Arduino Workshop – Advanced with Arduino

(This workshop is longer then the regular 1.5 hour -> 2hour maybe longer)

Components of Kit:

- Arduino Uno with Cable
- Breadboard (30 pin)
- Ultrasonic Sensor (HC-SR04)
- Temperature and Humidity Sensor (DHT11)
- LCD display
- MotorShield
- DC motor
- DC Servo
- Relay

*One common lightbulb holder AC circuit

The main purpose of this workshop is to become more familiar with the variety of sensors and different outputs. These are more complicated then the basic Arduino. The basic Arduino workshop is required as a pre-requisite to this workshop. If someone hasn't done that workshop or has no experience they will come across a few difficulties.

*DO NOT spend too long covering the first few slides as most are already fairly familiar with arduinos

Libraries

- Explain the use of libraries as a method to simply coding
- Explain that some sensors may have specific libraries
- There will be a download package available to everyone on Makerepo
- Show how to install all the necessary libraries for this workshop
    - Temp and humidity library
    - LCD library (already installed)
    - Motor shield library

LCD Display (NOT IMPLEMENTING SHOW HOW ITS DONE BUT WE WILL BE USNG SERIAL MONITOR)

Once this is wired up use the example code for hello world to describe how the LCD is interfacing.

- Make it an ongoing activity to try and implement the information from sensors onto this screen instead of the information being sent to the serial monitor

LCD §

```
#include <LiquidCrystal.h>// includes the LiquidCrystal Library

LiquidCrystal lcd(1, 2, 4, 5, 6, 7); // Creates an LC object. Parameters: (rs, enable, d4, d5, d6, d7)

void setup() {
 lcd.begin(16,2); // Initializes the interface to the LCD screen, and specifies the dimensions (width and height) of the display }

}
void loop() {
  |
 lcd.print("Arduino"); // Prints "Arduino" on the LCD
 delay(3000); // 3 seconds delay
 lcd.setCursor(2,1); // Sets the location at which subsequent text written to the LCD will be displayed
 lcd.print("LCD Tutorial");
 delay(3000);
 lcd.clear(); // Clears the display
 lcd.blink(); //Displays the blinking LCD cursor
 delay(4000);
 lcd.setCursor(7,1);
 delay(3000);
 lcd.noBlink(); // Turns off the blinking LCD cursor
 lcd.cursor(); // Displays an underscore (line) at the position to which the next character will be written
 delay(4000);
 lcd.noCursor(); // Hides the LCD cursor
 lcd.clear(); // Clears the LCD screen
}
```

Ultrasonic Sensor

- Echo pin will send ultrasonic wave
- It will determine how much time it has taken for the trig pin to then hear the echo
- Use these values to compute the actual distance of the sensor from obstacle

Ultrasonic §

```
// defines pins numbers
const int trigPin = 9;
const int echoPin = 10;

// defines variables
long duration;
int distance;

void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  Serial.begin(9600); // Starts the serial communication
}
void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);
// Calculating the distance
distance = duration*0.034/2;
// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
}
```

Temperature and Humidity Sensor

- Very simple to setup will display the information clearly in the serial monitor
- This implements a library in order to function
    - Explain how the library allows use of DHT function
    - If this wasn't included, you would need to code all the specific functions

Temp

```
#include <dht.h>

dht DHT;

#define DHT11_PIN 7

void setup(){
  Serial.begin(9600);
}

void loop()
{
  int chk = DHT.read11(DHT11_PIN);
  Serial.print("Temperature = ");
  Serial.println(DHT.temperature);
  Serial.print("Humidity = ");
  Serial.println(DHT.humidity);
  delay(1000);
}
```

Arduino Shields (Motor Shield)

- Explain its purpose in that you can only do one motor with a Arduino standalone
- This allows you to connect multiple motors and have easy control over them using the library code
- Explain the library code using the motorparty or motor test code found in the examples

MotorParty

```
// Adafruit Motor shield library
// copyright Adafruit Industries LLC, 2009
// this code is public domain, enjoy!

#include <AFMotor.h>
#include <Servo.h>

// DC motor on M2
AF_DCMotor motor(2);
// DC hobby servo
Servo servo1;
// Stepper motor on M3+M4 48 steps per revolution
AF_Stepper stepper(48, 2);

void setup() {
  Serial.begin(9600);           // set up Serial library at 9600 bps
  Serial.println("Motor party!");

  // turn on servo
  servo1.attach(9);

  // turn on motor #2
  motor.setSpeed(200);
  motor.run(RELEASE);
}

int i;

// Test the DC motor, stepper and servo ALL AT ONCE!
void loop() {
  motor.run(FORWARD);
  for (i=0; i<255; i++) {
    servo1.write(i);
    motor.setSpeed(i);
    stepper.step(1, FORWARD, INTERLEAVE);
    delay(3);
 }

  for (i=255; i!=0; i--) {
    servo1.write(i-255);
    motor.setSpeed(i);
    stepper.step(1, BACKWARD, INTERLEAVE);
    delay(3);
 }
```

Relay (no library)

- To show how we can interact with devices that run on AC power source (wall)

- Allows you to make “smart” devices that can control your appliances
- Can be combined with other sensors to then turn on and off a circuit
- They are essentially very powerful on and off switches

Relay

```
//KY019 5V relay module

int relay = 10; // relay turns trigger signal - active high;

void setup ()
{
  pinMode (relay, OUTPUT); // Define port attribute is output;
}
void loop ()
{
  digitalWrite (relay, HIGH); // relay conduction;
  delay (1000);
  digitalWrite (relay, LOW); // relay switch is turned off;
  delay (1000);
}
```

SMART Device

- Use imagination to combine some of the sensors and outputs to form some kind of smart device