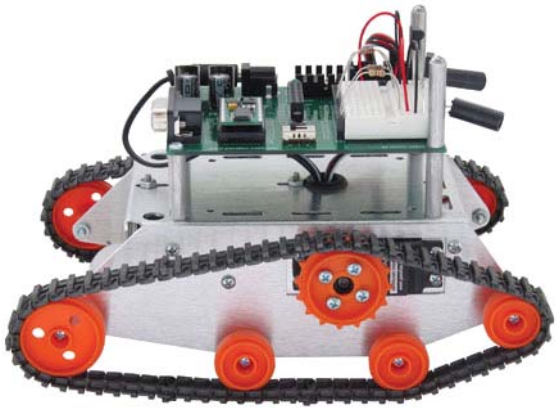
599 Menlo Drive, Suite 100
Rocklin, California 95765, USA
Office: (916) 624-8333
Fax: (916) 624-8003

General: info@parallax.com
Technical: support@parallax.com
Web Site: www.parallax.com
Educational: www.stampsinclass.com

Infrared Vision Object Avoidance with optional Memsic® 2125 Accelerometer Tilt Sensor

Application for Boe-Bot Tank Treads (#28106)



The infrared emitters and detectors allow your Boe-Bot tank to avoid obstacles. Adding the optional Memsic 2125 Dual-axis Accelerometer will keep the Boe-Bot tank from flipping over when it encounters very uneven terrain.

Parts Required

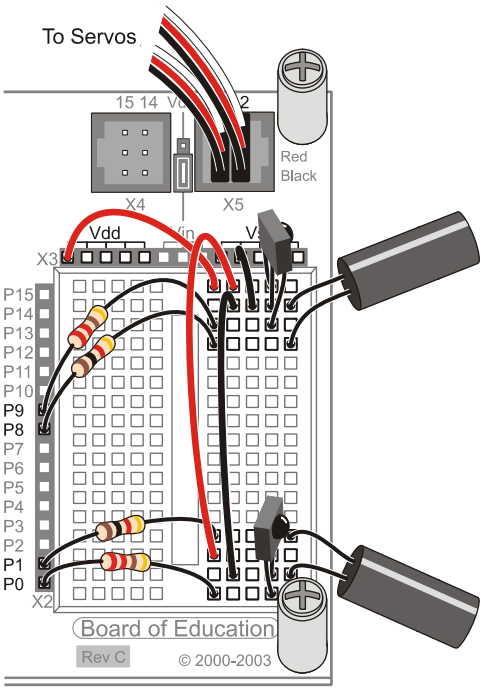
This project requires the Boe-Bot Full Kit with the Boe-Bot Tank Tread Kit installed and tested. The Memsic 2125 Accelerometer is optional. The first 5 items on the list are included in your Boe-Bot Full Kit.

- (2) Infrared LEDs with standoff and light shield assemblies (#350-00003, 350-90000, 350-90001)
- (2) Infrared receivers (#350-00014)
- (2) 1 k ohm resistor, 1/4 watt (#150-01020)
- (1) 220 ohm resistor 1/4 watt (#150-02210)
- (misc) jumper wires
- Optional: (1) Memsic 2125 Dual-axis Accelerometer (#28017)

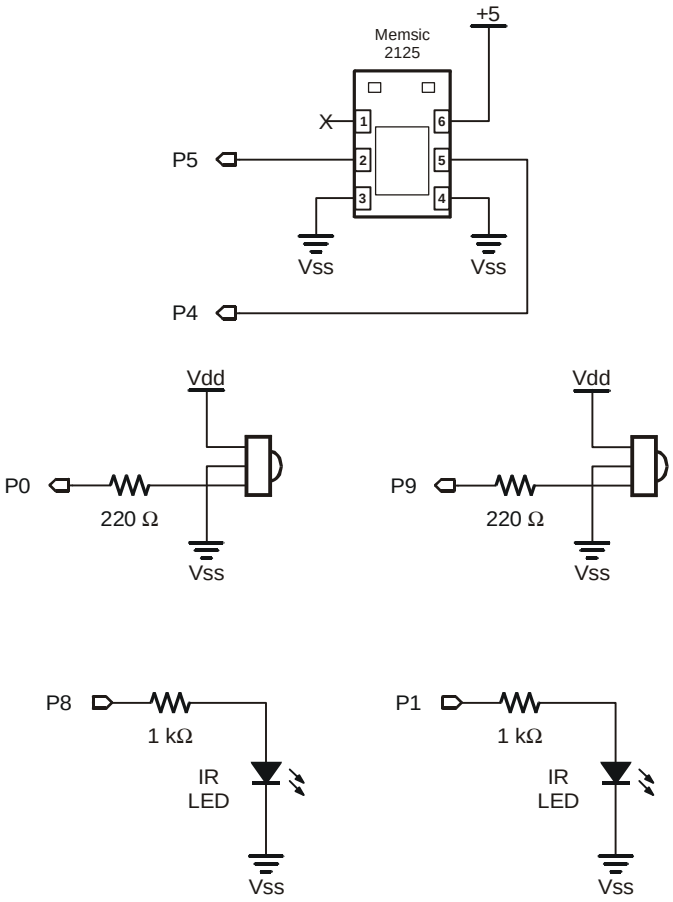
Building the Circuit

Build the circuits for the IR LEDs and detectors, and also the Memsic accelerometer if you are using it. The wiring diagram shows placement for all of the parts. If you are not using the accelerometer, you do not need to add any of the wires that connect directly to it.

Wiring Diagram



Schematic



BASIC Stamp® Code

This code is written for infrared vision object avoidance and tilt detection. To use the program without the Memsic accelerometer, add an apostrophe in front of the GOSUB Check_Level command in the Program Code section's main routine to comment it out.

```
' =============================================================================
'
'   File..... Advanced_Tank_Bot.BS2
'   Purpose... Tank Bot with Tilt Sensing
'   Author.... Parallax
'   E-mail.... support@parallax.com
'   Started...
'   Updated... 12 APRIL 2004
'
'   {$STAMP BS2}
'   {$PBASIC 2.5}
'
' =============================================================================

' -----[ Program Description ]---------------------------------------------
' This program gives infrared vision object avoidance capabilities to the
' Boe-Bot robot Tank to keep it from running into objects.
' An optional subroutine incorporates the Memsic 2125 accelerometer to allow
' the tank to explore uneven terrain without tipping over.


' -----[ Revision History ]------------------------------------------------


' -----[ I/O Definitions ]-------------------------------------------------

LfIrOut         PIN     8                       ' left IR LED output
LfIrIn          PIN     9                       ' left IR sensor input
RtIrOut         PIN     1                       ' right IR LED output
RtIrIn          PIN     0                       ' right IR sensor input

LMotor          PIN     13                      ' left servo motor
RMotor          PIN     12                      ' right servo motor

TiltX           PIN     4                       ' X tilt input
TiltY           PIN     5                       ' Y tilt input


' -----[ Constants ]------------------------------------------------------

LFwd            CON     1000                    ' left motor forward
LStop           CON      750                    ' left motor stop
LRev            CON      500                    ' left motor reverse

RFwd            CON      500                    ' right motor forward
RStop           CON      750                    ' right motor stop
RRev            CON     1000                    ' right motor reverse

IsHigh          CON     1                       ' high-going pulse
IsLow           CON     0                       ' low-going pulse

YThresh         CON     20                      ' Y tilt threshold
```

```
' -----[ Variables ]------------------------------------------------------

pulses          VAR     Byte                    ' counter for servo control
irBits          VAR     Nib                     ' ir detection bits
irLeft          VAR     irBits.BIT1             ' left IR detection
irRight         VAR     irBits.BIT0             ' right IR detection
xAxis           VAR     Word                    ' x-axis tilt reading
yAxis           VAR     Word                    ' y-axis tilt reading


' -----[ EEPROM Data ]-----------------------------------------------------


' -----[ Initialization ]---------------------------------------------------

DEBUG "Program Running!"
Reset:
  LOW LMotor                                    ' initialize motor outputs
  LOW RMotor


' -----[ Program Code ]-----------------------------------------------------

Main:
  DO
    ' comment out this GOSUB command if not using the Memsic accelerometer
    GOSUB Check_Level                           ' verify terrain okay

    ' navigate around obstacles

    GOSUB Read_IR_Sensors
    ON irBits GOSUB Forward, Go_Left, Go_Right, U_Turn
  LOOP

  END


' -----[ Subroutines ]------------------------------------------------------

Check_Level:
  PULSIN TiltY, IsHigh, yAxis                   ' check longitudinal tilt
  yAxis = yAxis / 100                           ' filter reading
  IF (yAxis =< YThresh) THEN                    ' if terrain too steep
    GOSUB U_Turn                                ' ... and turn around
  ENDIF
  RETURN


Read_IR_Sensors:
  irBits = %00
  FREQOUT LfIrOut, 1, 38500                     ' modulate left IR LED
  irLeft = ~LfIrIn                              ' read input (1 = target)
  FREQOUT RtIrOut, 1, 38500                     ' modulate right IR LED
  irRight = ~RtIrIn                             ' read input (1 = target)
  RETURN


Forward:                                        ' move tank forward
  FOR pulses = 1 TO 5
```

```
    PULSOUT LMotor, LFwd
    PULSOUT RMotor, RFwd
    PAUSE 20
  NEXT
  RETURN


Go_Left:                                        ' turn to left
  FOR pulses = 1 TO 15
    PULSOUT LMotor, LStop
    PULSOUT RMotor, RFwd
    PAUSE 20
  NEXT
  RETURN


Go_Right:                                       ' turn to right
  FOR pulses = 1 TO 15
    PULSOUT LMotor, LFwd
    PULSOUT RMotor, RStop
    PAUSE 20
  NEXT
  RETURN


U_Turn:                                         ' turn around
  IF (yAxis > YThresh) THEN
    GOSUB Back_Up                               ' back-up if flat terrain
  ENDIF
  PULSIN TiltX, IsHigh, xAxis                   ' check longitudinal tilt
  xAxis = xAxis / 100                           ' filter reading
  IF (xAxis < 24) THEN                          ' turn left
    FOR pulses = 1 TO 60
      PULSOUT LMotor, LRev
      PULSOUT RMotor, RFwd
      PAUSE 20
    NEXT
  ELSE                                          ' turn right
    FOR pulses = 1 TO 60
      PULSOUT LMotor, LFwd
      PULSOUT RMotor, RRev
      PAUSE 20
    NEXT
  ENDIF
  RETURN


Back_Up:                                        ' back up a bit
  FOR pulses = 1 TO 10
    PULSOUT LMotor, LRev
    PULSOUT RMotor, RRev
    PAUSE 20
  NEXT
  RETURN
```