

# Lego Robotics Workshop

## July 21-23, 2003

Here are some robots for you to build during the workshop.

1. **Acrobot:** This is a simple robot made of Lego bricks. It can completely flip-over and keep on driving. In order to flip over, Acrobot has to drive backward and then forward. It either does a wheelie or completely flips over, depending on the speed it has picked up.
  - **Estimated Building Time:** 30 to 45 minutes
  - **Building Difficulty:** Easy
  - **Programming difficulty:** Easy
  - **Building instructions:** Can be found in Constructopedia accompanying the Robotics Invention System 1.0, 1.5, and 2.0
  - **Extra pieces:** None
  - **Further improvement:** One special feature that can be added to Acrobot is the ability to know when it is upside down. To achieve this we will need a light sensor, some weight (like a stack of three pennies or a small block) and a black and white circular paper to detect when Acrobot is upside down. Once it detects that, it can perform an additional flip over to come back to an upright position.
2. **Trusty:** This robot is fast, yet very simple in mechanical design. It can follow a white or black line on a sheet of paper or ground. The idea is to use feedback from the light sensor to adjust its position. The light sensor is mounted on the front of the robot. Also, another special feature of Trusty is that it is a three-wheeled structure. Unlike other robots which use four wheels, Trusty uses a swivel wheel as a third wheel.
  - **Estimated Building Time:** 45 to 60 minutes
  - **Building Difficulty:** Easy
  - **Programming difficulty:** Medium
  - **Building instructions:** See Chapter 3 of *The Unofficial Guide to Lego Mindstorms Robots* for details.
  - **Extra pieces:** None
  - **Further improvement:** To further improve the line following ability of Trusty, we can attach an extra light sensor and adjust the position of the robot based on the inputs from the two sensors.
3. **Roverbot:** This is a sturdy and steady robot which can move around obstacles. It can be built with wheels, treads, or legs. Also, it can have a single bumper or double bumper.
  - **Estimated Building Time:** 60 to 75 minutes
  - **Building Difficulty:** Medium
  - **Programming difficulty:** Medium
  - **Building instructions:** Can be found in Constructopedia accompanying the Robotics Invention System 1.0, 1.5, and 2.0
  - **Extra pieces:** None
  - **Further improvement:** A light sensor can be added in front of the Roverbot to give it line following ability. Also, it can be converted into a dumpster truck by adding an additional motor to lift the cargo bin up and down.

4. **Diffbot:** This is a modification of Roverbot but with a fundamentally different idea. It uses two differentials in its design: one for moving forward and other for turning. A differential, similar to those in real cars, permits two turning wheels to rotate differentially to each other. This robot design also introduces the feature of a remote control.
- **Estimated Building Time:** 90 to 120 minutes
  - **Building Difficulty:** Hard
  - **Programming difficulty:** Medium
  - **Building instructions:** See Chapter 14 of *Dave Baum's Definitive Guide to Lego Mindstorms*.
  - **Extra pieces:** 1 differential, 1 bevel gear (only required when using set #9747 (RIS 1.5) and #3804 (RIS 2.0)) and 2 16-tooth gears
  - **Further improvement:** Using an additional RCX, the remote control can be converted into a totally wireless remote control communicating through infrared (IR) sensors.
5. **Roboarm:** This is a mechanically complex robot. It uses all the inputs and outputs of the RCX. Its three motors allow it to spin around looking for objects, grab and release them, and lift them up and down.
- **Estimated Building Time:** more than 2 hours
  - **Building Difficulty:** Hard
  - **Programming difficulty:** Hard
  - **Building instructions:** See Chapter 19 of *Dave Baum's Definitive Guide to Lego Mindstorms*.
  - **Extra pieces:** 1 extra motor, 14 2x4 brick, 4 1x4 brick and 1 2x8 brick (only required when using set #9747 (RIS 1.5) and #3804 (RIS 2.0))
  - **Further improvement:** Think of something!
6. **VisionCommand:** This is a digital camera add-on that can be connected to an RCX. Anyone who can complete all the above robots qualifies to work with this!

### Additional Information:

This document was prepared by Mayur Patel (RPI).

Please contact Srinivas Akella ([sakella@cs.rpi.edu](mailto:sakella@cs.rpi.edu)) of Rensselaer Polytechnic Institute, and Lourdes Lejano and Jenn Novak ([jnovak@junior-museum.org](mailto:jnovak@junior-museum.org)) of the Troy Junior Museum for additional information on the Lego Robotics Workshop.