Light Sensors

The Scribbler contains three forward looking light sensors. The particular light sensors used on the Scribbler are known as Cadmium Sulfide (CDS) photoresistors. The resistance of a photoresistor decreases with increasing light intensity. (The brighter the light the smaller the resistance.)

The light sensors are deeply set in the Scribbler to narrow their focus. The side sensors look 30 degrees off of center.

Pins 0, 1 and 2 are connected to the right, middle and left light sensors respectively.

To determine the light level first take a pin HIGH. This raises the voltage at the sensor to almost 5 V. We then change the pin to an input pin and measure how long it takes the voltage to fall to 1.4 V using RCTIME.

The voltage at the light sensor decreases with time according to the following formula:

\[ v(t) = V_0 e^{-t/(R_{sensor} C)} \]

where \( V_0 \) is the initial voltage (5 V), \( R_{sensor} \) is the resistance of the sensor and \( C \) is the value of capacitance.

Solving for \( t \) we have:

\[ t = R_{sensor} C \ln \left( \frac{V_0}{v(t)} \right) \]
Lecture 6 – Follow That Light!

Light Sensors

- The program (01_Light_Sensor.bs2) displays the RCTIME value for each of the sensors. Download and run the program. What happens if you cover a sensor with a finger? What happens if you shine a flashlight at a sensor?

```pascal
DO
  HIGH LT_LS
  HIGH CT_LS
  HIGH RT_LS
  PAUSE 3 'Let V rise to 5
  RCTIME LT_LS, 1, dark
  DEBUG CLS, HOME, DEC dark", "
  RCTIME CT_LS, 1, dark
  DEBUG DEC dark", "
  RCTIME RT_LS, 1, dark
  DEBUG DEC dark
  PAUSE 500
LOOP
```

- You may have noticed that the light sensors are not identical. To follow a light we need to track changes in the RCTIME value instead of comparing absolute levels.
- When your program first starts you will need to record the initial ambient light levels for all three sensors. Then in the main loop, read the light sensors and compare the current light level with the ambient light level to determine if a light is shining on the sensor.

```
RT_LS PIN 0
CT_LS PIN 1
LT_LS PIN 2
dark VAR Word
```

Using EEPROM Memory

- You can store, read and write values in the 2 kB EEPROM using the PBASIC DATA, READ, and WRITE commands. Your program is stored at the high end of the EEPROM so you will normally use low addresses for storing your own data.
- Selecting “Memory Map” from the Run menu will display the current memory layout of your program. (NOT of the actual EEPROM contents.)

```
DATA stores values when the program is downloaded. READ and WRITE are used to access data when the program is running.
```

```
DATA @16, 0 '0 when downloaded
reset VAR Byte
READ 16, reset
IF (reset = 1) THEN Main:
  WRITE 16, 1 'Write 1 on 1st run
STOP
```

Assignment

- Modify the test program so that the Scribbler turns to the left if a light is shined on the left light sensor and turns to the right if a light is shined on the right light sensor. Otherwise the Scribbler should move forward.
- Add bells and whistles as desired ...