ENGG1100 Introduction to Engineering Design

Faculty of Engineering

The Chinese University of Hong Kong

Project Specification

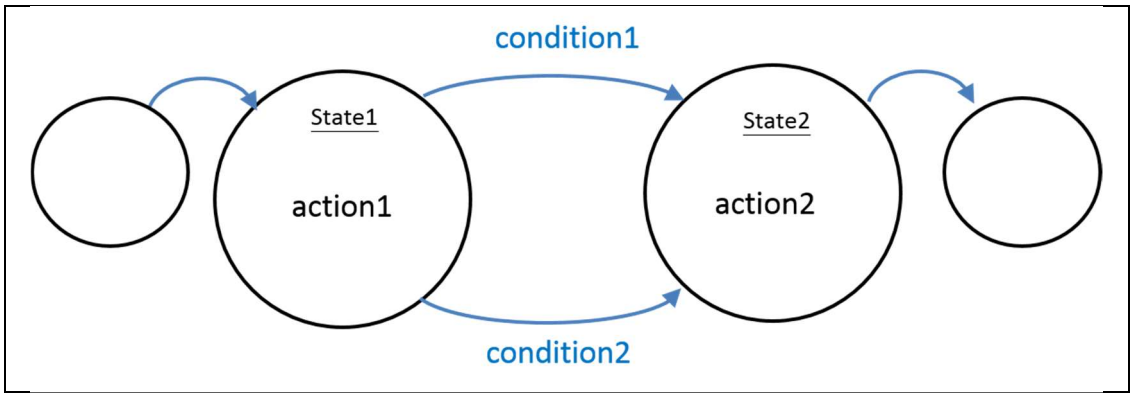
Objectives

- To develop students' creativity in problem solving.
- To develop students' solution implementation skill.
- To gain experience in basic programming with finite-state machine instead of sequential programming.

Background

In today's engineering world, problem solving using computer and programming are common. Finite-state machine (FSM) is one of the mathematical models of computation. It performs a predetermined sequence of actions depending on a sequence of events with which they are presented [1], and is useful in tackling problems and developing solutions.

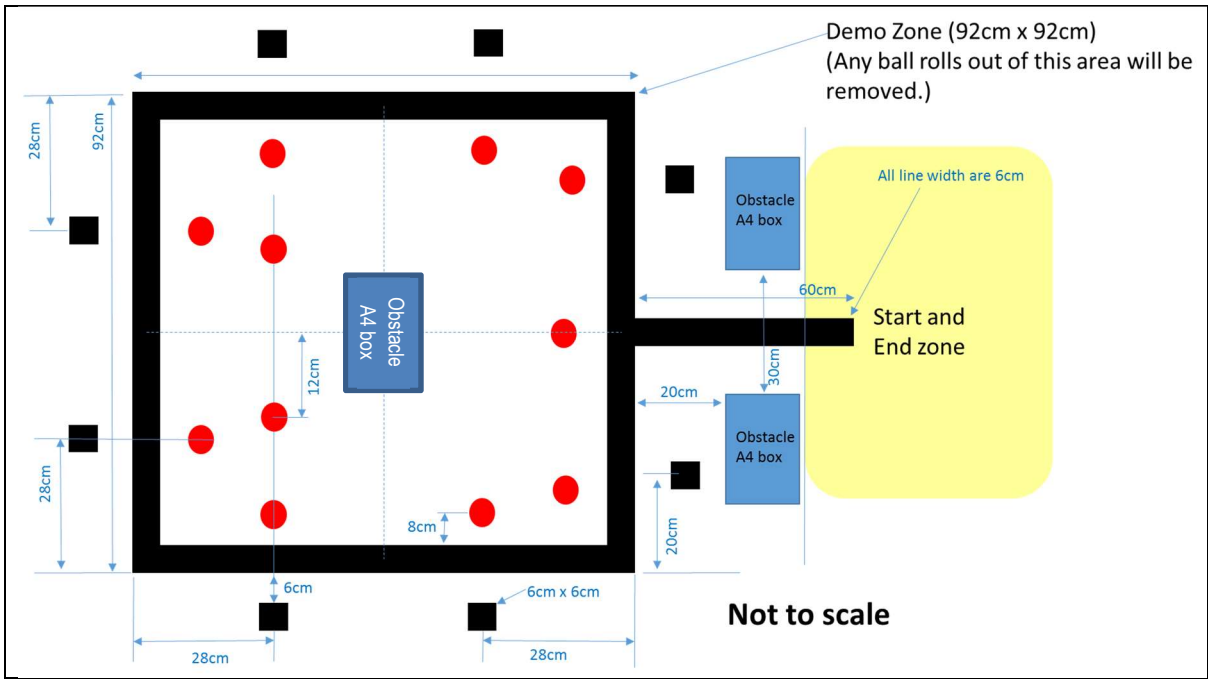
Problem solving with Finite-state machine is very much like in our everyday life: what should be done with the current situation. At every **state** of the Finite-State Machine, students have to analyze the situation (i.e., current **conditions**), and determine the output (i.e., **actions**).



The project task is relatively simple: Using a robot car to find and pick up as many balls as possible and drop them off at a specific location within a given time limit. The route of the car and the sequence of ball retrieval are flexible.

Specifications

1. Assemble a robot car with the components studied in the laboratory sessions.
2. Design and fabricate a ball catcher. You can use your 3D Design homework-2 as the ball catcher if you wish.
3. The number of IR modules, ultrasound modules, servos and motors are limited by the number that the project board can support.
4. The time limit of the demo is **5 minutes**.
5. Your robot car must start at the Start Zone.
6. All black lines at the demo site are for navigation reference only. The robot car is not required to follow the lines.
7. The number of retrievable balls is 11. All balls will be placed at specific locations. No balls will be replaced if they were caught or knocked off.
8. The size (Length x Width x Height) of all A4 Box Obstacles are 32 x 23 x 24 cm.
9. Any ball rolls out of the Demo Zone (92cm x 92cm area) will be counted as out-of-bounds, and will be removed.
10. You can attempt unlimited number of trials within the time limit. Should your car is out of control, you can power off the car, place it back to the Start Zone, power the car back on and start a new trial. However, balls not returned to the End Zone by the car will be counted as out-of-bounds and will not be counted as a returned ball.
11. You can pick up more than one ball in each trial. However, only balls that are returned to the End Zone will be counted. Balls that are not released from the catcher will not be counted.



Project Assessment

1. There are 2 assessment criteria in the project demo:
   (i) the number of balls returned to the End Zone, and
   (ii) the required time for the last successfully returned ball reaches the End Zone.
2. All students' demo results will be sorted on a single list, which will be sorted firstly by the number of successfully returned balls (i.e., more balls means higher place), then by the time required (i.e., shorter time means higher place). That means returning 4 balls in 4 minutes will be placed higher on the list than returning 3 balls in 1 minutes.
3. The group that cannot successfully return any ball will get 0% in demo mark, and will be removed from the list.
4. The group that successfully returns 1 ball with the longest time used will be placed at bottom of the list, and will get 50% in the demo mark.
5. The group at the top of the list will get 100% in the demo mark.
6. All other student groups will be graded in uniform distribution with the results in the list.

References

[1] https://en.wikipedia.org/wiki/Finite-state_machine