

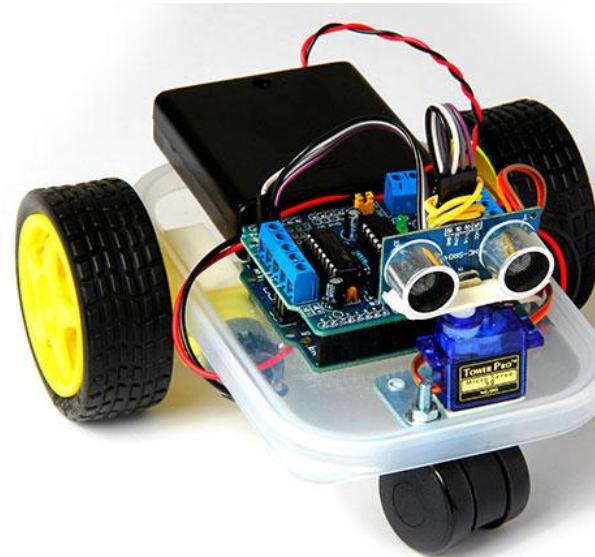


EP486 Microcontroller Applications

Topic 6

Step & Servo Motors

**Joystick & Water
Sensors**



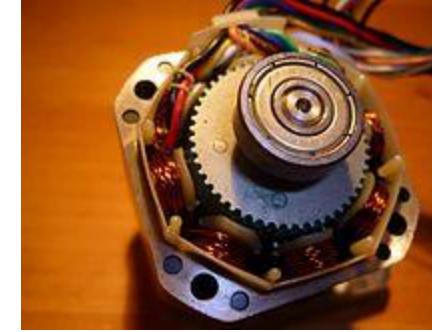
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Engineering Physics**

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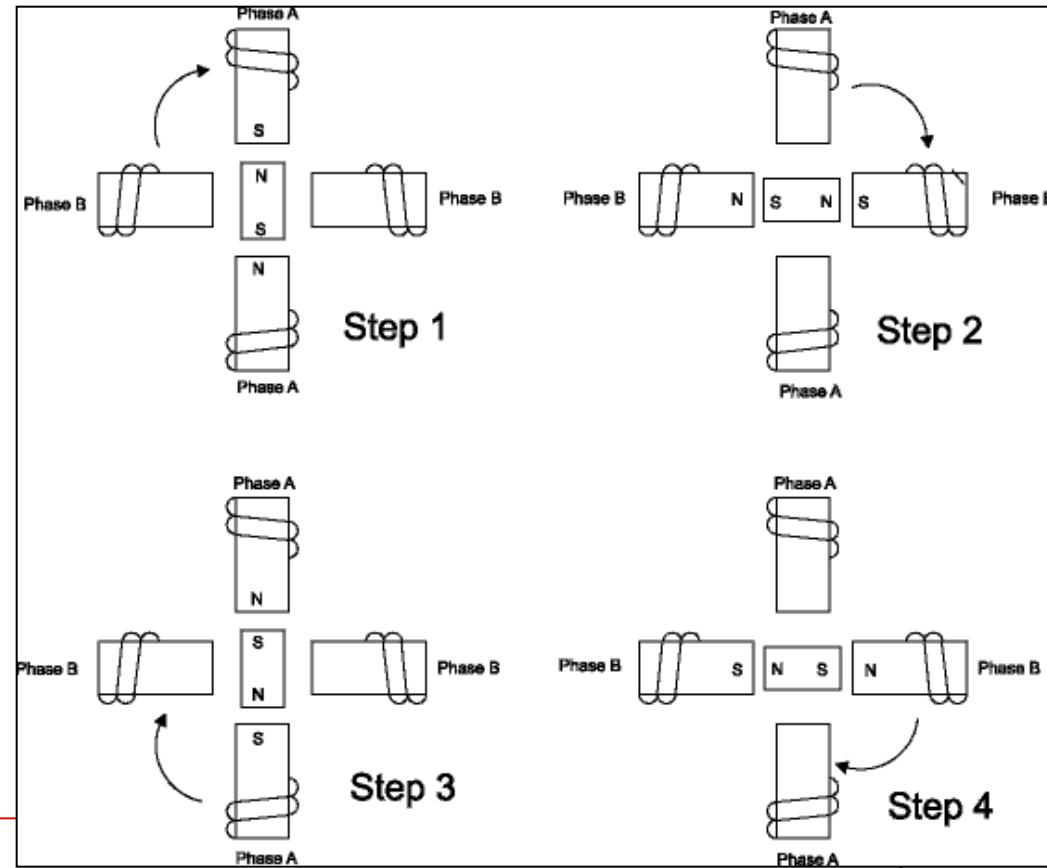
Step Motor

http://en.wikipedia.org/wiki/Stepper_motor



A stepper motor (or step motor) is a brushless DC electric motor that divides a full rotation into a number of equal steps.

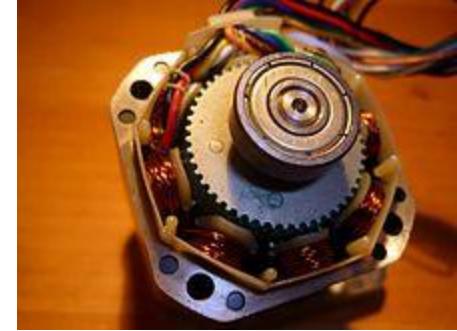
The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor.



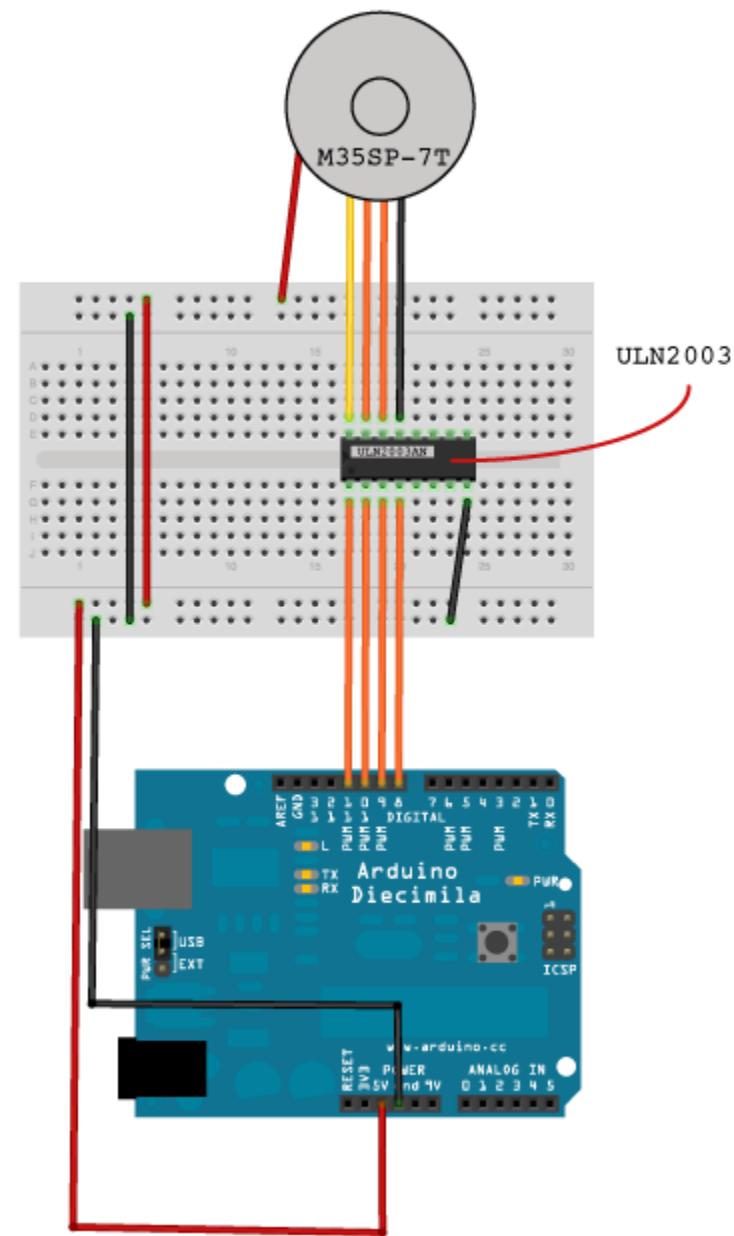
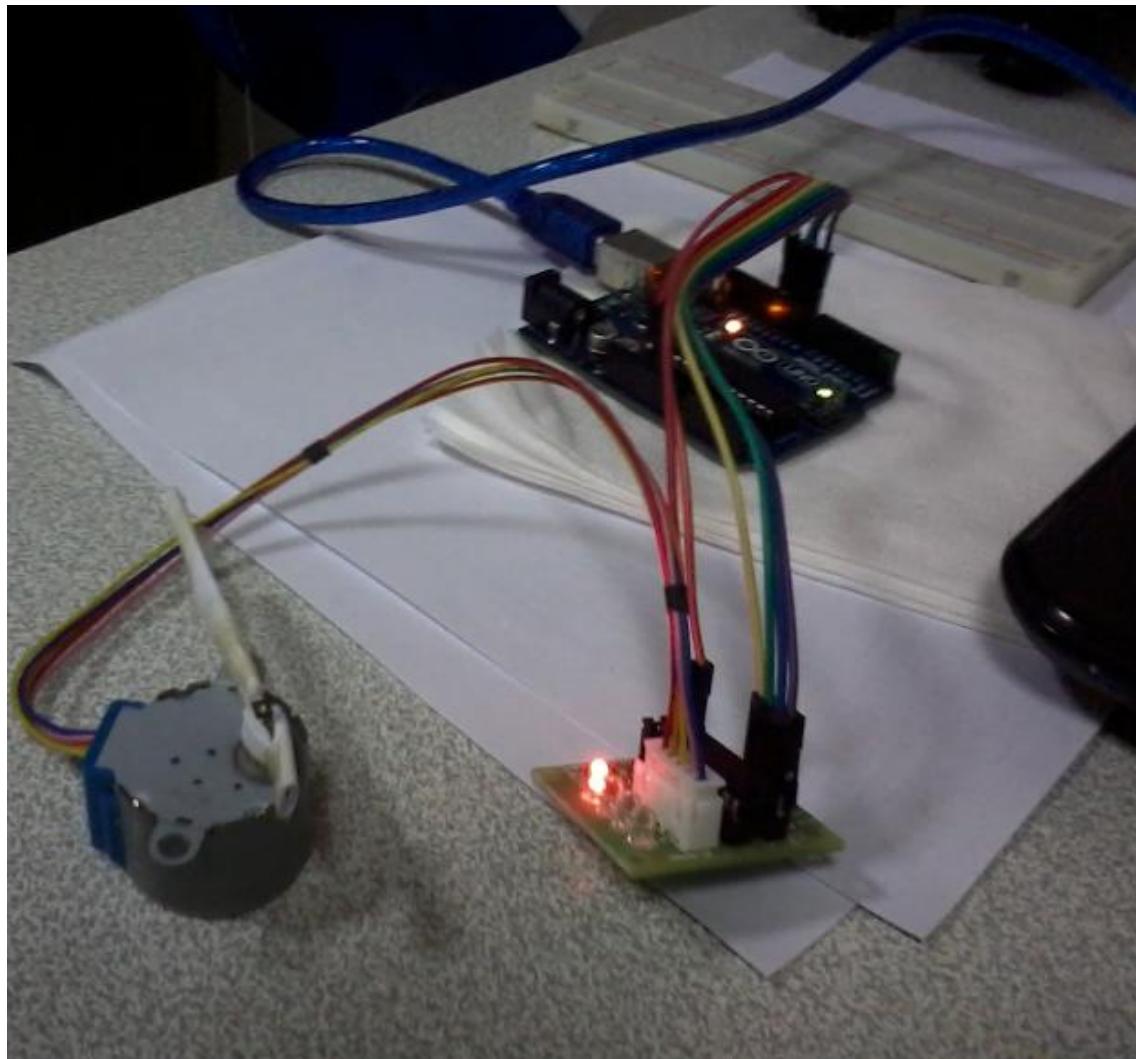
Step Motor

- There are two types of steppers, Unipolars and Bipolars.
- It is very important to know which type you are working with:
<http://www.tigoe.net/pcomp/code/circuits/motors/stepper-motors>
- Stepper motors can be driven by transistors or (as in our case) by an ULN2003 integrated circuit.
- Our step motor has 64 steps per one revolution.
That is the angular resolution is:

$$\Theta(\text{min}) = 360^\circ / 64 = 5.625^\circ$$



Step Motor (circuit)



Step Motor (code)

```
int motorPin1 = 8;
int motorPin2 = 9;
int motorPin3 = 10;
int motorPin4 = 11;
int delayTime = 50;

void setup() {
    pinMode(motorPin1, OUTPUT);
    pinMode(motorPin2, OUTPUT);
    pinMode(motorPin3, OUTPUT);
    pinMode(motorPin4, OUTPUT);
}

// . . .
```

```
void loop() {
    digitalWrite(motorPin1, HIGH);
    digitalWrite(motorPin2, LOW);
    digitalWrite(motorPin3, LOW);
    digitalWrite(motorPin4, LOW);
    delay(delayTime);

    digitalWrite(motorPin1, LOW);
    digitalWrite(motorPin2, HIGH);
    digitalWrite(motorPin3, LOW);
    digitalWrite(motorPin4, LOW);
    delay(delayTime);

    digitalWrite(motorPin1, LOW);
    digitalWrite(motorPin2, LOW);
    digitalWrite(motorPin3, HIGH);
    digitalWrite(motorPin4, LOW);
    delay(delayTime);

    digitalWrite(motorPin1, LOW);
    digitalWrite(motorPin2, LOW);
    digitalWrite(motorPin3, LOW);
    digitalWrite(motorPin4, HIGH);
    delay(delayTime);
}
```

Step Motor Library

<http://arduino.cc>

```
/* The turns of a potentiometer (or other sensor) on analog input 0 are
used to control the movement of a stepper motor while using the Arduino
Stepper Library.*/
#include <Stepper.h>
// change this to the number of steps on your motor
#define STEPS 100
// create an instance of the stepper class, specifying
// the number of steps of the motor and the pins it's attached to
Stepper stepper(STEPS, 8, 9, 10, 11);
// the previous reading from the analog input
int previous = 0;

void setup(){
    // set the speed of the motor to 30 RPMs
    stepper.setSpeed(30);
}

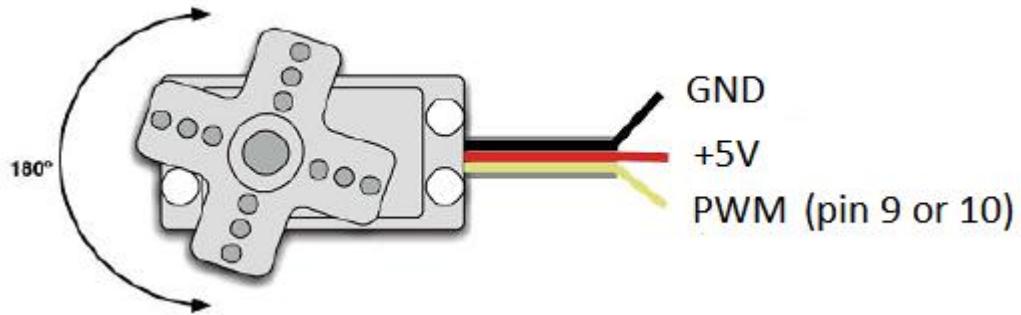
void loop(){
    // get the sensor value (potentiometer)
    int val = analogRead(0);
    // move a number of steps equal to the change in the sensor reading
    stepper.step(val - previous);
    // remember the previous value of the sensor
    previous = val;
}
```

Servo Motor

<http://en.wikipedia.org/wiki/Servomotor>



A servomotor is a rotary actuator that allows for precise control of angular position, velocity and acceleration.



This library allows an Arduino board to control
Simply servo motors.

Standard servos allow the shaft to be positioned at
various angles, usually between 0 and 180 degrees.

Functions:

attach()

write()

writeMicroseconds()

read()

attached()

detach()

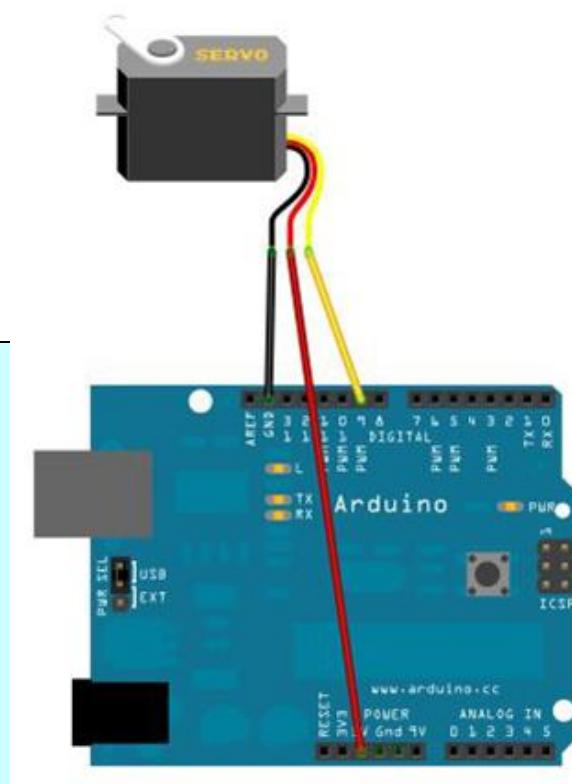
Servo Motor Library (code)

```
#include <Servo.h>

Servo myservo;

void setup () {
  // only digital pin 9 or 10 are available
  myservo.attach(9);
}

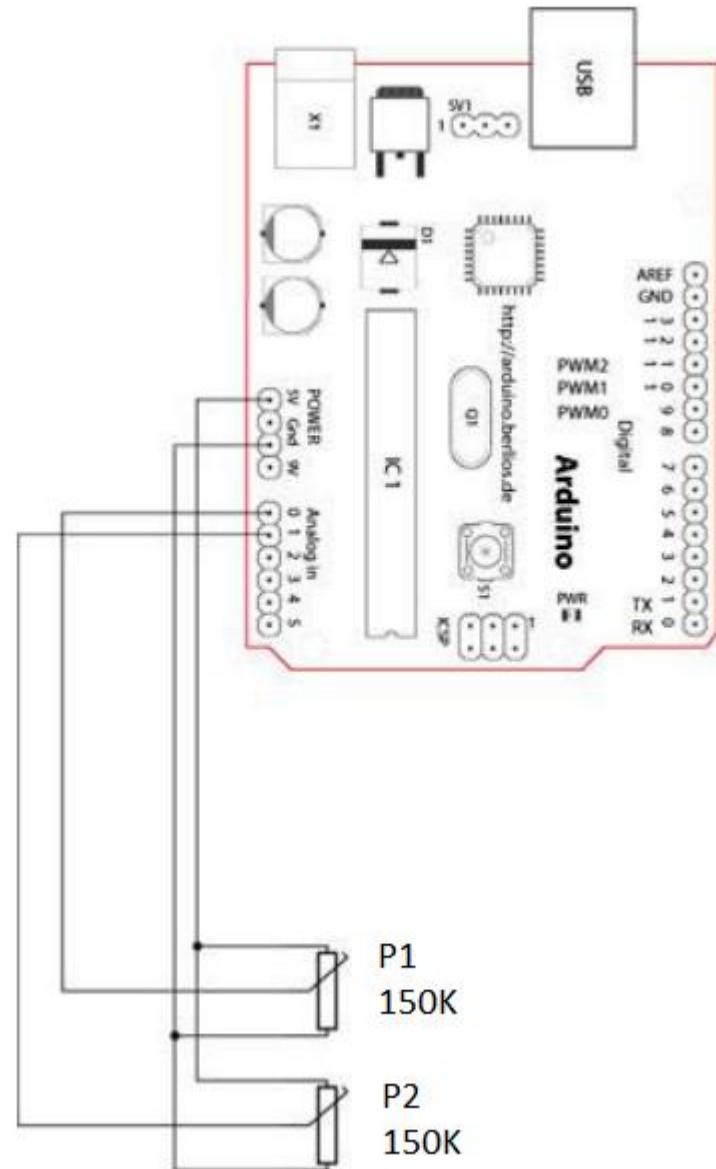
void loop () {
  myservo.write(0);    delay(1000); // rotate 0 deg
  myservo.write(45);  delay(1000); // rotate 45 deg
  myservo.write(90);  delay(1000); // rotate 90 deg
  myservo.write(135); delay(1000); // rotate 135 deg
  myservo.write(180); delay(1000); // rotate 180 deg
}
```



Game joystick axis sensor module

A simple joystick is a system consisting of two potentiometers and a button switch.

X-Y : 2-axis analog output,
Z : 1 digital output channel button.

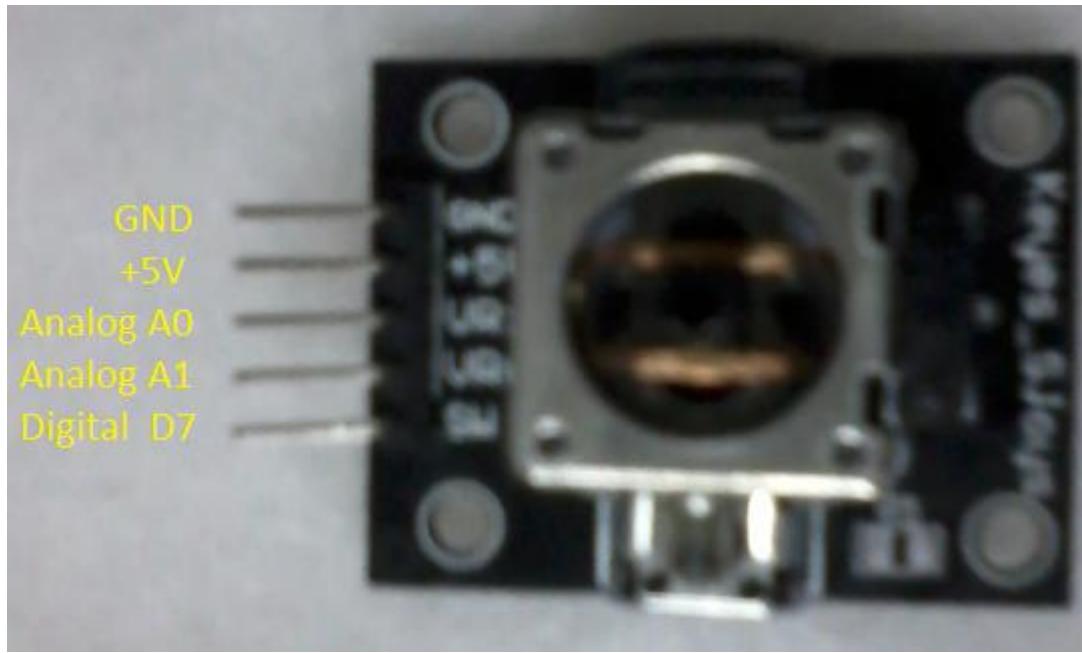


Game joystick axis sensor module (code)

```
// VRx <---> A0
// VRy <---> A1
// SW  <---> D7
int value = 0;
void setup () {
    pinMode (7, INPUT);
    Serial.begin(9600);
}
void loop () {
    value = analogRead (A0);
    Serial.print ("X= ");
    Serial.print (value);

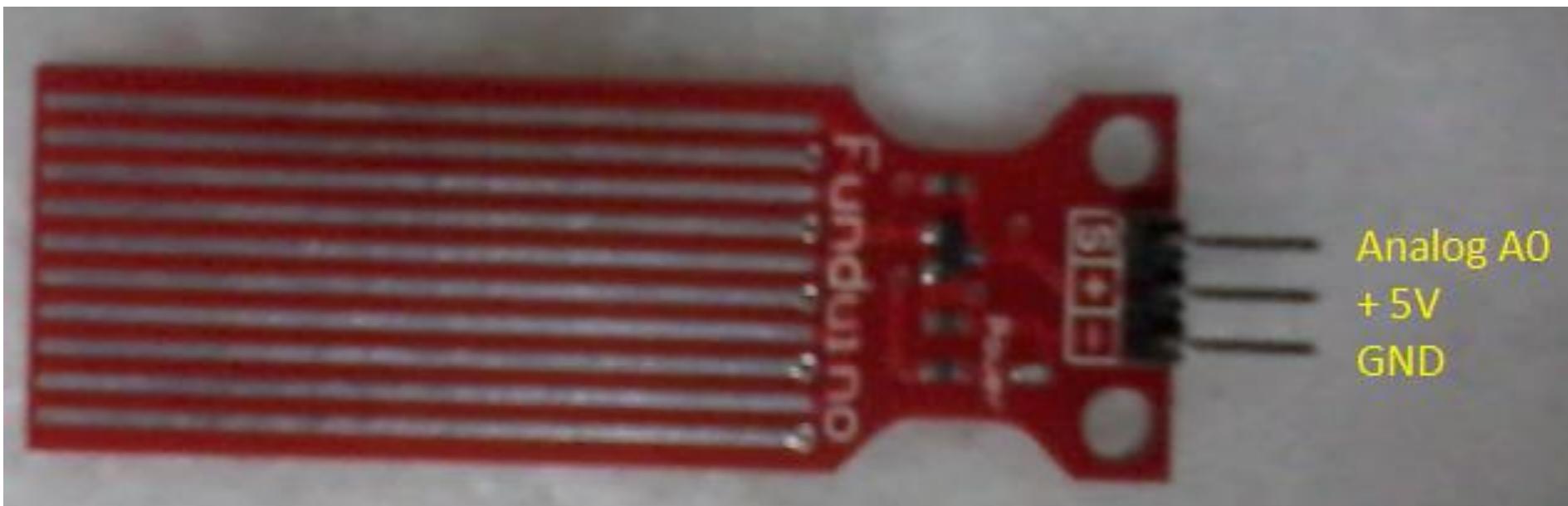
    value = analogRead(A1);
    Serial.print (" | Y=");
    Serial.print (value);

    value = digitalRead (7);
    Serial.print (" | Z= ");
    Serial.println (value);
    delay (100);
}
```



Water Sensor Module

This is basically measures amount of water droplets exposed through a series of parallel wires.



Water Sensor Module



Water Sensor Module (code)

```
// level sensor connected A0
int analogPin = A0;
int led = 13;
int value = 0;

void setup (){
    pinMode (led, OUTPUT);
    Serial.begin (9600);
}

void loop (){
    value = analogRead(analogPin);
    if (value> 300) digitalWrite (led, HIGH);
    else           digitalWrite (led, LOW);

    Serial.println (value);
    delay (100);
}
```