P-Bots2019: School Robotic Competition
Department of Electrical and Electronic Engineering
Faculty of Engineering
University of Peradeniya

Round 2: Develop and Implement a Control Algorithm for a KuKa Youbot and Simulate that in a Webots Simulation Environment

Deadline: 11.59 pm on 15th November, 2019

Conditions:

- Second round of the competition is also entirely based on the *Webots* (*www.cyberbotics.com*) simulation software.
- Only the selected/winning teams from the First Round (*on 10th October 2019*) are allowed for the second round of the competition.
- Your controller and the simulation environment (code and a video) should be uploaded to the system and will be evaluated online.
- Results of the second round will be announced by 20th November, 2019.
- All teams will be awarded with a certificate of participation.
- Winning teams will be rewarded separately.

Task:

1) In this task, you will be using the built-in KuKa youbot robot model (proto) and a sample controller implemented in "C". You should receive a complete webots project directory as a zipped folder (Round2.zip).
    a. The project is named as Round2 (you may rename it with your group name, etc). The world file (***Round2.wbt***) is in the *worlds* directory and the corresponding controller (***my_controllerC.c*** inside the my_controllerC sub-directory) is in the *controllers* directory.
        - C libraries needed to control the youbot robot is included in the *libraries* directory
    b. The controller is already linked to the Youbot robot in the world file.
    c. The proto model of the Youbot robot is incorporated with a ***camera*** and a ***range-finder*** device at the front (See Fig.1; yellow and red boxes on the robot indicate the camera and the range-finder respectively).
    d. At the start of each simulation, the robot is kept at the center of a square arena with a side length of 10 m. Also, there are 50 green colored ***cubes*** randomly placed on the arena.
    e. The controller code provided with the project includes code snippets:
        - for initiation of the robot, the camera and the range finder devices,
        - for random placement of 50 green cubes on the arena,
        - for teleportation of the cubes when contacted with any object.

f. Further, a simple code snippet (in the main loop) that can be used for detecting color blobs using the camera and a steering mechanism is also provided.
g. When you first open the world, the camera and the range-finder views may be on top of each other at one top corner of the 3D view pane. If that is the case, grab one to the other corner as shown in the Fig. 1 (you may change the size of the views).
h. Study the world and the controller and run the simulation for couple of seconds (when you build the 'C' controller, you will get warning messages for not used variables, etc. You may ignore that for the time being and you will use those variables later).

2) Modify the controller so that the robot base will not be collided with any green cube or the boundary wall when moving forward. For this, you should use the attached range-finder device.

3) As the final task, you will be playing a game. You are asked to implement an algorithm to steer Youbot robot to reach any 25 green boxes and touch them using the **gripper** to teleport them (you may use/modify the provided code snippet). The fastest teams to finish the job will be advancing to the final round of the competition. Make a video showing the Youbot robot reaching couple of green cubes and touch them using the gripper to teleport them.

Conditions:

a. You are not allowed to change the world and the robot parameters. Specially, TIME_STEP of the simulation and speed parameters of the robot.
b. You are supposed to use youbot robot base, arm and gripper control functions given in the header (.h) files (***Round2\libraries\youbot_control\include***).

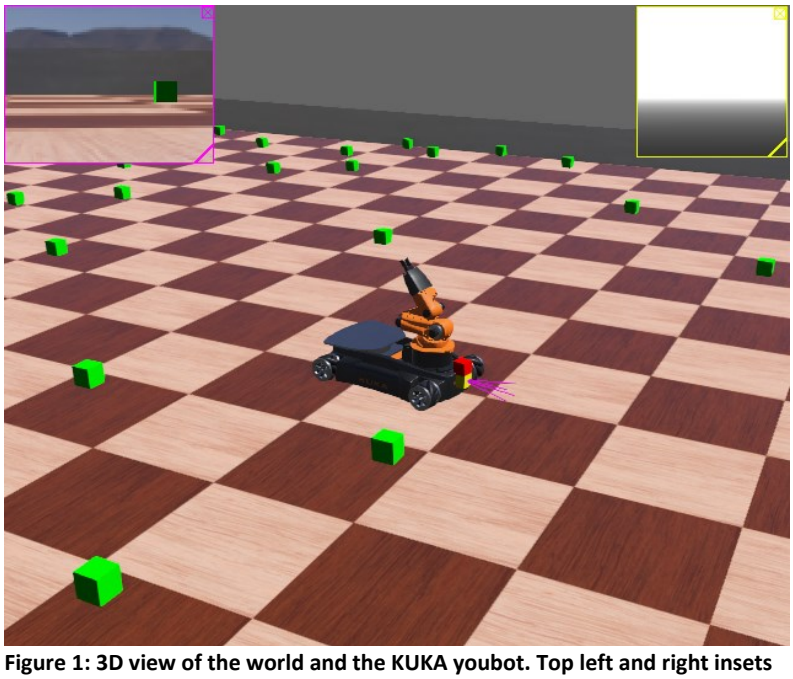

Figure 1: 3D view of the world and the KUKA youbot. Top left and right insets show the camera (yellow box) and the range-finder (red box) views.