VIRTUAL COURSE
BUILD YOUR OWN DATA LOGGER

WILDLABS.NET
[ The conservation technology network ]
MODULE 1-2A
UNDERSTAND THE FULL DESIGN STACK - HARDWARE
Device Design Stack

Device (data logger)

- Physical Hardware
  - Libraries & Drivers
  - Application
    - Data to SD card
      - internet via wireless, cellular
        - Data into database
Device Design Stack

- Physical Hardware
- Libraries & Drivers
- Application
- Device (data logger)

- Data into database
- Data to SD card
  internet via wireless, cellular
Physical Hardware

Enclosure

WildLogger Board
Circuit Board
Microcontroller
Memory
Power

Plus other components & circuitry

Peripherals
WildLogger - DH11 Sensor
WildLogger - PIR Motion Sensor

Accessories
WildLogger - Battery case
Peripherals

- Interface with the real world

Send information (data) as
- an input (sends data to circuit board) eg. sensors, microphone
- an output (receives data from circuit board) eg. speakers
- both eg. LCD

- Data is sent or received in analogue or digital format
Accessories

- connect to the circuit board
- passive, no ‘active parts
- battery cases, antennas, solar panels
Circuit Board

Controls the device

1) How peripherals connect and interact with the circuit board, (ports and interfaces, input / output pins)

2) Circuit Board
Central Processing Unit (CPU)
MCU versus MPU
Memory
Power

Circuit Board

CPU
Memory
Power

plus other components and circuitry
Ports / Interfaces

- physically connects peripheral, accessory or other hardware to circuit board
- used interchangeably eg. serial interface, serial port
- USB Dongle connects to serial interface and downloads code
- I2C is a common interface used to connect LCD and other sensors

Sensor interfaces eg. for temp/humidity, infrared proximity, photoresistor for light sensing, microphone module
Input /Output (I/O) Pins

- Connect peripherals to circuit board
- Send or receive info in digital or analogue format
- Connect digital peripherals to digital pins
- Connect analogue peripherals to analogue pins

Analogue Pins

Digital Pins

Arduino Uno R3 Pinout
Input /Output (I/O) Pins

**Analog Signal**
- High (3.3 volts)
- Values between ok

**Digital Signal**
- High (3.3v) on
- Low (0 Volts) off
- Values between rounded up or down
Input /Output (I/O) Pins

• In our code, we use pin number to access and control the hardware

Example Code

The code makes the digital pin 13 **OUTPUT** and Toggles it **HIGH** and **LOW**

```c
void setup() {
  pinMode(13, OUTPUT);  // sets the digital pin 13 as output
}

void loop() {
  digitalWrite(13, HIGH); // sets the digital pin 13 on
  delay(1000);            // waits for a second
  digitalWrite(13, LOW);  // sets the digital pin 13 off
  delay(1000);            // waits for a second
}
```
Input /Output (I/O) Pins

On WildLogger

- using digital sensors and pins
- allocated the pin number for you
Circuit Board

Microcontroller
- central processing unit (CPU)
- memory
- peripherals (I2C, ADC)

PLUS other components and circuitry
- power distribution, voltage management
- controls peripherals
- storage
- communications
- realtime clock / calendar

Microcontroller
- CPU
- Memory
- Peripherals

plus other components and circuitry that’s application dependent
Block Diagram

- diagram of the system showing the key parts and functions, and how they’re connected to each other
Microcontroller versus Microprocessor

**MCU = Microcontroller**

- CPU
- Memory
- Peripherals

** MPU = Microprocessor**

- For computers such as laptops and desktops
- Multiple, complex applications
- Less structured i/o interactions
- External memory, power
- Higher cost
- Higher power consumption

- Simpler applications / devices such as data logging
- Has defined, specific i/o interactions
- Executes code quickly, quick start up time
- Lower cost
- Lower power consumption
Central Processing Unit (CPU)

- brains of the system
- within the microcontroller

Function
- takes input (eg. data from sensor)
- stores input in memory
- requests instructions from memory on how to process the data
- processes the data & saves results in memory
- when finished processing, sends data as output as per instructions
COMING UP - 1-2B
UNDERSTAND THE FULL DESIGN STACK - HARDWARE