Roboxsumo – An Introduction

What is Roboxsumo

Roboxsumo is a simple and cost effective robotics activity that can be used across a wide range of age groups and skill sets. Participants build cost effective cardboard robots (often old boxes) and compete in a simple "sumo" match contest where the robots try to push each other out of the ring. More advanced students can upgrade the sumo robots with simple, programmable controllers. Students are exposed to a wide variety of technical skills and old fashioned teamwork.

Advantages to Roboxsumo

There are many wonderful technology starter kits and robotics systems available on the market. In most cases, as the robotics kit becomes more advanced, it requires more infrastructure (trained teachers, technical assistants, special tools and equipment) to utilize and be successful with these packages. The Roboxsumo program was developed to fill the need for a simple, cost effective, easily deployed program with high accessibility. There are many advantages to a Roboxsumo Program.

1. Low cost supplies.
2. Easily deployed to a diverse range of students
3. The scope of the project can easily be expanded or contracted to fit the situation
   This program can be simplified to work with younger or less experienced students
   The curriculum can easily be expanded to include more advanced concepts.
4. Only a simple list of hand tools is required for this project
5. The program can be operated on a flexible schedule.
6. The program requires only simple training for leaders and facilitators.
7. The program can be performed in almost any setting.
8. The challenge does not require complex or expensive competition areas

How does Roboxsumo meet these objectives?
1. Use simple, readily available materials. Typically, the robots are constructed from cardboard and assembled with tape and hot glue. These materials are cost effective and easy for most people to locate, source and use.
2. Robots "share" a brain. The robots are driven by standard, off-the-shelf RC controls systems. Each robot has a LAN connector on the wire harness that plugs in to the controller. Instead of providing a controller to each student, robots share the controllers. The LAN connection makes it easy to install and remove the controls quickly. This also reduces the complexity of the challenge.

Basic Roboxsumo and variations

At the center is the "Basic" Roboxsumo program. The students use a standard kit of parts to assemble robots. A standard remote control "brain" is provided to the students and shared between robots. No soldering or electrical wiring is needed for the Basic part of the challenge as all electrical components are supplied complete. The Basic challenge is the easiest and least technically challenging. However, it is still fun and educational for students of all ages. Several additional technical challenges can be

added/included to increase the technical rigor of this program. Instructors and leaders are encouraged to develop new and interesting modifications to the program.

Motor Assembly – In a core Robox kit, the motor assembly is provided complete. It consists of two wheels, two small gearmotors, a piece of LAN cable and a standard RJ45 connector. One of the first and simplest expansions is to have the students solder together their own motor assembly. This adds wire stripping, and crimping, and soldering.

Simple controller – In the core Robox competition, students use the provided controllers. When students leave, they may want to continue to use the robots. In this expansion, students assemble a simple, two switch controller to run the robot. This continues what the student has learned in motor assembly and they learn more about basic circuits.

Programmable controller – In this expansion, students install a simple, programmable controller to operate the robot. Students will install, wire and program the controller to perform some basic tasks. This uses the Arduino Uno controller. The software for this controller is open source and readily available online.

A standard Sumo kit (without tools) costs about $35.00. On a basic Roboxsumo competition, each participant or team should have the following items:

ITEM	DESCRIPTION	QUANTITY
Wheels*	Pololu # 1420 60mm wheel for 3mm shaft	1 Set
Gearmotor*	Pololu #1125 4.5v 120 rpm gearmotor	2
Motor cable*	Lowes 303092 – Lan Cable	1 - 15" length
Crimp Terminal*	Lowes 111346 – RJ 45 Male	1
Boxes	Uline S-4125 12x12x12 box	½ box
Ping Pong Ball	40MM Ping Pong ball	1
Foil tape	Lowes 225505 – Aluminum Tape	1 - 6' lengths
Zip Ties	Lowes 76328	10
Pencil	Sharpened #2 Pencil	1
Paper	8.5 x 11 paper sheet	2
Shears	Scissors or Shears	1 pair
Sharpie Marker	Sharpie marker – Colors optional	1
Ruler	12" Desk ruler	1
Safety Glasses	Standard, clear safety glasses	1 pair per student

* The wheels, motors and electrical connections are typically pre-assembled.
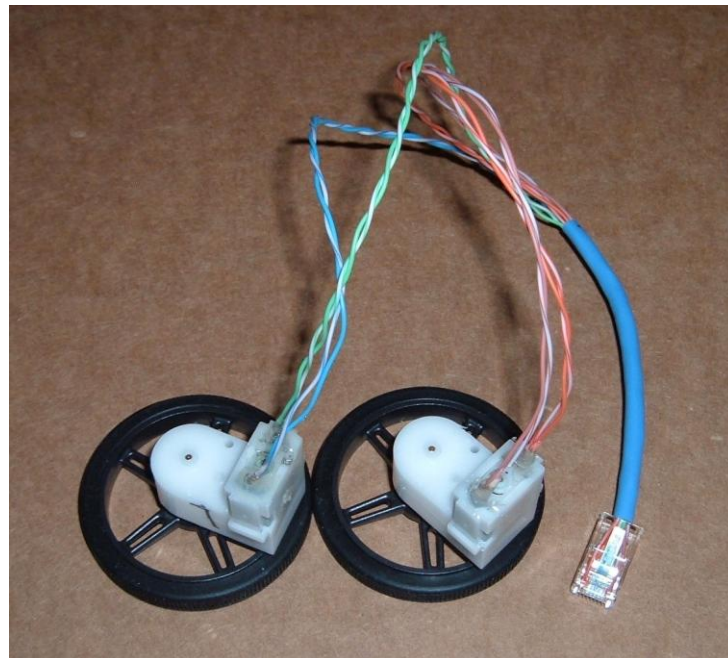
Some additional tools and supplies include:
Hot Glue guns and hot glue sticks
Utility knives
Safe cutting surfaces (cutting boards)

Standard Student Kit – Motors and wheels unassembled

Standard Motor/Wheel/Wire Assembly

Robot Controls

To keep costs down, robots controllers are not distributed to each participant. Instead, a simple controller is shared between the participants. The controller can be wired or wireless. Participants install and remove the controls between matches. The RJ45 connector on the motor assembly makes this easy to do. There are two standard controllers in use. The first is a simple wired controller (now available in 4 switch configuration). This connects a simple on-off switch assembly to the motors. This is a potential expansion project for more advanced students. Parts for this assembly cost about $35.00.

Wired Controller with 15' Cable

The wireless controller uses a standard 49mhz radio control tied to a motor controller. This allows the robots to compete without wires. The 49mhz radio system allows multiple radios to operate in the same location without interference. These are shared, but the cost per controller is significantly higher (about $180.00 per 2 motor control assembly).

Robot Controls – Wireless System

Outline – Standard activity Day

Listed below is the standard outline of the activity as used in a Middle School student setting. This can easily be updated. Depending on the number of students, the basic activity can require about 4 – 6 hours. Here is a standard 4 hour, afternoon program. This is a tight schedule. If there are more than 6 robots competing, it will be necessary to have more time for the competition. Or, split into multiple fields so competitions can occur at the same time.

- 0:05   Before beginning, break students up in to groups of 2 or 3. In most settings, 3 is the largest number that should be on each team.
0:10   Introduction – Introduce the program and presenters. Explain the purpose of the program and the goals of the Roboxsumo competition.
0:10   Safety – Discuss safety issues with students.
0:10   Kit of parts – Review all of the components and their use.
0:10   Contest Rules
0:10   Planning – Students discuss and plan their design – No building
1:30   Construction and testing time. Students need to complete the robot, and get it tested and inspected.
0:10   Clean up and prepare for competition
1:30   Competition. Students compete with their robots.

Contacts, Information and Supplies

This document provides a brief overview of the objectives, plans and materials for Roboxsumo. If you need assistance, materials or support, please feel free to contact us. We can help coordinate your event, provide parts, or just help you to develop your own variant of this exciting project. Updates, improvements and modifications are happening all the time. Contact information is provided below.

Pitt Pirates Web Site – www.pittpiratesrobotics.com
Roboxsumo website – www.roboxsumo.com – Go here for the latest updates and details
Bill McClung – Coach/Engineering Mentor –   email – juhling@suddenlink.net
                                               Cell – 252-347-3498

A great You Tube of our competition with Pitt County Schools to help better understand this program:

http://www.youtube.com/watch?v=6IhNHjE6-kY

Roboxsumo Rules

1. **DESCRIPTION:** Students will design and construct a robot (bot) from the provided materials. Each bot will attempt to move an opponent's bot from a ring.
   # OF TEAM MEMBERS: 2-4   **APPROXIMATE TIME**: 1 minute competition bout
2. **CONSTRUCTION DETAILS**
   a. Robots must be constructed from supplied materials only. Each team will receive the same materials.
   b. Robots must be controlled by provided controls. Motors on robot will be provided with connector for competition.
   c. Robots are powered by electricity only. Batteries will be part of provided controls.
   d. The robot's maximum dimensions will be 12" wide x 12" long x 12" high at any time in any configuration during the contest.
   e. The team number and team member's names must be written on the robot.
   f. Maximum weight of any robot is 1.0 kg. This does not include the weight of the provided controls or battery.
   g. The robot may have devices to remove the opponent from the square except any projectiles (Tethered or untethered), flames, sharp objects (3mm radius), and magnets. Only parts from the kit may be used in the construction of the robot.
   h. The robot must have a means (lid, opening, flap) to insert and remove the standard control assembly. The control assembly will be available for inspection and testing during construction.
3. **COMPETITION**
   a. Competition will proceed in tournament fashion. Single or double elimination may be used.
   b. Once called to compete, teams will have a maximum of 90 seconds to prepare their bot. Any robot not ready to compete in 90 seconds will forfeit the match.
   c. Robots will be inspected and weighed before the first round of competition. After the first round, teams may affect repairs on their robot between matches.
   d. Battery packs will be supplied by the event leader as part of the controls package.
   e. The "ring" will be a 5' x 5'square with designated starting points on each corner.
   f. Bots will start facing each other from opposite corners of the square
   g. Teams will have 60 seconds to force their opponent from the ring. If no winner has been declared at the end of the timed match, the lighter of the two robots will be declared the victor.
   h. Any bot damaging or depositing foreign substances on the surface of the ring will forfeit the match.
   i. If a part falls of a robot, at the judge's discretion, the clock can be stopped so the part can be removed from the ring. Then the match will continue.
   j. If any judge determines that a bot is taking a defensive posture and is backing away continually for 15 seconds, time will be called and that team will receive a stalling

penalty. This will reduce the clock by 15 seconds and the competition will resume where it left off. If it is the second stalling penalty, the team will forfeit the match.

k. If the bots become entangled so that neither bot can move for 10 seconds, the judges will stop the clock. The teams will place their bots back at the starting positions and the match will continue.

l. A judge may call time if any bot is obviously experiencing controls interference.

m. When the match time is over, teams must stop operating their bot immediately or risk forfeiting the match.

n. Except as noted above, one the match has started, there will be no time-outs until the match is over.

o. Definition of "out of the Ring". A bot is declared the winner when the other bot is completely out of the ring (pushed outside the boundary line of the ring).

p. Any bot inadvertently leaving the ring under its own power forfeits the match.

4. **SCORING**

a. Any team that deliberately attempts to do physical damage to an opponent bot will be disqualified.

b. Final rankings will be determined as follows: The team that wins the tournament will be awarded first place. The team defeated by the winning team will in the last bout of the tournament will be awarded second place. All other teams will be ranked by the number of wins. Ties will be broken by:
    i. Total number of wins divided by robot mass (High score wins)
    ii. Robot mass (lower mass wins)

c. Bots that do not pass inspection may not compete against bot that meet specifications. All bots will be inspected before they compete.

d. Any bot that is determined to be unsafe by the event supervisor will be disqualified.