

Introduction to Microcontrollers

Pete Keefe

November 2018

Outline

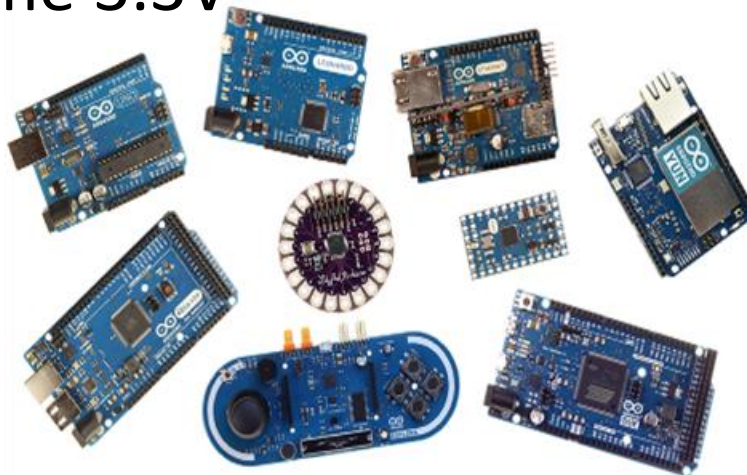
- Microcontroller – programmable to support single purpose. Inexpensive intro to computers and useful for automation.
- Arduino family of microcontroller boards
- Arduino Integrated Development Environment (IDE) installation
- IDE board type selection and examples
- Blink example
- ESP8266 family of microcontroller
- Add support to Arduino for ESP8266 boards
- IDE board type selection and examples
- ESP8266 Simple Web Server
- [esp8266-alexa-wemo-emulator](#)

Don't Panic!

- There are a lot of examples available already – most programmers learn from looking at examples*
- YouTube tutorial videos available on most topics for more info and how to's*
- Inexpensive way to experiment with “computers” and home automation*

Arduino Family

- Open Design easily programmable microcontrollers – many manufacturers of “non-official” boards
 - See <https://www.arduino.cc>
 - Usually no built in wifi support
 - 5V and some 3.3V



Arduino IDE

- IDE : Integrated Development Environment
- Free download from arduino.cc supports Windows, MAC, Linux
- Easy to install with lots of examples already added to IDE
- Select board type first

Arduino Programs

- Written in C like language
- Basic structure must be followed:
 1. *Optional declarations, definitions, inclusions*
 2. *void setup() {*
program instructions that run once at start
}
 3. *void loop() {*
program instructions that run over and over
}

Blink Example

- Using Arduino Uno
 - Gets power from USB connection to PC
 - Program is compiled (converted to bits & bytes) then downloaded to Uno
 - Once program loaded it stays even if power turned off
 - Once programmed can be powered by multiple sources
- Breadboard with jumper cables
 - allows for quick setup with soldering
 - Will use LED and resistor to limit current
 - Too much current could damage Uno and/or LED

Kits Make Good Learning Tools

- i.e., [Uno Super Starter Kit](#)
 - Inexpensive
 - No soldering
 - Step by step videos

ESP8266 Family

- First model available 4 years ago to be used to add wifi support to other
 - First model required separate USB programming interface module
- Quickly re-used for standalone work
 - Built in wifi radio
 - Faster processor and more memory than Uno
 - Multiple programming languages supported
 - Programming support & example added to Arduino IDE
 - Many new models



Adding ESP8266 to Arduino IDE

- Start Arduino and open Preferences window.
- Enter http://arduino.esp8266.com/stable/package_esp8266com_index.json into *Additional Board Manager URLs* field.
- Open Boards Manager from Tools > Board menu and find *esp8266* platform.
- Select the version you need from a drop-down box.
- Click *install* button.
- Don't forget to select your ESP8266 board from Tools > Board menu after installation.
- See board selection & examples

ESP8266

- Demo uses NodeMCU DevKit 1
 - 2015/6 originally designed for LUA program development
 - ESP8266-12E 4MB uses 3.3v (regulated down from 5v on USB)
 - Widely used with Arduino IDE
- 1st: Examples/ESP8266WebServer/HelloServer
 - Must supply my routers SSID & password
 - Led on pin D1
 - Access via web (using IP address)
- 2nd: ESPEasy 2.0 pre-built image has been preloaded
 - https://www.letscontrolit.com/wiki/index.php/Main_Page
 - Initially comes up as router access point (AP), connect wifi to “router” and then open browser to 192.168.4.1
- Other pre-built images emulate devices (Wemo, Philips, etc) so that they allow direct access by Alexa devices, Samsung SmartThings Hub, or other home automation smart speakers and hubs
 - i.e., [Wemo emulator](#)

What Next?

- ? Raspberry Pi – inexpensive (\$5 to \$35) microcomputer
 - Add screen & keyboard = equivalent to laptop from 2005+
 - uses
 - Python ?
 - Node-RED ?
- ? openHab
 - Very flexible software that can replace hardware hubs
 - Can run on any Windows, MAC, Linux machine (i.e., Raspberry Pi)
 - Interfaces with smart speakers (Alexa, ...)
 - Improved dramatically in past three years
- And always looking for presenters or suggestions