Omni-Directional Rover Wireless Control System

Sponsor: Tim Lexen
Sponsor's General Mission or Business Statement: The sponsor is employed full time in industry. This project is a personal/private project to help prototype and test an invention.
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Senior Design Clinic I-II 2005-6 Project Mission Statement: Design a wireless control system to demonstrate the capabilities of the omni-directional rover.

Design requirements:

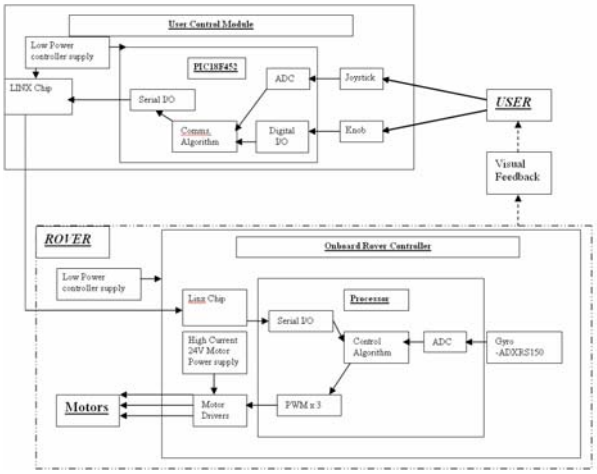
1. Control module shall provide wireless control at a distance of at least 30 feet.
2. Control module shall allow full three degree-of-freedom motion control allowing the user to independently specify the following:
    a. Orientation
    b. Direction of movement
    c. Speed
3. Project budget of $2000 excluding the cost of additional motors.

Project summary:

Our project goal is to create a wireless control solution to exhibit the capabilities of the unique locomotion method of the omni-directional rover provided us. We determined that, for reasonable demonstration of these capabilities, it would be necessary to discern the dynamics of the rover and implement an algorithm that utilized closed-loop control, as well as create a wireless user interface for portability and ease of use.

We identified three main areas to attack this problem from: control algorithm, wireless communication, and user interface. The highest risk and priority among those was the algorithm, as it was the most open-ended of the three areas. After attempting to develop an exact physical model, we moved on to a discrete-time controller, which has been able to reduce steady-state error and attain the movement we sought. We tried out different methods of sensory input, narrowing things down to an accelerometer-gyroscope tandem input. We eventually eliminated the accelerometers, leaving us with a single gyroscope as our sensory feedback mode. Next in priority was the user interface. We selected a joystick and rotary pulse generator combination to accept directional and rotational inputs, respectively. Finally, we had experience with a particular wireless module from a previous class, and we chose to make use of that experience in our design, as it fit our specifications and requirements. The result is a joystick and pulse generator, as part of a control box held by the user, being used to move the rover in any and every direction at every angle.

System Block Diagram



Control Diagram