Lecture 3 – Robot Motion

Variables

It is convenient to use a variable to label a memory location. You must declare a variable before using it:

\[
\text{name VAR size}
\]

size determines the range of values the variable can hold:

- BIT 0-1 (1 bit)
- NIB 0-15 (4 bits)
- BYTE 0-255 (8 bits)
- WORD 0-65535 (16 bits)

Always use the smallest size necessary.

Motor Control

The right and left motors are controlled by signals on pins 12 and 13. Instead of using just a HIGH or LOW signal to turn the motors on or off (like the LEDs), motor speed (and direction) are determined by the duration of a high voltage pulse on the motor control pin.

\[\text{PULSOUT PIN, DURATION} \]

A duration of 1000 (2 ms) is full reverse, 2000 (4 ms) stops the motor, and 3000 (6 ms) is full forward. (Duration is in units of 2 us).

The PIN declaration can be used to assign a label to a particular PIN. The CON declaration can similarly be used to assign a label to a constant value:

\[
\begin{align*}
\text{RtMotor PIN 12} \\
\text{LtMotor PIN 13} \\
\text{FwdFull CON 3000} \\
\text{RvrFull CON 1000} \\
\text{StpFull CON 2000}
\end{align*}
\]

PULSOUT actually inverts the signal at a PIN so to be sure to send a HIGH pulse we must set the PIN LOW first. Here is code to turn the RIGHT motor on at full speed for 5 seconds and then stop the motor:

\[
\begin{align*}
\text{LOW RtMotor ' REQUIRED} \\
\text{PAUSE 100 ' INITIALIZATION!!} \\
\text{PULSOUT RtMotor, FwdFull} \\
\text{PAUSE 5000 ' 5 seconds} \\
\text{PULSOUT RtMotor, StpFull}
\end{align*}
\]
Lecture 3 – Robot Motion

Motor Control

- The following program will send the robot forward at full speed for 5 sec, stop for 5 sec, full reverse for 5 sec, and then stop:

```plaintext
LOW RtMotor     ' REQUIRED
LOW LtMotor     ' INITIALIZATION!!
PAUSE 100
PULSOUT RtMotor, FwdFull
PULSOUT LtMotor, FwdFull
' Cont. on next slide ...
```

- The motors are not identical. A PULSOUT duration of 3000 to BOTH motors may not cause the Scribbler to go straight ahead. If the Scribbler veers to the right, you will need to slow down the left motor by using a duration of less than 3000.

- You will need to follow the calibration procedure on pages 16 and 17 of the Writing Programs guide to find the duration values that cause your Scribbler to go straight.

Lecture 3 – Robot Motion

Motor Control

- This code snippet uses a variable and a FOR loop to smoothly accelerate the Scribbler:

```plaintext
speed VAR Word
FOR speed = StpFull TO FwdFull
    STEP 250
    PULSOUT RtMotor, speed
    PULSOUT LtMotor, speed
    PAUSE 1000
NEXT
```

Lecture 3 – Robot Motion

Making Music

- The PBASIC FREQOUT command is used to play a tone on the speaker:

```plaintext
FREQOUT pin, duration, freq1, freq2
```

The speaker is connected to pin 11. The duration is in ms. freq1 is the frequency (in Hertz) of the tone you want to play. freq2 is an optional second frequency (you can play two tones at once).

- The following code plays five tones, each is slightly longer and at a higher frequency than the one preceding it:

```plaintext
speaker PIN 11
FREQOUT speaker, 200, 500
FREQOUT speaker, 400, 1000
FREQOUT speaker, 600, 1500
FREQOUT speaker, 800, 2000
FREQOUT speaker, 1000, 2500
```
Lecture 3 – Robot Motion Assignment

- Reproduce the effect of the program on the previous slide using a FOR loop and a single FREQOUT command.
- Page 14 of the “Writing Programs” book shows the mapping between musical notes and frequencies. Program the Scribbler to play the beginning of a song ...
- Find the calibration values for your robot and record them. You will need them in the future.