

SUMO BOT 6 for Lego Mindstorms

Introduction

The SUMO BOT 6 and SUMO BOT 6 SETUP programs have been created by David Musgrave of Winthrop Development Consultants using Lego Mindstorms NXT and Lego Mindstorms EV3 to provide a starting point for software for Sumo Robots built by students without requiring them to learn programming skills.

Robot Design

The software is designed to work with the following components:

- Lego Mindstorms NXT or Lego Mindstorms EV3 Controller Brick
- 2 Large Motors connected via Ports B & C (NXT or EV3)
- 2 Light or Colour Sensors connected via Ports 1 & 3 (NXT or EV3)
- 1 Ultrasonic Sensor connected via Port 4 (NXT or EV3) or
- 1 Infrared Sensor connected via Port 4 (EV3 only) or
- 1 SumoEyes Sensor connected via Port 2 (NXT or EV3)

The robot can be designed with wheels or tracks. They should be strong, stable and able to rotate on the spot. If using the SumoEyes Sensor from Mindsensors.com, the plug must be located on the underside and the sensor must point forward so it can see the target robots without detecting the ground.

Installation

There are two programs provided as self-contained distribution files (SumoBot 6.rbtX and SumoBot 6 Setup.rbtX for NXT and SumoBot 6.ev3 for EV3). For NXT: Open the SumoBot 6 Setup.rbtX file first. After clearing the contents of the NXT brick (Connect NXT Brick, click on NXT Window Button, select Memory tab and click Delete All), download the program to the NXT Brick. Then open the SumoBot 6.rbtX file and download it to the NXT Brick. For EV3: Open the SumoBot 6.ev3 file and download it to the EV3 Brick.

The Programs

There are two programs provided, the Sumo Bot 6 main program and the Sumo Bot 6 Setup configuration program. Below are descriptions of the programs' functions.

Sumo Bot 6 Program

This program is the Sumo Wrestling program and performs the following functions:

1. Reads data saved by setup program or loads default settings.
2. Displays the settings being used to the display.
3. Counts down from 5 seconds.
4. Self-calibrates by taking light readings for white, black is defined as a reading 10 less than white.
5. Starts in Mode 1, see below for modes.
6. Enters the main program loop which has the following modes:
 - 6.1. Move forward with a slight random curve. After a random distance, change to Mode 7.
 - 6.2. If Left sensor sees black, the robot will back up and rotate away from edge and go to Mode 1.
 - 6.3. If Right sensor sees black, the robot will back up and rotate away from the edge and go to Mode 1.
 - 6.4. If the Ultrasonic, Infrared or SumoEyes sensor sees an object, it will head towards the object
 - 6.5. If SumoEyes sees an object on the left, it will move forward while turning towards object
 - 6.6. If SumoEyes sees an object on the right, it will move forward while turning towards object

- 6.7. Rotate left or right a random number of degrees and return to Mode 1.
- 6.8. If the Enter button on the Brick is pressed, the program will end.
7. If an action does not change within a specified a timeout period, a timeout occurs, and the robot will back up and rotate in a random direction at a random speed before returning to Mode 1.

Sumo Bot 6 Setup Program

This program allows the configuration of the nine settings which control the Sumo wrestling program. If it has not been run, default settings are used.

For NXT: Once started, press the Enter Button to cycle through the settings and options, and press the left and right arrows to change settings or execute actions.

For EV3: Once started, press the up and down buttons to move through the settings and options, and press left and right arrows to change settings or the Enter Button to execute actions.

The following chart shows the settings which can be changed to control the behaviour of the Sumo Bot program. The default values are the settings used when no settings have been configured or when the option to restore defaults is used.

Mode	Setting	Min Value	Max Value	Default Value
1	Sensor Mode	Light Sensor	Colour Sensor	Light Sensor
2	Sensor Ports	L = 3, R = 1	L = 1, R = 3	L = 3, R = 1
3	Motor Direction	Forward Motor	Reverse Motor	Forward Motor
4	Motor Speed	20 %	100 %	75 %
5	Turn Direction	Forward Turn	Reverse Turn	Forward Turn
6	Turn Speed	20 %	100 %	50 %
7	Ultrasonic/Infrared Range	0 cm = SumoEyes	50 cm	0 cm = SumoEyes
8	Deadlock Timeout	5 seconds	15 seconds	10 seconds
9	Wheel Circumference	50 mm	450 mm	200 mm

The next 3 modes are options, pressing either left or right arrow for NXT or the Enter Button for EV3 will execute the action.

Mode 10 - Test Settings: This will move the robot forward approx. 10cm and then back approx. 10cm. Then turn on the left sensor and turn left approx. 90 degrees and turn off the left sensor. Then turn on the right sensor and turn right approx. 90 degrees and turn off the right sensor. Finally, it will say whether or not the ultrasonic sensor or SumoEyes sensor can detect an object. To exit the test, press the Enter button.

Mode 11 - Save and Exit: This will save the current settings and exit.

Mode 12 - Reset Settings: This will reset the settings to default values and delete any saved settings.