ECE 480 - Design Team 3
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How to use MSP 430 Peripheral Sensors and use of LEDs as sensors
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Abstract: How to use light-emitting diodes as a light sensor (i.e. receiver) to use for detection. How to output MSP 430 peripheral sensors’ data for user’s reading.

What is an LED?

Light-Emitting Diode is a semiconductor device which emits light when current flows through it. LED works due to p-n junction i.e. when diode is on electrons move from negative side i.e. cathode to the positive side of diode i.e. anode.
Use of LEDs for light detection

LEDs are mainly designed to make light not to detect it. In this cases, LEDs are in forward bias i.e. electrons flow from cathode to anode. To make LEDs useful for light detection, LEDs should be set in reverse bias i.e. electrons flow from anode to cathode. Moreover, it will be simpler that power source for example, line laser and LED will have the same wavelength. Red LEDs are fully compatible and are able to detect line laser. While laser emits at LED, LEDs will provide voltage to stay powered on. To provide stable voltage it will be useful to provide resistor load. In such applications LED is working as a light receiver. For projectile detection, LEDs can be used as detectors when projectile blocks laser’s light and therefore voltage drop decreases, it triggers interrupt to the attached microcontroller e.g. TI MSP 430 microcontroller.

Figure 2: Reverse biased LED circuit that working as a receiver
MSP 430 Peripheral Sensors

TI MSP 430 microcontroller allows usage of different peripheral sensors that can output data measurements depending on type of sensor into the MSP 430 microcontroller. To make these sensors work with MSP 430, it is needed to solder sensor’s breakout connectors into MSP 430 pin-out connections. As attachment is done, it is needed to program MSP 430 microcontroller to make it to interface with sensor to get required data. This objective can be achieved using Code Composer Studio which is TI’s certified development software for MSP 430 microcontroller.

![Sample sensor attached to MSP 430 microcontroller](image)

**Figure 3: Sample sensor attached to MSP 430 microcontroller**

Sensor Programming using Code Composer Studio

To make sensor work, it is crucial to create a C program that tells MSP 430 to interface with a sensor. First of all, it is needed to declare variables that should work as outputs for data. Moreover, it is needed to set up pins where a sensor is attached to MSP 430. Depending on a type of sensor, it is also needed to tell microcontroller, when to output data measurements from a
There is no need for advanced programming i.e. creating own library files for different sensors as Texas Instruments provide most library files on their support website. For example, to make use of altitude sensor on MSP 430 microcontroller, following code can be used with little changes depending on your pin-out connections to make altimeter output data about altitude into MSP 430. The following demo is based on TI’s sample code and provided by Texas Instruments. This demo helps end-user to be able to use MSP 430 without advanced programming skills.

![Figure 4: MSP 430 TI’s altimeter demo](image)

![Figure 5: Definitions for altimeter sensor usage](image)
Above TI’s sample code can be used by user to make altimeter sensor interface with MSP 430. It will require little changes from user to configure everything right but it won’t require writing everything from scratch as most vital software elements are provided by Texas Instruments.
Conclusion:

This application note summarizes information on how to use LEDs as a receiver which is uncommon in most diode applications. Moreover, it shows how it will interface with microcontroller in case of interrupt i.e. power source that emits light into LED is blocked by an object. In addition, it covers how to program MSP 430 using Code Composer Studio to make it interface with peripheral sensors based on TI’s altimeter demo.
References


2. LED’s as Light Detectors. Stony Brook University, Spring 2002.
