Project Kratos
Electronics QSTP

Week 2 : Sensors and Actuators

Sensors

- Push button : It's like a key in a circuit. It connects two points when pressed. Learn about it from this tutorial and simulate the circuit shown there.
- LDR : It stands for light dependent resistor. As the name suggests, it is just like any other resistor, but it's resistance value depends on the intensity of light falling on it. Learn about it from this tutorial. Simulate everything shown in there, except the relay part at the end.
- Ultrasonic distance sensor : An ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. Learn about it from this tutorial and simulate the circuit shown there.

Actuators

- Servo motor : A servo motor is an electrical device which can push or rotate an object with great precision. Read about servo motors on this tutorial, any try the knob and sweep examples shown there.
- DC motor with a motor driver : A simple dc motor has two terminals. It's direction of rotation is determined by the polarity of the potential difference applied, and the speed of rotation depends on the value of the potential difference. You can use a dc motor directly, but we usually use a motor driver to drive it. TinkerCad has only one motor driver (L293D), so we will be using it for now. Learn about it from this tutorial, and simulate the circuit shown there.

Additional Resource

- https://www.arduino.cc/en/Tutorial/Foundations The tutorial page on arduino has some very good material. You can learn about more predefined arduino functions, discover language references, and fill any gaps in your knowledge

Weekly assignment (Submit before 11.59pm, 24th May 2020)

Arduino

- It's summer season and you have this idea of making a cap with a small fan, whose speed of rotation depends on the intensity of sunlight. So, your first job is to build the circuit that controls the speed of the motor that will rotate the fan. Use an LDR, and a DC motor driven by a motor driver, to build this circuit.
- You plan to build a home security system. It has an alarm which will ring if someone is close to your door. At the main gate you have to enter a 4 bit pin. If the pin is correct, then the alarm will turn off. Implement the circuit using a piezoelectric speaker, ultrasonic sensor, and an array of 4 push buttons for the 4-bit pin.
- Create a light intensity sensor. It should have a dial with a needle. The position of the needle depends on the intensity of light outside. Use an LDR, and servo motor to build the circuit.
- Write a controller for the gripper (like a claw) in the robotic arm. It uses two dc motors. The gripper opens if both motors rotate in the same direction, and closes if the motors rotate in the opposite direction. Take inputs from the serial monitor.
    - 1 is for open
    - 2 is for close
    - 3 is for stop

Python

- Create a function that takes a 2d list as an input. Where each row represents a point in 3d space. Hence each row is of the form (x,y,z) i.e the cartesian coordinates of that point. Find the pair of points with the shortest euclidean distance. Return the index numbers of those two points.
- There is a 10x10 grid of houses in a colony. Some of those houses are COVID-19 infected. The infected houses are represented by 1, and the not infected houses are represented with 0. A house is safe, if it is not infected and neither of the surrounding 8 houses are infected. A 2d list is used to represent the entire colony. Create a function that takes this 2d list as input and returns the number of safe homes.

Note 1: Submit the assignments before the due date. Any delay has to be notified with reasons. Punctuality is an essential part of the Kratos Team.

Note 2: Most of you would be doing these things for the first time, so you are bound to get struck at some point and may get overwhelmed by the course content. We don't expect you to solve everything in the first try. You have a week. We highly encourage you to ask any doubt, however small or dumb you think it is. That is the only way by which you grow. Your job here is to learn and our job is to help you.

Note 3: Any feedback regarding the course structure or the assignments, is very valuable. We are also students, just like you and we have a lot of scope for improvement.