Laboratory 10: Other sensors and shift registers

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Music from piezo component

Refer CIRC-06 and CIRC-07 to demonstrate the change in octaves (higher or lower frequency) as push-button is pressed.

Here you will use a piezo element which will mimic the clicking sound as it is driven by current. If we pulse it at certain musical note frequencies, we will hear song tone. An example of *Twinkle Twinkle little star* song tone is demonstrated in CIRC06. For example if one note has a frequency of 440 HZ, then a note above its Octave has a frequency of 880 Hz. Note below this octave has a frequency of 220 Hz. Changing octaves means changing note frequencies related to a tone by doubling or halving.

Photoresistor with a piezo buzzer

Refer CIRC-09 and integrate a piezo element to produce a sound whenever the photoresistor is in relative darkness. A low value will occur when the sensor is well lit and a high value will occur when it is in darkness. For trouble shooting, you may print the values of light-level voltage to Serial console. However remember to set the baud-rate of serial configuration in *setup* function using the following code:

```
Serial.begin(9600);
```

You can print the light level converted voltage values using *Serial.println* function call. Calibrate your light sensor thoroughly such that you have two different range of values when the sensor is lit and when the sensor is in dark. Get a threshold value and put it in your program to generate a tone whenever the light level goes beyond the threshold value.

Temperature sensor

Refer to CIRC-10 and display the 2 digit temperature in a display. For example if the ambient temperature is 21.17 °C, display the integer numerals *21*. The temperature sensor outputs 10 mV per °C on the signal pin. There is an offset of 0.5 V to measure temperature below freezing point. An example code is already available in the manual which reads and calibrates the temperature accordingly.

For two digit display, you will have to use two 7-segment display units and program the common anode pins such that either of the display is enabled at a single time. This is called time multiplexing. With respect to

time, only one device out of two device is active. However the time multiplexing needs to be fast such that the afterimage is thought to persist, providing us both digits.

Shift registers

The shift register you had used in the homework section of previous lab, was used as a storage element. The values from 0 to 255 was latched and was used to glow LEDs in patterns. However we did not see the bits shifting. Hence you will do an experiment which will help you understand the shifting process. The datasheet of this shift register is uploaded in the LMS. The chip 74HC595 is a high speed shift and storage register. The Latch drives the storage register and clock drives the shift register. Drive the clock and latch to 1 Hz and provide a data of digital *HIGH*. Connect LEDs to all eight output pins of 74HC595 chip. Demonstrate the LED glowing from 0000 0000 to 1111 1111. Check what happens when the clock frequency is double of latch frequency.