

Developing WiFi IoT ESP8266-Arduino Based Devices

DAY 4 : Wireless Servo Motor Controller

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Don Wilcher

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Course Kit:

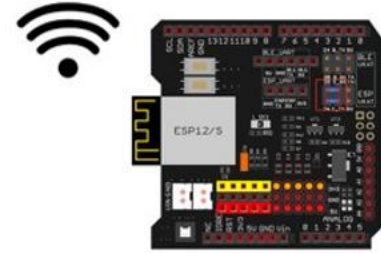


Agenda:

- Servo Motor Basics
- Basic Servo Motor Controllers and Circuits
- Osoyoo ESP8266 Arduino Kit Overview
- Lab: Wireless Servo Motor Controller



Internet of Things :



“ The Internet of Things (IoT) is a concept in which the virtual world of information technology integrates seamlessly with the real world of thing.” (Uckelman, Harnson & Michahelles, 2011, p.2).

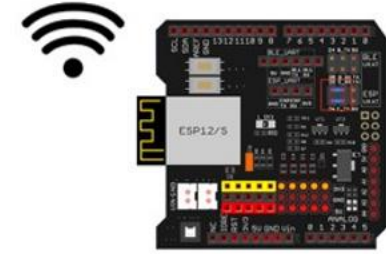
Servo Motor Basics

What is a Servo Motor?

- a) Closed-loop servomechanism
- b) An electromechanical component that uses position feedback to control:
 - i. it's motion
 - ii. final position
- c) input Digital or Analog control signals are used to operate the output shaft appropriately.



Servo Motor Basics



What is a Servo Motor?

d) Can be controlled more precisely than DC motors

e) They have three wires

i. Vsupply

ii. Gnd

iii. Control

Question 1

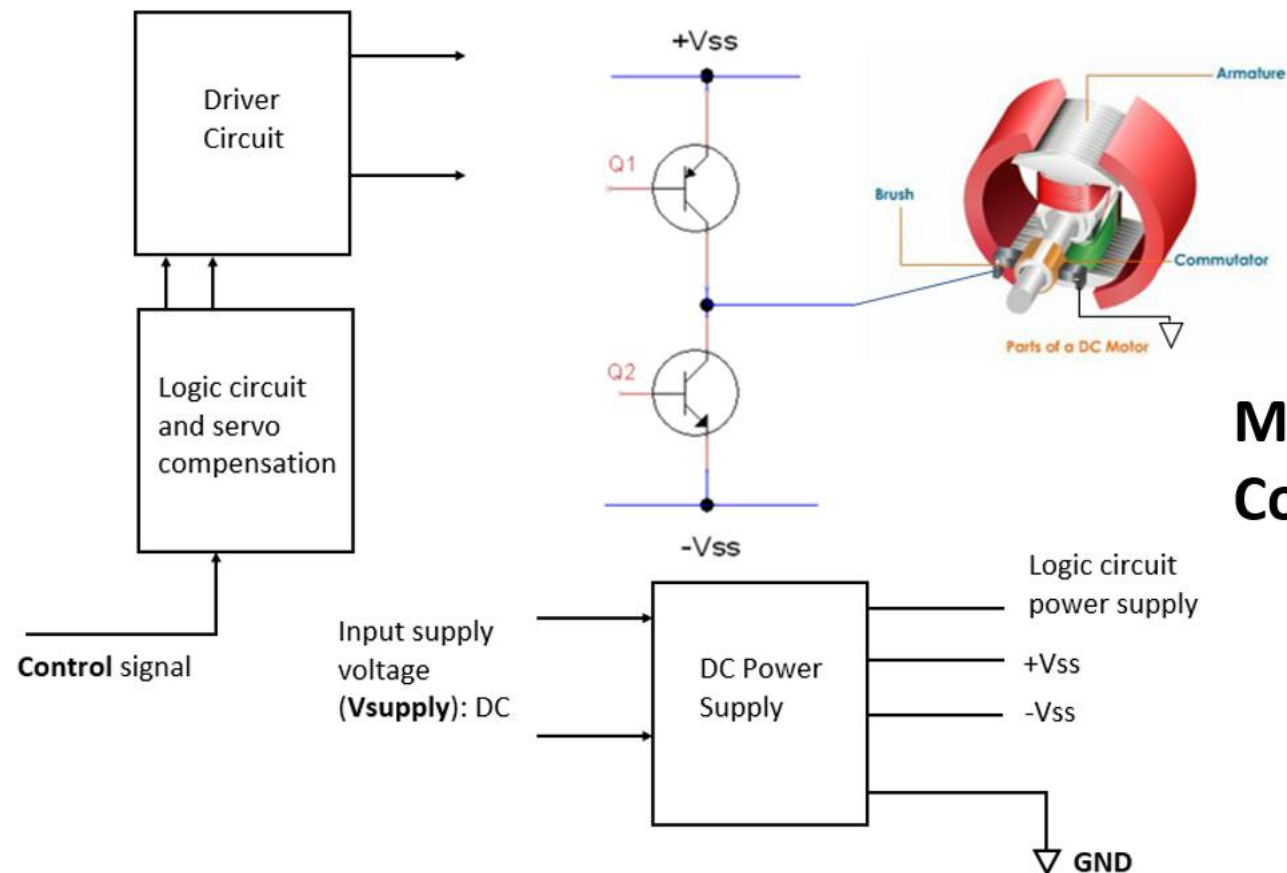
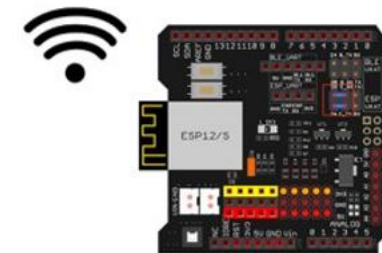
A servo motor is_____

- a) a closed-loop servomechanism**
- b) an open-loop servomechanism**
- c) an electromechanical component that does not use position feedback**



Servo Motor Basics ...

What is a Servo Motor?

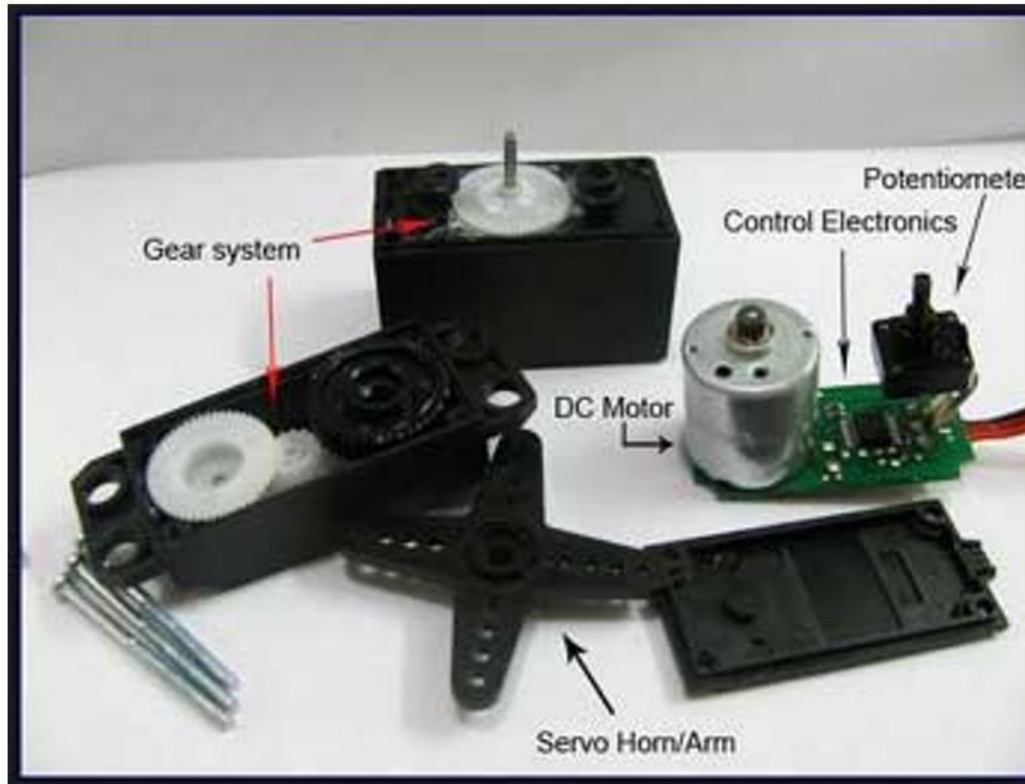
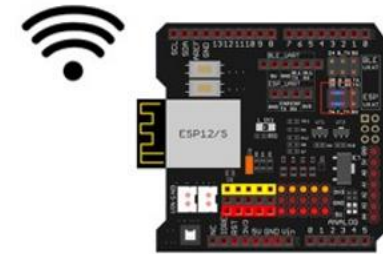


**Main Parts of Servo Motor:
Control Electronics**

Servo Motor Basics ...

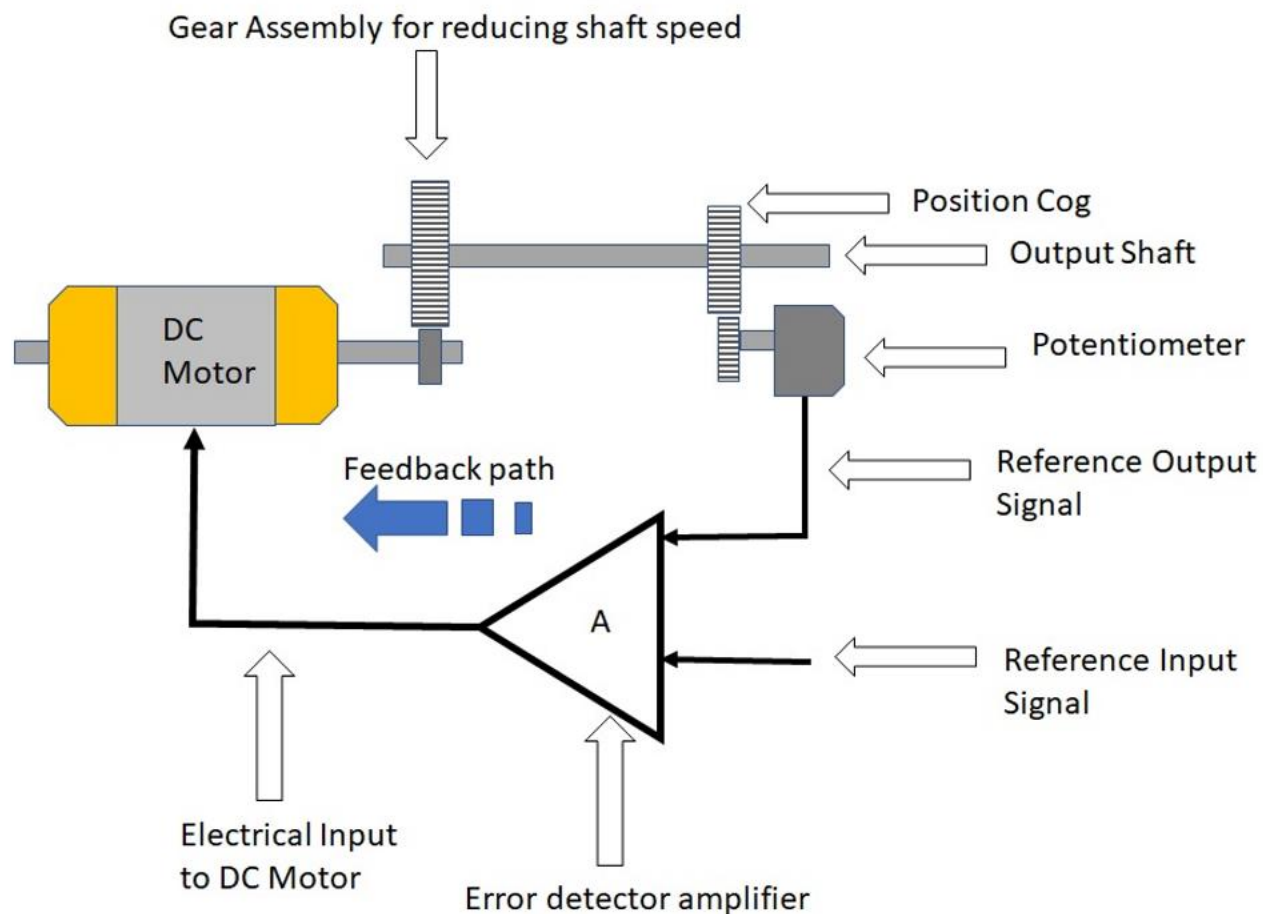
What is a Servo Motor?

Main Parts of Servo Motor: Control Electronics and Mechanicals

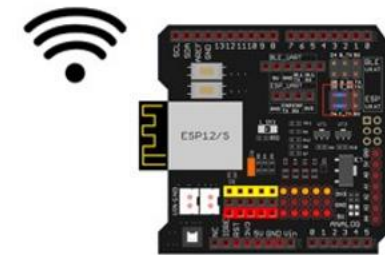


Servo Motor Basics ...

What is a Servo Motor?



Servo Motor Functional Block Diagram



Question 2

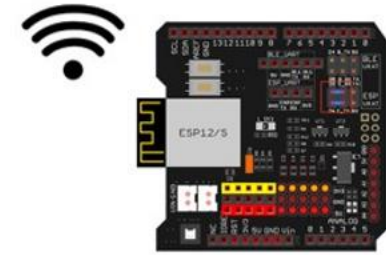
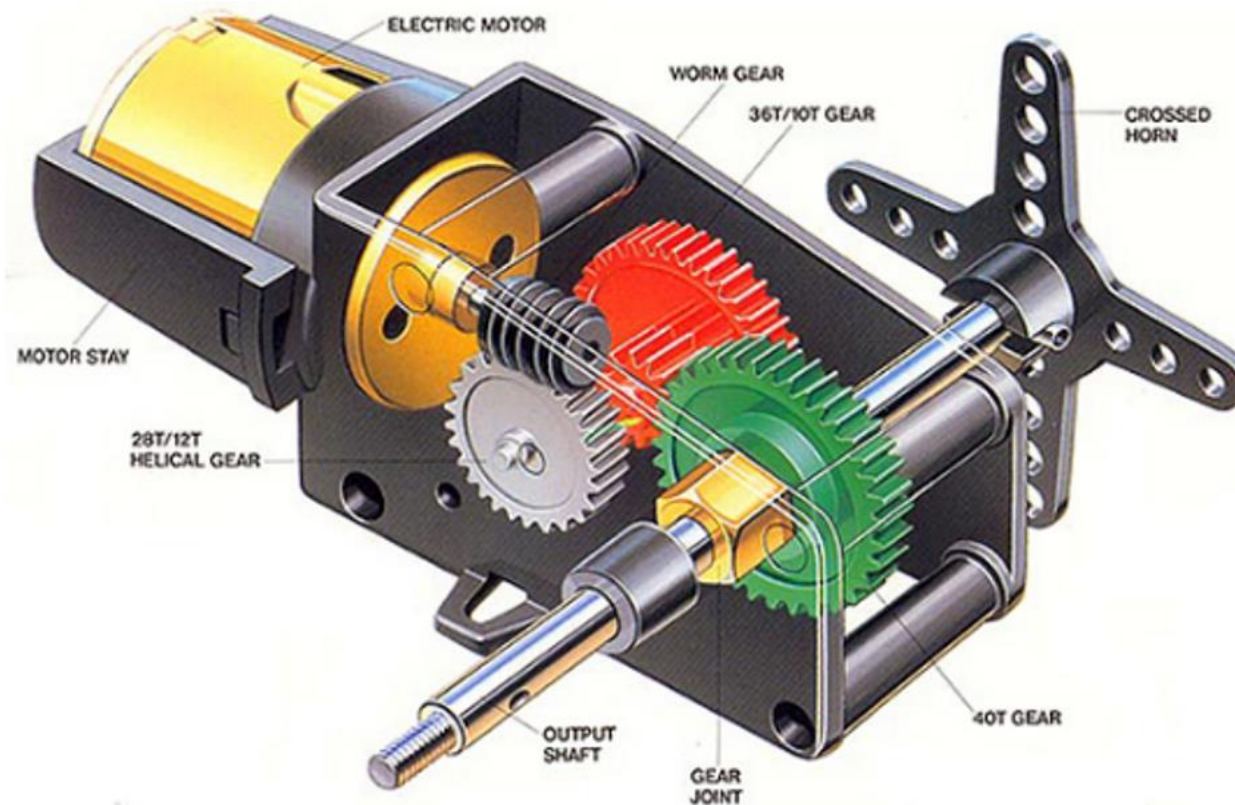
On slide 12, what circuit is used to detect errors?

- a) a difference amplifier**
- b) an error detector amplifier**
- c) a summing amplifier**



Servo Motor Basics ...

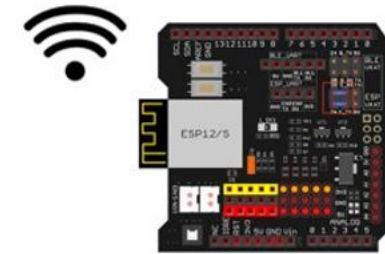
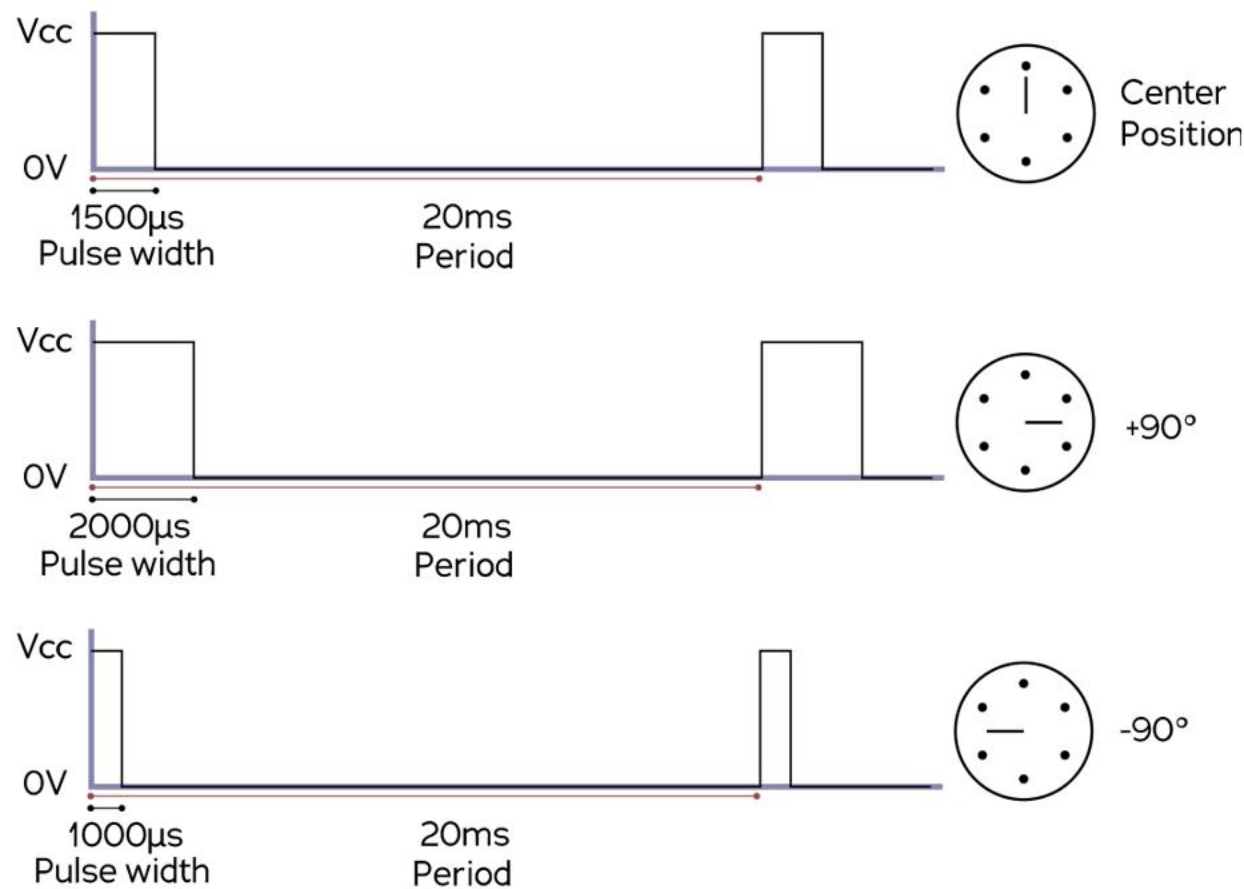
What is a Servo Motor?



Main Parts of a Servo Motor: Mechanical Parts

Servo Motor Basics ...

What is a Servo Motor?



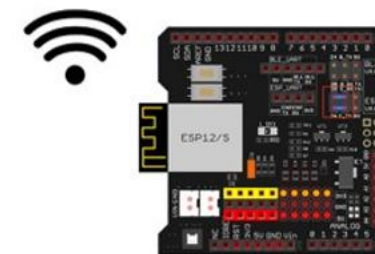
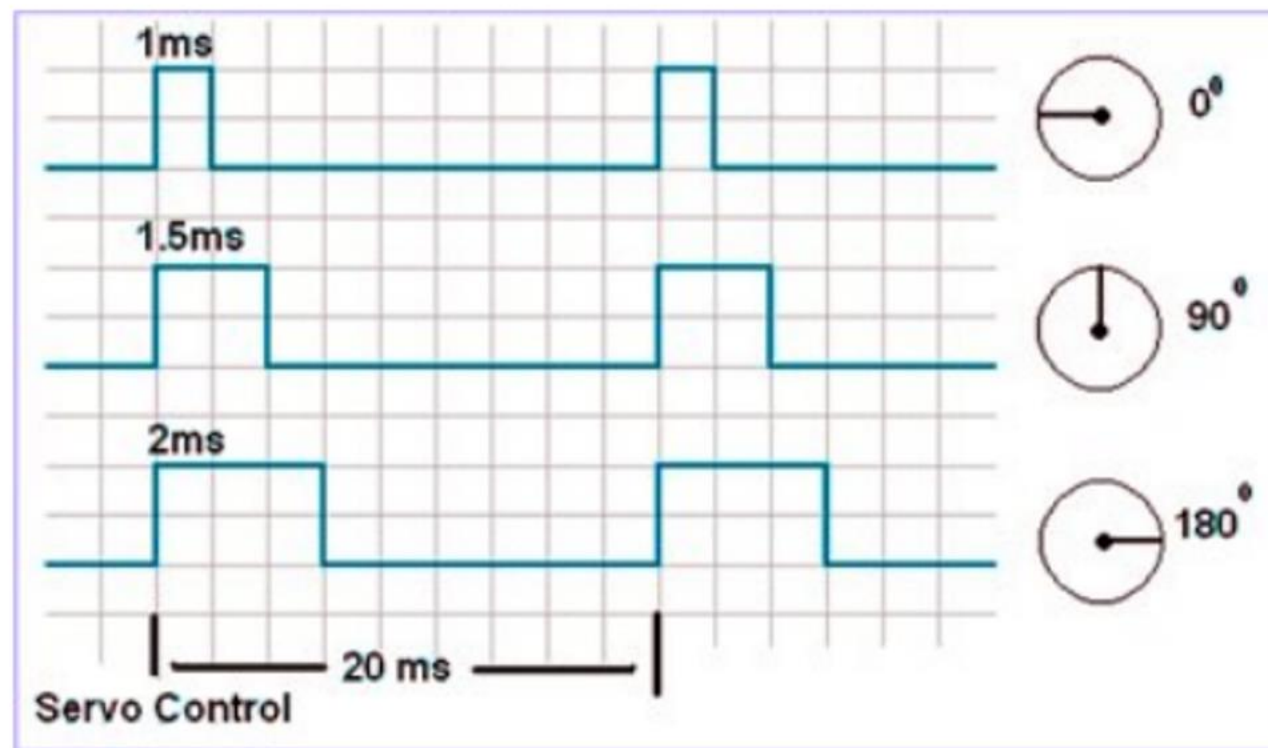
Typical Pulse Width Modulation (PWM) Timing Diagram for Servo Motor

Source:

https://en.wikipedia.org/wiki/Servo_control

Servo Motor Basics ...

What is a Servo Motor?

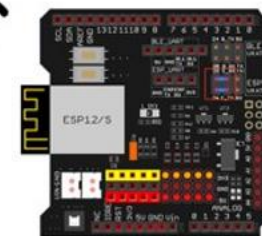


**Typical Pulse Width
Modulation (PWM)
Timing Diagram for
Servo Motor**

Source: https://www.circuitlib.com/index.php/schematics/product/107-basic-servo-motor-controller/category_pathway-35

Variety of Servo Motors

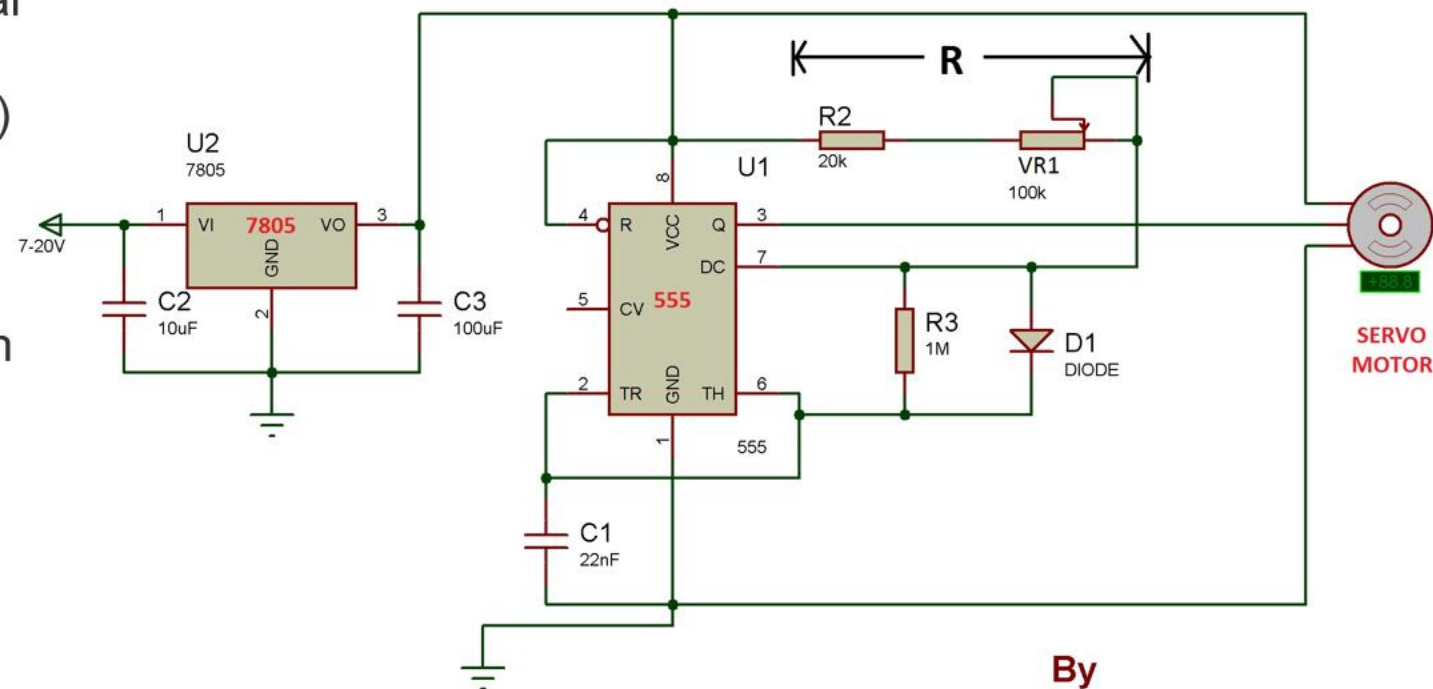
Servo Motor Basics ...



Basics Servo Motor Controllers and Circuits

SERVO CONTROLLER USING 555 TIMER

Pulse Width Modulated signal usually with a frequency of 50Hz (i.e., a period of 20msec) or 25Hz (Period of 40msec). The angle of the servo varies according to the ON period of the signal (which is also known as the duration of the pulse or the width of the pulse.)

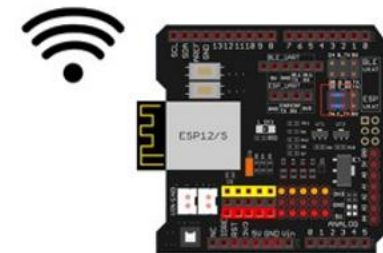


By
GANESH SELVARAJ

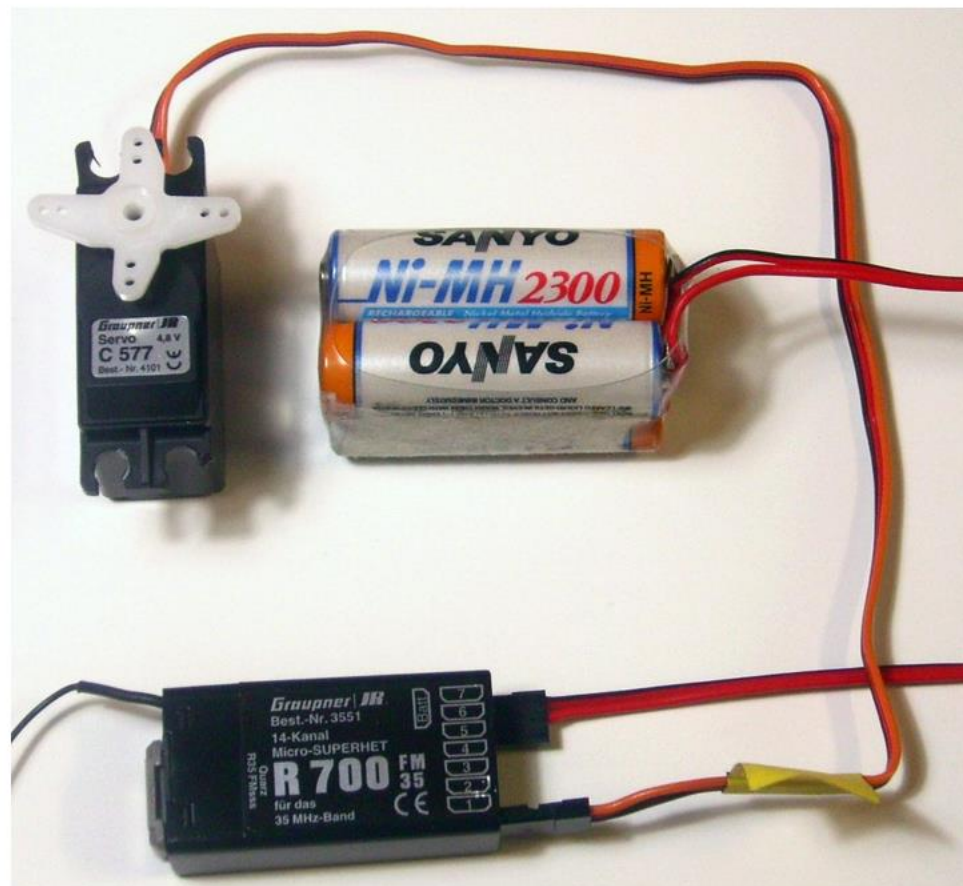
Source:

<https://www.engineersgarage.com/servo-motor-control-using-555-timer-ic/>

Basics Servo Motor Controllers and Circuits



Radio Controller for a
typical Servo Motor



Source:

https://en.wikipedia.org/wiki/Servo_control

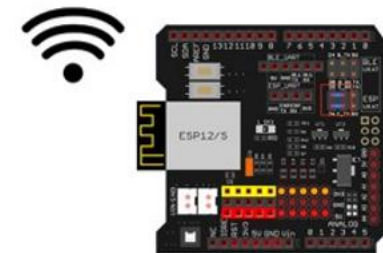
Question 3

A period of 40msec equals

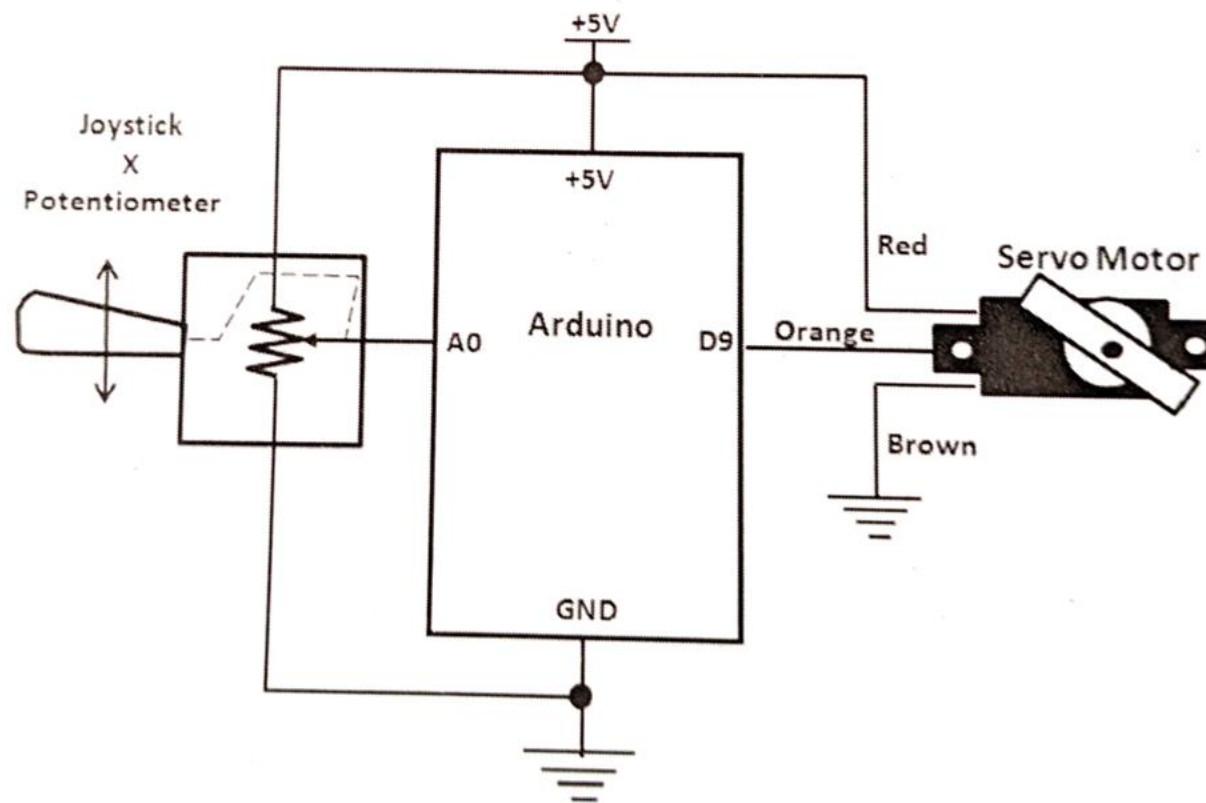
- a) 50Hz**
- b) 30Hz**
- c) 25Hz**



Basics Servo Motor Controllers and Circuits



A joystick-controlled servo motor



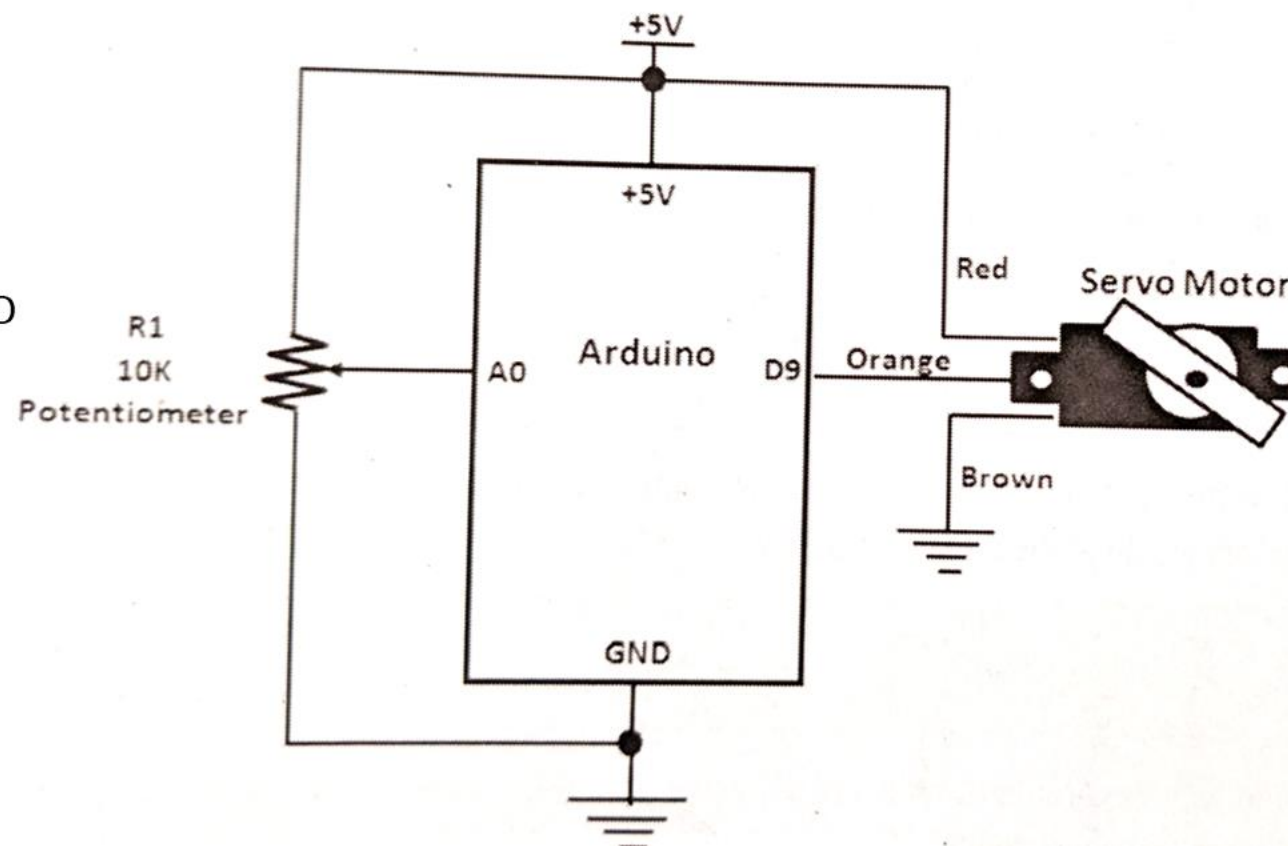
Source:

Wilcher, D. (2012). *Learn electronics with arduino*. Apress.

Basics Servo Motor Controllers and Circuits



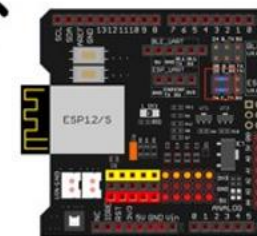
A potentiometer-controlled servo motor



Source:

Wilcher, D. (2012). *Learn electronics with arduino*. Apress.

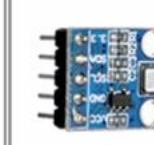
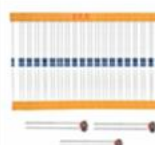
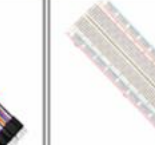
Osoyoo ESP8266 Arduino Kit Overview



Osoyoo ESP8266 Arduino Kit Overview

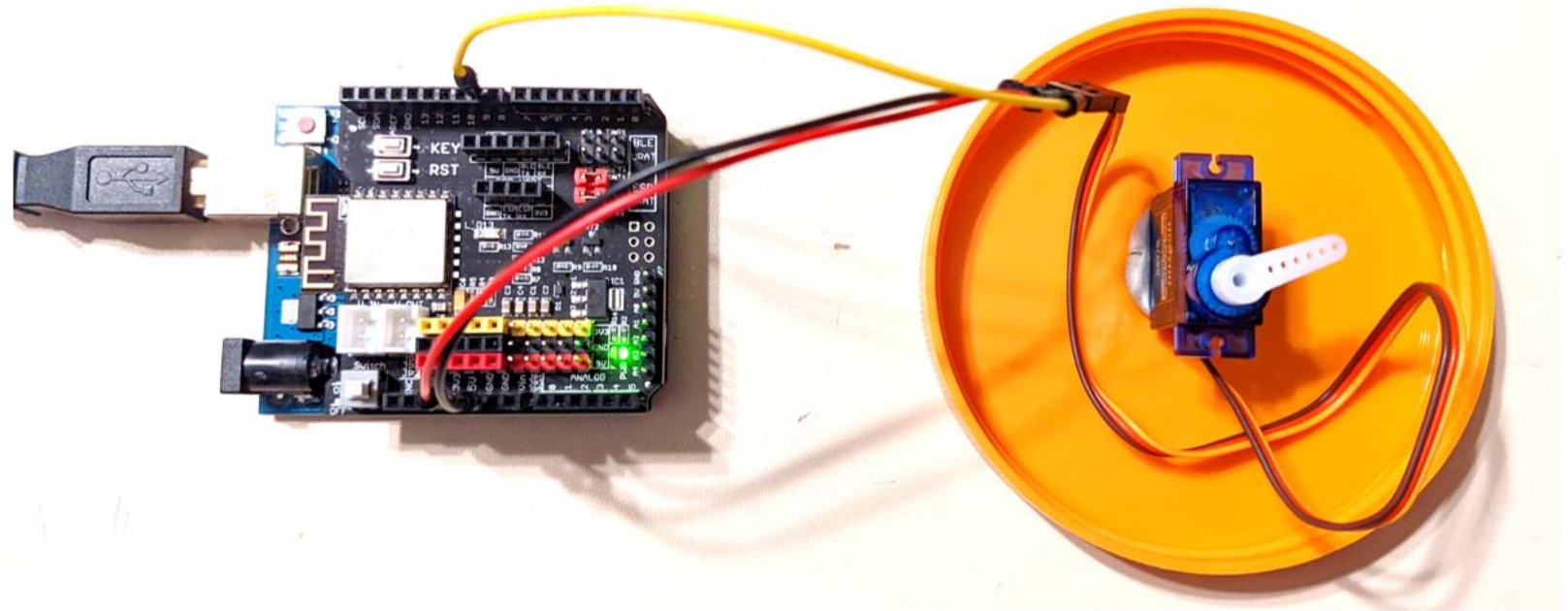
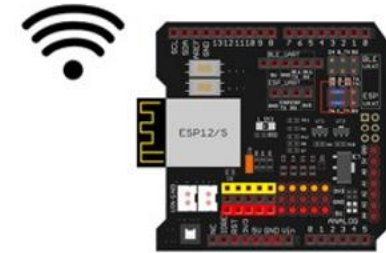
OSOYOO WiFi Internet of Things Learning Kit For Arduino

Model:2020003000

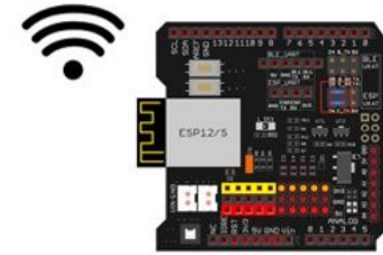
 OSOYOO ESP8266 WIFI shield	 OSOYOO Basic Board with cable	 Photoresistor Sensor Module	 Water Level Detection Sensor	 Sound Detection Sensor Module	 Active Buzzer Module	 Temperature & Humidity Sensor
 Relay Module	 Gas Sensor Module	 Digital Barometric Pressure Sensor Module	 Infrared Sensor Module	 Ultrasonic Sensor Module	 LED(6 x White, 6xRed, 6xYellow, 6xGreen)	 Push Buttons
 Servo Motor	 Pack of Resistors	 40 pin Jumper wires(15cm, Male to male)	 8 pin Jumper Wires(20cm, Female to Female)	 20 pin Jumper wires(15cm, Male to Female)	 Solderless Prototype Breadboard	 philips screwdriver



Lab: Wireless Servo Motor Controller



Lab: Wireless Servo Motor Controller ...

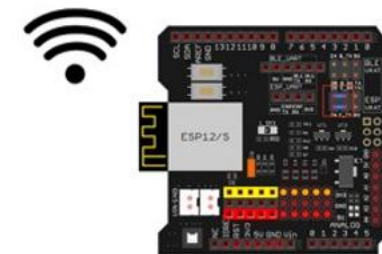
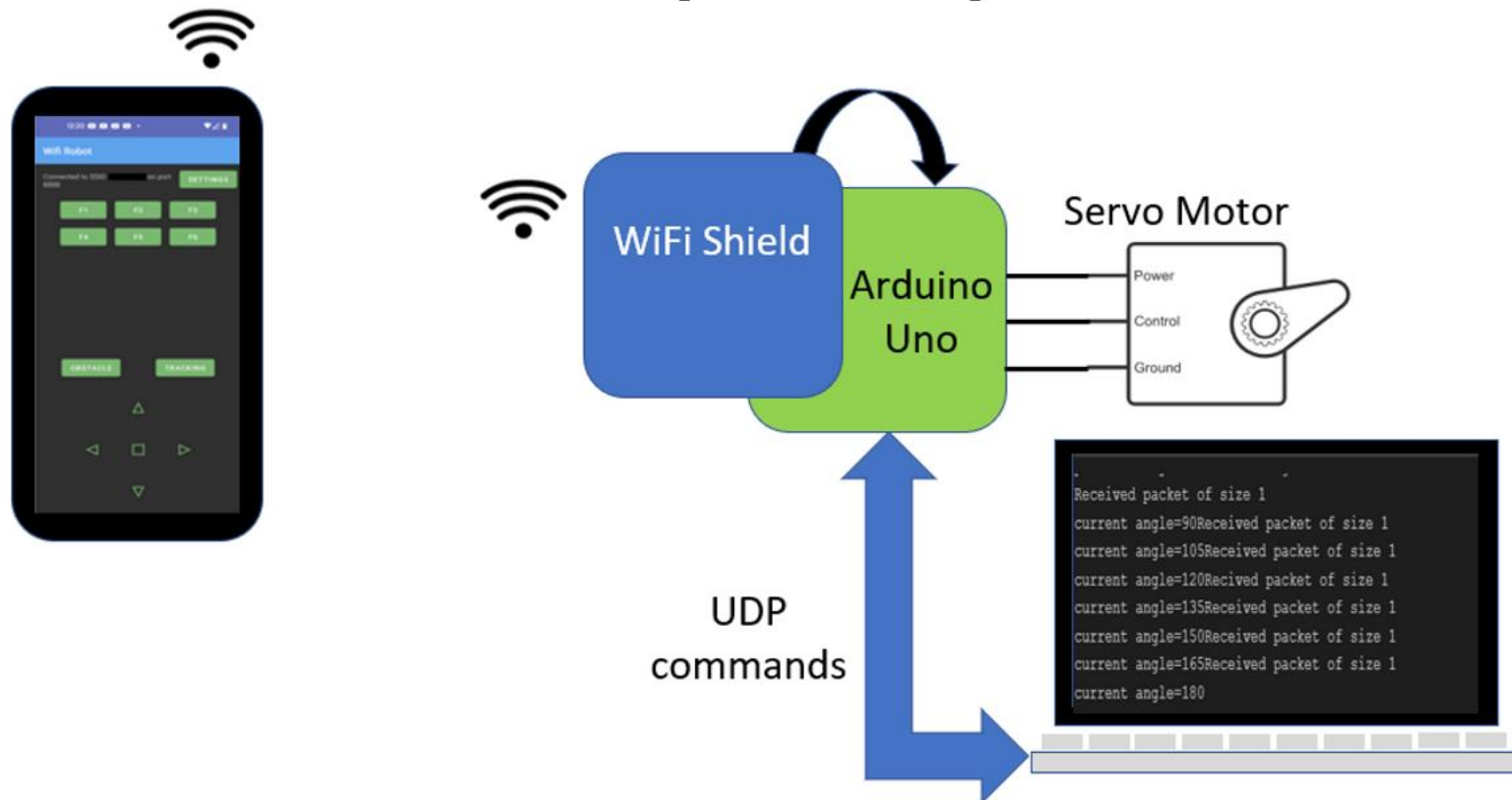


Learning Objectives:

- You will learn how to use a WiFi Shield with an Arduino Compatible.
- You will learn how to use an Arduino Compatible as a wireless light sensor.
- You will learn how to use a mobile app to communicate with WiFi to adjust a servo motor's rotational angle.

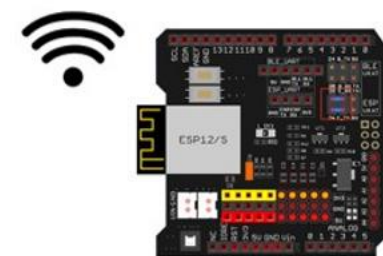
Lab: Wireless Servo Motor Controller...

Lab Setup Concept



What is an Internet-based Control System?...

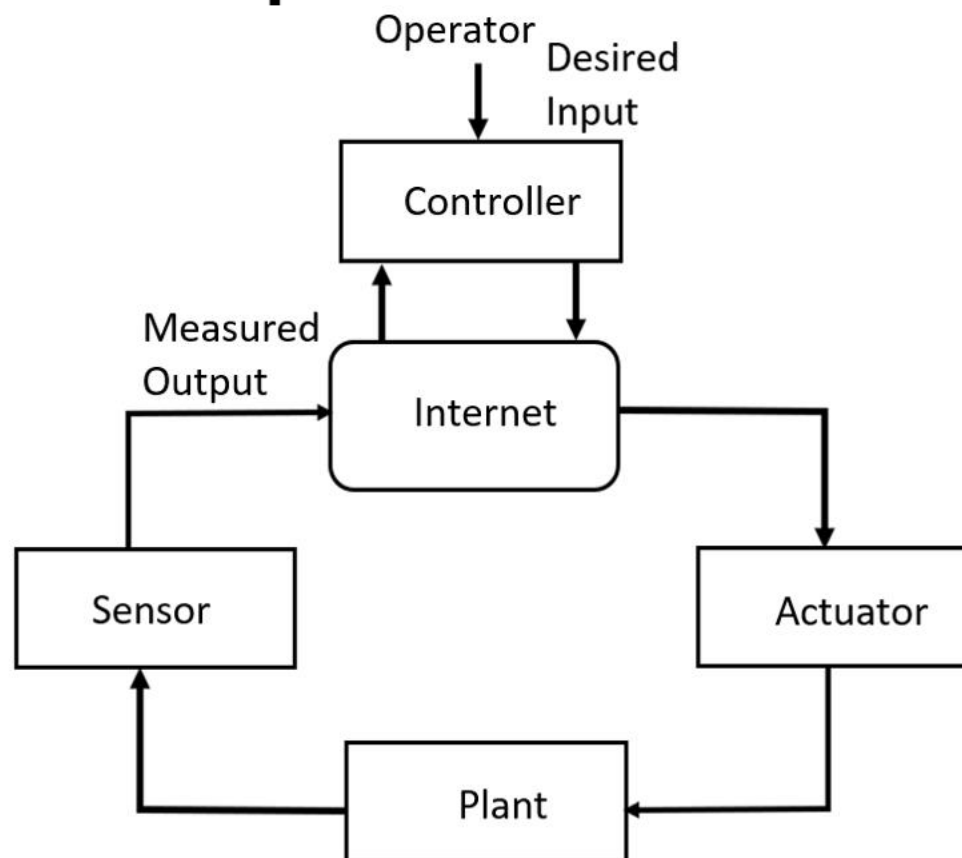
Lab Setup Concept



Control structure with the controller located remotely

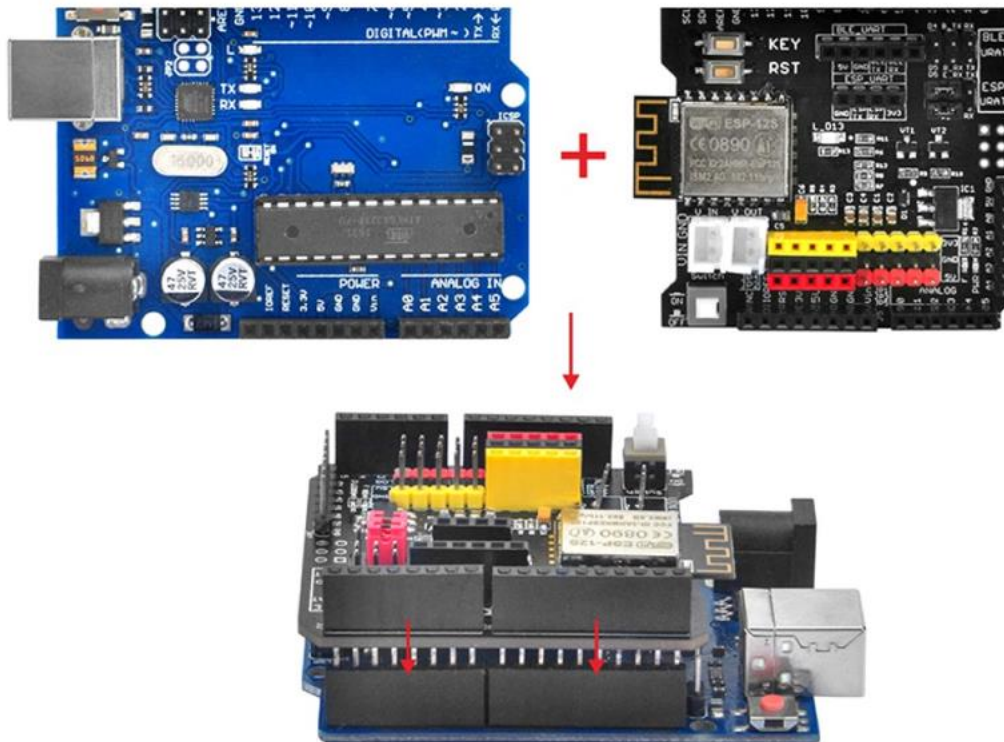
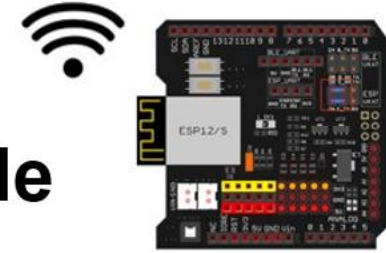
Notes:

- a) Plant: The combination of an actuator and a process.
- b) Inputs and output



Lab: Wireless Servo Motor Controller...

Lab Setup: Attaching WiFi Shield to the Arduino Compatible

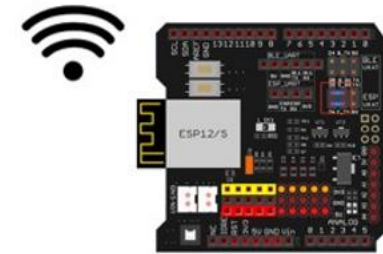


Notes:

- a) Attach IoT unit to your development machine
- b) Connect your Arduino Compatible to the correct COM port

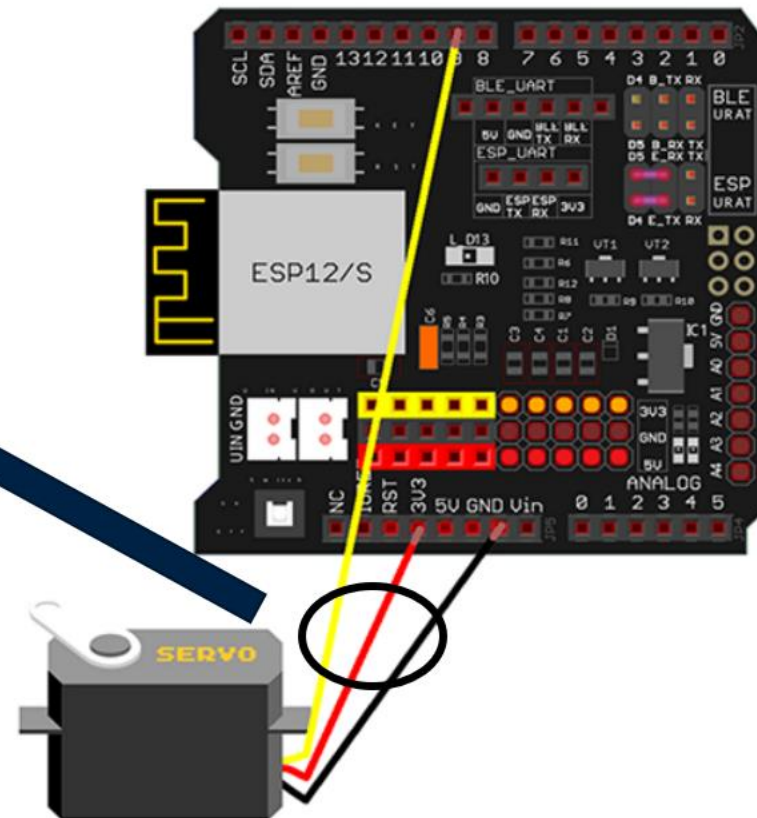
Lab: Wireless Servo Motor Controller ...

Lab Setup: Wiring the Servo Motor to the IoT unit



Wiring Chart:

OSOYOO basic board	Servo Wire
GND	Brown
3.3V	RED
D9	Orange



Question 4

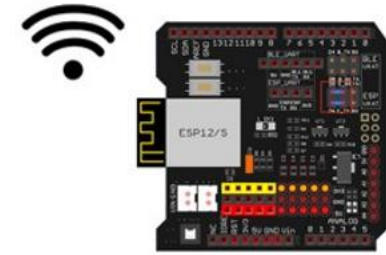
On slide 28, the plant is the combination of

- a) an actuator and a controller**
- b) an actuator and a sensor**
- c) an actuator and a process**



Lab: Wireless Servo Motor Controller ...

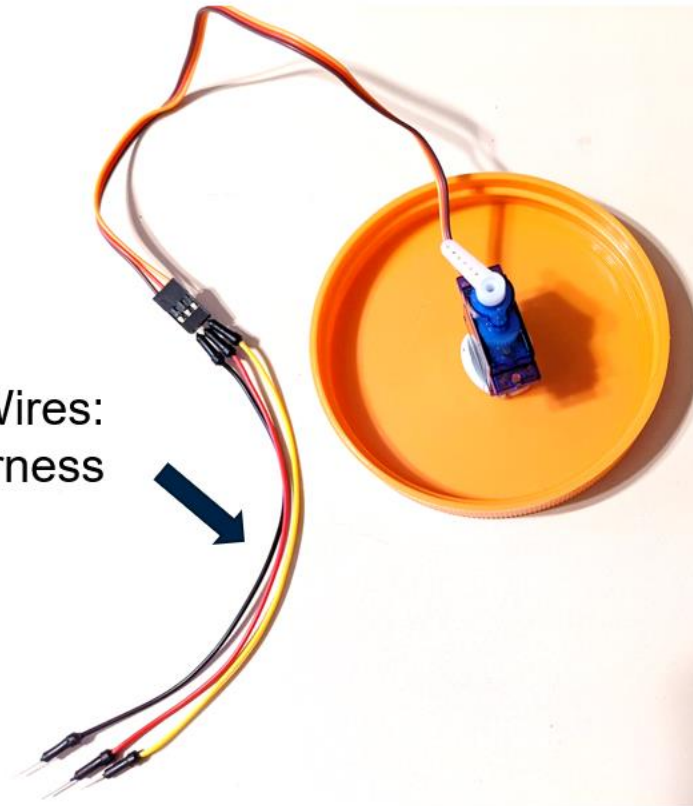
Lab Setup: Wiring the Servo Motor to the IoT unit



Jumper Harness Notes:

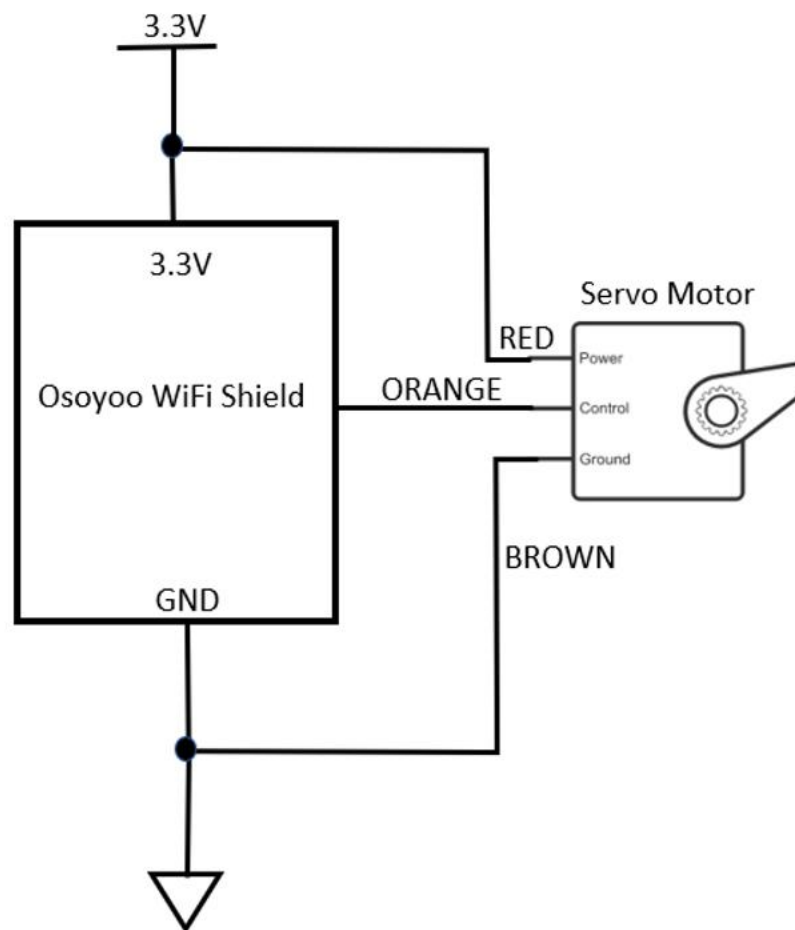
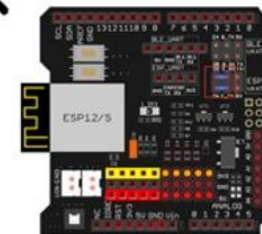
- a) Insert individual jumper wires into servo motor's 3pin female connector
- b) Individual jumper wire color scheme:
 - i. Brown to Black(GND)
 - ii. Red to Red(3.3V)
 - iii. Orange to Yellow(D9)

Extended Wires:
Jumper Harness
Assembly



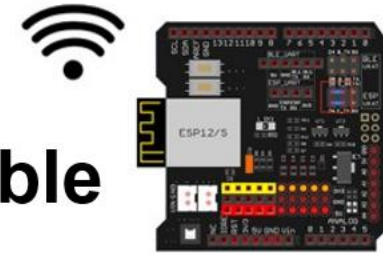
Lab: Wireless Servo Motor Controller ...

Lab Setup: IoT Receiver - Servo Motor Controller Circuit Schematic Diagram



Lab: Wireless Servo Motor Controller...

Lab Setup: Upload Lesson 6C code to Arduino Compatible



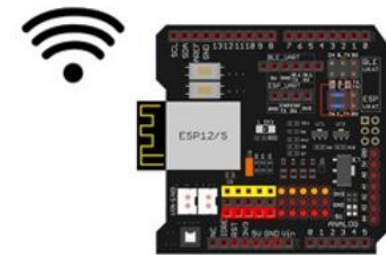
« DWilcher F » Wifi_IoT Kit » Lessons					Search Lessons	
☐ Name	Date modified	Type	Size			
 esp8266-lesson1	3/5/2022 11:42 PM	File folder				
 esp8266-lesson2	3/5/2022 11:42 PM	File folder				
 esp8266-lesson3	3/5/2022 11:42 PM	File folder				
 esp8266-lesson4D	3/5/2022 11:42 PM	File folder				
 esp8266-lesson5	3/5/2022 11:42 PM	File folder				
 esp8266-lesson6C	3/5/2022 11:42 PM	File folder				
 esp8266-lesson7	3/5/2022 11:42 PM	File folder				

Download the code from here!

[WiFi Internet of Things Learning Kit for Learn Coding with Arduino IDE 6: Servo motor « osoyoo.com](https://www.osoyoo.com/WiFi-Internet-of-Things-Learning-Kit-for-Learn-Coding-with-Arduino-IDE-6-Servo-motor/)

Lab: Wireless Servo Motor Controller ...

Lab Setup: Mobile App Control



Mobile App:

OSOYOO WiFi UDP Robot Car APP

Note:

To get the best servo motor rotation response, the keys on the mobile device screen



Mobile App keys mapped to UDP commands

➔

Button	UDP message
F1	F
F2	G
F3	H
F4	I
F5	J
F6	K
▲	A
▼	B
▶	R
◀	L
square	E

Servo motor response

servo will rotate about 5 degree counterclockwise(left side)

servo will rotate about 5 degree clockwise(right side)

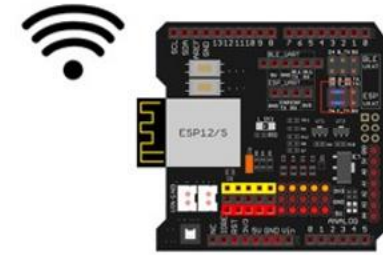
servo will rotate to right end (0 degree position)

servo will rotate to left end (180 degree position)

servo will rotate to central position (90 degree position)

Lab: Wireless Servo Motor Controller ...

Partial C++ UDP Commands Code

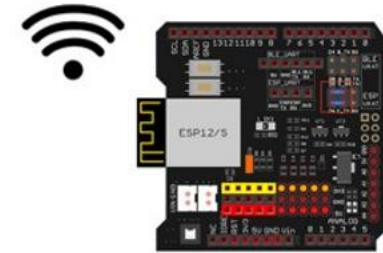


```
switch (c)    //serial control instructions
{

    case 'A': angle=angle+5 ;break; //▲ button pressed, rotate 5 degree counterclockwise
    case 'B': angle=angle-5 ;break; //▼ button pressed, rotate 5 degree clockwise
    case 'L': angle=180 ;break; //< button pressed, rotate to 180 degree position case 'R': angle=0
    case 'E': angle=90 ;break; //SQUARE button pressed, rotate to 90 degree position
```

Lab: Wireless Servo Motor Controller ...

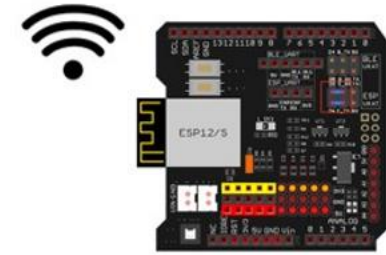
Lab Setup: Arduino IDE Serial Monitor Response



```
Received packet of size 1
current angle=90Received packet of size 1
current angle=105Received packet of size 1
current angle=120Received packet of size 1
current angle=135Received packet of size 1
current angle=150Received packet of size 1
current angle=165Received packet of size 1
current angle=180
```

Lab: Wireless Servo Motor Controller ...

Play with the Code!



Line 17: Change the servo pin and observe the servo motor response

```
#define servo_pin 9
```

Line 18: Change the angle initialize value and observe the servo motor response

```
int angle=90;
```

Question 5

On slide 36, case 'B' is mapped to what key of the mobile app?

- a) the up arrow key**
- b) the down arrow key**
- c) the square key**



Thank you for attending

Please consider the resources below:

555 timer application: <https://www.engineersgarage.com/servo-motor-control-using-555-timer-ic/>

ESP8266 Hardware Design Guidelines (www.espressif.com)

Osoyoo Website.(2022). WiFi iot learning kit. <https://osoyoo.com/2020/05/30/wifi-iot-learning-kit-for-arduino/>

Wilcher, D. (2012). *Learn electronics with arduino*. Apress.

Yang, S. (2011). *Internet-based control systems: Designs and applications*. Springer.



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