Dragrove User Manual

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Wiki: http://www.seeedstudio.com/wiki/Dragrove

Bazaar:http://www.seeedstudio.com/depot/Dragrove-Generic-gateway-for-internet-of-things-p-1118.html?cPath=73

Document Revision History

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Disclaimer

For physical injuries and possessions loss caused by those reasons which are not related to product quality, such as operating without following manual guide, natural disasters or force majeure, we take no responsibility for that.

Under the supervision of Seeed Technology Inc., this manual has been compiled and published which covered the latest product description and specification. The content of this manual is subject to change without notice.

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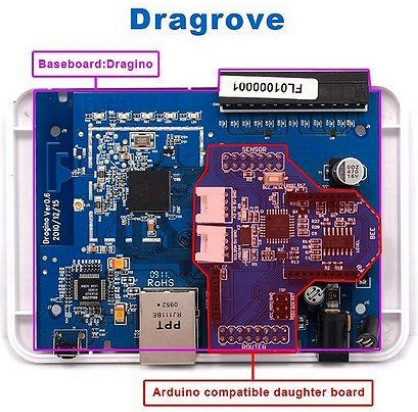
1. Introduction

Dragrove is an open-source-based generic gateway for the Internet of Things. It combines a Dragino (Easy Internet Access, powerful CPU, Linux system), an Arduino-compatible daughter board (monitoring the physical world), and RF networks like XBee.

The base board Dragino MS12 is a WiFi/Linux-enabled appliance for MCU projects. The goal of the Dragino is to solve the connectivity problem and greatly enhance micro-controller products such as the Arduino.

The Arduino compatible daughter board for the Dragino was designed by SeeedStudio. With the rich interface it provides, developers can easily integrate or develop products with both advantages of the Dragino (Easy Internet Access, powerful CPU, Linux system) and the Arduino (monitoring the environment).





2. Features

- Network gateway: bridges physical measurements with the Internet;
- User-friendly. Easy to configure the settings with a user interface;
- Daughter board remote firmware download;
- Compatible with SeeedStudio Groves & Xbee Socket;
- Dual NIC for Wifi and LAN. Can be ased as a normal router;
- Based on Linux OpenWRT and Arduino;

3. Specification

- 8M Flash, 32M SDRAM;
- 1X10/100M Ethernet Port;
- DC Input 9V~15V;
- Wifi:802.11b/g;
- Wifi Power: 20dbm;
- Frquency band: 2.412GHz~2.472GHz;
- External antenna;
- 8 External sensor connectors plus 2 internal Grove connectors.

4. Bug Tracker

There are two known bugs in the Dragrove daughter board's design:

- System does not boot and keeps resetting (COLD Reset pin stays low)
- I^2C bus pins (SCL/SDA) are shorted to GND

Here are the details of these two bugs and the suggested workarounds:

4.1 Dragino does not boot with daughter board installed

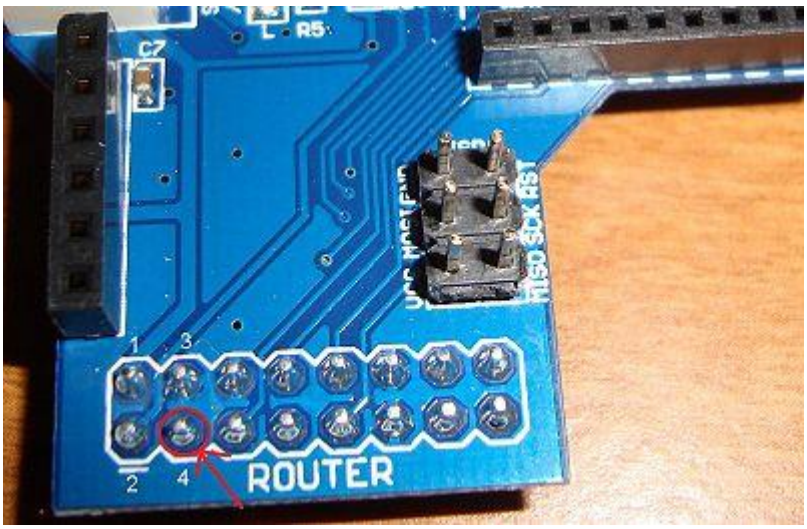
Users have observed that the system does not boot with the daughter board installed on Dragino.

Thanks to Tamir for pointing this out via his blog:

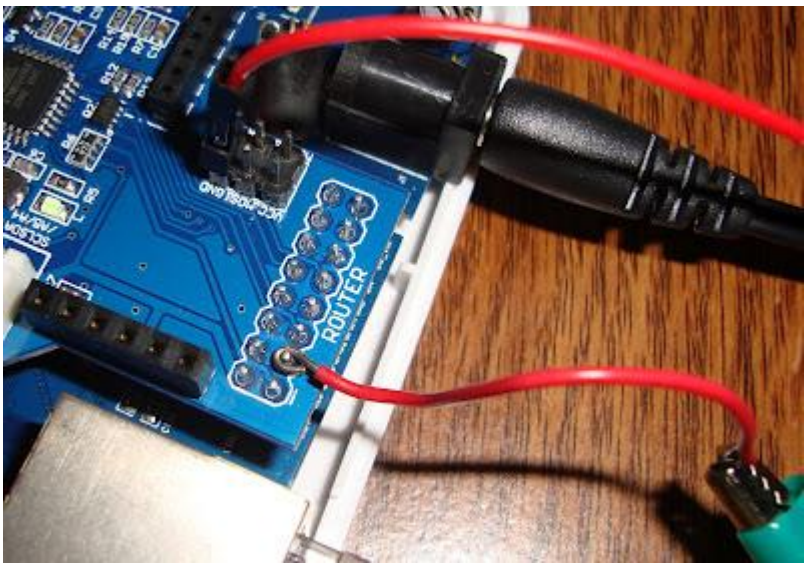
http://tae09.blogspot.com/2012/04/dragrove-daughter-board.html

Summary of his investigation:

The Dragino does not boot while the Dragrove daughter board is plugged in. This is because AR2317's reset pin (labelled COLD on the Router Connector) stays high and hence the AR2317 keeps resetting. If you look at the daughter board's schematic, you will observe that pin labelled "COLD" on the Router connector is connected to pin PD4 (via resistor) of the AVR micro-controller on the daughter board. Note that a '*Pull-down*" resistor has not been connected to this signal and the AVR microcontroller might be keeping this pin to logic high by default and hence AR2317 keeps resetting non-stop.



The solution is to link a wire between COLD pin and Ground as shown in the image below:



This solution forces COLD to LOW, which then allows the board to boot. You have to keep the COLD pin LOW to prevent Dragino from rebooting. Once the Dragino boots, you can program the daughter board (as described in the wiki further below) to bring COLD to LOW at startup.

Once that is done, you can remove the jumper and reboot the Dragino without any problems. Make sure that every Arduino sketch you upload later on to the daughter board sets the COLD pin to LOW at start up. Here is the code to do that:

```
//COLD_RST pin is PD4 i.e. Digital Pin 4
 #define COLD_RST (4)

 .....

 pinMode(COLD_RST, OUTPUT);
 digitalWrite(COLD_RST,LOW);
```

5. Tutorial

This manual is a tutorial for how to set up the platform and the program between Dragino and the Daughter board. In this manual we will provide following topics:

- HOW TO - Access Dragrove and configure the network parameters
- HOW TO - Program the Daughter board via Dragino
- HOW TO - Configue Dragrove with Pachube support or record value in local file
- HOW TO - Send value from daughter board to Dragino via UART interface
- HOW TO - Send To/Get Command from Dragino to daughter board via SPI interface
- HOW TO - Setup DDNS service for remote access from internet
- HOW TO - Upgrade firmware of Dragino
- REFERENCE- software/hardware/mechanical relates documents

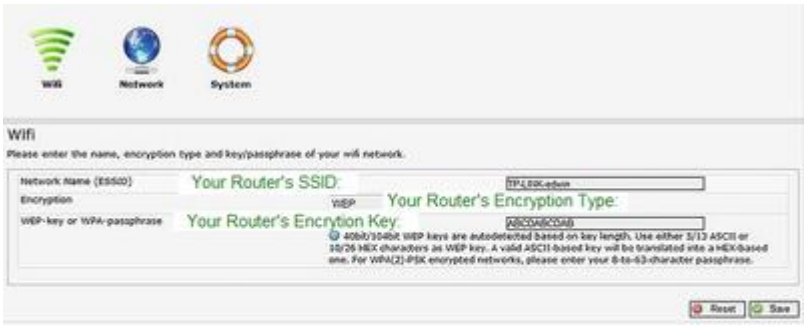
6. Configure Dragino to Access Internet

Access Dragrove via WEB

You need to configure your Dragrove the first time you use it to set up the WAN. The Base board Dragino has a default IP address of 192.168.255.1 via its LAN port. To access the Dragrove, you can simply Set your computer to DHCP and connect an Ethernet cable between your computer and Dragrove.

Dragrove will auto assign an IP address to your computer. Type 192.168.255.1 in your browser and you will see the Dragrove setup page.

The Dragrove Wifi interface works in AP Client mode by default. You can configure it to connect to your wifi router and get Internet access.



You can select the WAN (here it's WiFi) in DHCP mode or manual mode in the network menu. Here I would suggest to use the manual mode:



Now the Dragrove has a WAN IP of 192.168.1.108. Disconnect the Ethernet cable between your

computer and Dragrove and connect your computer to the Internet as usual. Type 192.168.1.108 in your browser and you will see the Dragrove setup page. That's it - the Dragrove is connected to your WiFi network.

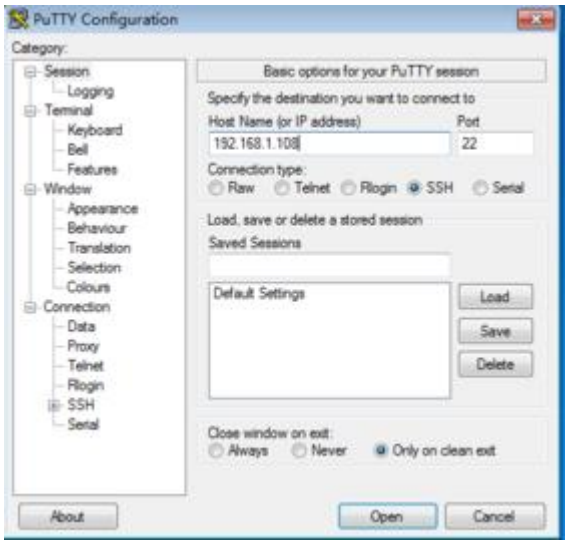
Access Dragrove via SSH

The Dragrove base board Dragino is based on the embedded Linux system *OpenWrt*. You can access it via SSH and customize the system for different applications. You can download Putty here.

If you connect your computer to Dragrove with an Ethernet cable, you can log in Dragrove through the LAN port:



Also, you can use the WAN port (WiFi port) to log in:



The SSH access for Dragrove is:

IP: 192.168.255.1 on LAN port. If you want to connect to the Dragrove via WiFi, the IP should be

192.168.1.108.

Username: root

Password: root

The SSH access password can be changed with this command:

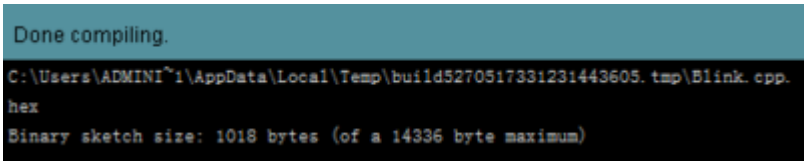
```
root@dragino-751aff:~#passwd
 Changing password for root
 New password:
 Retype password:
 Password for root changed by root
```

Notice: For security reason, it is recommended that you change the SSH password after your first log in.

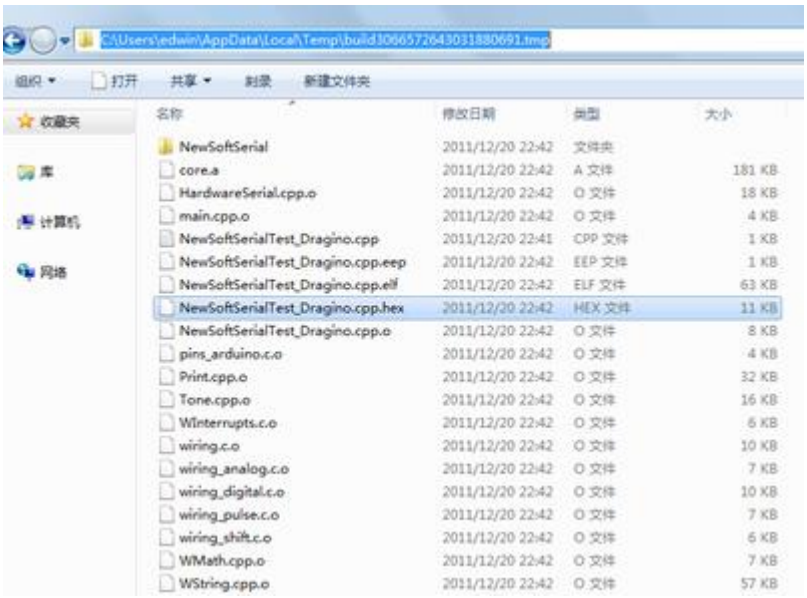
7. Program the daughter board via Dragino

For the Dragino, we are using *avrdude* to upload the program (.hex format) to the daughter board.

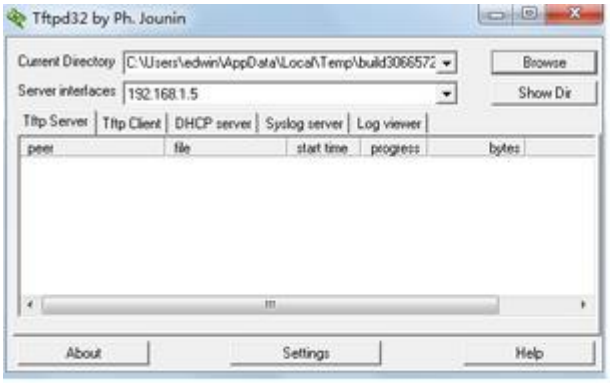
You can use the Arduino IDE to generate the hex file. The Arduino IDE will generate the hex file in a temporary directory. In the Arduino IDE press the "Shift key" as you click the "compile" command button. The Arduino IDE will automatically generate the .hex file for you. **NOTE that the .hex file will automatically be cleared when you close the Arduino sketch.**



You can find this hex file in your USER_TEMP_LATEST_build_directoy. Below is an example.



To transfer this file to the daughter board, we can run a Windows TFTP server (tftpd32) and point the TFTP directory to where the hex file is and the IP of your server computer. You can download tftpd32 here



Select the daughter board .hex file path and select you server PC's IP address.

Now we need to set up Dragino so it will automatically get the hex file and program the daughter board.

In SSH access to Dragino, run:

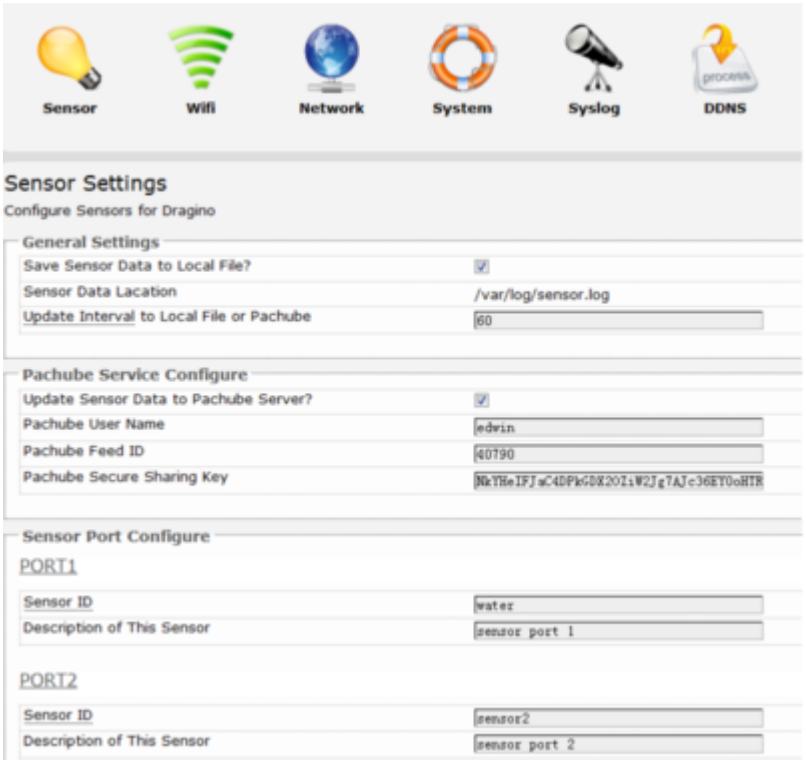
```
root@dragino-751aff:~# wget http://svn.dragino.com/scripts/upgrade_avr.sh
 // get the upgrade_avr script from Dragino SVN server
 root@dragino-751aff:~#sh upgrade_avr.sh YOUR_HEX_FILE_NAME YOUR_TFTP_SERVER IP
```

The script will now transfer the file from your TFTP server and upload to the daughter board.

Note: You can modify the upgrade.avr.sh for different configurations.

8. Sensor Configuration Page/How to get data from the daughter board's UART

This page is used to configure the Dragrove to update different sensor values to Pachube or to save in a local file.



Save Sensor Data to Local File: Enable/Disable local save.

Sensor Data Location:the location to store the sensor value.

Update Interval: How often to store the data value to local file or update to Pachube.

'*Note:* 'local save will be cleared after reboot. You can change the local file location in /etc/config/sensor manual or to other location if you want to keep the data after reboot.

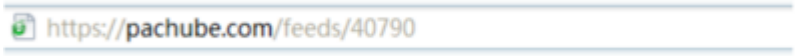
Pachube (www.pachube.com) is a free, public server where you can upload and plot your sensor data. You can configure Dragino to update the sensor value and upload it to your Pachube account.

Update Sensor Data to Pachube: Enable/disable update to Pachube service.

Pachube User Name: Input your Pachube User Name here.

Pachube Feed ID: Your Pachube ID.

You can find this in your Pachube URL:



For example, above feed has the ID: 40790

Pachube Secure Sharing Key: Input Your Secure Sharing Key or API key here.

Sensor Port Configure: Dragino offer 6 sensor ports to store data/sent data to Pachube. The sensor ID used for record/update to Pachube.

How does Dragrove record data and update to Pachube?

The baseboard Dragino runs a daemon that checks all data get from its UART interface and checks whether it matches this format: <sensor ID>VALUE[... ...]. if it matches, then the Dragino will store this value as the latest value of the sensor ID. It will store the data on a local location or upload to Pachube periodically and then clear the data buffer.

Examples of data format:

- 1.)<sensor1>89<sensor2>133<sensor3>67
- 2.)<sensor1>100<sensor2>43<gas>78

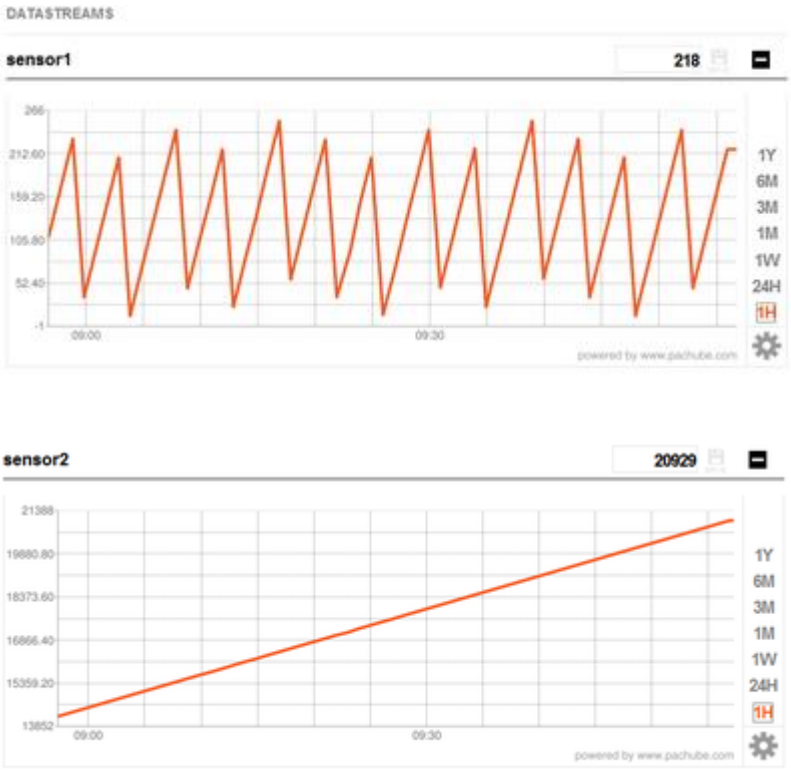
In (1), Dragino will store: sensor1=89, sensor2=133 and sensor3=67. In (2), Dragino will store: sensor1=100, sensor2=43, but no gas since gas is not a valid ID. **Note:** In the data format there should be one or more spaces between different sensor IDs.

SOFTWARE in the daughter board

The daughter board is used to send the sensor data to the Dragino via its UART interface.

An example sketch for the daughter board can be download from:http://svn.dragino.com/examples/SerialToPachube/avr/

This demo code sends sensor data from the daughter board to the Dragino. After you upload this code to the daughter board and configure Pachube as described above, you should see your feed updated every minute. Below is a plot example.


DATASTREAMS
sensor1
218
266
212.60
159.20
105.80
52.40
-1
09:00
09:30
1Y
6M
3M
1M
1W
24H
1H
powered by www.pachube.com
sensor2
20929
21388
19880.80
18373.60
16866.40
15359.20
13852
09:00
09:30
1Y
6M
3M
1M
1W
24H
1H
powered by www.pachube.com

9. Send Commands from the Dragino to the Daughter board via SPI

Besides the UART interface, the Dragino also connects to the Daughter board via its SPI interface. We can use this interface to send commands and get feedback from the Arduino compatible Daughter board.

You can find the example code on the link below (For Arduino022):http://svn.dragino.com/examples/Dragrove_SPI_Test/**avr/** is the code running the Daughter board and **SPI_Test.lua** is the code running in the Dragino.

AVR code include:

SPI/: SPI library, copy this to Arduino\libraries.

Buffer/: buffer library, copy this to Arduino\libraries.

NewSoftSerial/: software serial library, copy this to Arduino\libraries

Dragrove_SPI_TEST.h: use Arduino IDE Sketch. Add this file to the sketch.

Dragrove_SPI_TEST.pde: Sketch for the Dragrove.

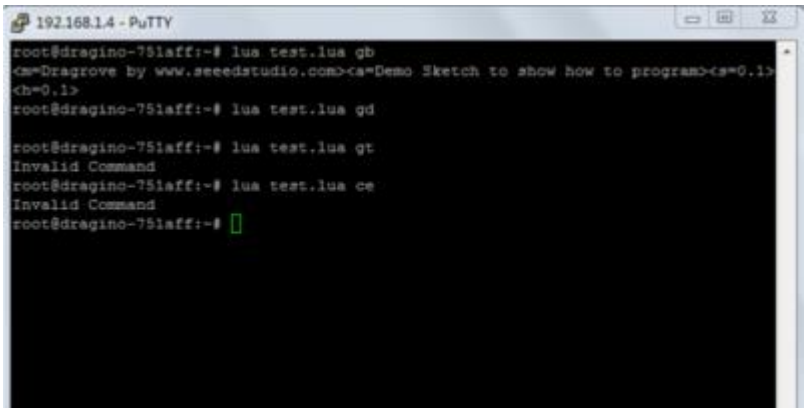
Dragrove_SPI_TEST.cpp.hex: Compiled hex file.

You can also edit this Arduino sketch, adding your own case and commands and then compile your code to .hex file or just upload the .cpp.hex file to the daughter board. Upload the .hex file to Daughter board as above.

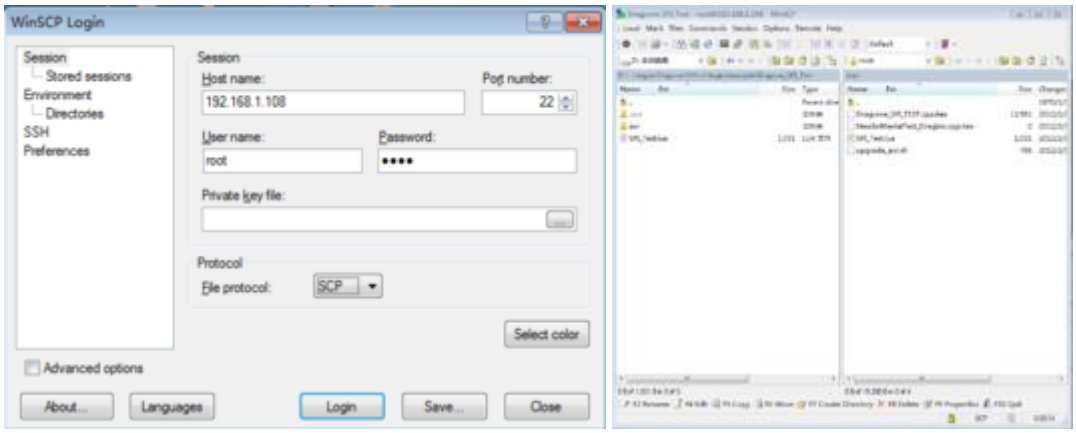
Then SSH to the Dragino, and run the SPI_Test.lun to send commands to the Dragrove:

```
root@dragino-751aff:~# lua SPI_Test.lua gb
```

The Dragino will send command “gb” (Get_Board_Info) to the daughter board via SPI interface, and the daughter board will send back the board info. The command **gb** is predefined in the daughter board. In the demo code there are two commands: gb: Get Board info. gd: Get data from the daughter board: the data will be sent via UART interface.



Notice: If SPI_Test.lua can not be found you need to put SPI_Test.lua at the root of the Dragino with SCP and use **SCP**to log in the Dragino. Put SPI_Test.lua at the root.



In the avr code running on the daughter board there is an interrupt code ISR(SPI_STC_vect). This will be called once there is a byte from the SPI interface. First it checks whether the byte is the end of the command message (“.”). If this it is not the end, then we add this to the Rx buffer. If it is the end, we set a flag that it is a new control message. The avr loop keeps checking the new message flag, so when this flag is set, it will run ctrlDecode to parse the command, which is stored in the Rx buffer.

You can define different commands in the switch/case condition code: for example control motor, get temperature etc. In this example, we only have a command “gb” which simply shows the pre-defined board information. You can easily add your own command here. For example, a "gn" command was added in the following code to turn on an LED connected to pin 16 of the daughter board on; also, a "gf" command was added to turn it off.

```
void ctrlDecode(void) {
  unsigned int cmd[2];
  ctrlFlushTxBuffer(); //clear TX buffer
  ctrlAddToTxBuffer(' '); // this bit will be ignored when transfer
  if (ctrlGetFromRxBuffer(cmd) && ctrlGetFromRxBuffer(cmd+1)) {
```

```
    // get the CMD from the databuffer
    switch (cmd[0]) {
      // switch case here to do action according to different command.
       case 'g': // get
          switch (cmd[1]) {
            case 'b':
              GetBoardInfo(); // gb: get board info and add them to tx buffer.
              break;
            case 'd':
              SendDataToUart(); //gd: send sensor data to UART
              break;
            case 'n':
              digitalWrite(16,HIGH); //gn to control the LED on
              break;
            case 'f':
              digitalWrite(16,LOW); //gf to control the LED off
              break;
            default:
              ctrlAddStringToTxBuffer((char *)invalid);
              break;
          }
          break;
          // case 'x': // add more custom commands here.
            //ctrlCmdSet(cmd[1]);
            // break;
       default:
         ctrlAddStringToTxBuffer((char *)invalid);
         break;
     }
   } else
     ctrlAddStringToTxBuffer((char *)invalid);
   ctrlFlushRxBuffer();   // clear RX BUffer
}
```

And added the pin in setup()

```
pinMode(16, OUTPUT);
```

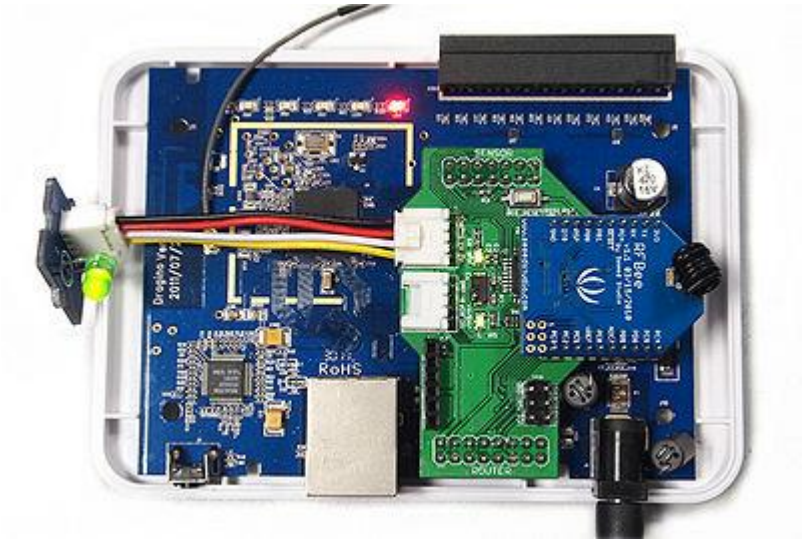
Then you can control the LED in the SSH input:

```
root@dragino-751aff:~# lua SPI_Test.lua gn
```

The LED connected to A2 of Daughter board will be turned ON. If you input:

```
root@dragino-751aff:~# lua SPI_Test.lua gf
```

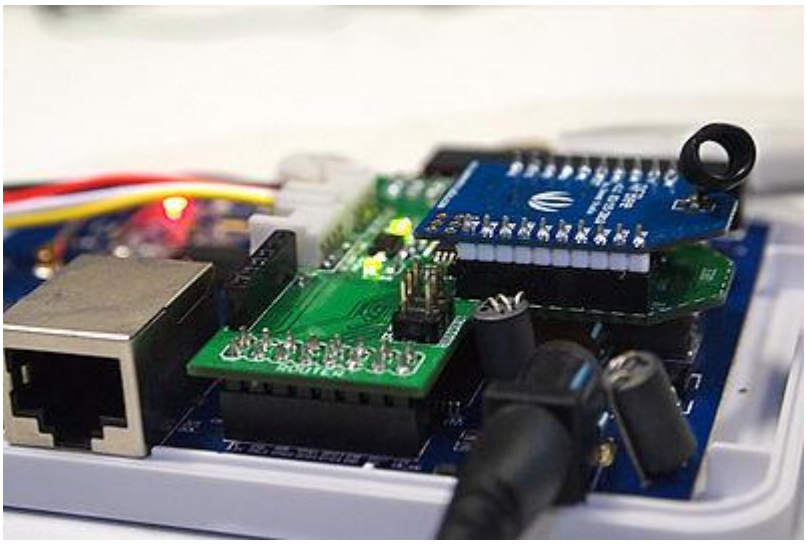
The LED will be turned off.



To send data back to the Dragino, we put the data string in the Tx buffer and use received_from_spi(tx) to send a byte each time. The Lua code in the Dragino shows how to write a message to the SPI interface, read the incoming SPI message and then print it out.

9.1 Wireless Communication Via Xbee Socket

There is an XBee socket included in the daughter board, making wireless communication and control possible. You can use SeeedStudio BEE series to achieve this.





There are two RFbees used in this demo. One was inserted onto the Dragrove's XBee socket and the other was inserted onto an XBee Carrier. Set the baudrate to 9600.

Add the following code in the AVR Sketch:

```
case 'f':
    digitalWrite(16,LOW); //gf to control the LED off
    break;
  default:
    ctrlAddStringToTxBuffer((char *)invalid);
    break;
  }
  break;
  case'x': // Switch the first char
    switch(cmd[1]) {
      case's': // Switch the second char
        Serial.print("hello,world!"); // Action from Dragrove, send this to RFbee.
```

```
        break;
    }
    break;
```

Add the serial definition in setup():

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

Compile your code to .hex file and Upload the .hex file to Daughter board as above.

Then SSH to the Dragino, and run the SPI_Test.lua to send commands to the daughter board.

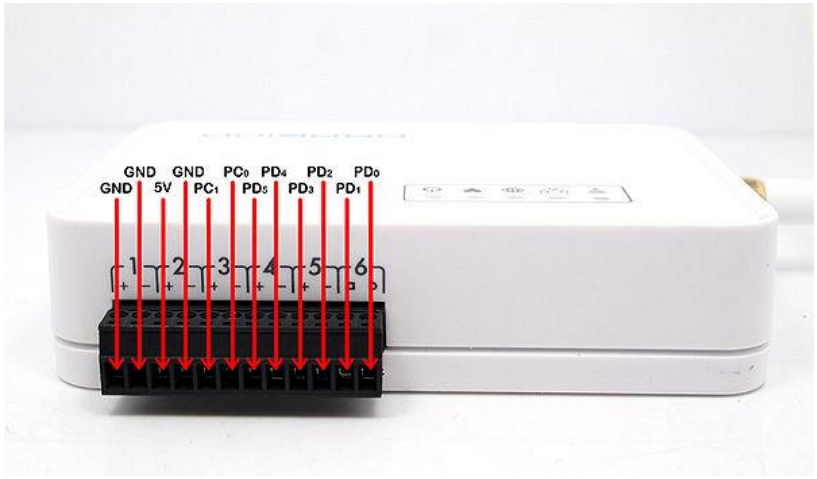
```
root@dragino-3c0ae0:~# lua SPI_Test.lua xs
```

You will see the message defined in the AVR sketch has been sent to the RFbee on XBee carrier:



9.2 Hardware Connection of the daughter board

Besides the two Grove connectors there are also some other pins of the daughter board routed out for your use:


GND
GND
5V
GND
PC1
PC0
PD5
PD4
PD3
PD2
PD1
PD0
1
2
3
4
5
6

10. Set up DDNS for remote access

Dynamic DNS allows you access/control the Dragino from other location even you don't have a fix IP address.



Enable DDNS Service: Enable/Disable DDNS service.

DDNS Service Provide: choose your service provide here.

Domain: the hostname provide by your DDNS service provider.

Username: Username of your DDNS service.

Password: Password of your DDNS service Source of IP-Address: Where to look for your external IP address, You can choose:

- Interface: Set external IP according to your hardware network interface info: eth0, ath0.
- URL: Set external IP according to URL info, for example, you can set it tohttp://www.whatismyip.com/automation/n09230945.asp so the Dragino will connect to this url and get its external IP. It is used when Dragino has a private IP address on its wan port.
- Check for changed IP: how often to check if it needs to update its IP to DDNS service provider.
- Force update: how often to force an update to DDNS service provider.

11. Upgrade the Firmware of your Dragino

The latest firmware of Dragino can be found on the link below: http://www.dragino.com/downloads/MS12/firmware/.

- Step1: Download the firmware .squashfs and .lzma
- Step2: Connect the LAN port of Dragino and your PC directly, disable your wifi interface
- Step3: Download and run FonFlash.exe

If your computer reminds you that there is some dll lost in this procedure, please download and install the **winpcap**first.

Configure the FonFlash:

- 1.) Firmware type: Openwrt
- 2.) Select the right Network Interface
- 3.) rootfs: choose openwrt-atheros-root.squashfs
- 4.) kernel: choose openwrt-atheros-vmlinux.lzma

- Step4 :Click Flash Router Now and power on your Dragino.

Fonflash will upgrade the device. It will show *upgrade successfully* after finished and exit.

Reference output during upgrade:

```
Peer MAC: 7c:dd:90:01:2b:c1
Peer IP : 192.168.255.1
Your MAC: 00:ba:be:ca:ff:ee
Your IP : 192.168.255.0

Setting IP address...
ip_addr -l 192.168.255.1/8 -h 192.168.255.0


Initializing partitions ...
fis init

loading file:
load -r -b 0x80100000 -m tftp file_1
```

```
creating flash partition (this may take some time)
fis create -f 0xa8030000 -l 0x006f0000   -e 0x00000000    rootfs
```

Wait until the Fonflash reminds you the upgrade has finished. It may take 5 minutes to finish this upgrade.

12. Resource

- Eagle file of Dragrove daughterboard

13. Reference

- www.openwrt.org: embedded linux used in Dragino.
- http://www.dragino.com/downloads/MS12/firmware/
- http://www.dragino.com/wiki/index.php?title=Main_Page

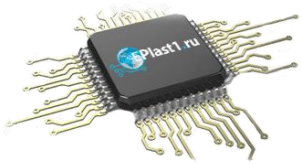
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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