Module-02: Dino can jump

Goal of the module:

1. To design a simple sensor-network to achieve an objective.
2. To learn the use of analog input pins and Analog-to-Digital (ADC) of an Arduino Uno.
3. To learn to interface a servo motor to an Arduino.

Pre-lab work (No submission required):

1. Play the dino game which can be accessed using the following link: `chrome:\\dino`. In this game, a dinosaur (dino) has to jump over incoming obstacles. In general (provided you have default theme in your OS), the background of the screen is white and the obstacles are grey in colour when the game starts. The dino jumps when the space-bar of the keyboard is pressed.
2. Watch the objective video (Check file section in MS-Teams).

Module-02 Objectives: The objective is to design LDR-based sensor network to help us automate Google's dino game.

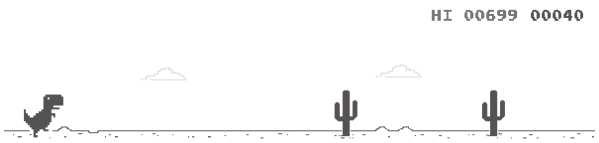

Figure 1: Dino game with white background

After the dino has traversed some distance avoiding the obstacles successfully, the background of the game changes to black as shown in Figure 2.

This toggling of the background colour keeps on happening throughout the game. Your objective for this module is to design a system that automates playing this game. An example for the same is shown in the video module (Check file section in MS-Teams). Note that the set-up demonstrated in the video module does not completely automate the game. It automates the game only when the background of the game is white as shown in Figure 1. Your task is to automate the *complete* game.

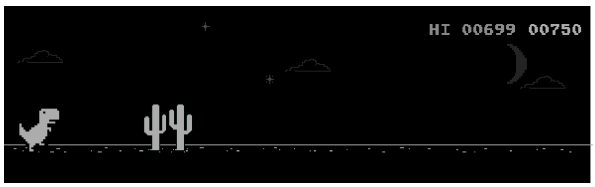

Figure 2: Dino game with black background

1. While desigining a sensor based system, it is essential to check the specifications of sensors carefully. In some cases you might need to subject the sensor to different environmental conditions to get different readings from them. For example, for a photoresistor you might need to measure the resistance at different lighting conditions. On the other hand, for a temperature sensor you might have to check the output voltage corresponding to different temperatures. Although in most cases the datasheets of the sensors have these values documented, it is a good practice to cross-check those values during practical implementation. In this module you have access to three LDRs.

2. Another important facet of sensor based system design is sensor placement. Notice the placement of the two LDRs in the video module. The sensors are placed such that they capture the obstacles. Wrong placement of sensor can lead to failure of the system. Hence, sensor placement is critical in sensor based system design. Keeping this in view, you will need to show the placement of the sensors in the report (a picture of the set-up will do).

   Since the photoresistors have different specifications and your code will change depending on the location of the sensors, do not forget to label the sensors using the names given above (LDR-01, LDR-02, LDR-03).

3. The action of the servomotor pressing the spacebar needs to be simulated by moving the servomotor from x^o to y^o and back again to x^o. The value of x and y depends on your setup. The values for your setup needs to be clearly stated in the report.

Report Guidelines: The report to be submitted must have the following:

1. Objectives of the module.
2. Circuit diagram with proper labelling.
3. Flowchart of the algorithm.
4. Observations, if any.
5. Answers to the questions below.

Answer the following:

1. Is the designed system an open-loop system or a closed-loop system? Depending on your answer map the components of your system to the different building blocks of an open-loop/closed-loop system as shown in Figure 3 and Figure 4 (modify the blocks if required).

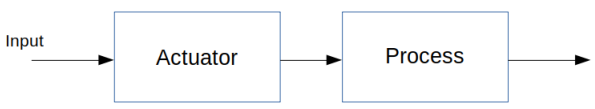

Figure 3: Open-loop system

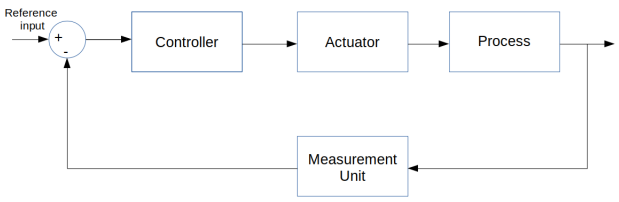

Figure 4: Closed-loop system

2. On executing the command `servo.write(30)` in Arduino Uno, a servomotor connected to the suitable pin of the Arduino rotates 30^o. How does the servomotor rotate to the designated angle? (Explain the internal working principle)

3. Explain how ADC is used to take input from the LDR.