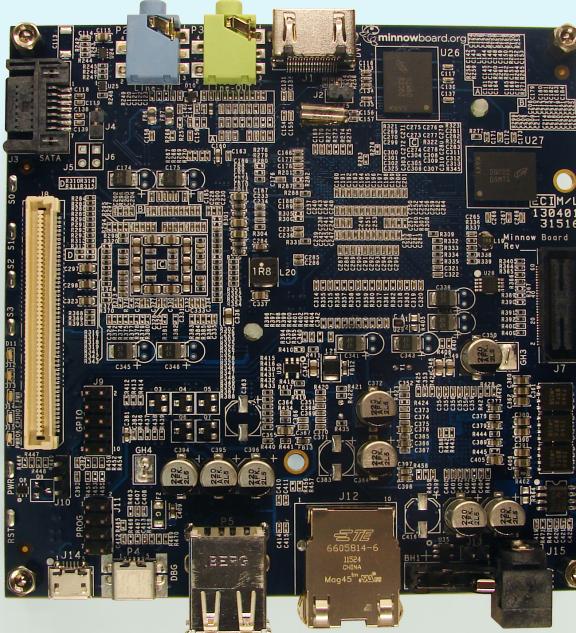


9-18-13

Intel Atom for Makers and Hackers: Getting Started with MinnowBoard



Speaker

Jayneil Dalal is a Technical Writer/Embedded Linux Engineer who loves to explore different open source technologies and is currently part of the Minnowboard.org project. Previously, he was a key member of the Pandaboard.org and Beagleboard.org projects at Texas Instruments.



Agenda

- **MinnowBoard Overview**
- **Tutorial -1**
Blinking the user LED on the MinnowBoard
- **Tutorial -2**
GPIO Programming on the MinnowBoard
- **Tutorial -3**
Physical computing on the MinnowBoard
- **Q&A**

Resources

You can download the tutorial material from the link below:

<https://github.com/jayneil/MHOT>

Please refer the websites below for more videos, tutorials, and projects you can do with your MinnowBoard:

<http://www.minnowboard.org/>

<http://elinux.org/Minnowboard>

MinnowBoard Overview



About me

- **Who am I?**

I am a low cost open source hardware board based on Intel atom chip.

- **What is my blood type?**

x86

- **How much do I cost?**

I cost \$199

- **Where to buy me?**

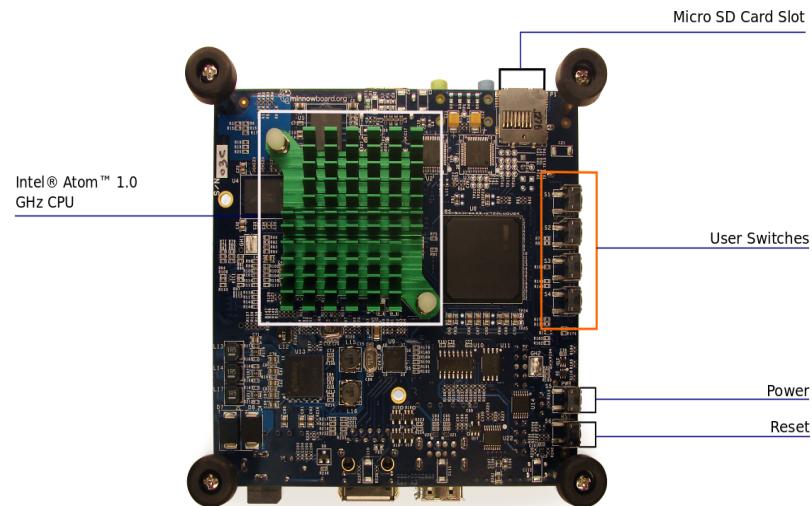
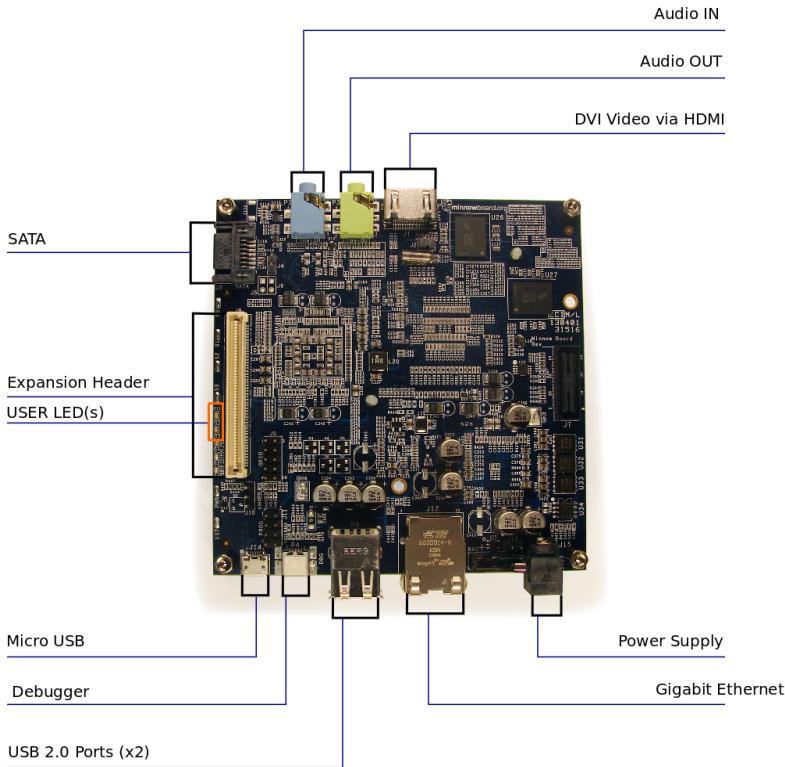
<http://www.minnowboard.org/where-to-buy/>

- **Want to contact me?**

#minnowboard [IRC]

'MinnowBoard' on google groups

Anatomy



I am so ripped!

Processor

- 1GHz Atom E640 chip
- 1GB RAM

Connectivity

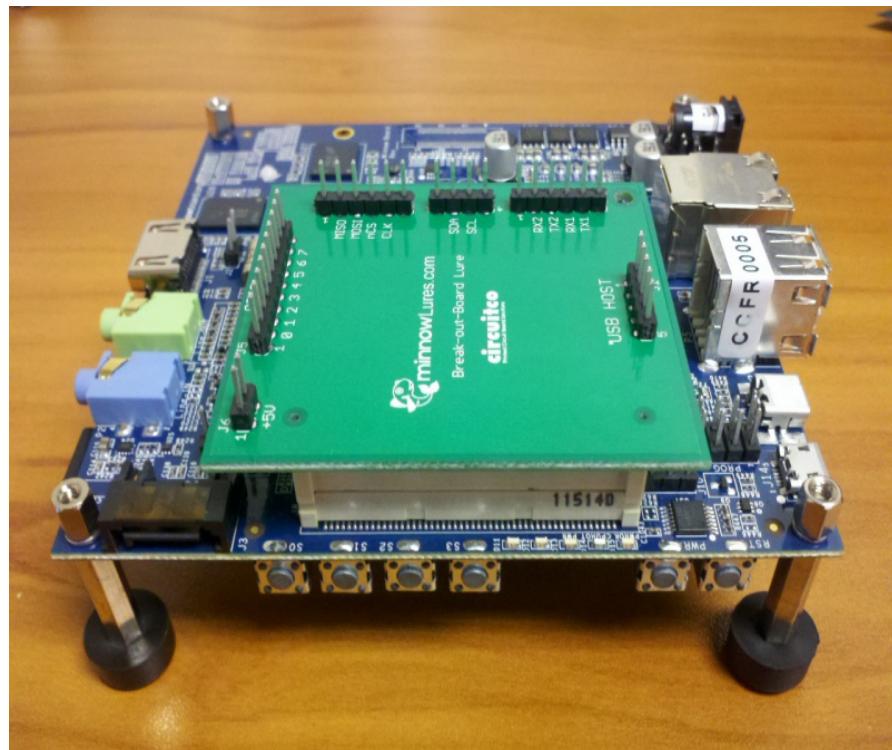
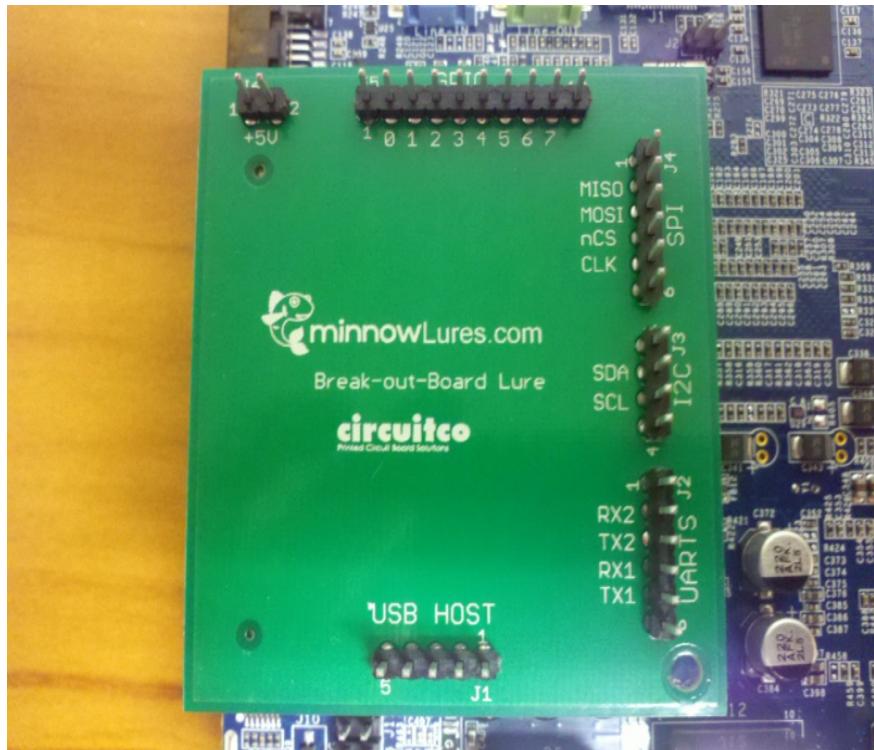
- SPI, I2C, CAN, SMB, SATA, PCIe, LVDS, SDIO
- USB host, HDMI, Audio in, Audio out, microSD, micro USB, USB debugger
- Gigabit Ethernet
- 4MB SPI Flash

Software

- 4GB microSD card with Angstrom Distribution
- Yocto Project compatible

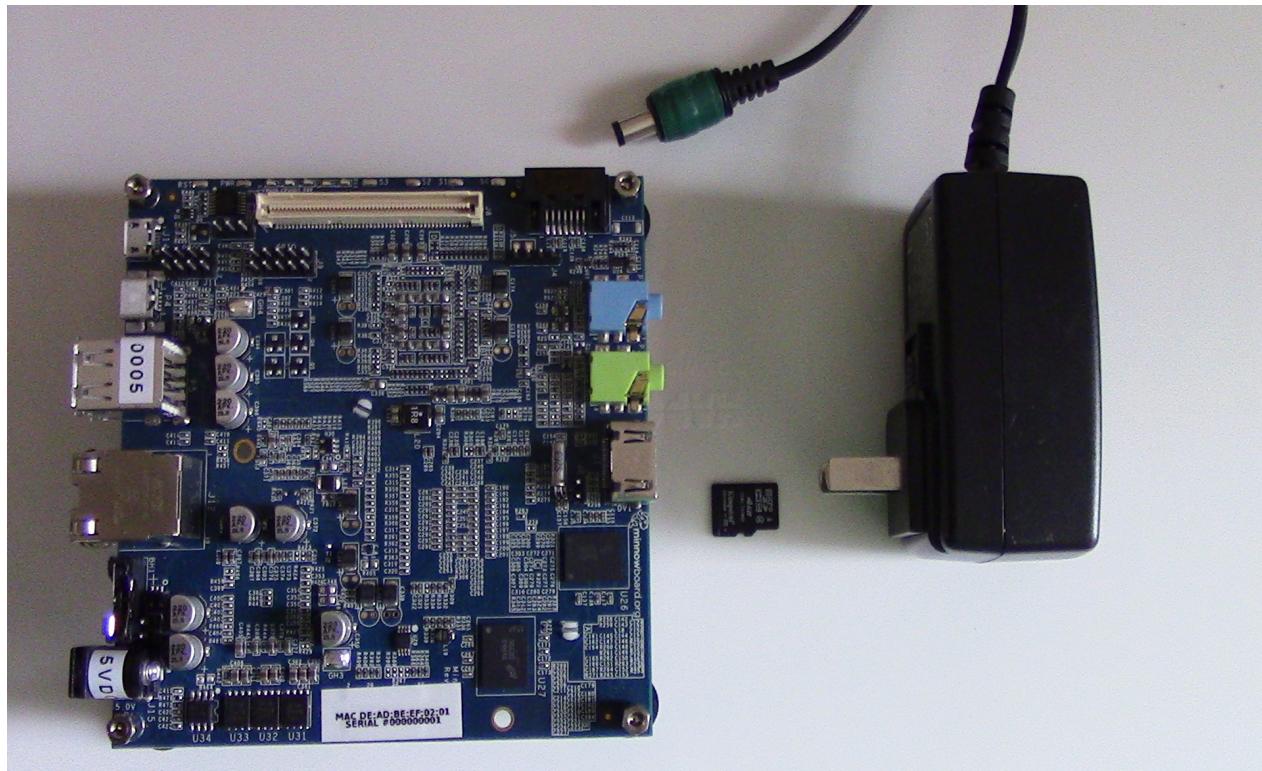


Lures



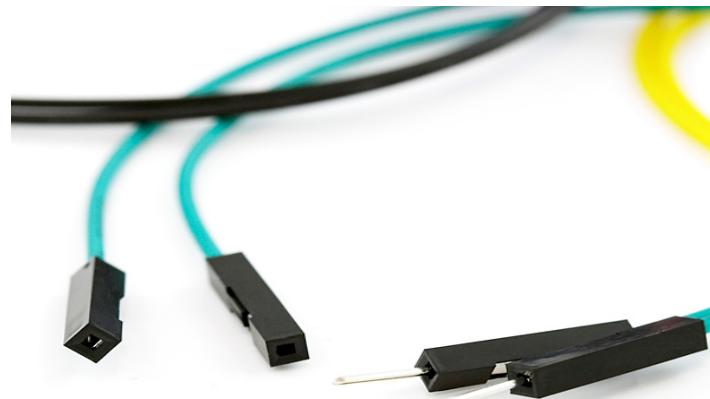
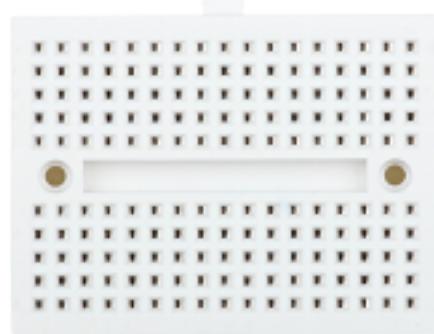
Box Contents

- MinnowBoard
- 4GB microSD card
- USB Cable
- Power Adapter



Tutorial Accessories

- Breadboard(x1)
- Hookup wires(x4)
- LED(x1)
- Resistor(x1)
- Pushbutton(x1)



Powering up the MinnowBoard

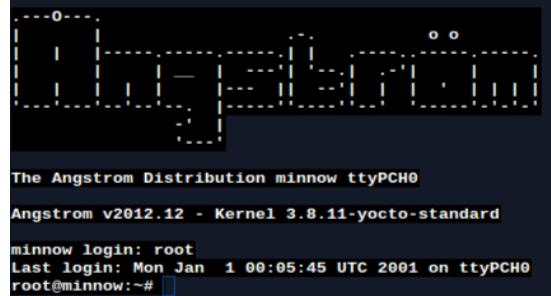
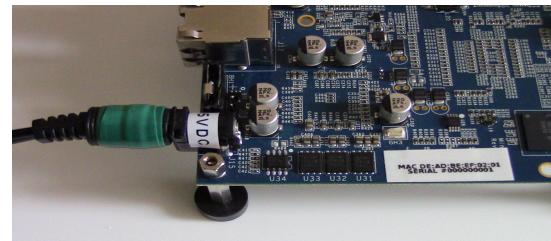
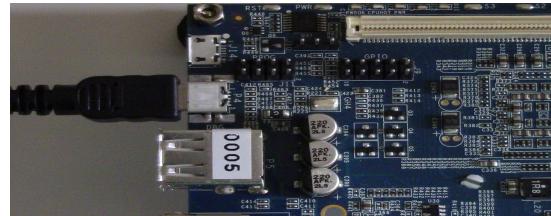
- Connect it to the computer via the usb cable. Then, connect the power adapter to it and power it ON.
- Access the MinnowBoard's serial console using 'screen':

```
$ screen /dev/ttyUSB1 115200
```

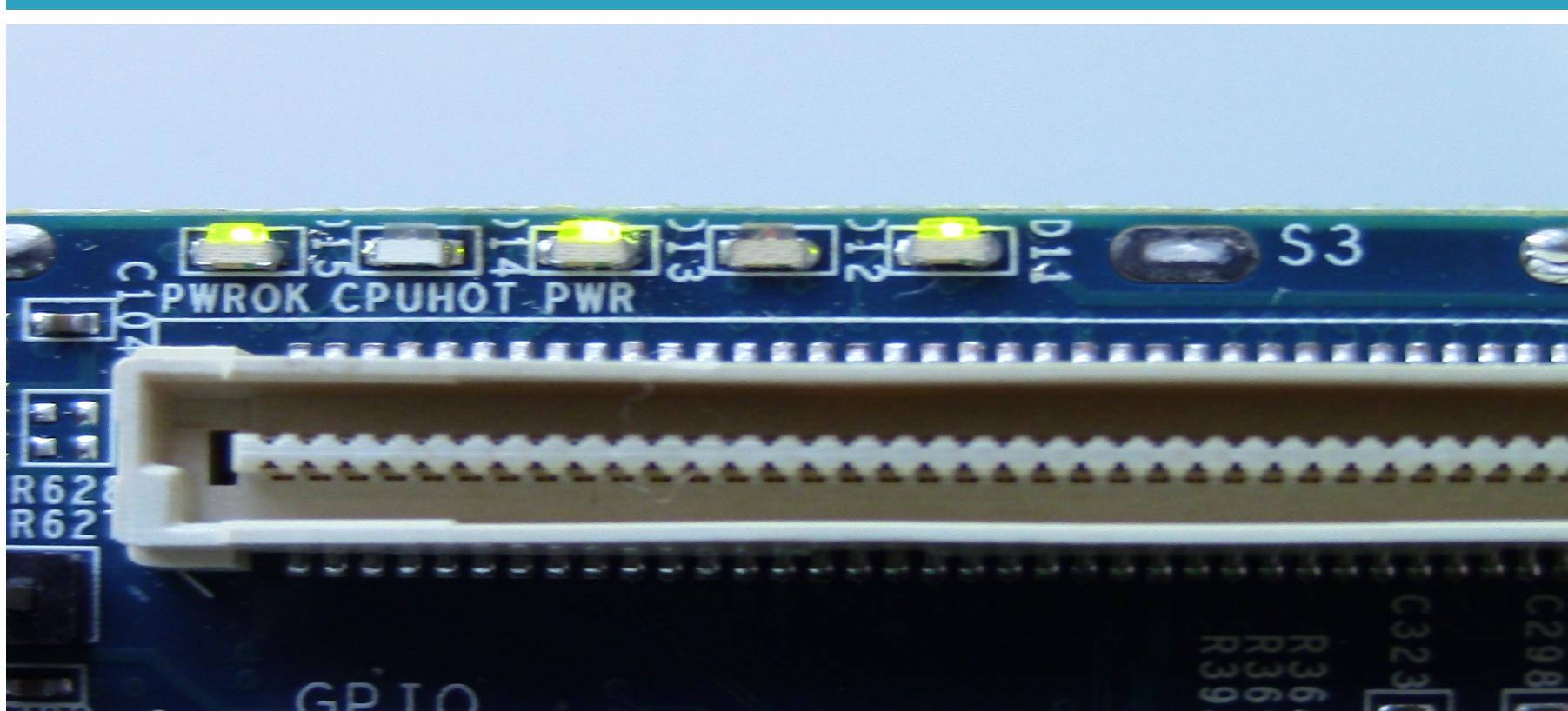
Note:- You can also use minicom. But this is just much easier! Also in most cases the virtual USB serial port is ttyUSB1. If it does not work, try ttyUSB0 .

- You should be greeted by an Angstrom login. The username for the same is 'root' and for password, just press 'ENTER'. You should see the following prompt:

```
root@minnowboard:~#
```



Tutorial – 1: Blinking USER LED



On board LED functions

Sr. No.	LED	Function
1.	D11	Heartbeat/USER LED*
2.	D12	microSD card activity/USER LED*
3.	D13	PWR
4.	D14	CPUHOT
5.	D15	PWROK

*You need to change the trigger for it to function as USER LED

Changing the default trigger

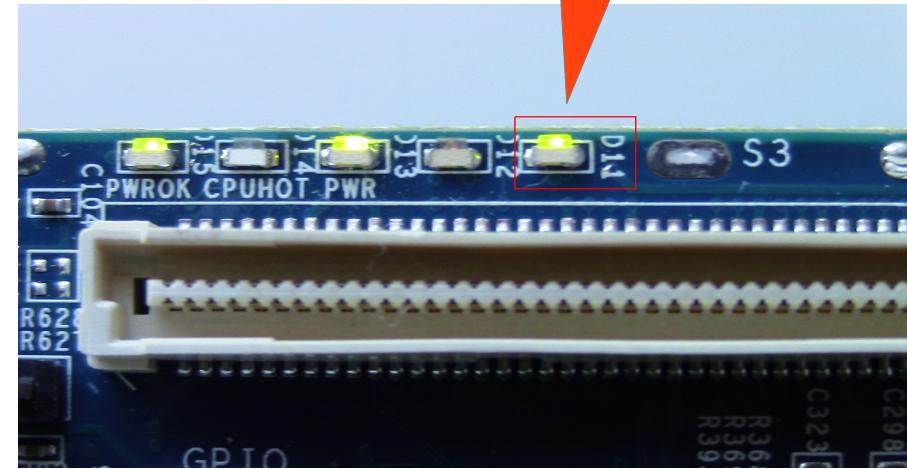
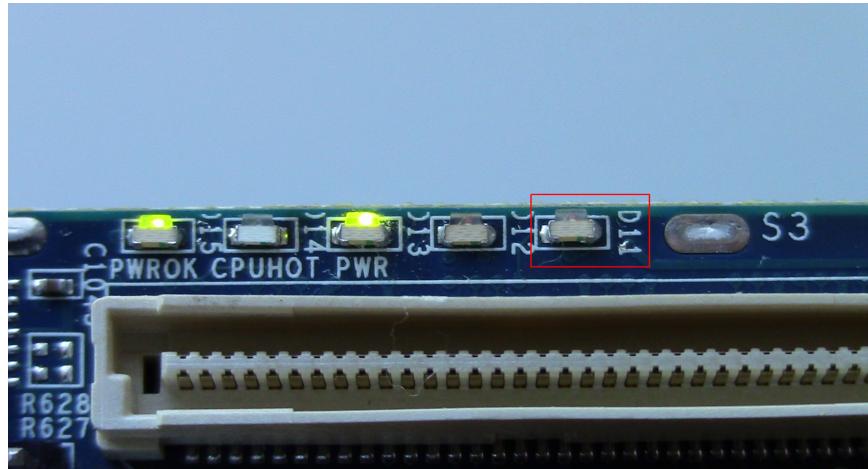
```
cd /sys/class/leds/minnow_led0  
echo none > trigger
```

```
root@minnow:/sys/class/leds/minnow_led0# ls  
brightness device max_brightness power subsystem trigger uevent  
root@minnow:/sys/class/leds/minnow_led0# cat trigger  
none mmc0 mmc1 timer oneshot [heartbeat] backlight gpio cpu0 cpu1 default-on  
root@minnow:/sys/class/leds/minnow_led0# echo none > trigger
```

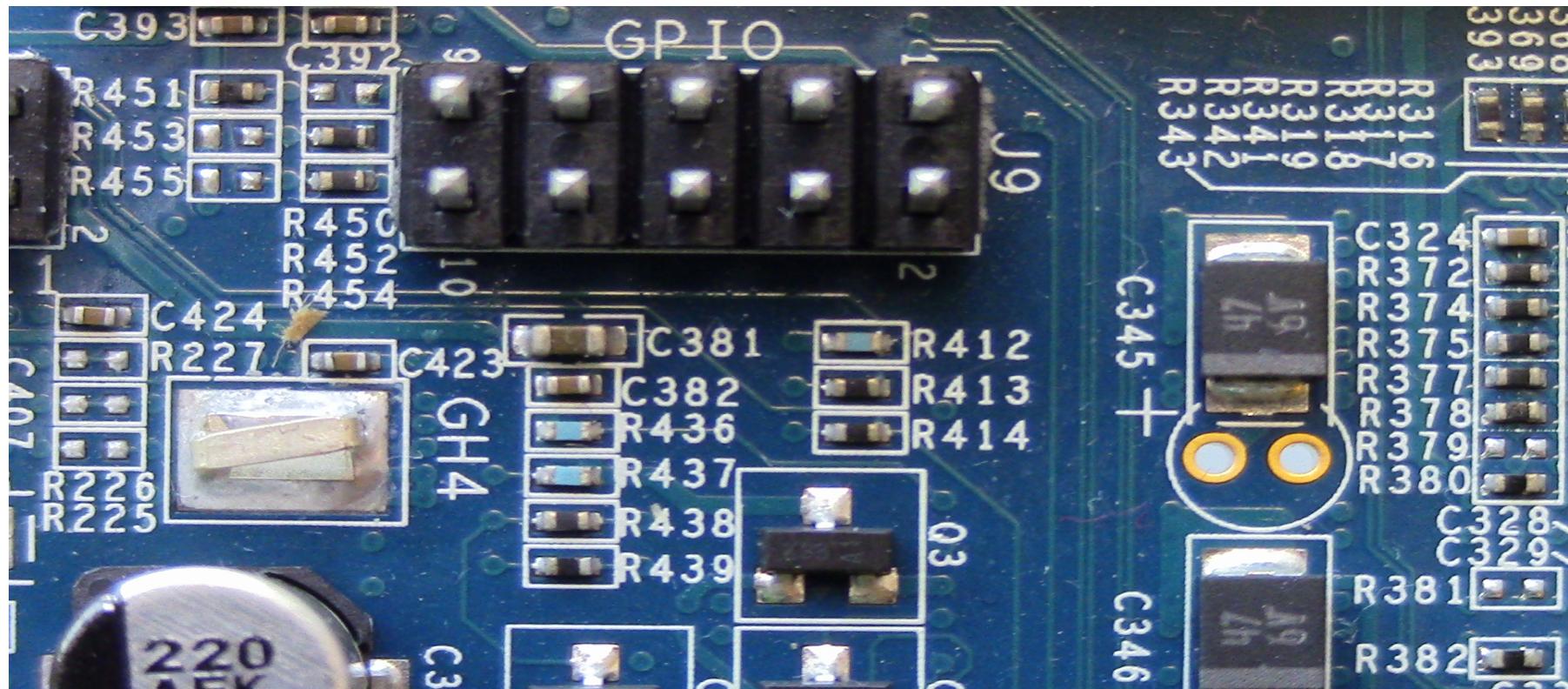
Lets Blink that LED!

Write the following commands in your terminal(First one is for turning ON and latter for OFF):

```
echo 1 > /sys/class/leds/minnow_led0/brightness  
echo 0 > /sys/class/leds/minnow_led0/brightness
```



Tutorial - 2: GPIO Programming

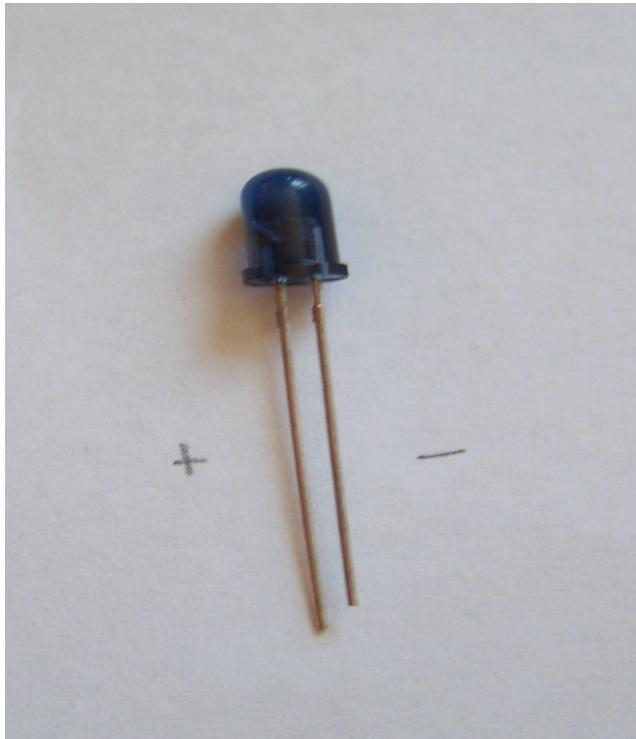


Numbering

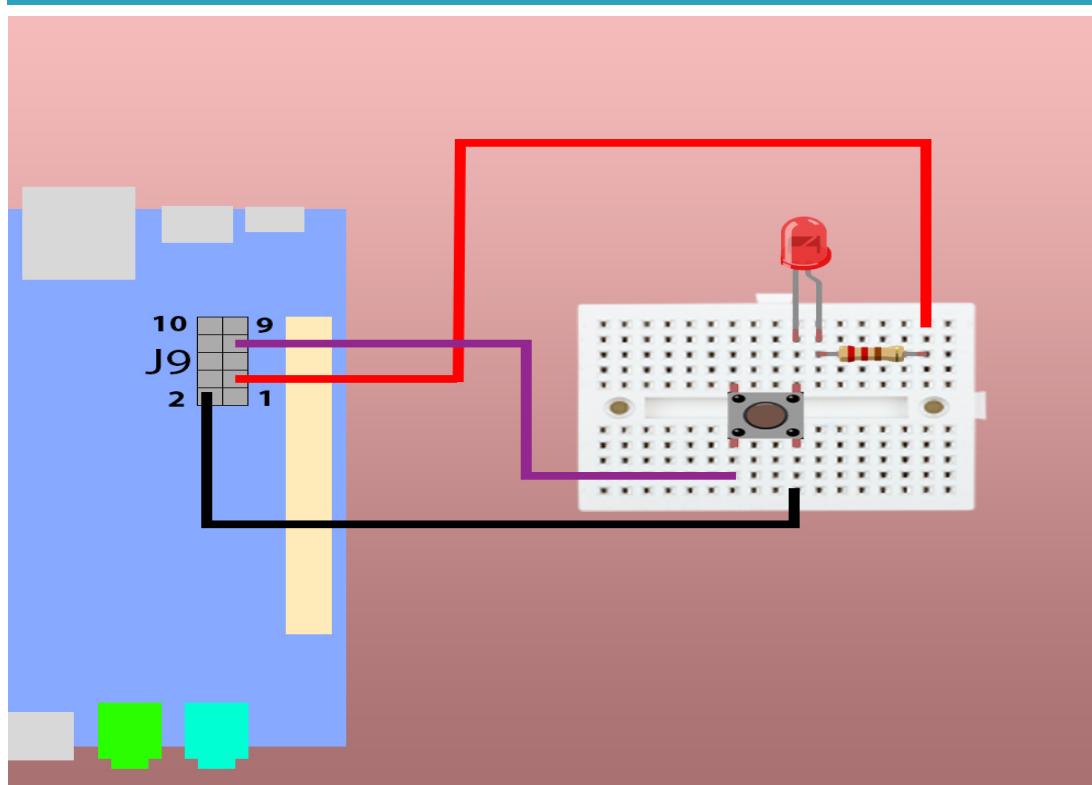
Sr. No.	GPIO	Reference number in the Kernel*	Default Mode	Default Value
1.	1	N.A.	N.A.	3.3V
2.	2	N.A.	N.A.	GND
3.	3	244	Input	HIGH
4.	4	245	Input	HIGH
5.	5	246	Input	HIGH
6.	6	247	Input	HIGH
7.	7	248	Input	HIGH
8.	8	249	Input	HIGH
9.	9	250	Input	HIGH
10.	10	251	Input	HIGH

*For example GPIO-3 on J 9 header will be referenced as gpio-244 in kernel

LED Basics



Connection Diagram



Lets toggle the LED

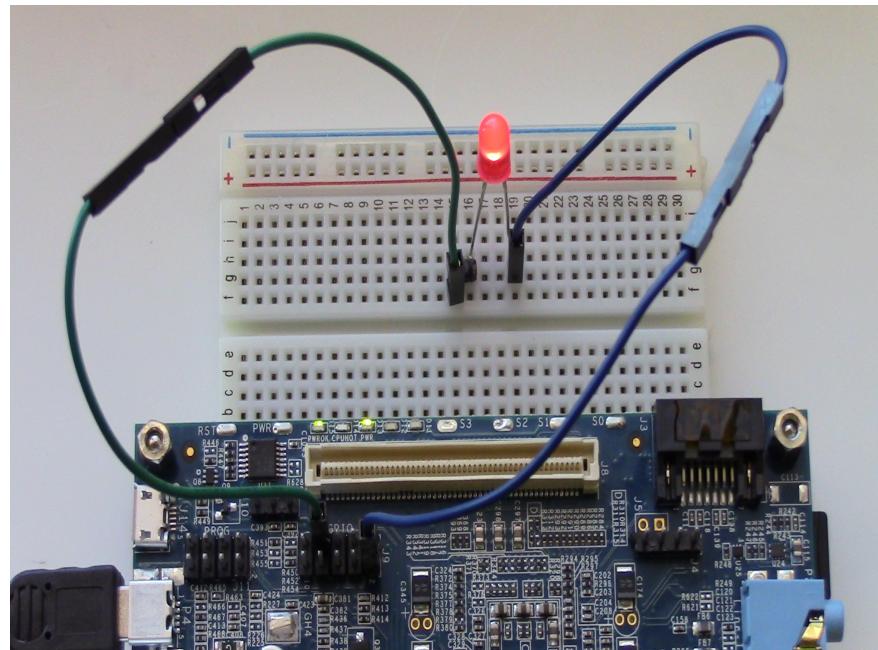
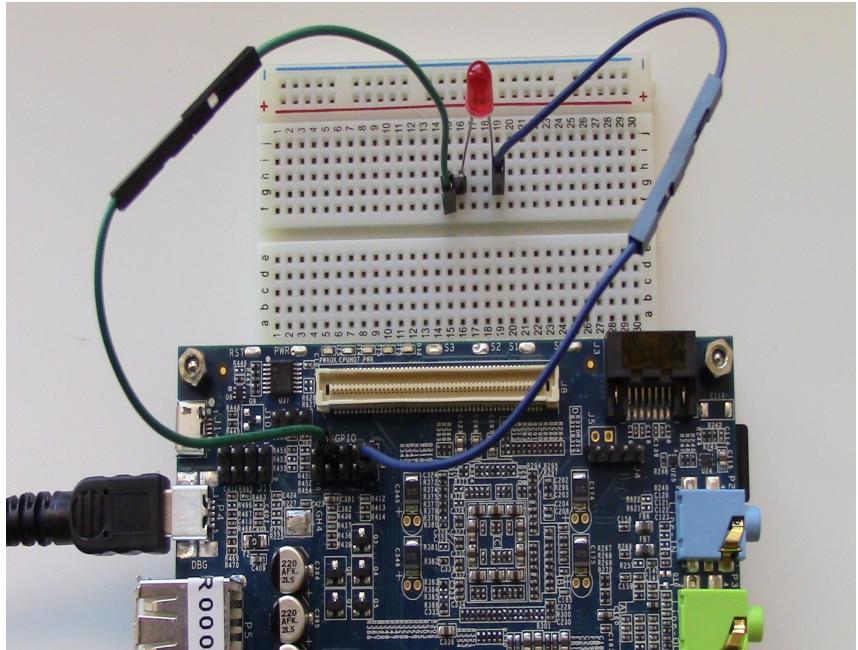
```
echo out > /sys/class/gpio/gpioX/direction
```

```
echo 1 > /sys/class/gpio/gpioX/value
```

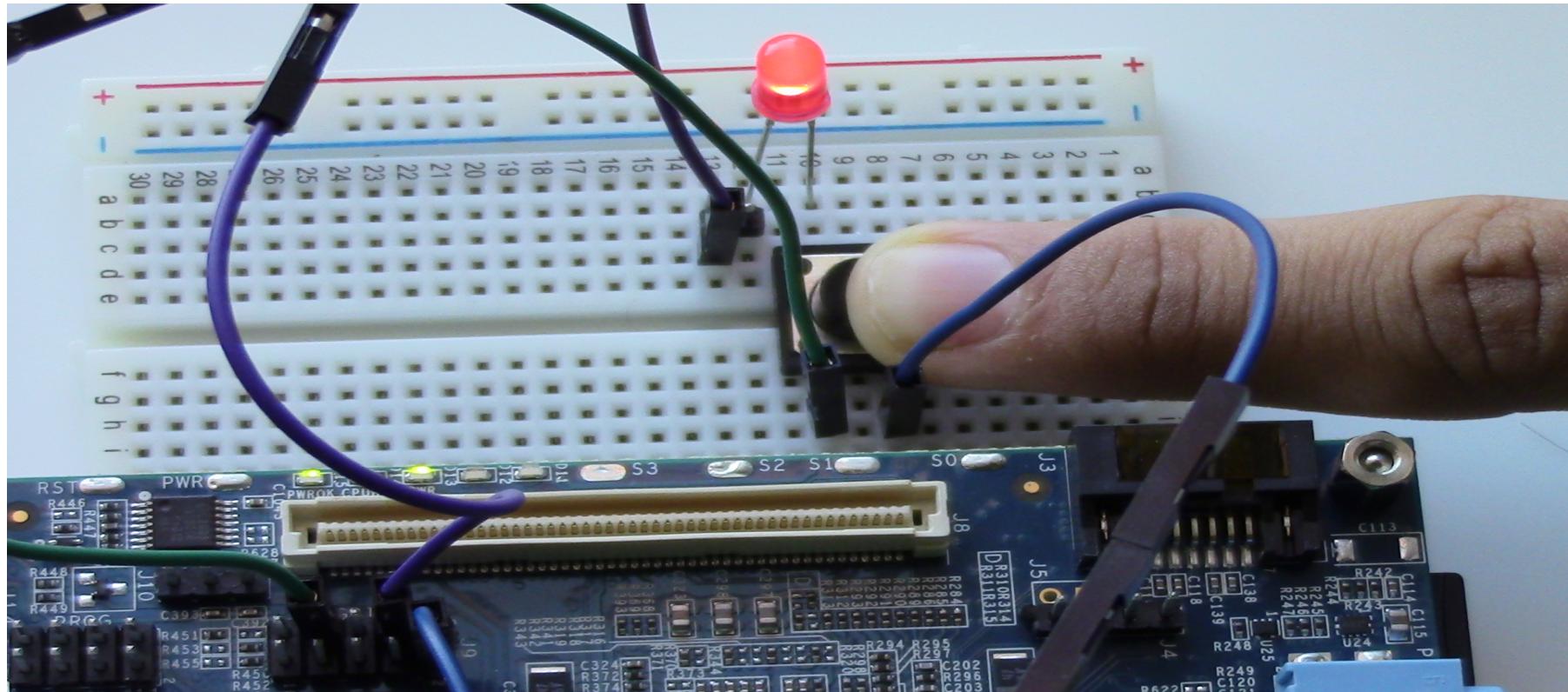
```
echo 0 > /sys/class/gpio/gpioX/value
```

Note:- 'X' is reference no. in kernel

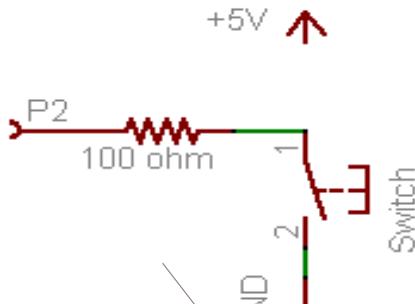
Output



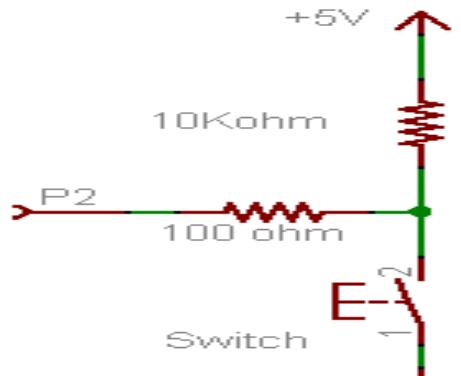
Tutorial - 3: Physical Computing



Pullup Resistors

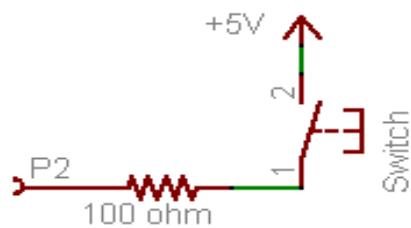


Circuit with
no pullup
resistor

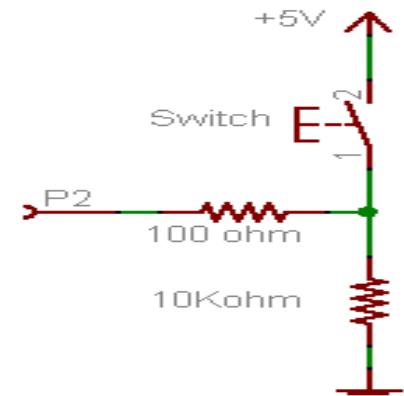


Circuit with
pullup
resistor

Pulldown Resistors

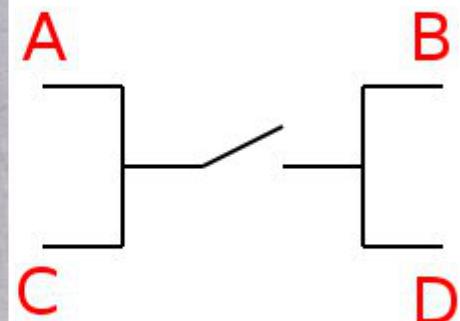
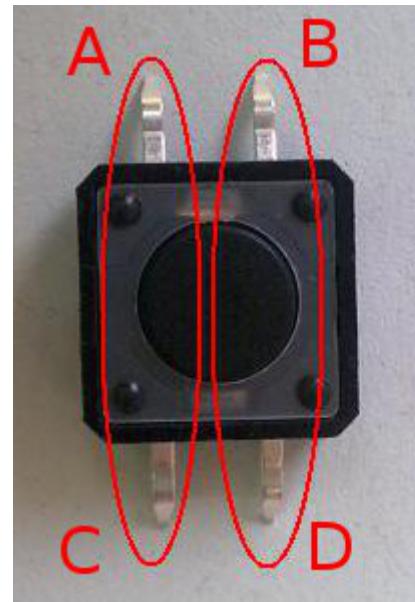


Circuit with
no pulldown
resistor

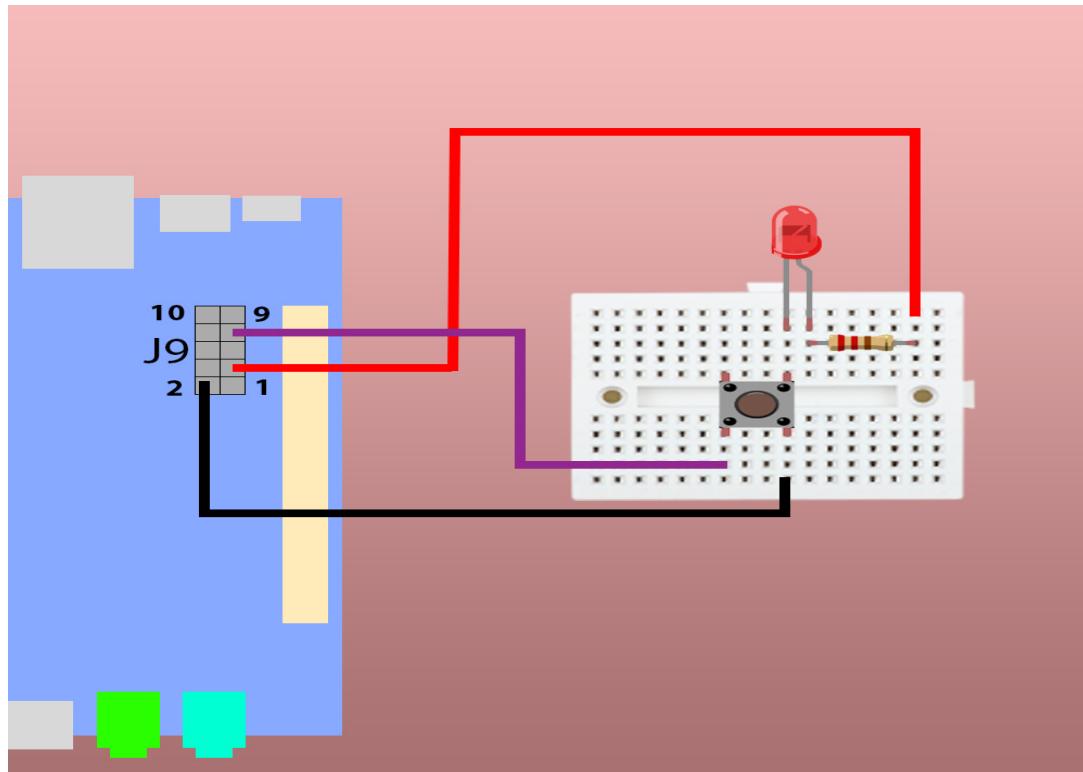


Circuit with
pulldown
resistor

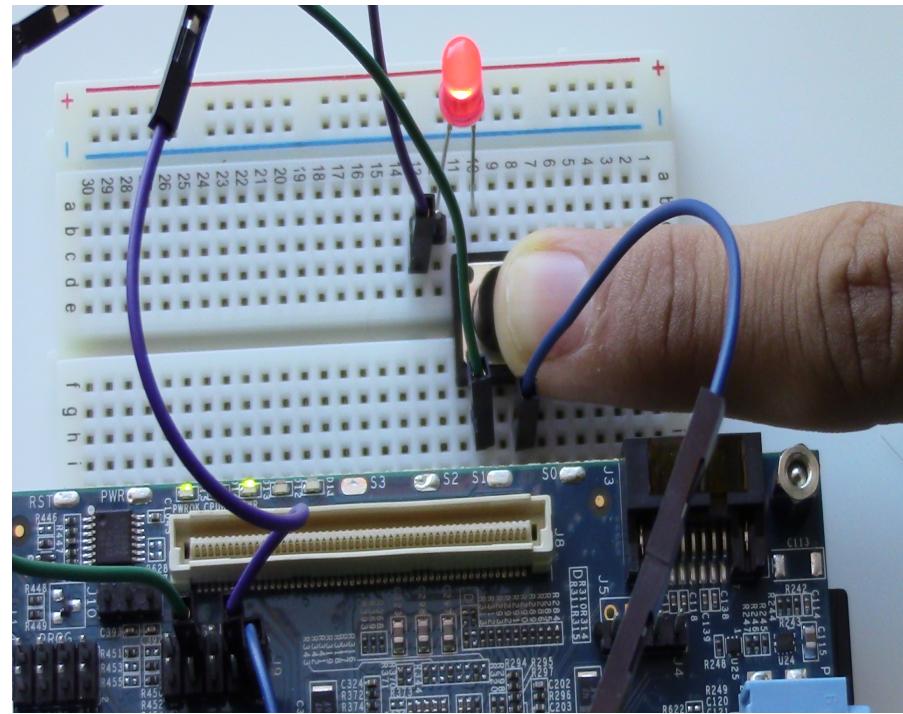
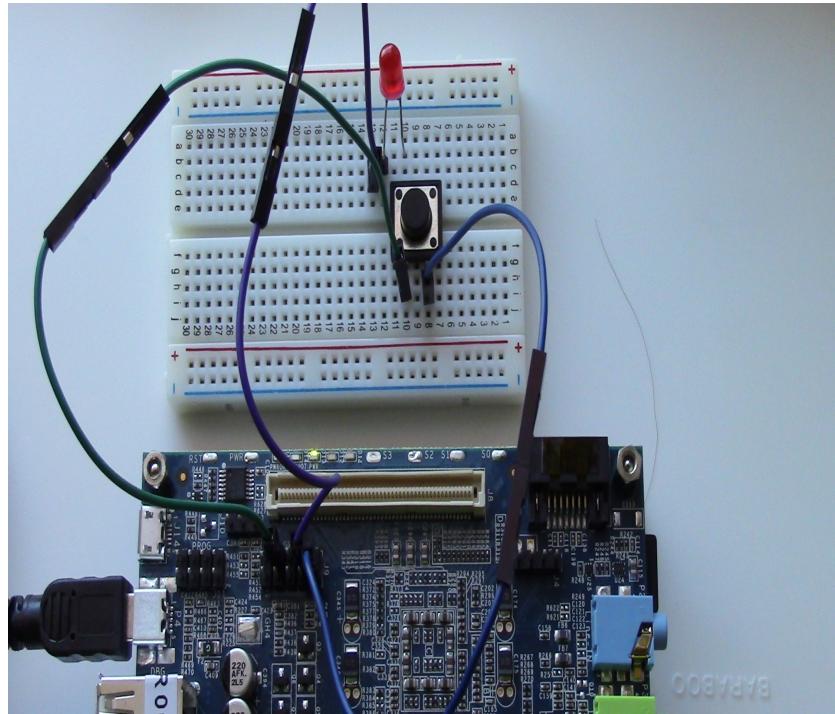
Push button



Connection Diagram



Output



Acknowledgments

I would like to thank the following people for their help and support:

- Scott Garman
- David Anders
- Yocto Project team at Intel
- Linux Foundation



TRIVIA:

How many Minnow(s) are there in the presentation???

