Cookie User Manual

For NuMicro Edition 1.0

Rev. 1.0 Release: 2012-08-09

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1 Introduction

Cookie is an open-source Arduino-compatible ARM prototyping platform based on 32-bit ARM Cortex M0/3/4 MCUs plus hardware and software building blocks.

Cookie expands the concepts of Arduino into 32-bit ARM Cortex MCUs. Different types of 32-bit ARM Cortex M0/M3/M4 MCUs can be selected and switched freely because of CooCox CoX Peripheral Interface.

CooCox CoX Peripheral Interface, a unified peripheral interface, makes it easy to reuse Arduino Shields across different Cookie boards.

CooCox also provides a complete tool kit including IDE, Flash Program, Graphical pin configuration, and code generation tool, etc. The CooCox Component Platform also makes it easy to share code.

The NuMicro edition of Cookie has been added into CooCox and will be released soon. As the next step, we will work on the ST edition, the TI edition, etc. of Cookie, as shown on our schedule on the Cookie's homepage: www.coocox.org/Cookie.html.

2 Features

- Hardware CAD design files open under CC BY-SA 3.0 license in Eagle format.
- **Fully compatible with Arduino, hundreds of Shields can be reused.**
- Types of 32-bit ARM Cortex MCUs available (M0/M3/M4).
- Working on both 3.3V and 5V, selectable with jumper.
- CoLinkEx (USB-JTAG/SW debug probe) onboard, Debug IN/OUT selectable with jumper.
- A set of free development tools provided by CooCox.
- Component platform makes it easy to share code.

3 Cookie NuMicro

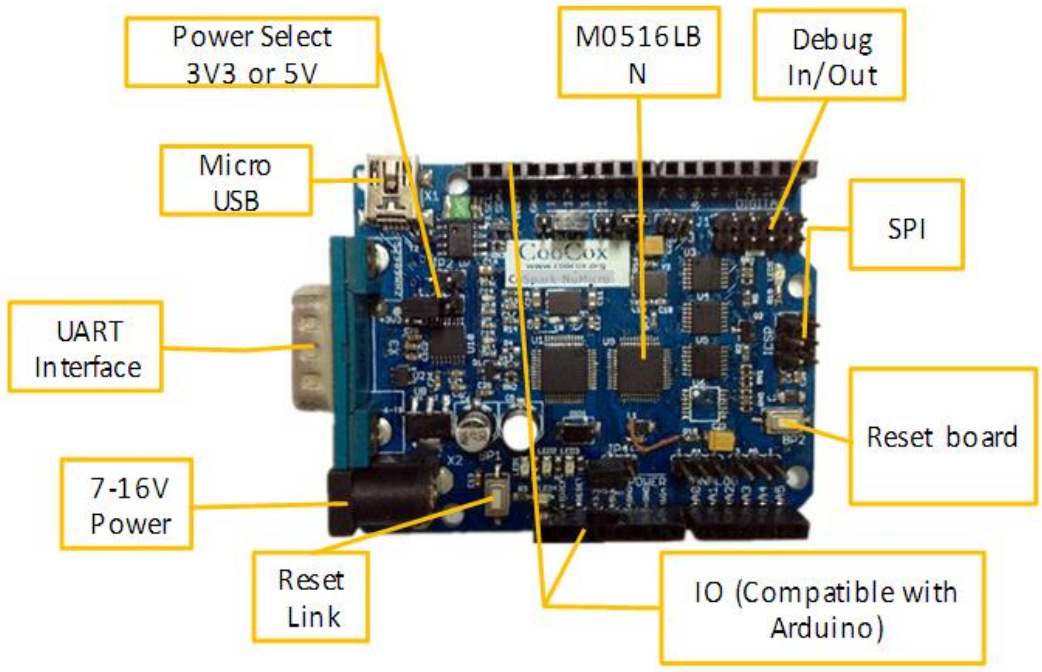
The Cookie NuMicro edition is based on the Nuvoton Cortex M0 microcontroller M0516LBN. The M0516LBN with Cortex-M0 core can run up to 50MHZ, with 64KB Flash for program memory, 4KB Flash for data memory, 4KB SRAM, 2 UARTs, 2 SPIs, and 1 I2C. Download data sheet from http://download.nuvoton.com/NuvotonMOSS/DownloadService/Member/DocumentsInfo.aspx?tp_GUID=DA00-M058/516

The Cookie NuMicro edition is **fully compatible with Arduino**, with 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a power jack, an ICSP header. It contains everything needed to support the microcontroller. There is also a **CoLinkEx onboard** to support program and debug. Simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

As Cookie is an open-source platform, all the documents and sources are free for download. You can find the Schematic, BSP Code, and also the PCB file on our website – www.coocox.org/Cookie/Cookie_Nuvoton.html.

4 Board Details

4.1 Block Diagram



4.2 Power

Like the Arduino, The Cookie NuMicro edition can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come from an AC-to-DC adapter (wall-wart) or a battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

Note:

The Board can be powered by 3V3, or 5V, if working with other shields, please check which power should be used. This can be switched by JP3.

The power pins are listed as follows:

- **VIN.** The input voltage to the board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7-12V), the USB connector (5V), or from the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- **3V3.** A 3.3 volt supply generated by the on-board regulator.
- **GND.** Ground pins.

4.3 Microcontroller

The Cookie uses a **Nuvoton M0516LBN** as the main microcontroller. The NuMicro M0516LBN is a 32-bit microcontroller with embedded ARM Cortex-M0 core for industrial control and applications which need rich communication interfaces. The Cortex-M0 is the newest ARM embedded processor with 32-bit performance at a cost equivalent to traditional 8-bit microcontroller.

- 32-bit with ARM Cortex-M0 core running at up to 50MHz.
- 64KB Flash for programming, 4KB SRAM, 4KB Flash for data memory, 4KB Flash for boot loader.
- Built-in LDO for Wide Operating Voltage Range: 2.5V to 5.5V.
- Up to 40 GPIO Pins with LQFP-48 package.
- 2 UARTs, 2 SPIs, 1 I2C, 4-channel 32-bit timer, 1 watchdog timer, up to 4 16-bit PWM generators with 8 PWM outputs, and 12bit SRC ADC up to 8 analog inputs.

4.4 IO

Each of the 14 digital pins on the Cookie can be used as an input or output or hardware peripheral function. The operate volt is determined by the JP1 (Board Power select), can be 3.3V or 5V.

Pin Map:

Arduino Pin	Arduino P Function	MCU IO Map	MCU Peripheral Function
D0	UART.RX	PA1	UART1.RTS/UART1.RX
D1	UART.TX	PA0	UART1.CTS/UART1.TX
D2	EXT.INT	PE0	PWM0/T2.EX
D3	EXT.INT / PWM	PE1	PWM1/T3.EX
D4		PE2	PWM2
D5	PWM	PE3	PWM3
D6	PWM	PC4	PWM4
D7		PD2	NINT0/T0.EX
D8		PD3	NINT1/T1.EX
D9	PWM	PC5	PWM5
D10	SPI.CS	PA4	SPI1.CS
	PWM	PC6	PWM6/CMP1.O
D11	SPI.MOSI	PA5	SPI1.MOSI
	PWM	PC7	PWM7
D12	SPI.MISO	PA6	SPI1.MISO
D13	SPI.CLK	PA7	SPI1.CLK
AREF		NC	
SDA	I2C.SDA	PD4	TIMCCP0/I2C0.SDA
SCL	I2C.SCL	PD5	TIMCCP0/I2C0.SCK

A0	AIN	PB0	ADC0/TIMCCP2
A1	AIN	PB1	ADC1/TIMCCP3
A2	AIN	PB2	ADC2/UART1RX
A3	AIN	PB3	ADC3/UART1TX
A4	AIN	PB4	ADC4/SPI0.CS/CMP0N
	I2C.SDA	PD4	TIMCCP0/I2C0.SDA
A5	AIN	PB5	ADC5/SPI0.MOSI/CMP0P
	I2C.SCL	PD5	TIMCCP1/I2C0.SCK
ICSP.1	SPI.MISO	PB6	ADC6/SPI0.MISO
ICSP.3	SPI.SCK	PB7	ADC7/SPIO.CLK
ICSP.4	SPI.MOSI	PB5	ADC5/SPI0.MOSI/CMP0P

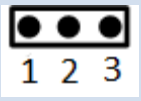
4.5 Communication

Interface	Port	Signal	Digital IO
SPI	SPI1	SS	D10
		MOSI	D11
		MISO	D12
		CLK	D13
	SPI0	MOSI	ICSP.4
		MISO	ICSP.1

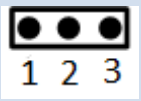
		CLK	ICSP.3
UART	UART1	RX	D0
		TX	D1
	UART0		UART Debug
I2C	I2C0	SDA	SDA / A4
		SCL	SCL / A5

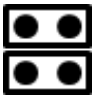
4.6 Jumper Setting

4.6.1 Power

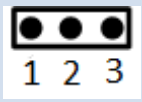
Jumper or Button		Description
JP1		Power is 3V3
		Power is 5V
RST2		Reset M0516

4.6.2 Debug

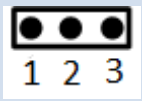
Jumper or Button		Description
JP2		Upgrade CoLinkEx

JP3		Connect J1.1(JTAG/SWD.VCC) with 3V3
JP4 JP5		Debug In / MCU
		Debug Output
RST1		Reset CoLinkEx

4.6.3 Digital

Jumper		**Description**
D10		SPI1.SS
		PWM6
D11		SPI1.MOSI
		PWM7

4.6.4 Analog

Jumper		**Description**
A4		AIN4(ADC4)

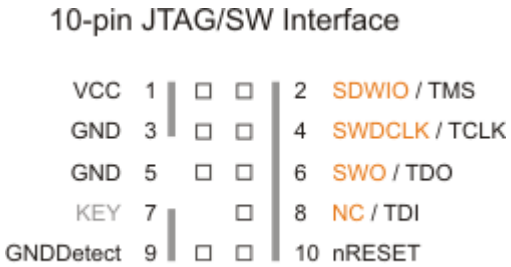
		I2C0.SDA
A5		AIN5(ADC5)
		I2C0.SCL

5 Getting Start

5.1 Program & Debug

The Cookie integrates a CoLinkEx on board. You can use the CoLinkEx to program and debug the Cookie MCU M0516, or program and debug other boards after setting debugging output through J1.

The J1 (Debug In/Out Connect) signal details:



5.1.1 Install

How to install the driver for the onboard CoLinkEx:

You need to select the version of CoLinkEx USB Driver according to your Windows OS. The newest version of CoLinkEx driver can be downloaded from www.coocox.org/Colinkex.htm.

1） 32 bit windows system, for example:

Windows XP / Windows Vista 32bit / Windows 7 32bit.

Installation file: CoLinkExUsbDriver-1.1.0.exe

2） Windows Vista 64bit or Windows 7 64bit.

Installation file: ColinkExUsbDriver-1.2.1.exe

Please connect CoLinkEx to the computer before you start installing this driver.

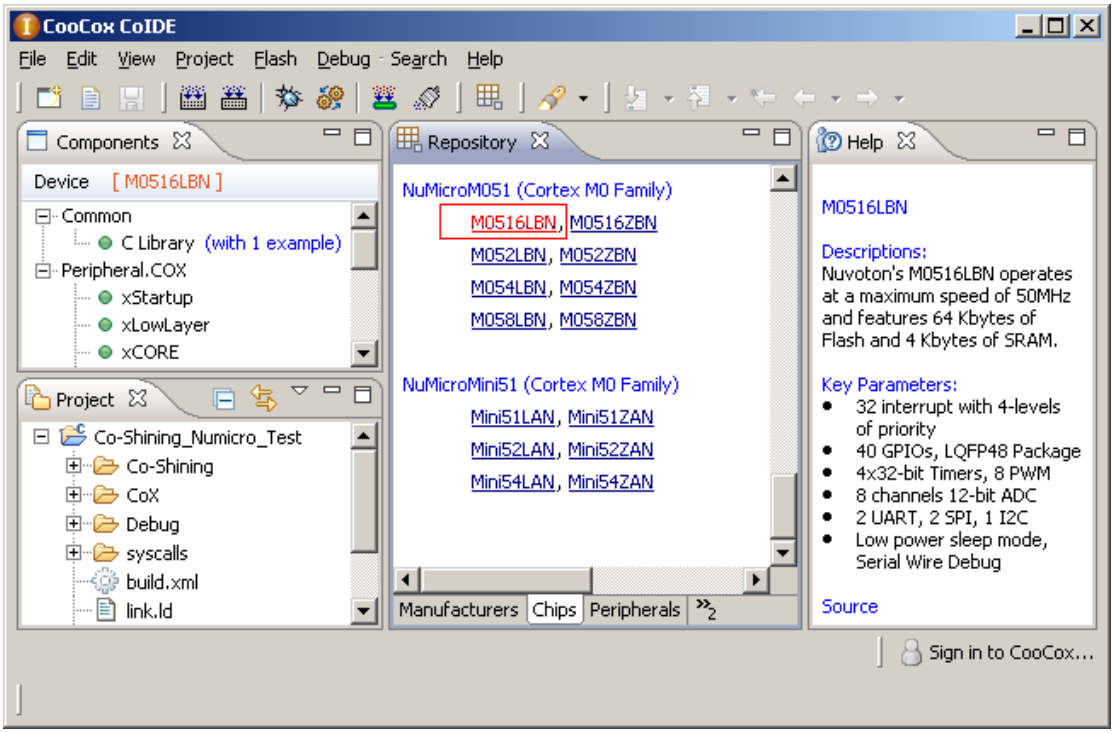
When you install the driver, in device manager, you will found CooCox（COM *x*）under Port and CooCox CoLinkEx Debug Interface under USB Controller.

If there is “?” in front of the devices, it means that the driver has not been installed on the system or install has failed; if there isn’t CooCox Port, it means that your CoLinkEx firmware and driver could be out of dated.

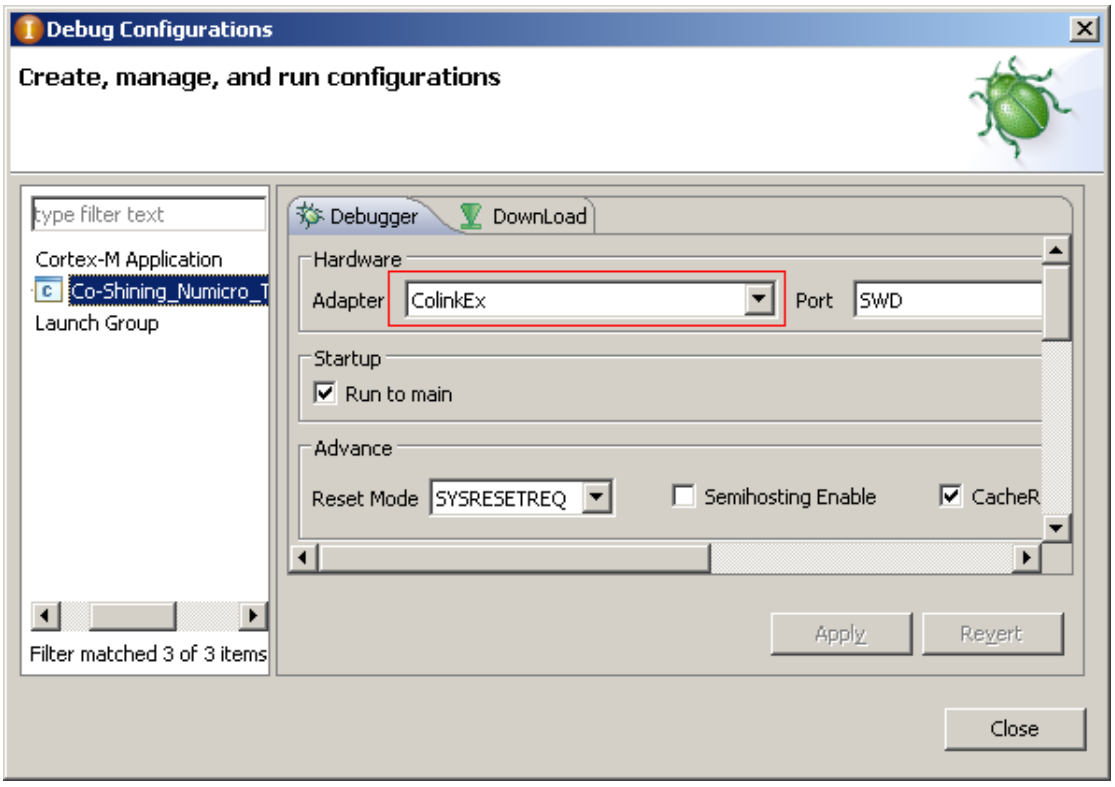
To get more information of the onboard CoLinkEx, please check the CoLinkEx User manual or visit CoLinkEx website – www.coocox.org/Colinkex.htm.

5.1.2 Using CoIDE to build and debug

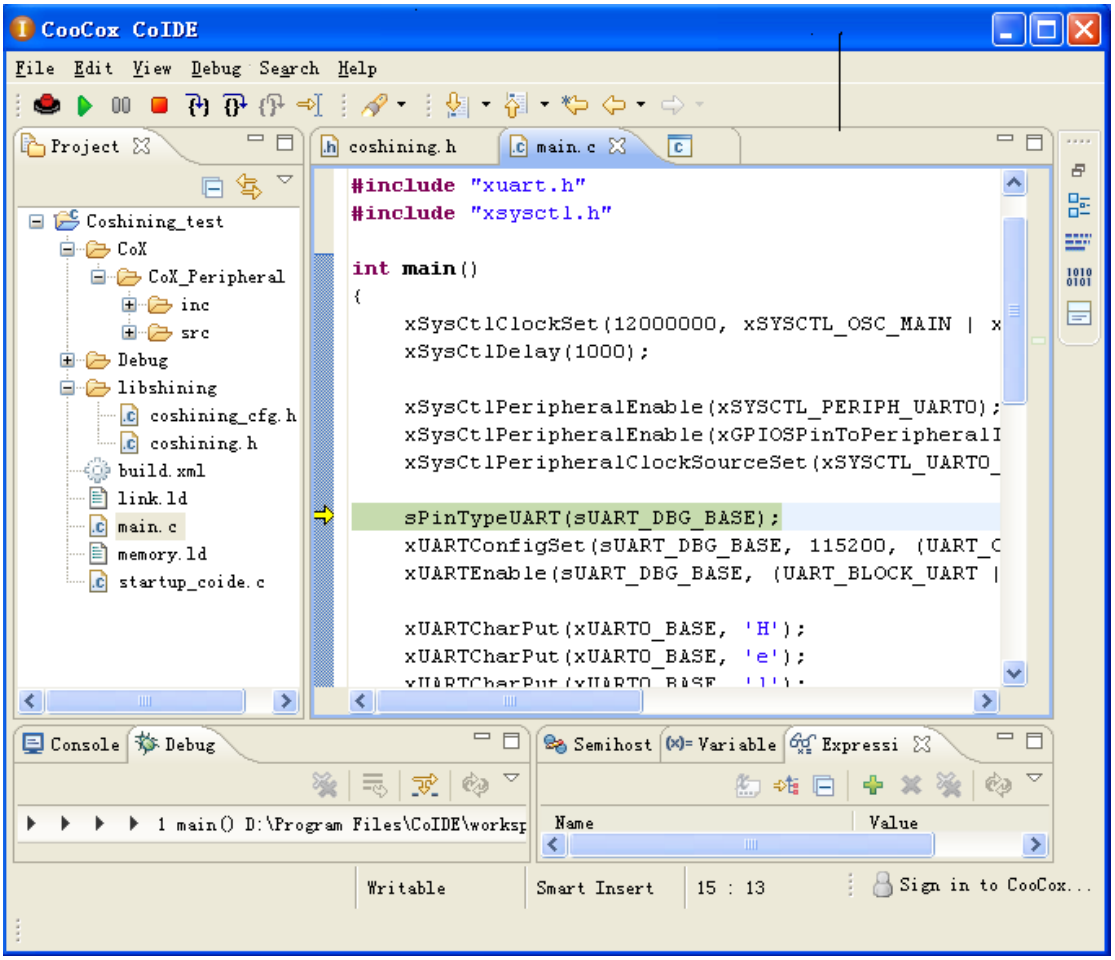
In CoIDE, you need to select Nuvoton, M0516LBN to start your project.



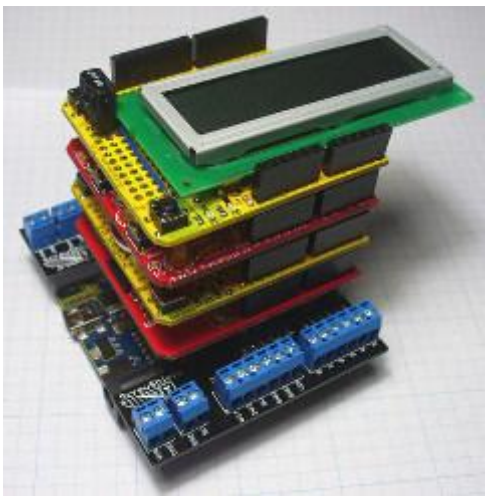
When you want to download or debug the M0516LBN, Select CoLinkEx in Debug Configuration.



Then you can debug your project.



5.2 Work with shields based on CoX



The Cookie, like the Arduino, features a common footprint for expansion headers that are intended to allow connectivity with a large number of expansion daughter cards called "shields". The shields have been developed by both the original Arduino

team and the community. These shields provide users with the ability to explore different technologies from a common and familiar environment such as motor control, advanced communications such as Ethernet, Wireless connectivity, and many more.

CoX Peripheral Library is the definition of a group of interface functions. It defines the functional access functions of MCU's common peripherals, such as IIC, SPI, UART, etc. CoX makes full functions, drivers based on CoX that can be ported to other MCU easily.

Here, we use the CoX as the base library of Cookie:

- Free and open source under BSD license
- Peripherals' library with an unified standard interface, can be ported to other MCUs easily
- Full functions of the peripheral, CoX still provides a set of APIs for special MCU features
- Supporting interrupt as CoX extracts a set of interrupt events
- A lot of reused drivers
- Extensive documentations generated using doxygen standard
- Standard definition of the API reference for almost all the Cortex-M0/M3 MCU manuals
- Adding a new innovative element, such as the short pin (PA2) in GPIO module
- Strict coding standard that does not affect code size and speed, through rigorous testing and verification

Like the shield for the hardware building blocks, CoX and the drivers based on CoX are the software building blocks.

You can develop the driver of a shield based on the CoX interface. Then the shield can be used in different editions of Cookie, such as NuMicro edtion or STM32 edition.

Note:

Please set the appropriate board power (3.3V / 5V) first according the shield you use.

6 Cookie Project

6.1 What is Cookie Project

Cookie is an open-source Arduino-compatible ARM prototyping platform based on 32-bit ARM Cortex M0/3/4 MCU, plus hardware and software building blocks.

What we want to do is to use Cookie board, Arduino Shields, CoX Library to build a Cookie Project, or an Arduino project on ARM Cortex M series' MCU.

To demonstrate the applications, we have designed an automatic system watering the flowers with remote monitoring. We will make more effort on it and build more interesting projects. We welcome you to participate.

6.2 Available Cookie Shields

To do the project, we also need to use some Arduino shields. Here listed are some Arduino shields that you may interested in.

Name	Producer	Description	CoX Supported
LCD1602	CooCox	The character LCD module uses HD1602 as the main controller.	✔
Motor	CooCox	The Motor Module uses LQ134 to drive the E-Motor.	✚

You can download the code from www.coocox.org/driver.html

6.3 How to participate in the Cookie Project

You can participate in the Cookie project via the following methods:

1) Upload your code in CoIDE

   The CoIDE 1.5.0 gives us the driver platform. You can upload the driver for your Arduino shields through this way. You can add the shields to the device list then upload the related driver. So all the person who use CoIDE will see your code.

2) Contribute through Github

   We will build some interesting projects on Github, and you can join us in those projects. All the shields that may be used in those projects can be bought through CooCox. You can also create a project using the shields at hands and commit it to our project.

3) E-mail your project to us

   If you already make a project and transplant it to CoX, you can send the project to us by E-mail.

   We will select the good projects to post on our website and blog. Then you can share your idea with everyone.