HOW TO CONTROL SERVOMOTORS WITH POTENTIOMETER BY USING UNOARDUSIM V2.2 SOFTWARE FOR ROBOTIC SYSTEM

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Abstract

Servomotor can be controlled by potentiometer with UnoArduSimV2.2 software which consists of a circuit board and can be referred to as a microcontroller and a ready-made software called Arduino IDE which used write and upload the computer code to the physical board and it consists of many I/O devices, we can use inside in it. In this experiment, servo can be connected directly to an Arduino. This arduino can be controlled by four Potentiometer attached to it, each potentiometer is used to control each servo. When we turn the potentiometer, we got the analog value first, after converting this analog value to digital value, we got the degree how to turn the servo with. So we can use these servos by rotating the pots to pick and move the object from one place to another in robotic system. We will connect the power and ground pin directly to the Arduino 5V and GND pins. The PWM input will be connected to one of the Arduino's digital output pins for servos and analog pins for potentiometer. After writing the sketch, compile, upload button and we can run my work inside in this software.

Keywords: Arduino, Arduino IDE, Servomotors.

Introduction

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment). The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. Download the Arduino IDE ,ARDUINO 1.8.7 , This software can be used with any Arduino board. And for this project, I just only apply by using UnoArduSimV2.2software and its UnoArduSimV2,2.exe software. Because this software can be used without any external hardware but it can write, read and run easily on it.

Servomotors can be connected directly to an Arduino which is an open source based on an easy - to - use hardware and software. Arduino compiler/IDE accepts C and C++ as-is. In fact many of the libraries are written in C++. We use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Arduino Uno

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. Arduino is development platform for developers. It is fairly easy to interface different sensors and actuators with arduino, which makes it quite attractive because it is a small computer on a single chip containing a processor, memory, and input/output. Typically "embedded" inside some device that they control. A microcontroller is often small and low cost.

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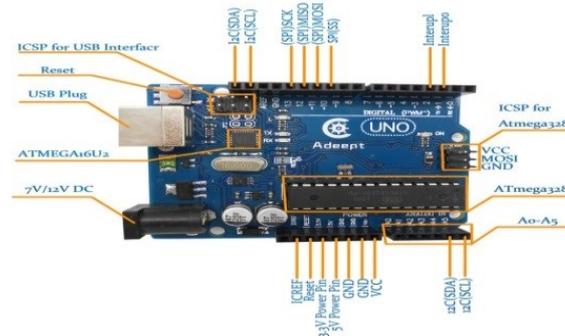
Figure 1 Photographic view of Arduino uno board

Table 1 Arduinouno Technical specifications

Sr No	Specifications	
1	Microcontroller	- ATmega 328
2	Operating voltage	- 5Volts
3	Input voltage	- 7volts to12volts (Recommended)
4	Digital I/O Pins	- 14 (out of which 6 pin provide PWM output)
5	Analog input pins	- 6
6	DC current for I/O Pin	- 40mA
7	DC current for 3.3 volt	- 50mA
8	Pin	- 32 kilo bytes of which 0.5 kB used bybootloader
9	Flash memory	- 2 kilo bytes
10	SRAM	- 1 kilo bytes
11	EEPROM Clock speed	- 16MHz

Servomotor

Servomotor is an electrical device which can push or rotate an object with great precision. If we want to rotate and object at some specific angles or distance, then we can use servomotor. Servomotors are used to control the position of objects, rotate objects. move legs, arms or hands of robots, move sensors etc, with high precision. Servomotor is controlled with the help of servomechanism. Inside a servo there is a small DC Motor, Potentiometer and Control Circuit. The motor is attached gears to the control wheel. A servo system mainly consists of three components namely a controlled device, an output sensor and a feedback system.

Figure 2 The image of a Servomotor

Inside a servomotor there is a small DC motor, potentiometer and a control circuit. The motor is attached by gears to the control wheel.

Figure 3 The internal devices of a servomotor

Methodology
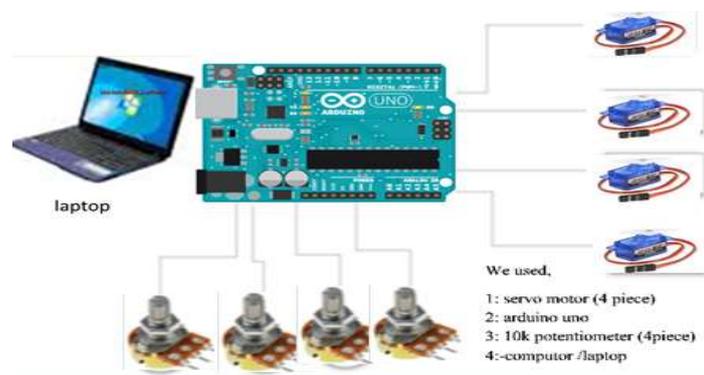
Figure 4 The block diagram of my circuit system

Figure (4) show the block diagram representing for the robotic arm. The components here used arduino uno board, servomotors, potentiometers (pot, variable resistors) and computer. If we want to rotate and object at some specific angle or distance, then servomotor can use to control the position of objects, rotate objects, move legs, arms or hands of robots, move sensors etc, with high precision. Servomotor is controlled with the help of servo mechanism. Inside a servo there is a small DC Motor, Potentiometer and Control Circuit. The motor is attached gears to the control wheel. A servo system mainly consists of three components namely a controlled device, an output sensor and a feedback system. The robotic arm is controlled by four potentiometer that is used to control each servo. We can move these servos by rotating the potentiometer to pick some object and move the object from one place to another. We used small servomotor which has more powerful to pick heavy object.

Components

| servomotor | Arduino Uno | Potentiometer | laptop |
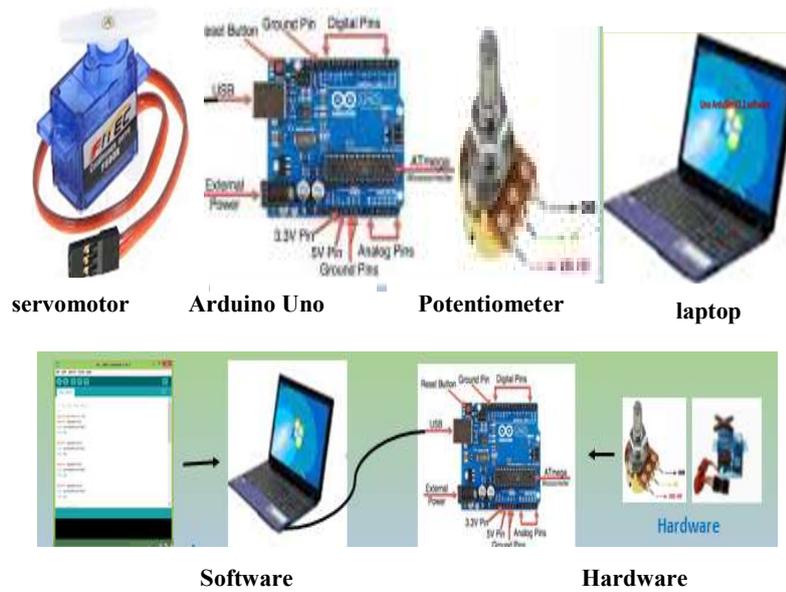
Software   Hardware

Figure 5 The connecting system of arduino with hardware and software

Controlling system for servomotor

Servomotors can be connected directly to an Arduino. This Arduino can be controlled by four Potentiometer attached to it, each potentiometer is used to control each servo. Servo motors are available at different shapes and sizes. We used small servo motors, here we used four servos. Now we got the voltage provided by these variable resistor (voltage which represents position control) into ADC channels of Arduino. We are going to use four ADC channels of UNO from A0 to A3 for this. After the ADC initialization, we will have digital value of pots representing the position needed by user. We will take this value and match it with servo position.
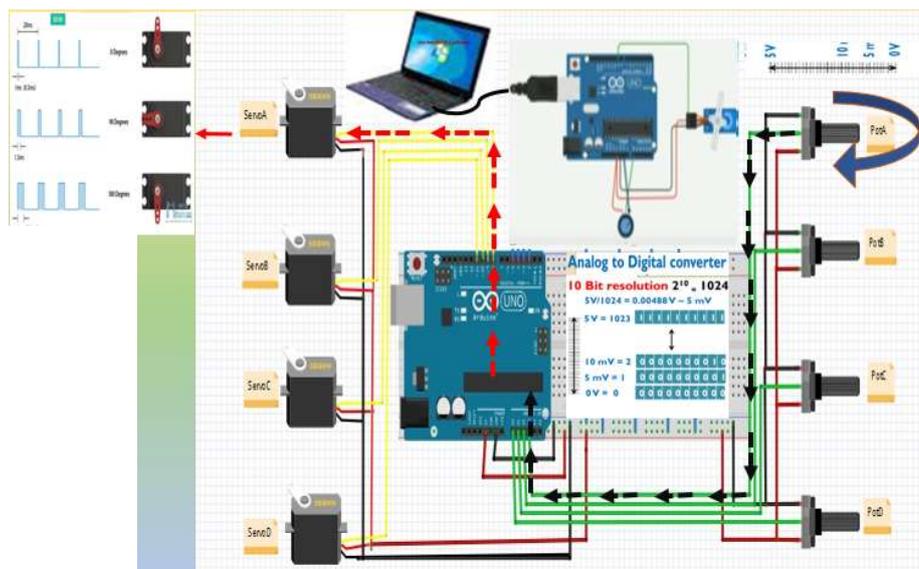
Figure 6   Circuit diagram of the processing system

The library for servomotor

I have created a servo object and declared the initial angle of the servomotor.

- After that I have adjust the rate, the rate at which Arduino communicates with the laptop/computer.

- Then I have defined the pin at which the servo motor is attached to the Arduino UNO's board.

- Inside the main loop, I have applied the condition that in between 0 and 180 degrees, the servomotor's angle will be increased with different steps and each step has 5 degrees of angular movement.

- When maximum limit is reached, the angle will be reduced from 180 to 0 degree with different steps, each step having 5 degrees of angular movement.

- Arduino has six ADC channels. We have used four for our Robotic. The UNO ADC is of 10 bit resolution so the integer values ranging from 0-1023 (2^10=1024 values). This means that it will map input voltages between 0 and 5 volts into integer values between 0 and 1023. So for every (5/1024= 4.9mV) per unit. Learn more about mapping the voltage levels using ADC channels in Arduino here.

- That was the brief description of the Arduino complete source code designed for Servo Motor Control using Arduino.

Source Code Description

- The complete Arduino source code for Servo Motor Control using Arduino is given below.

- By uploading the source code to Arduino board we will be able to control the servo motor using Arduino.

- Once the program is started, rotating the potentiometer should cause the shaft of the servo motor to rotate.

When we write the sketch,

/* Servo Motor Control using the Arduino servo library

　　　　By　Dr Oak Kar Shin

　*/

```
#include<Servo.h>      // Servo Library
Servo myservo1;        // initialize a servo object for the connected servo
int potenPin1=A0;      // initialize the A0 analog pin for potentiometer
int w;                 // let the potentiometer value
Servo myservo2;
int potenPin2=A1;
int x;
Servo myservo3;
int potenPin3=A2;
int y;
```

```
Servo myservo4;
int potenPin4=A3;
int z;
void setup()
{
myservo1.attach(3);// attach the signal pin of servo the pin 3 of arduino
myservo2.attach(5);
myservo3.attach(6);
myservo4.attach(9);
}
void loop()
{
// put our main code here,to run repeatedly:
W=analogRead(potenPin1);     // this will read the value from the potentiometer
                             between 0 and 1023 and store it

W= map(w,0,1023,0,180);       // this will map the value from the    potentiometer
                             to values the servos can use and store it for later se
myservo1.write(w);           // these will make the servos move to the mapped
                             angles
delay(15);                   //wait for 1 ms
  x=analogRead(potenPin2);
  x= map(x,0,1023,0,180);
  myservo2.write(x);
delay(15);
  y=analogRead(potenPin3);
  y= map(y,0,1023,0,180);
  myservo3.write(y);
delay(15);

z = analogRead(potenPin4);
  z= map(z,0,1023,0,180);
myservo4.write(z);
delay(15);

}
```

Results and Discussion

When I use this software, I can choose I/O devices what I need to control, then they are connected with the circuit and write the sketch and run inside this software. In my project, these all servos are attached with the digital pin 3,5,6 and 9 of the arduino circuit and the 4 potentiometer are connected with the analog pinA0-A3. After connection, I wrote the sketch what I want to control. In this here, we connect with computer and circuit. when I turn the potentiometer, the 0-5V will come out from the arduino circuit. So this voltage flow from the potentiometer to the arduino IC pass through the analog pin. This analog value are converted to digital value which make the servo how will turn as shown in figure 6. So I got the analog value of potentiometer and the digital value. When I used this Uno ArduSimV2.2 software (7.a), I can

choose 4 servomotor and 4 analog slider (potentiometer)and tick USB Serial to show connection the computer whit this program from the box of Attaced I/O devices , after choosing I pressed ok key from (7,b). So we get the figure (7.c).
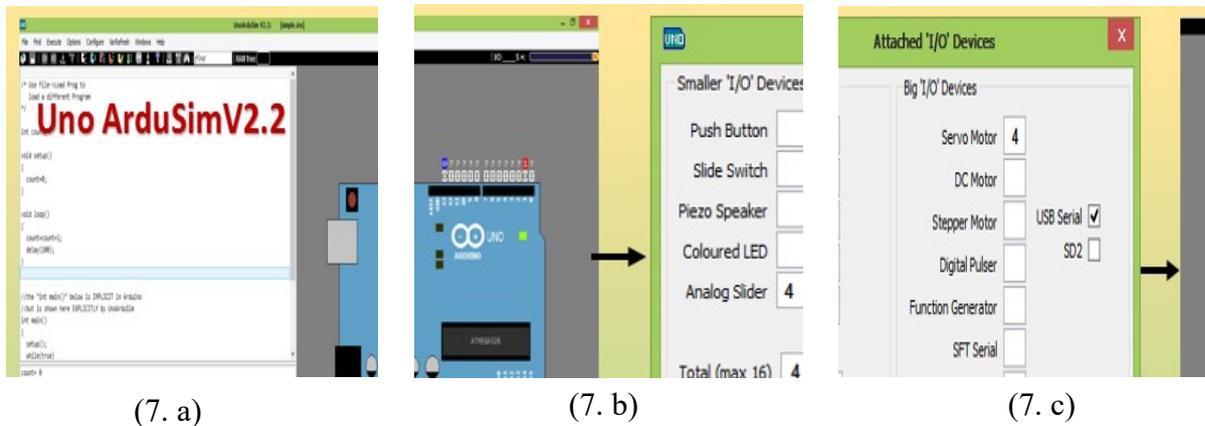
(7. a)   (7. b)   (7. c)

Figure 7 The usage of the uno ardusim V2.2 software

Connection system and its simulation

Figure 8 The connecting system of circuit and devices

This Figure (8)shows the connection of the arduino digital pin 3,5,6,9 and 4 servomotors (1,2,3,4) and then 4 potentiometer are attached with analog pin of arduino (A0 –A3).
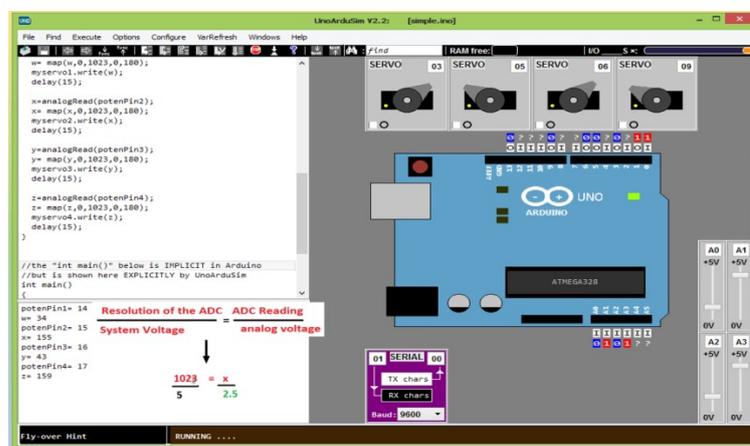
Figure 9 The result of the value and degree for servo

This Figure (9) represents when I turn the slider with different value, firstly we got the analog value which were convered as digital value by ATMEGA328 Arduino IC. So servomotor will rotate any degree according to the digital value.

Analog to Digital converter equation is

```
.ogRead(potenPin4);
(z,0,1023,0,180);
o4.write(z);
15);
```

```
.nt main()" below is IMP  CIT
```


Figure 10   The input area of UnoArduSimV2.2 software

When I write the sketch, we can write the program what you want to control in this edit/View box of figure (10).
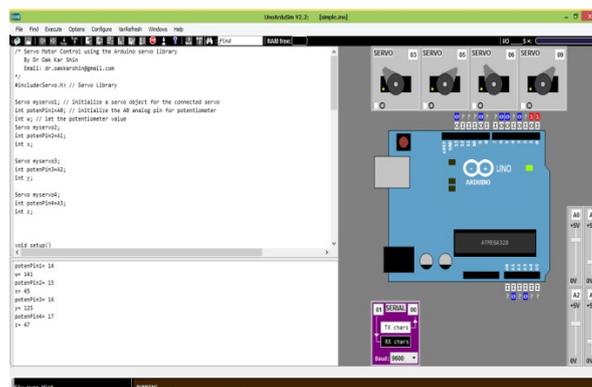
Figure 11   The output area of UnoArduSimV2.2 software (Getting and running)

When I run the sketch, we can run the program how I want to control the servomotor by turning the potentiometer (slider) in this box of figure (11).
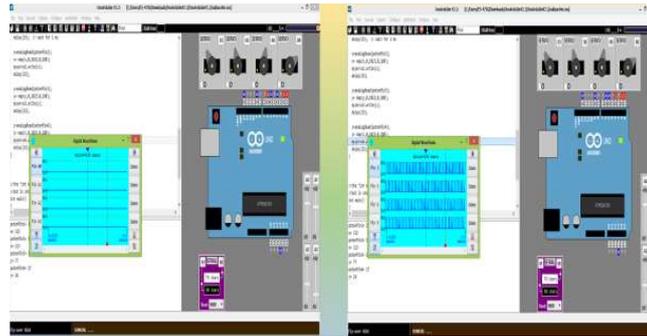
Figure 12   The waveform of analog pins and digital pins input

Getting up and running

Plug it into the USB port and install the USB drivers that come with the IDE. Open up the Arduino IDE and select the communication speed for serial connections. And by using the pot means by rotating the pot which changing its voltage value will change the servo angular rotation.
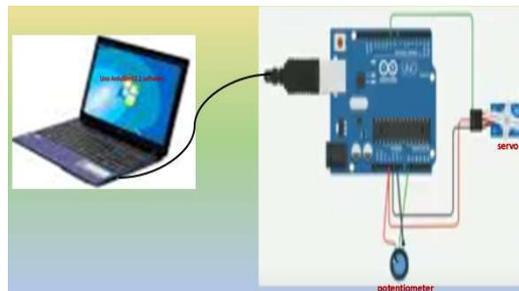
Figure 13   Running system of Arduino software

Conclusion

Servomotors are small in size, and because they have built-in circuitry to control their movement, they can be connected directly to an Arduino. Servomotor works on PWM(Pulse width Modulation)principle, means its angle of rotation is controlled by the duration of applied pulse to its control PIN. DC motor of servo which is controlled by a variable resistor (potentiometer and some gears). This Arduino can be controlled by four Potentiometer attached to it, each potentiometer is used to control each servo. So we can move these servos by rotating the pots to pick some object, with some practice we can easily pick and move the object from one place to another. We have used low torque servos here but we can use more powerful servos to pick heavy object. This proposed work is an overview of how we can use the Servomotors can to control the position of objects, rotate objects, move legs, arms or hands of robots, move sensors, etc , which is controlled by using potentiometer and Arduino UNO.

Acknowledgement

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http://www.arduino.cc/playground/Learning/SingleServoExample Additional descriptions of servos

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