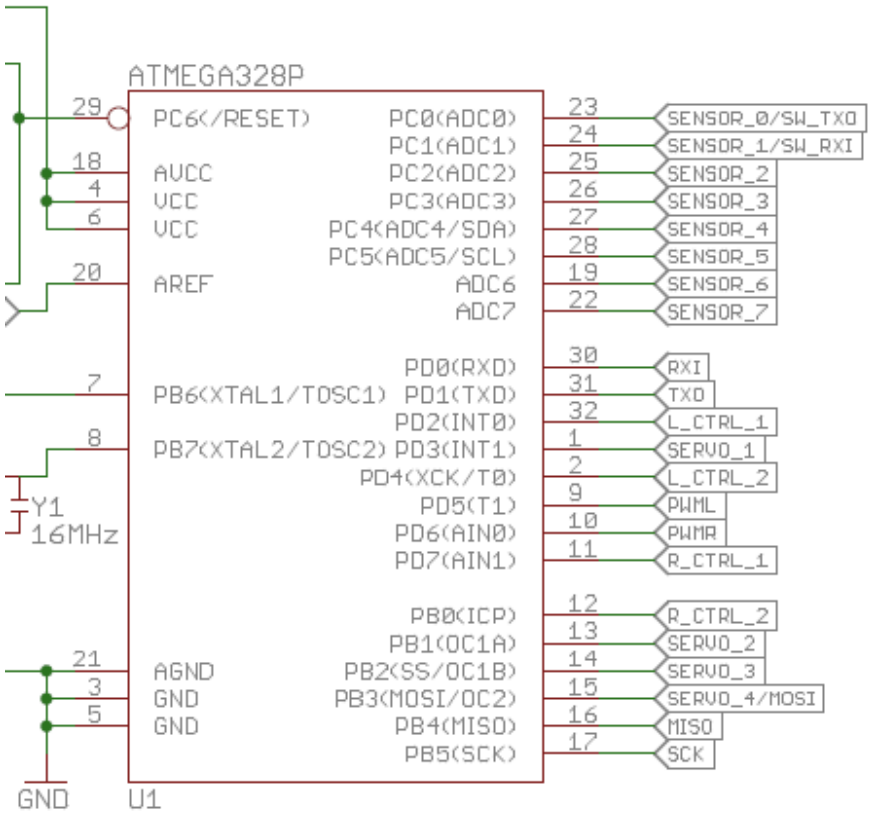


Atmega328 TQFP



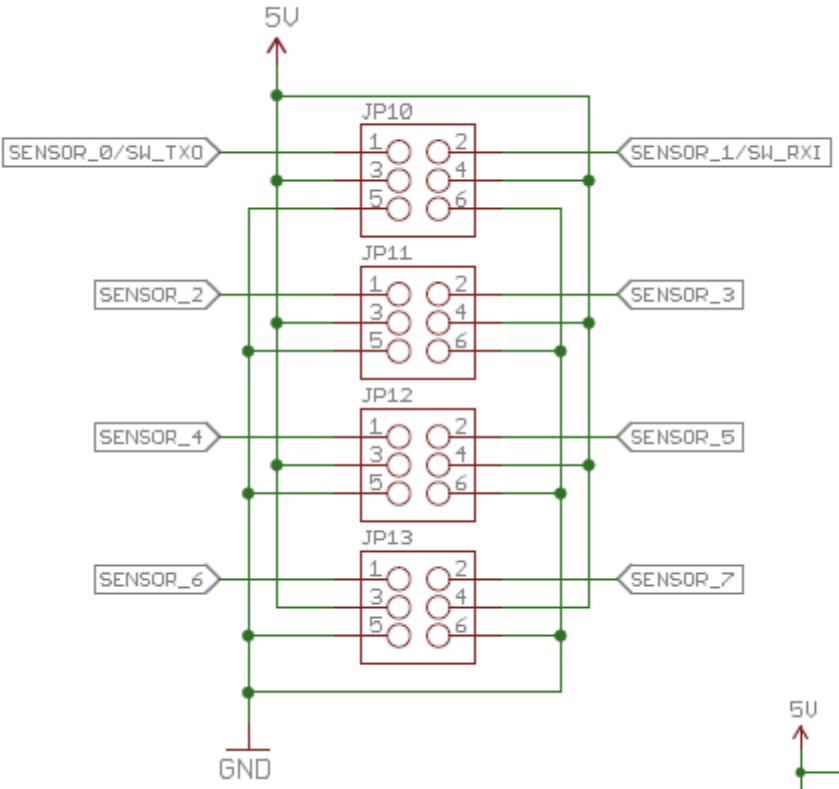
- 8 bit AVR core
- 28 Pin 32kByte Flash memory
- GPIO: 23
- 8 ADC channels in TQFP
- 6 PWM channels
- USART
- I2C

Atmega328 Pin Assignment for RedBot



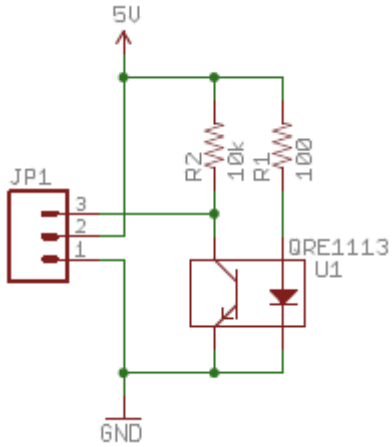
Pin#	Pin Name	Port Name	Ext Circuit
19, 22~28	ADC	PC0 ~ 5	ADC Input
30, 31	USART	PD0, PD1	XBEE
32, 2	L_CTRL_1/2	PD2, PD3	Left Motor
1, 13~15	SERVO_1/2/3/4	PD3, PB1, PB2, PB3	
9~10	PWML/R	PD5, PD6	
11~12	R_CTRL_1/2	PD7, PB0	Right Motor
29	/RESET	PC6	
7, 8	CLK	PB6, PB7	
18,4,6	AVCC,VCC		
21,3,5	AGND, GND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

Line sensing mechanism



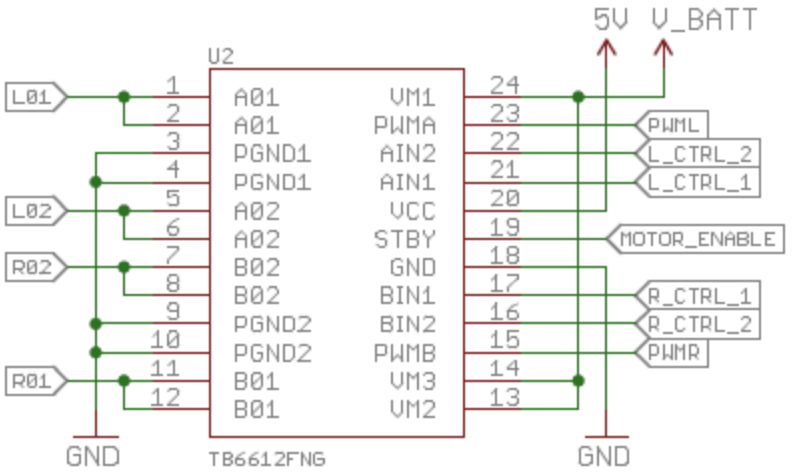
Pin#	Pin Name
1	Sensor Output #1
3	VCC: 5V
5	GND

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

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, Buzzer, Encoder, motor control, and so on.
- Build up a modular program
- Combine modular programs for line follower program
- Test and debug