Lecture 5 – Subprograms

Why Subprograms?

- If you have a common block of code that appears several times at different locations in your program, you may want to move that block of code into a subprogram (also known as subroutines, functions or methods).
- Splitting your program into subprograms usually results in better organized code that is much easier to maintain. It may result in smaller programs that use less memory (and require less typing) too.

PBASIC Subprograms

- An example that uses subprograms:
  ```
  GOSUB Main 'At start of
  END 'program
  
  Main: 'Main Program
  GOSUB GoForward
  PAUSE 1000
  RETURN
  
  GoForward: 'Drive Forward
  PULSOUT RM, RMFull
  PULSOUT LM, LMFull
  RETURN
  ```

- A GOSUB statement causes program execution to branch to the program label that follows the GOSUB keyword. A subprogram should end with a RETURN statement, this causes program execution to continue at the statement following the GOSUB.
- Another advantage of using subprograms is obvious here, to change the way in which the Scribbler goes straight we need only make changes to the GoForward subprogram.

Object Avoidance

- There are two IR emitters and an IR receiver on the front of the Scribbler.
The IR detector has a **filter** that allows it to see IR light flashing at around 38,500 Hz. We use FREQOUT to generate the proper frequency IR at one of the emitters:

- ObsTxRight PIN 14
- FREQOUT ObsTxRight, 1, 38500

A short duration (1 ms) is used so that only a short IR burst of light is emitted.

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The program on the following slides alternately emits a short IR pulse on the right and left emitters. After each pulse is sent we look for a reflection back to the detector.

The detector sends a low signal to PIN 6 (binary 0) if there is reflected IR. A high signal (1) is sent if there is no reflected IR.

Download (02_Eye_Test.bs2) from the web site. Run and then test it by holding a piece of paper about 6” in front of the robot.

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' I/O Pin Definitions
 ObsRx PIN 6 ' IR detector
 LedRight PIN 8
 LedLeft PIN 10
 ObsTxRight PIN 14 ' RT IR emitter
 ObsTxLeft PIN 15 ' LT IR emitter

' Variable Declarations
 eyeRight VAR Bit
 eyeLeft VAR Bit

' Main Program
 DO
  GOSUB CheckRightIR 'Look RT
  GOSUB TestRightIR 'Set LED
  GOSUB CheckLeftIR 'Look LT
  GOSUB TestLeftIR 'Set LED
 LOOP
 END

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CheckRightIR:
  FREQOUT ObsTxRight, 1, 38500
  eyeRight = ObsRx
  RETURN

TestRightIR:
  IF (eyeRight = 0) THEN
    HIGH LedRight
  ELSE
    LOW LedRight
  ENDIF
  RETURN

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CheckLeftIR:
  FREQOUT ObsTxLeft, 1, 38500
  eyeLeft = ObsRx
  RETURN

TestLeftIR:
  IF (eyeLeft = 0) THEN
    HIGH LedLeft
  ELSE
    LOW LedLeft
  ENDIF
  RETURN
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Assignment

- Modify the test program so that the Scribbler turns to the left if there is an object on the right and turns to the right if there is an object on the right. Otherwise the Scribbler should move forward. Also check for a stalled condition and take appropriate action.
- Add bells and whistles as desired ...