This is the Revision A verion of the RoboBRiX Irline2 module. The status of this project is work in progress.

Irline2 (Revision B)

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This document is also available in PDF format.

1. Introduction

The IRLine2 RoboBrix can connect to operate 2 Fairchild® QRB1134 Infrared photorelective sensors. These sensor can detect the difference between light and dark at a distance about 4mm (.15 inches.) Thus, they are excellent for detecting the edges of lines for line following robots. The two QRB1134's are mounted directly on the IRLine2. The board is mounted on edge with the two sensors facing down toward the floor and stradling the line to be followed. The QRB1134 sensers can be moved back and forth across the board edge to accomadate different line widths.

2. Programming

The IRLine2 RoboBrix is continuously reading the analog inputs from its four A/D pins. The controlling program can just read the results of the digital conversion, or it can have the result down converted into a single binary bit. Each pin has has a threshold high and threshold low register that is used for the down conversion. Whenever the digital conversion exceeds the high threshold register, the down coversion results in a 1. Whenever the digital conversion is lower than the low threshold register, the down conversion results in a 0. A hysterisis effect can be introduced by having some spread between the high and low threshold values.

After the down coversions to binary bits, the result is 4−bits of binary data. A complement mask can be used to selectively invert individual bits in the 4−bit data.

The IRLine2 RoboBrix supports RoboBrix Interrupt Protocol for those lines that are being used as inputs. The interrupt pending bit is set whenever the the formula:

$$L\&(\sim I) | H\&I | R\&(\sim P)\&I | F\&P\&(\sim I)$$

is non−zero, where:

- I is the current input bits XOR'ed with the complement mask (C)
- P is the previous value of I
- L is the low mask

- H is the high mask
- R is the raising mask
- F is the falling mask

and

- ~ is bit−wise complement
- | is bit−wise OR
- & is bit−wise AND

Once the interrupt pending bit is set, it must be explicitly cleared by the user.

In addition to the common shared commands and the shared interrupt commands, the IRLine2 RoboBrix supports following commands:

Command	Send/Receive	7	6	5	4	3	2	1	0	Discussion
Read Pin	Send	0	0	0	0	0	0	b	b	Read pin *bb* and respond with 8−bit value *vvvvvvvv*
	Receive	v	v	v	v	v	v	v	v	
Read Binary Values	Send	0	0	0	0	0	1	0	0	Return the binary values *abcd* (after XOR'ing with complement mask)
	Receive	0	0	0	0	a	b	c	d	
Read Raw Binary	Send	0	0	0	0	0	1	0	1	Return the raw binary values *abcd* (no XOR with complement mask)
	Receive	0	0	0	0	a	b	c	d	
Reset	Send	0	0	0	0	0	1	1	0	Reset everything to zero
Read Complement Mask	Send	0	0	0	0	1	0	0	0	Return the complement mask *cccc*
	Receive	0	0	0	0	c	c	c	c	
Read High Mask	Send	0	0	0	0	1	0	0	1	Return the high mask *hhhh*
	Receive	0	0	0	0	h	h	h	h	
Read Low Mask	Send	0	0	0	0	1	0	1	0	Return the high mask *llll*
	Receive	0	0	0	0	l	l	l	l	
Read Raising Mask	Send	0	0	0	0	1	0	1	1	Return the raising mask *rrrr*
	Receive	0	0	0	0	r	r	r	r	
Read Falling Mask	Send	0	0	0	0	1	1	0	0	Return the falling mask *ffff*
	Receive	0	0	0	0	f	f	f	f	
Read High Threshold	Send	0	0	0	1	0	0	b	b	Return high threshold for pin *bb* of *hhhhhhhh*
	Receive	h	h	h	h	h	h	h	h	
Read Low Threshold	Send	0	0	0	1	0	1	b	b	Return low threshold for pin *bb* of *llllllll*
	Receive	l	l	l	l	l	l	l	l	
Set High Threshold	Send	0	0	0	1	1	0	b	b	Set high threshold for pin *bb* to *hhhhhhhh*
	Send	h	h	h	h	h	h	h	h	
Set Low Threshold	Send	0	0	0	1	1	1	b	b	Set low threshold for pin *bb* to *llllllll*
	Send	l	l	l	l	l	l	l	l	
Set Complement Mask	Send	0	0	1	0	c	c	c	c	Set complement mask to *cccc*
Set High Mask	Send	0	1	0	0	h	h	h	h	Set high mask to *hhhh*

Set Low Mask	Send	0	1	0	1	*l*	*l*	*l*	*l*	Set low mask to *llll*
Set Raising Mask	Send	0	1	1	0	*r*	*r*	*r*	*r*	Set raising mask to *rrrr*
Set Falling Mask	Send	0	1	1	1	*f*	*f*	*f*	*f*	Set falling mask to *ffff*
Read Interrupt Bits	Send	1	1	1	0	1	1	1	1	Return the interrupt pending bit *p* and the interrupt enable bit *e*.
	Receive	0	0	0	0	0	0	*e*	*p*	
Set Interrupt Commands	Send	1	1	1	1	0	*c*	*c*	*c*	Set Interrupt Command *ccc*.
Shared Commands	Send	1	1	1	1	1	*c*	*c*	*c*	Execute common shared command *ccc*

3. Hardware

The hardware consists of a circuit schematic and a printed circuit board.

3.1 Circuit Schematic

The schematic for the IRLine2 RoboBrix is shown below:
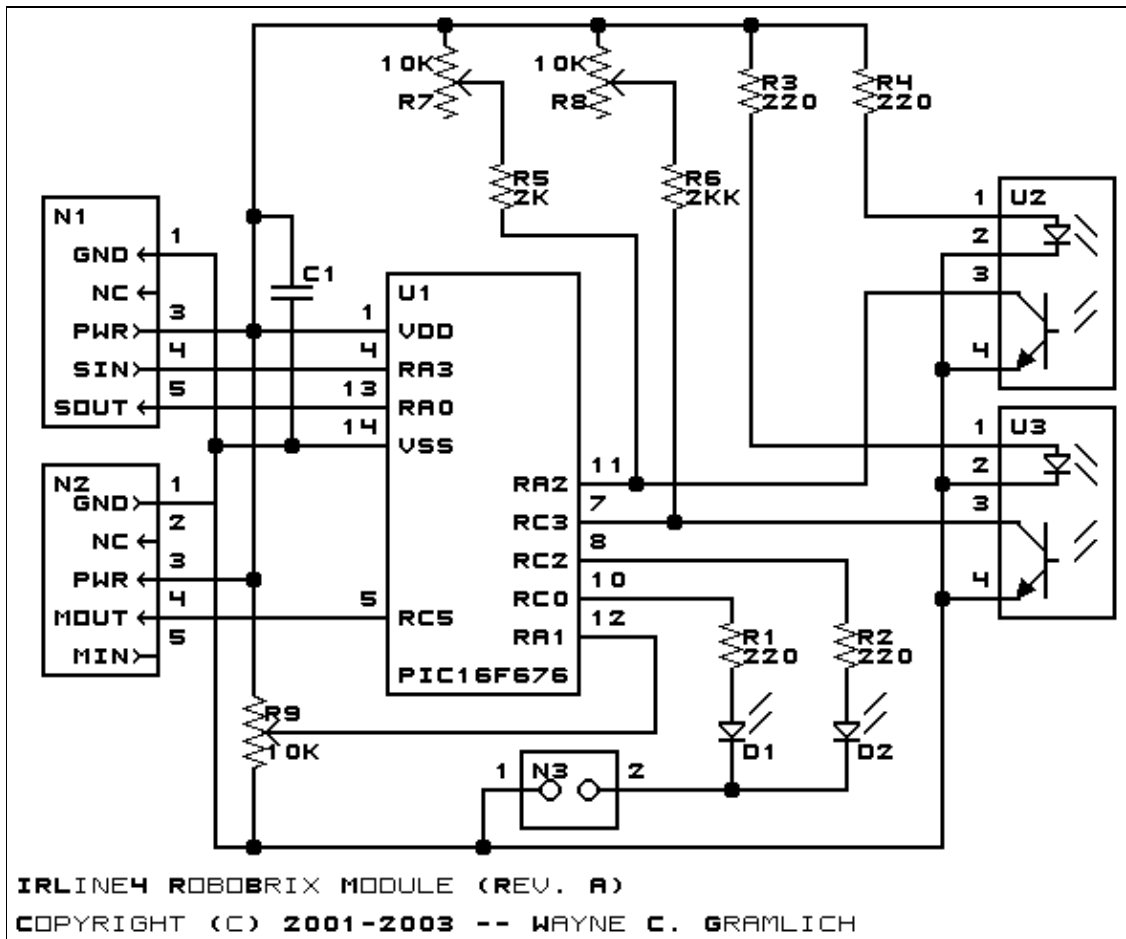
The parts list kept in a separate file –– irline2.ptl.

3.2 Printed Circuit Board

The printed circuit board files are listed below:

irline2_back.png
  The solder side layer.
irline2_front.png
  The component side layer.
irline2_artwork.png
  The artwork layer.
irline2.gbl
  The RS−272X "Gerber" back (solder side) layer.
irline2.gtl
  The RS−272X "Gerber" top (component side) layer.
irline2.gal
  The RS−272X "Gerber" artwork layer.
irline2.drl
  The "Excellon" NC drill file.
irline2.tol
  The "Excellon" tool rack file.

3.3 Construction Instructions

The construction instructions are in a separate file to be a little more printer friendly.

4. Software

The IRLine2 software is available as one of:

irline2.ucl
  The µCL source file.
irline2.asm
  The resulting human readable PIC assembly file.
irline2.lst
  The resulting human readable PIC listing file.
irline2.hex
  The resulting Intel® Hex file that can be fed into a PIC programmer.

The IRLine2 test software is available as one of:

irline2_test.ucl
  The µCL source file.
irline2_test.asm
  The resulting human readable PIC assembly file.
irline2_test.lst
  The resulting human readable PIC listing file.
irline2_test.hex
  The resulting Intel® Hex file that can be fed into a PIC programmer.

5. Issues

Any fabrication issues will be listed here.