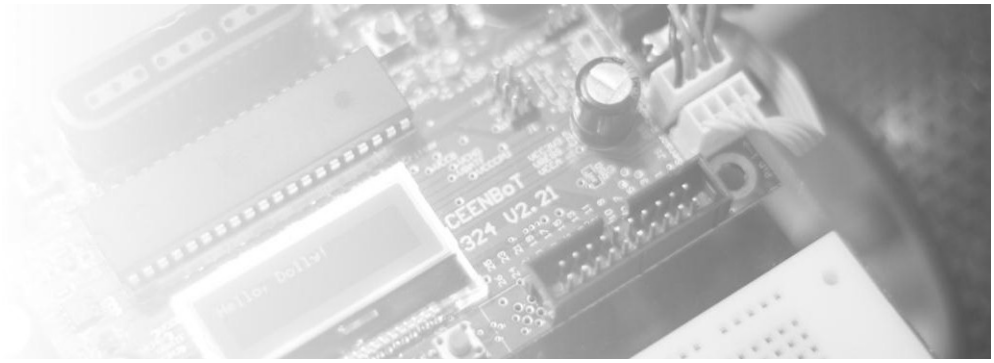
Mobile Robotics I: Lab 10

Choose Your Own Adventure: Defining Tasks with Behavior-Based Control

CEENBoT™ Mobile Robotics Platform Laboratory Series
CEENBoT v2.21 – '324 Platform



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Mobile Robotics I – Choose Your Own Adventure

Purpose

The purpose of this lab is to create up to 3 simple tasks for your CEENBoT that are each implemented using a collection of 3 or more behaviors. First, define each task. Then, to implement each task, use existing behaviors created in earlier labs and/or define new behaviors as needed. The new behaviors are to be created using the CEENBoT's existing sensors.

Lab Objectives

By following the directions in this lab, you are expected to achieve the following:

- Define up to three tasks for your CEENBoT using creativity and pulling together previous functionality (behaviors) of your CEENBoT and/or by creating new behaviors using its existing sensors.
- Implement a task by ordering several behaviors and testing and modifying them so that the behaviors individually work together to achieve an ***overall emergent task behavior*** in the BBC program structure.
- Document your process of creating each task, and provide a BBC diagram for each task like that shown in the Jones text to illustrate the behaviors used for each task and the arbitration order.
- Demonstrate the performance of each task.

Preliminary Readings

- Read about Programming, Decomposition, Implementation, and Emergent Behavior in course texts: Mataric, Chapter 18 and Jones, Chapters 5, 6, and 8.

Required Equipment

- CEENBoT, platform '324 v2.21.
- Means to program your CEENBoT. (i.e., USB or Serial ISP programmer).

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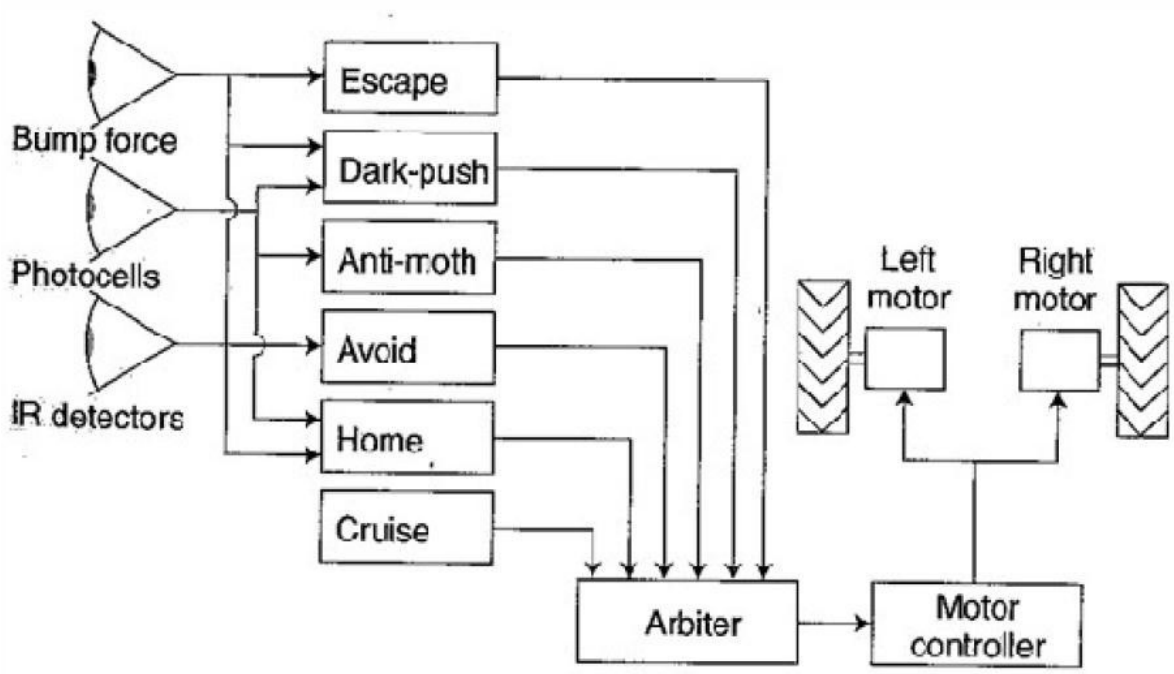
Background

This lab represents a culmination of BBC programming techniques to implement specific robot tasks.

A task achieves a desired purpose. It is implemented using a collection of behaviors in a BBC program. For example, the SodaBot had the task of moving all abandoned soda cans in an office to the recycle bin. This task was implemented using a collection of eight behaviors. Other tasks are simpler and require fewer behaviors to implement. For example, a coverage task that provides full coverage to an area in which the robot roams can be implemented using only three behaviors: Cruise, Avoid-Random, and Wall Follow.

You are to choose and define up to ***three simple tasks*** for your CEENBoT to perform. The goal of the task creation is to choose behaviors that will individually work together in the robot's environment to achieve an ***overall emergent task behavior*.**



Each task can be represented using a Behavior-Based Control (BBC) Diagram. It shows the sensors, behaviors and arbitration order involved. The example BBC Diagram above shows six behaviors in order of ***decreasing*** priority.

For each task you specify, you are to include its BBC diagram like that above.

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ROBOT PROGRAMMING

You are to use your BBC C-program structure used in previous labs. For simplicity, you can use one BBC program for each task. The program will have only the behaviors appropriate for the task. Or you may include all tasks in one program, selected by push button switch input (this will require minor modifications of the program structure along the lines of making only select behaviors active that are appropriate for the selected task).

Directions

1. Define up to three separate simple tasks for your CEENBoT. List the purpose or desired emergent behavior for each task. Use creativity and pull together previous functionality (behaviors) of your CEENBoT and create new behaviors using existing sensors as needed to implement each task.

2. Implement each task by ordering at least 3 or more behaviors. Test and modify the Task's BBC program as needed so that the behaviors individually work together to achieve an ***overall emergent task***. Each task must be distinct and clearly observable as the robot moves around and interacts with its environment.

3. Once a task is working successfully, document the task created as outlined in the section below.

Provide this written documentation in lieu of a Report:

Provide the following for each Task:

1. A short description of the task, including the purpose or desired emergent behavior that constitutes the task.
2. A short description of what each behavior does that makes up the task, if you created new behaviors.
3. A BBC diagram that shows the behaviors that make up each task in their order of priority.
4. During the demo, talk through how the individual behaviors were designed to work together to produce the emergent task behavior, in theory (how you planned it) and in reality (what you actually observed). Did you have to make any changes to the behaviors or to how the behaviors interacted with the environment in order to achieve the task you originally desired?
5. Also discuss additional details on how you implemented each task, where the idea for the task came from, and hurdles you had to overcome.