RichardVannoy.info

Lynxmotion.com 4-Wheel Drive Rover Kit

Recently, in appreciation for my robotics and electronics work with my students, my supervisors gave me the gift of a '4WD1 Rover Kit' from Lynxmotion.com. The kit includes:

- The rover body with four wheels and four drive motors
- A Sabertooth 2X10 Motor Controller
- A Bot Board II Carrier Board
- A Basic Micro microcontroller NOTE: Since I am teaching several classes using the Arduino Uno Board, I'll be replacing the Basic Micro with the Arduino Uno for this project.
- Three Infrared sensors
- A 12 Volt battery with a Universal Smart Charger
- I've added a 6 volt battery so that it can power the electronics and the 12 volt battery can be used only for the motors.

My plan is to use this page to let you walk through the assembly, testing and operation of this rover project along with me.

Since this page is getting longer every day, and I will have quite a few photos, I will do two things:

1. Use a free program called FastStone Photo Resizer to reduce the pixels on the high resolution photos I take. This reduces a 1 Megabyte photo to about 30-50 KB at 72 Pixels per inch.
2. To further reduce loading times, I'll split up this page into several pages. The links just below will be near the top of each page. Use these links to move around:

Assembly Language

Glossary of Robotics and Electronics Terms

SSE8680 Development Board

The First Steps

The kit comes with no instructions, but a slip of paper in the kit referred me to the Lynxmotion web site to find the instructions. I was directed to the pages that should give me all the information I need. Several links had internal links to other pages, so the first task seemed to be to find and print all available documentation. Set up a folder on your hard drive to store all the information on your project. There will be a number of things you will find and want to save. I used 'C:\MyStuff\MyRobots\Rover', but use any folder you like.

Here are the steps to gather the documentation:

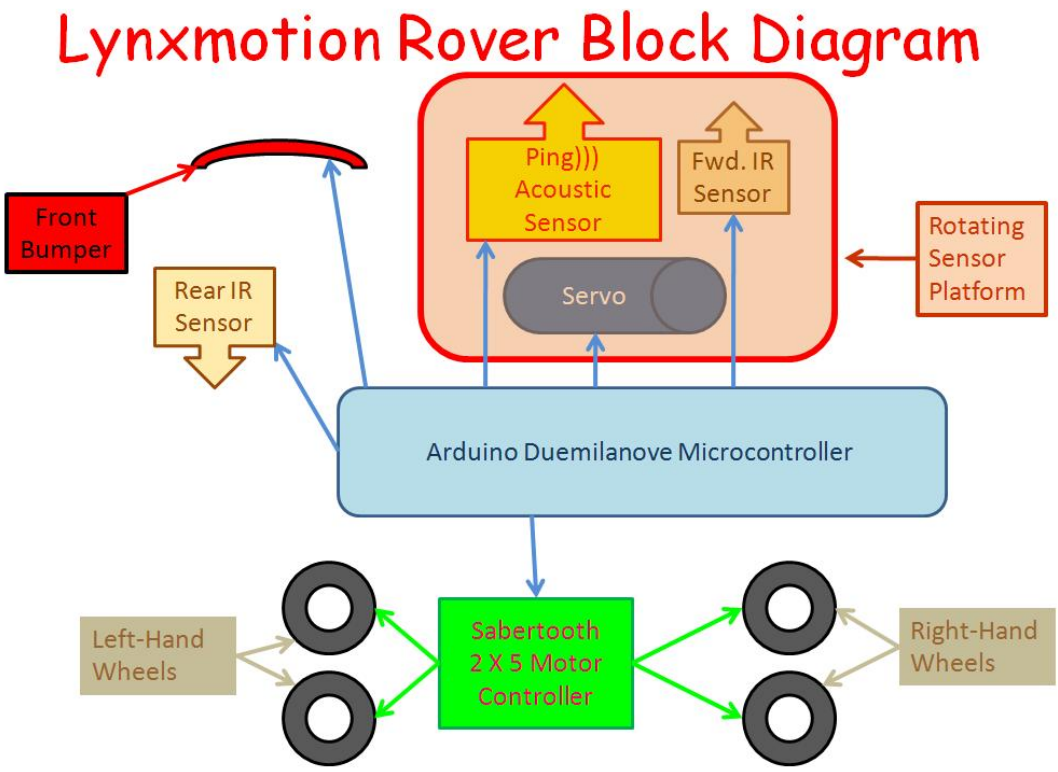
Go to the Lynxmotion home page: http://www.lynxmotion.com/

1. In the left-column menu, click on 'Information'. This will take you to: http://www.lynxmotion.com/s-1-information.aspx. On this page, click on 'Assembly Guides'. On the page that appears, click on the image labeled '4WD Rovers'.
2. You are going to download, save or print a number of documents shown on this page. Since I have a color printer, it was easiest for me to just print each document. All of the documents are in printer friendly format. You can also do 'Save As..." for each document. Documents below labeled 'Optional' only need be downloaded if you intend to use this feature in your rover. Here are the documents you will want:
   Tutorial for preparation of the laser-cut Lexan used in the kits
   Tutorial for Motor Wiring
   Tutorial for Encoder Assembly (Optional)
   Tutorial for Tire Mounting
   Tutorial for Servo Mid Position
   Tutorial for Servo Horn Information
   Tutorial for Adjusting End Stops on Digital Servos
   Tutorial for Autonomous Behavior (Bot Board II/ATOM Pro 28)
   Assembly Guide for A4WD1 v1
3. If you print these documents, I suggest you put them in a three ring binder in the order above. The order above is the order I will go through each document during construction.
4. THROUGHOUT THIS DOCUMENT I WILL REFER TO THE DOCUMENTATION ABOVE, SO YOU NEED TO HAVE IT HANDY. It makes no

sense to me to write detailed instructions here when the manufacturer already provides a complete set of assembly instructions. Rather than reinvent the wheel, I will follow those instructions and supplement them here with anything I feel another hobbyist might want to know. The headings below that are links, when clicked, will guide you to the appropriate instructions document.

The Rover's Mission

Before we get rolling on the construction, this would be a good time to discuss the robot's mission. The mission should dictate what sensors and hardware will be required. Since I teach electronics and programming, I wanted a bot that did something interesting for my students. My first goal is this: Bring the robot to class, start it, and have it wander around the classroom without hitting anything. There are a number of improvements such as voice control, follow the teacher, and others, but that can come later. I also like to make a block diagram of any robot I build, to keep me focused on the mission and the hardware required. Here is my block diagram:



Lynxmotion Rover Block Diagram

Several comments on this block diagram...

- The part marked 'Rotating Sensor Platform' is where the Ping and forward IR sensor will be mounted. It will be a small, simple place to mount the two sensors directly on to the servo. The servo mounted on the front of the robot will turn both sensors. The plan is to use the full servo range of 180 degrees. Starting at 90 degrees left of center, the sensors will be rotated in increments of

30 degrees until they reach 90 degrees right of center. These six readings will then give an idea of the terain ahead.

- The Ping sensor was chosen to provide longer range detection, up to about three meters, and the IR sensor will look closer in. I also mixed sonar and IR to improve detection. In the robots actual environment, a classroom, there are several difficulties. Some chairs have black non-reflective legs that will be harder to detect with IR and easier with sonar. There are also several things in the room that might better be 'seen' by sonar than IR. Hopefully, the mix of frequencies will improve detection and reduce the number of collisions.
- Just in case, there will be a front bumper mechanically connected to a microswitch to detect head-on collisions. This will be the last resort for obstacles not detected by either the sonar or IR sensors.
- The rear IR sensor will normally only be used when manuevering to get out of a corner or a tight spot. When backing, it will provide distance information.
- I considered a 'looking down' IR sensor on the front of the robot, to keep it from falling down stairs, but since the robot won't be allowed near any stairs for a while, this was reserved for a later addition.
- I experimented with Microsoft Visio, Word and several other diagramming softwares with unsatisfactory results. This diagram above was done in PowerPoint which has a wide range of shapes and is quite easy to work with.

Although not shown here, I decided that I wish to use sound to tell the human what the robot is doing.In part 3, I will be setting up sounds using the Uno Board.

Part 1: First Steps Part 2 Mechanics Part 3 Sensors Part 4 Source Code

Please email me at RoboticsProfessor@gmail.com if you have any questions or comments.