XC4388 Arduino Yun Shield

Overview:

The XC4388 Yun Shield consists of a Linux based SBC running the OpenWRT firmware. It features USB, Ethernet and WiFi connectivity, and can be controlled by the attached Arduino main board. Because the OpenWRT firmware is primarily designed to control routers, it has a similar web configuration interface, and also supports installation of extra packages to add extra functionality. For example, it is possible to connect a 3G USB Wireless Broadband stick and use that to provide internet connectivity to the shield.

Connection:

Being a shield, the connections are quite straightforward to make, but the important connections that are made to the Arduino main board are power, the serial pins on D0 and D1, and the ISP programming pins on the ISP programming header. Regular commands and responses are passed via the serial pins, while the ISP pins can be used to reprogram the Arduino main board via WiFi (using the Yun Shield as a bridge).

Configuration:

The Yun shield can connect to any R3 main board (ie Uno, Mega or Leonardo), but connection to the Leonardo is preferred, as the serial connection to the Yun Shield interferes with the USB-serial programming link on the Uno and Mega. A Leonardo with Yun Shield attached is functionally equivalent to a [Yun Main Board](). An Uno or Mega may be used, but the Yun Shield will have to be detached to successfully upload sketches via USB, and may need a jumper installed to allow WiFi upload.

Web Configuration:

When reset to initial settings (which can be achieved by holding the reset button for 30s whilst the Yun Shield is powered), the Yun Shield sets up a WiFi network called 'duinotech-xxxxxxxx'. Initial setup can be done by connecting to this. The web configuration will ask for a password- in all cases, the default username is 'root' and the default password is 'duinotech'.

For WiFi, use the web setup by connecting to the 'duinotech-xxxxxxxxxxxx' network and going to 192.168.240.1 in a browser. Log in with the 'duinotech' password, click the 'System' option and enter your WiFi network in the Wireless Parameters, then press 'Configure & restart'. After this, the Yun Shield will be on a different IP address. It's also recommended to set the timezone, as the Yun Shield gets it time from NTP servers, and needs to know the timezone to correctly calculate the correct time. This will be sufficient for minimal setup.

See this page for more detail:

https://www.arduino.cc/en/Guide/ArduinoYunShield#toc3

System Configuration:

To access the OpenWRT console, and run commands to set up packages, an SSH client is recommended. In this case, connect to the Yun Shield's IP address with your SSH client, and login using the default username/password of 'root'/'duinotech'. If you don't have an SSH client, you can use a Leonardo board as a serial link with the sketch in the next section.

Libraries:

To communicate with the Yun Shield requires the Bridge library, which is built-in from Arduino IDE version 1.6.0. See https://www.arduino.cc/en/Reference/YunBridgeLibrary for more information on the members and examples in the Bridge Library.

Alternatively, commands may be sent directly to the Yun Shield Console via the serial port. Use the following sketch on a Leonardo to configure it as a simple pass through:

```
#define BAUDRATE 250000

void setup() {
  Serial.begin(BAUDRATE);
  Serial1.begin(BAUDRATE);
}

void loop() {
  if (Serial1.available()){Serial.write(Serial1.read());}
  if (Serial.available()){Serial1.write(Serial.read());}
}
```

A terminal program like PuTTY or TeraTerm will offer more features than the Arduino Serial Monitor.

OpenWRT:

As mentioned above, OpenWRT is a version of Linux designed for small devices like routers. If you are familiar with Linux commands and file systems, you should find the Yun Shield has few surprises. One major difference worth remembering is that most of the file system is held on flash, which can wear out if used excessively. Files which are not required to be kept can be worked on in the /tmp folder, which exists as a ramdisk which is lost when power is lost. If you need large amounts of writeable storage, a USB stick or similar is recommended.

If you are unsure about how a command works, try the command name followed by '--help', eg:

```
ls --help
```

Although the Yun Shield has only one USB socket, a hub can be used to add extra devices. The Yun Shield has limited power ability, so a powered hub should be used if possible.

Connecting a 3G USB Wireless Broadband Stick

The following instructions were successful with a Huawei E173 USB Wireless Broadband Stick, but may work with other models. You will need to connect to the console of the Yun Shield with a terminal program like PuTTY or TeraTerm. If you have not used the Linux Command Line Interface before, see https://www.arduino.cc/en/Tutorial/LinuxCLI for information on connecting to the console.

After ensuring the Yun Shield has an internet connection, type the following two commands at the console:

```
opkg update
```

```
opkg install comgt kmod-usb-serial kmod-usb-serial-option kmod-usb-serial-wwan usb-modeswitch usb-modeswitch-data luci-proto-3g
```

The first command updates the package list, and the second installs various drivers and the 3G USB interface addon for the web configuration utility.

Power down the Yun Shield, plug in the USB Wireless Broadband Stick, and power up the Yun Shield.

Enter the following command at the console:

```
dmesg | grep tty
```

and note down which devices are listed. Names like ttyUSB0, ttyUSB1 or ttyUSB2 are typical, but they may be something like ttyACM. If nothing appears here, your stick may not be working or may not have drivers installed- check for specific drivers for the modem type in this case.

Now, open a web browser on the same network as the Yun Shield and open the Yun Shield's web configuration page. Click through to the Advanced Configuration Panel (luci), and go to Network>Interfaces and click add new interface. Give it a name like '3G', select 'UMTS/GPRS/EV-DO' as the protocol and click submit. Choose the device as what you found with the `dmesg | grep tty` command, and the service type (UMTS only is a good start). The PIN applies if there is a PIN lock on the SIM card, leave blank if there is no PIN. The other three parameters vary by ISP, and they should be able to provide the correct APN name, username and password.

Click 'Save & Apply' and go back to the Netowrk>Interfaces page. The new interface should appear, and after a few seconds will connect if the settings are right. If it doesn't connect, try other devices from the `dmesg | grep tty` command, and double check the APN settings.

From here, the Yun Shield will use whatever internet access is available to connect.

Webcam:

The following commands will install packages to allow a webcam to be used to take (jpg) photos.

Run:

```
opkg update
```

```
opkg install kmod-video-uvc fswebcam
```

We tested this following on our [QC3203 Webcam](#), and also some cheap generic webcams, but your mileage may vary, and extra drivers may be needed.

Use the following command to capture an image to the /tmp folder:

```
fswebcam -S 10 /tmp/image.jpg
```

Image Manipulation:

Run the following:

```
opkg update
```

```
opkg install ffmpeg
```

After capturing a .jpg as above, run this command:

```
ffmpeg -i /tmp/image.jpg -vf scale=640:-1 /tmp/image.bmp
```

This will scale the file to 640 pixels wide and convert to bitmap format. This may be handy of you are using the Arduino to display or manipulate the image, as it is difficult to read .jpg files due to the compression, but .bmp files are uncompressed.

Audio:

Using our [XC4953 USB Soundcard](#), we were able to play MP3's and stream audio from the internet:

```
opkg update
```

```
opkg install kmod-usb-audio kmod-sound-core madplay
```

To play sounds:

```
madplay test.mp3
```

To stream from an internet MP3 stream:

```
wget -O - http://live-radio01.mediahubaustralia.com/PBW/mp3/ | madplay –
```

USB Storage:

By default, drivers should be installed for USB flash drives, and should work as long as they have a FAT or FAT32 partition. Flash drives appear at:

```
/mnt/sda1
```

For example, enter the following to work in the root directory of the flash drive:

```
cd /mnt/sda1
```

Multiple drives may have names like /mnt/sdb1.