



嵌入式系统联谊会
www.esbf.org.cn

ARM Cortex MCU处理器教学实践

李宁

武汉理工大学 UP Team



UP Team, Wuhan University of Technology

Agenda

- 嵌入式系统课程设置（计算机、软件工程）
- 与8051教学重点的差异
- 硬件平台建设
- 与物联网、Linux操作系统的结合
- 问题与困难



嵌入式系统课程设置（软件工程）

课程	教学内容	实践内容
嵌入式系统基础	<ul style="list-style-type: none">⑩ Cortex M处理器编程模型⑩ ARM汇编语言⑩ 常用接口编程	<ul style="list-style-type: none">• 开发工具使用• 无OS外设驱动及应用开发
嵌入式操作系统	<ul style="list-style-type: none">• 嵌入式操作系统概念• RTOS概念• 任务管理、内存管理	<ul style="list-style-type: none">• RTOS移植• 多任务应用开发
嵌入式系统应用	<ul style="list-style-type: none">• Android平台软件架构• Linux驱动开发*• Android应用开发	<ul style="list-style-type: none">• Android 系统移植• Android应用开发

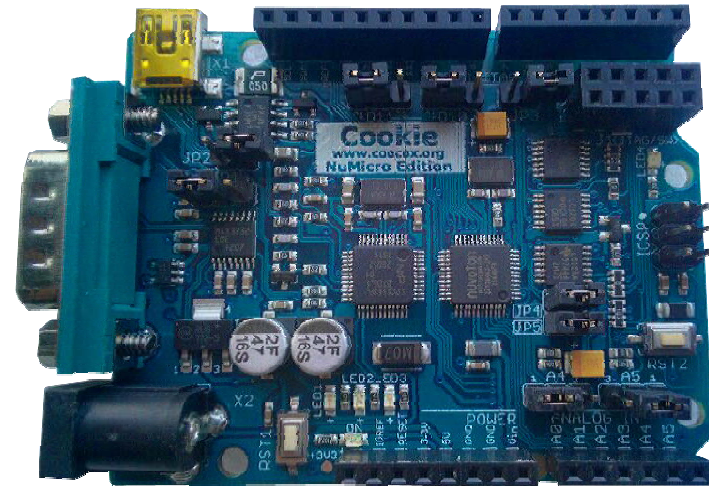


与8051教学重点的差异（硬件）



8051

- 不再DIY最小系统
- 模块化扩展外设



Cortex M0



与8051教学重点的差异（软件）

```
INC R0
DJNZ R7, LOOP20T05F
;-----
SETB STAT.0  初始状态为等号状态

MOV R7, #00H
MOV SCON, #00H  串行工作方式 0
;-----
;; DISPLAY INIT
;-----
LCALL LCDINIT
MOV  COM,#06H
LCALL  PR1
MOV  COM,#0C0H
LCALL  PR1

MAIN_LOOP:
```

8051

- 弱化汇编语言，强化C语言
- 弱化寄存器操作，强化API
- 中断与任务调度并重

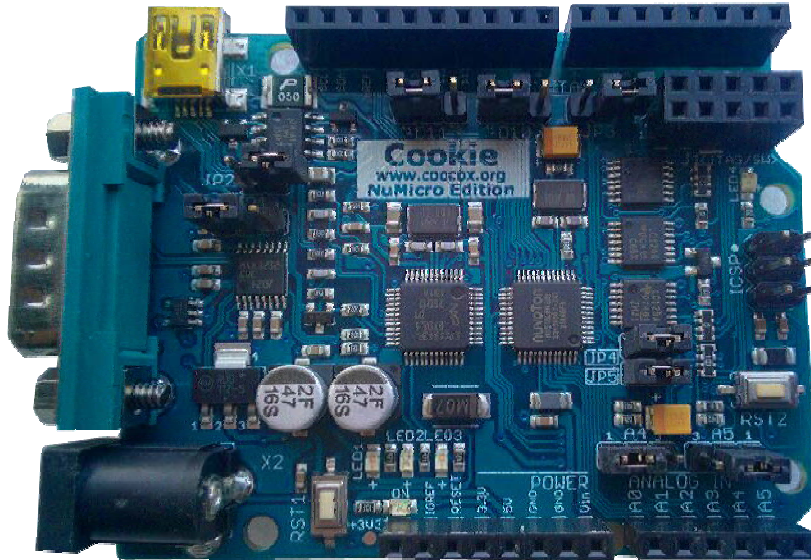
```
/*define arrays used for the stack of the tasks */
OS_STK stkTASK0[SIZE_TASK];
OS_STK stkTASK1[SIZE_TASK];
OS_STK stkTASK2[SIZE_TASK];
OS_STK stkTASK3[SIZE_TASK];
...
void task1(void *param)
{
    for(;;) {
        CoTickDelay(20); /* Delay 200ms */
        /* Turn On Led */
        GPIOSetValue(PORT2, 1, 0);
        CoTickDelay(20); /* Delay 100ms */

        /* Turn Off Led */
        GPIOSetValue(PORT2, 1, 1);
        CoTickDelay(40); /* Delay 100ms */
    }
}
```

Cortex M0



硬件平台建设—Cookie



SCH, BOM List, PCB are all open, CoLinkEx Firmware is free to use, users can DIY.

Cookie Shields, Peripheral Expansion Modules based on Cookie Extended Interfaces, are also in plan.



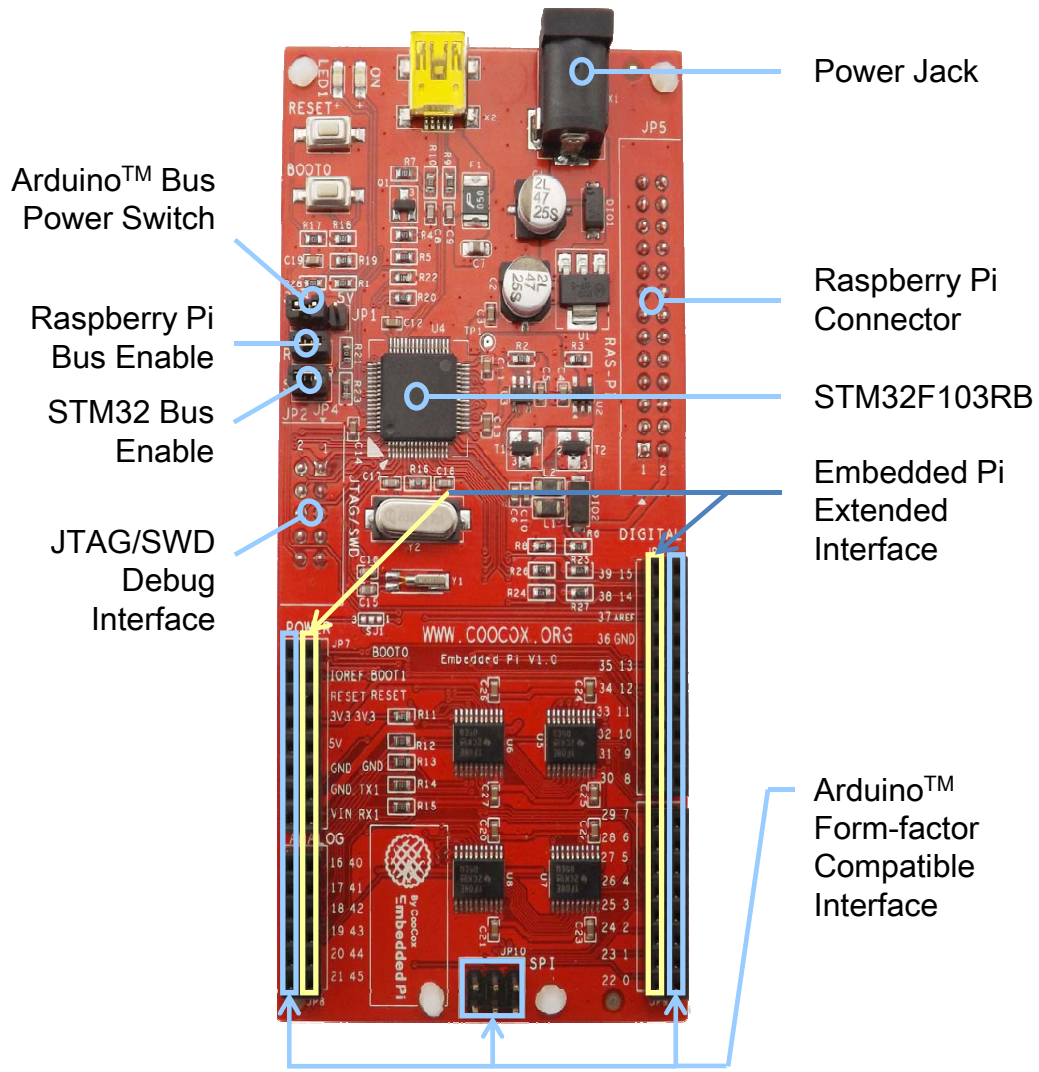
Features

- **Hardware open under CC BY-SA 3.0 license**
- **Fully compatible with Arduino, over 280 shields can be reused**
- **Types of 32-bit ARM Cortex MCUs available (M0/M3/M4/M0+)**
- **Work on both 3.3V and 5V**
- **Extended interfaces* beyond Arduino form-factor available**
- **CoLinkEx* (USB-JTAG/SW debug probe) onboard, Debug IN/OUT selectable with jumper**

* OPTIONAL



硬件平台建设—EPI



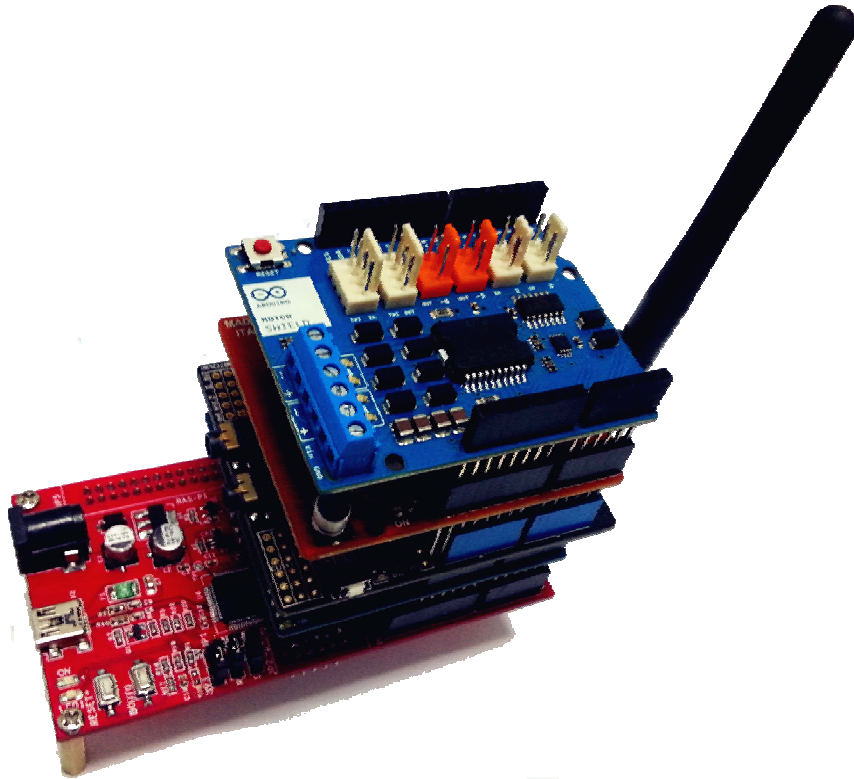
One board with multiple use

Depending on the jumper placement on the Embedded Pi, you can select each of the three modes of operation:

- **STM32/Standalone Mode**
An Arduino™ form-factor compatible mother board
- **ST-Adapter Mode**
An Arduino™ form-factor compatible mother board with Raspberry Pi working as the GUI
- **Raspberry Pi Mode**
A hardware connection bridge between Raspberry Pi & Arduino™ shields

All corresponding resources are available on CooCox website to help you get started quickly

硬件平台建设—EPI



A Cortex-M3 Arduino™ form-factor compatible mother board

Embedded Pi is an Arduino™ Uno form-factor compatible platform based on the STM32F103RB MCU, expandable with both 5V and 3.3V stackable Arduino™ shields, as well as a number of additional interfaces like ADC and CAN, taking full advantage of the power and functionality of STM32.



硬件平台建设—EPI

An ideal add-on for Raspberry Pi

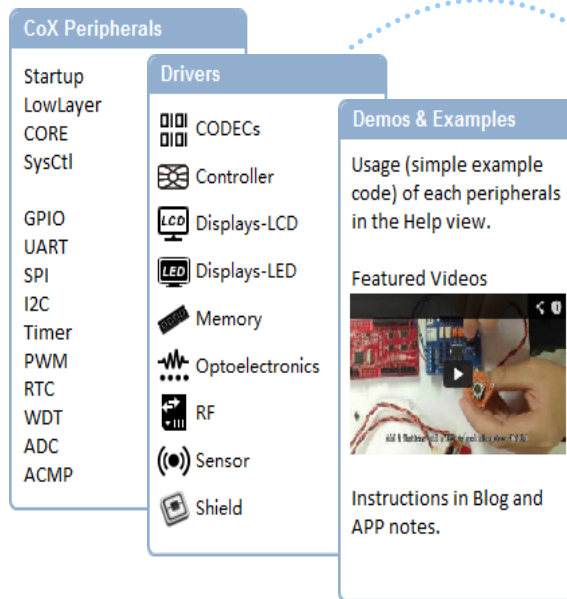
Embedded Pi provides your Raspberry Pi with easy access to 100+ Arduino™ shields on the market, allowing you to detect and respond to external physical events using the abundant sensors and actuators.



开发社区平台建设—CooCox

Free and easy tool for ARM development

Free and easy-to-use CoIDE is provided by CooCox for embedded development, integrated with “stackable” and reusable code components in C and detailed documents, allowing you to build a project for the STM32 in just a few seconds!



CoX Peripherals

- Startup
- LowLayer
- CORE
- SysCtl
- GPIO
- UART
- SPI
- I2C
- Timer
- PWM
- RTC
- WDT
- ADC
- ACMP


Drivers

- CODECs
- Controller
- Displays-LCD
- Displays-LED
- Memory
- Optoelectronics
- RF
- Sensor
- Shield

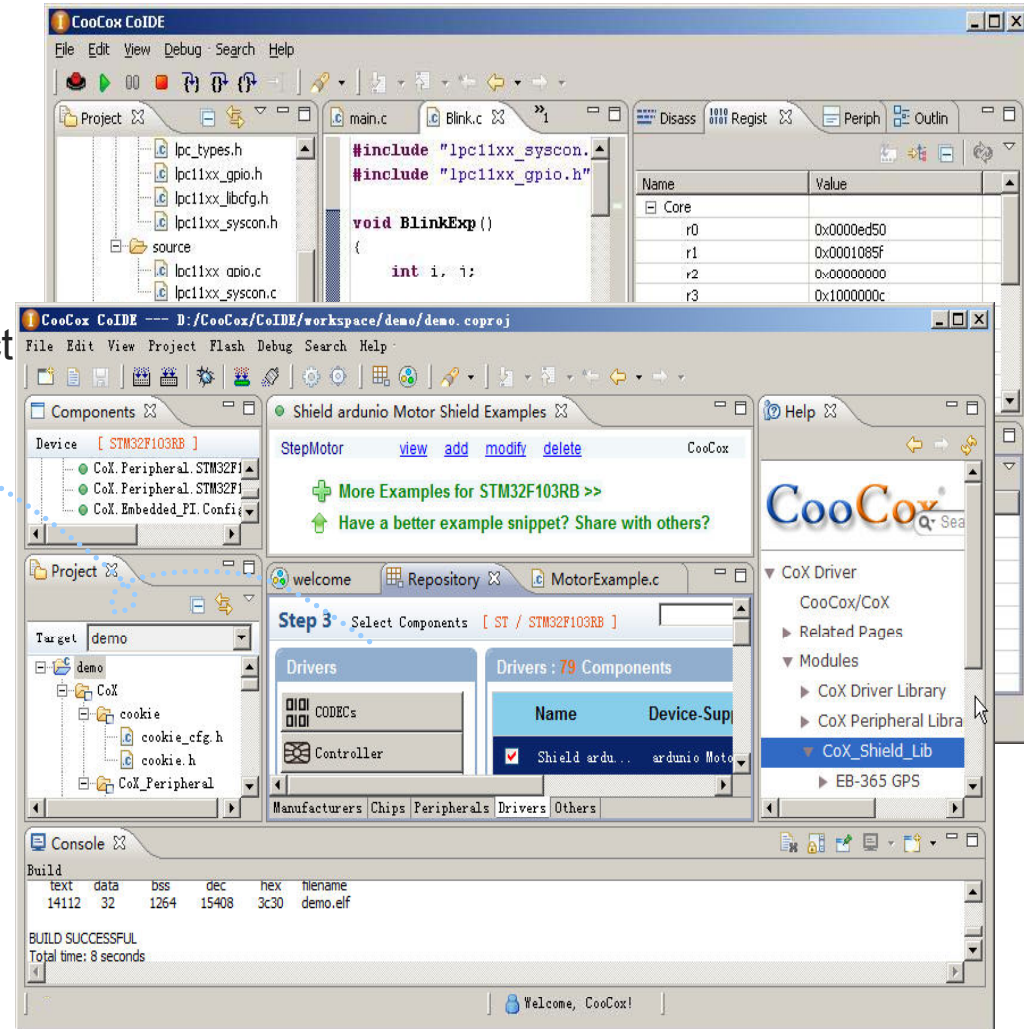
Demos & Examples

Usage (simple example code) of each peripherals in the Help view.

Featured Videos



Instructions in Blog and APP notes.



CooCox CoIDE

File Edit View Debug Search Help

Project: main.c Blink.c

```
#include "lpc11xx_syscon.h"
#include "lpc11xx_gpio.h"

void BlinkExp ()
{
    int i;
}
```

Core

Name	Value
r0	0x0000ed50
r1	0x0001085f
r2	0x00000000
r3	0x1000000c

Components

Device: [STM32F103RB]

- CoX_Peripheral_STM32F1
- CoX_Peripheral_STM32F1
- CoX_Embedded_PI_Config

Project: demo

Target: demo

Step 3: Select Components [ST / STM32F103RB]

Drivers: CODECs, Controller

Drivers: 79 Components

Name	Device-Supp
Shield ardu...	arduino Moto

Console

```
Build
text  data  bss  dec  hex  filename
14112  32    1264  15408  3c30  demo.elf

BUILD SUCCESSFUL
Total time: 8 seconds
```

Welcome, CooCox!



与物联网及Android教学结合



- Android实验箱
- Cookie板
- 无线通讯模块WiFi、Bluetooth、Zigbee
- 电机、灯、喇叭、开关、各种常见传感器



与物联网及Android教学结合

UP研发中心 实验室环境监测项目

实现了实验室办公环境温度等参数的实时监控，并且能够通过Web及Android移动端用户实时展示数据曲线等信息。

首页 | 项目介绍

用户名:
密码:

登陆 注册

温度 24.0°C
2013-10-27 11:49:32

温度 24.0°C
2013-10-27 11:49:32

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HOME 智慧家庭监控系统

实现了对家庭环境的远程采集、安防远程报警、灯光远程遥控等。

首页 | 项目介绍

用户名:
密码:

登陆 注册

环境监测

温度: 16°C
湿度: 49%
空气质量: 1052

安防系统

安防系统工作中, 没有检测到异常

灯光控制

客厅顶灯 卧室灯 婴儿房灯

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Arduino+MQTT+Xively(Pachube)



UP Team, Wuhan University of Technology

问题与困难

- 教材
- 内容多，学时少，实践少
- 软件、硬件能力如何平衡？
- 与嵌入式应用教学的结合





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Thanks !

Q&A



UP Team, Wuhan University of Technology