Actuators

🏆 A.2.1 Learning Activity

Types of commercial electric actuators

Objective

Develop an investigation and presentation to be exposed in class about sensors.

✏️ Development

1. Using the following list of comercial sensors to develop the investigation:

   - ☐ Double shaft gearmotor.
   - ☐ Unipolar stepper motor.
   - ☐ Bipolar stepper motor.
   - ☑ SG90 model servo motor.

2. Wait for the advisor to tell you what type of sensor will be the one that your team will develop and once you have, mark the sensor within the previous point.

3. Once you know the topic to be developed, research and write the following points in this document:

Computer Systems Engineering, Information and Communication Technologies, and Computer Science

SCC-1023/SC7A Programmable Systems

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## Tuesday, May 4th, 2021

Introduction

This document will present information about SG90 servo motor, covering various physical and electrical characteristics, some possible applications and explaining the stimulus which it responds to.

Development

Meaning A servomotor is a structural unit of a servo system and is used with a servo drive. The servo motor includes the motor that drives the load and a position detection component, such as an encoder. The servo system varies the controlled amount, such as position, speed, or torque, according to the set target value (command value) to precisely control the machine operation. The Tower Pro SG90 servo is an inexpensive but high quality servo with small dimensions. As with other servos, it works with most microcontroller electronic control boards as well as most commercial RC systems.
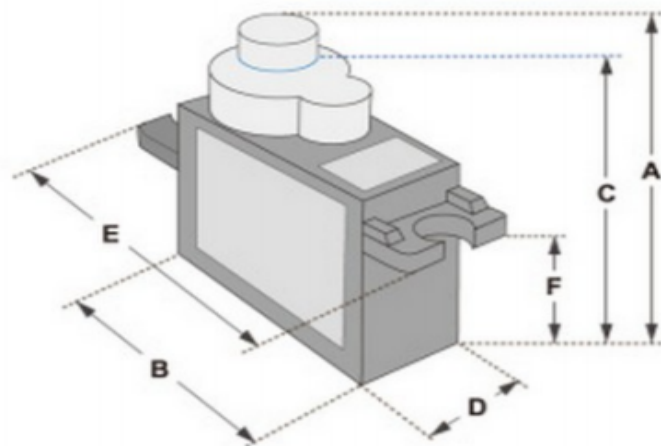
Images
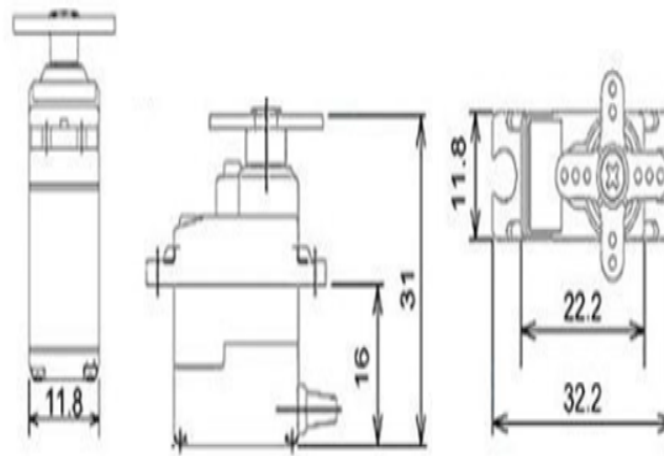
## Physical characteristics

- Gear Type: Plastic

Dimensions & Specifications
A (mm) : 32
B (mm) : 23
C (mm) : 28.5
D (mm) : 12
E (mm) : 32
F (mm) : 19.5
Speed (sec) : 0.1
Torque (kg-cm) : 2.5
Weight (g) : 14.7
Voltage : 4.8 - 6

Electrical characteristics

- Operating Voltage is +5V typically(the safest).
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Rotation : 0°-180°

Wire Number	Wire Colour	Description
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor
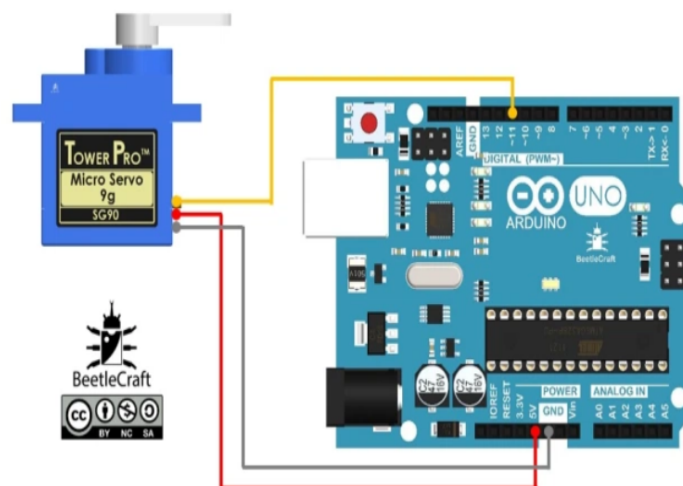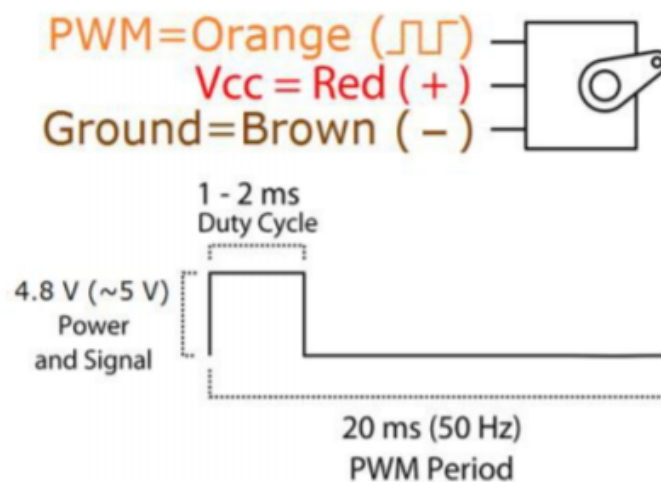
Pulse width modulation (PWM), or pulse-duration modulation (PDM), is a method of reducing the average power delivered by an electrical signal, by effectively chopping it up into discrete parts.

Explain how it behaves with the *environment* or what stimulus it responds to.

Servo motors are controlled by sending a variable width electrical pulse, or pulse width modulation (PWM), through the control cable. There is a minimum pulse, a maximum pulse, and a repetition rate. Generally, a servo motor can only rotate 90 ° in any direction for a total movement of 180 °. The neutral position of the motor is defined as the position in which the servo has the same amount of potential rotation both clockwise

and counterclockwise. The PWM sent to the motor determines the position of the axis, and is based on the duration of the pulse sent through the control cable; the rotor will rotate to the desired position.

The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor rotates. For example, a 1.5ms pulse will cause the motor to rotate to the 90 ° position. If the time is less than 1.5ms, it moves counterclockwise to the 0 ° position, and if the time is more than 1.5ms, the servo will rotate clockwise toward the 180 ° position.

When the servos are commanded to move, they will move into position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist pulling out of that position. The maximum amount of force the servo can exert is called the servo torque. However, the servos will not hold their position forever; the position pulse should be repeated to signal the servo to stay in position.

Application uses.

- Radio-controlled aircraft to control the position and movement of elevators.
- Robots due to their smooth on and off and precise positioning.
- Ideal for educational practices in electronics and robotics. It is also commonly used in RepRap printer self-leveling systems.
- Such as Gimbals, useless boxes, door lockers and more.

Video

Conclusions

😎 **Oliver**: The SG90 servo motor has a wide range of applications, such as gimbals, robot arms, door lockers, pretty much anything that needs a torque between 0 and 180 degrees. Since the sg90 is really small, it can fit in most school projects as well in professional ones. Still, the MG90S since its the uptaded model is way better.

👽 **Ariel**: The servomotor sg90 is a tiny and fragile but high quality electronic component, is very cheap and accessible. It has various applications, does not need much voltage to work, and had very interesting way of interacting with the environment due to how it work with pulses to stay on a certain degree, but because of this, it doesn't provide to much strength.

🐶 **Edgardo**: The sg90 servo motor is an economical servo motor with quite interesting characteristics to make simple practices besides that it can be found in many everyday.

😻 **Javier**: The SG90 servo motor is an easy-to-use electric actuator device because its mode of operation as well as its function is quite simple, making it a very ideal device to learn how to use actuators. Its only shortcoming is the cheap material that it is made but that makes the device accessible to all the public.

🙈 **Mauricio**: The SG90 servo motor that we investigated is small, light, and cheap but for the same reason it can also be very weak or fragile since it is made of plastic compared to others on the market that can be made of more resistant materials, that is why the use of this servomotor is reduced to completing simple tasks that not require a lot of work or a lot of force.

Bibliography.

- https://www.ia.omron.com/data_pdf/guide/14/servo_tg_e_1_1.pdf

- http://www.ee.ic.ac.uk/pcheung/teaching/DE1_EE/stores/sg90_datasheet.pdf
- https://components101.com/motors/servo-motor-basics-pinout-datasheet

4. Insert images of **evidence** such as meetings of the team members held for the development of the activity.

💣 Rubric
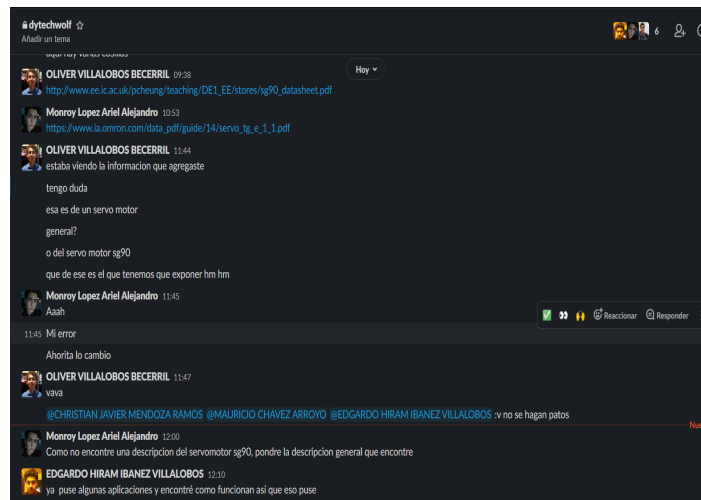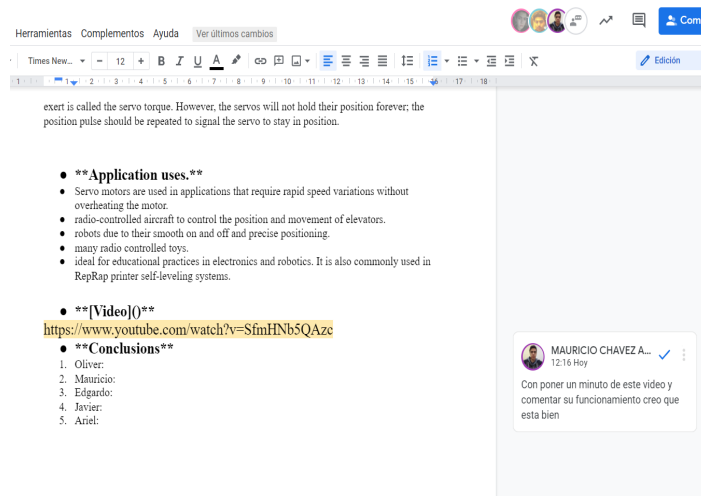
Criteria	Description	Score
Instructions	Is each of the points indicated in the Instructions section fulfilled?	10
Development	Was each one of the points requested within the development of the activity answered?	60
Demonstration	Does the student introduce himself during the explanation of the functionality of the activity?	20
Conclusions	Is a personal opinion of the activity included by each of the team members?	10

- 😎 Go to Oliver's Github.
- 👽 Go to Ariel's Github
- 🐶 Go to Edgardo's Github
- 😻 Go to Javier's Github
- 🙈 Go to Mauricio's Github