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TITLE: Light Monitoring

MAIN GOAL: Visually display a high dynamic digital light sensor's data using BeagleBone Black

SUB-GOALS:

- Interface TSL2591 with BeaglBone Black with I2C
- Interface ESP8266 with BeagleBone Black with UART
- Upload data to ThingSpeak in C

ACCOMPLISHMENTS:

- TSL2591 communicates to BBB using I2c
- Uploaded data to ThingSpeak.com by using HTTP socket level request and BBB connected to router instead of the ESP8266.

COMPONENTS:

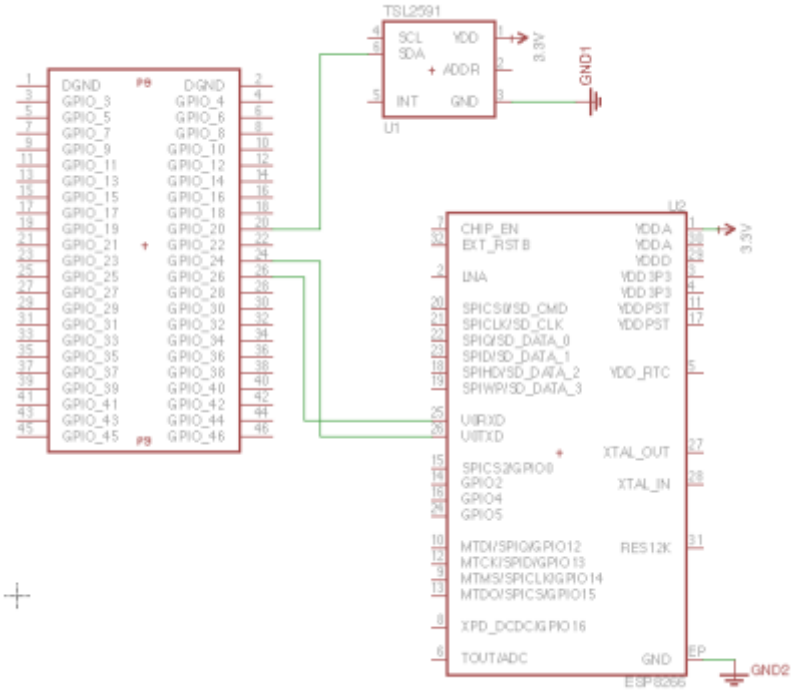
BeagleBone Black(BBB) – A MCU that controls the entire project that runs a Debian SD card image that was burned to the on-board eMMC. It provides a built-in Ethernet adapter to allow a constant connection to the internet and it uses the I2C-2 bus to communicate with the TSL2591 sensor.

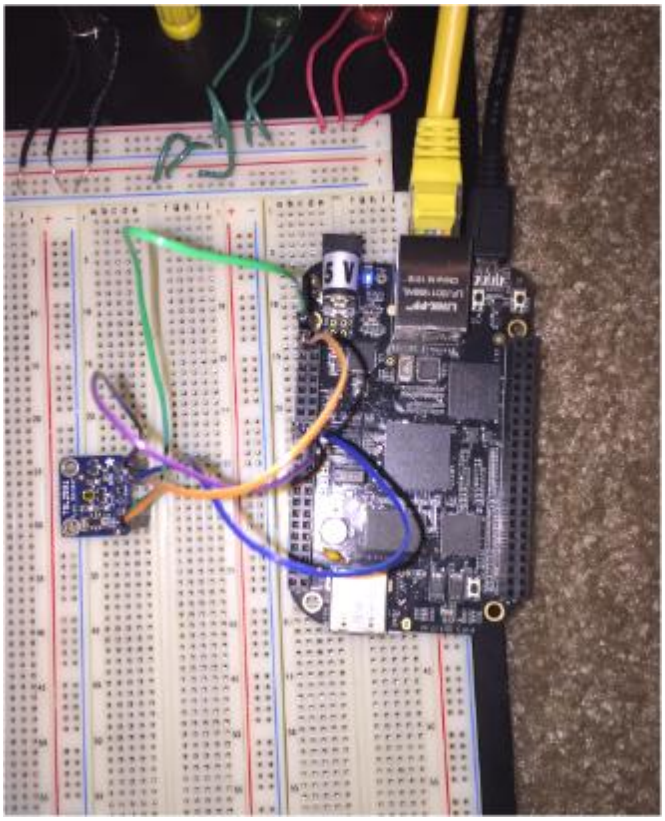
TSL2591-A high dynamic digital light sensor capable of measuring Lux up to ranges 188u – 88,000 Lux. It is interfaced with the Tiva C by using I2C. It was initialized by trying to read the Device ID register, setting the gain, setting the timing, and setting the Power On register to 1.

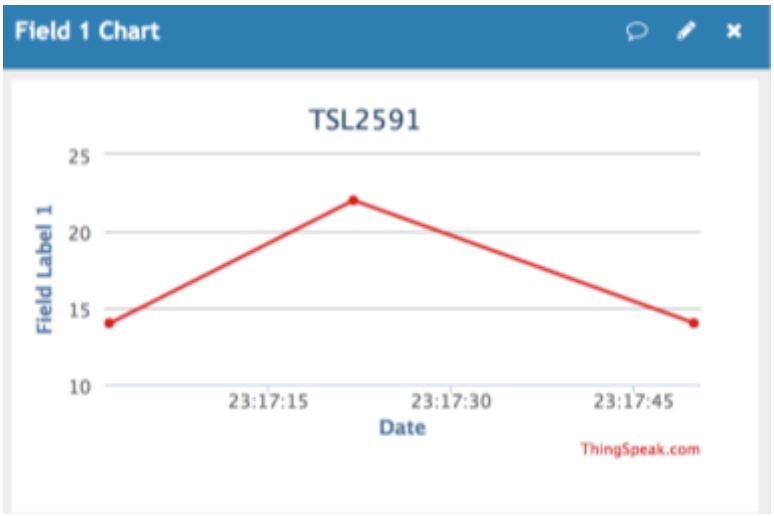
Router and Ethernet Cable- Used for internet connection posting to ThingSpeak.

Jumper Wires – Used for connecting the sensor to the BBB.

SCHEMATICS:


TSL2591
SCL
SDA
ADDR
INT
VDD
GND
U1
3.3V
GND1
P9
DGND
GPIO_3
GPIO_5
GPIO_7
GPIO_9
GPIO_11
GPIO_13
GPIO_15
GPIO_17
GPIO_19
GPIO_21
GPIO_23
GPIO_25
GPIO_27
GPIO_29
GPIO_31
GPIO_33
GPIO_35
GPIO_37
GPIO_39
GPIO_41
GPIO_43
GPIO_45
GPIO_4
GPIO_6
GPIO_8
GPIO_10
GPIO_12
GPIO_14
GPIO_16
GPIO_18
GPIO_20
GPIO_22
GPIO_24
GPIO_26
GPIO_28
GPIO_30
GPIO_32
GPIO_34
GPIO_36
GPIO_38
GPIO_40
GPIO_42
GPIO_44
GPIO_46
U2
CHIP_EN
EXT_RSTB
LNA
SPICS0/SD_CMD
SPICLK/SD_CLK
SPIQ/SD_DATA_0
SPID/SD_DATA_1
SPIHD/SD_DATA_2
SPIWP/SD_DATA_3
U0RXD
U0TXD
SPICS2/GPIO9
GPIO2
GPIO4
GPIO5
MTDI/SPIQ/GPIO12
MTCK/SPID/GPIO13
MTMS/SPICLK/GPIO14
MTDO/SPICS/GPIO15
XPD_DCDC/GPIO16
TOUT/ADC
VDDA
VDDA
VDDD
VDD3P3
VDD3P3
VDDPST
VDDPST
VDD_RTC
XTAL_OUT
XTAL_IN
RES12K
GND
EP
ESP8266
3.3V
GND2






```
root@beaglebone:~/FinalProj# ./final
Device ID = 80
Lux = 14
Sending Data to ThingSpeak.com...
Data Sent
Device ID = 80
Lux = 15
Sending Data to ThingSpeak.com...
Data Sent
Device ID = 80
Lux = 22
Sending Data to ThingSpeak.com...
Data Sent
Device ID = 80
Lux = 178
Sending Data to ThingSpeak.com...
Data Sent
Device ID = 80
Lux = 14
Sending Data to ThingSpeak.com...
^C
root@beaglebone:~/FinalProj#
```

TOOLS USED IN DESIGN:

EAGLE: Used for creating the schematic of the project.

I2C ToolSet: Useful for ensuring information gathered from the sensor was correct and could determine the correct registers were being read.

Debian(BeagleBone Black): Stored on a microSD card and then was burned to the on board eMMC by inserting the SD card into (powered-down) board, hold switch S2 (Boot Switch)down by pressing on it and holding it while plugging in the power cable. Continued to hold the button until the first User LED came on.

ThingSpeak.com: Used to visually display the sensor data

IMPLEMENTATION DETAILS:

The TSL2591 sensor used the SDA and SCL pins which were connected to P9.20 and P9.19 on the BeagleBone Black. The sensor was powered by the 3.3V (pin 3 on BBB)and grounded by Pin 1 on the BBB. The sensor communicated to the BBB by the opening of the i2C-2 and the address being sent to acquire the bus in the code. The function, TSL2591_INIT() sent command bits to set the timing, gain, and to power the sensor on.

GetFullLumnosity() is a subroutine that actually reads raw data from CH0 and CH1 of the sensor, calculates the lux and then send the final value back to main. Then my SendDataToThingSpeak() function takes the lux value and uses a TCP socket to communicate and send data to ThingSpeak.

RESULTS AND CONCLUSIONS:

In conclusion, almost all the goals were met and demonstrated. Interfacing a sensor to the BeagleBone black is simple, but interfacing the BBB to a Wi-Fi module is very difficult. However, I discovered there is an alternative way to push data to the ThingSpeak.com through TCP socket. The TSL2591 can be used for many applications that deal with light monitoring such as printer detection, keyboard illumination control, and ambient light sensing (ALS) for mobile handsets, tablets, notebooks, TVs and monitors.

REFERENCES:

https://sites.google.com/a/unlv.edu/unlvcpe403f16/

https://makingaquadrotor.wordpress.com/2012/07/08/i2c-on-the-beaglebone/

https://github.com/phfbertoleti/ThingSpeakC