Initial investigations into two different approaches for applying autonomous ground vehicle technology to the vehicle convoying application are described. A minimal capability system that would maintain desired speed and vehicle spacing while a human driver provided steering control could improve convoy performance and provide positive control at night and in inclement weather, but would not reduce driver manpower requirements. Such a system could be implemented in a modular and relatively low cost manner. A more advanced system would eliminate the human driver in following vehicles and reduce manpower requirements for the transportation of supplies. This technology could also be used to aid in the deployment of teleoperated vehicles in a battlefield environment. The needs, requirements, and several proposed solutions for such an Attachable Robotic Convoy Capability (ARCC) System are discussed. Included are a discussion of sensors, actuators, computers, communications, control systems, and safety issues. This advanced robotic convoy system will provide a much greater capability, but will be more difficult and expensive to implement.
Guidance of a Mobile Robot Using an Omnidirectional Vision Navigation System
Sung Jun Oh and Ernest L. Hall (Center for Robotics Research, University of Cincinnati, Cincinnati, OH 45221-0072)

Navigation and visually guided control are key topics in the design of a mobile robot. Omnidirectional vision using a very wide angle or fish eye lens provides a hemispherical view at a single instant that permits target location without mechanical scanning. The inherent eye movement, which is associated with this view, is easily corrected to provide accurate position determination for navigation and control.

The purpose of this paper is to present an analysis and experimental results relating to the accuracy, resolution, errors, and other imaging characteristics of the omnivision system. These experiments were conducted using a prototype sensor, laboratory vision processor, and an industrial robot for controlled motion. Multiple target detection and tracking have been performed. The significance of this work is that the experimental information provides a greater understanding of the dynamic omnivision characteristics and the ability to evaluate and improve the prototype sensor. This sensor system is currently being developed for a robot lawn mower.

Development of an Electrical Flywheel for Surge Power Applications in Mobile Robots
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A flywheel can greatly extend the capabilities of mobile robots by increasing the power available to operate special equipment like transmitters, drills, manipulator arms, mobility augmenters, and other surge power devices. The electromechanical design of a reliable, energy efficient and (relatively) low cost flywheel is discussed in this paper. Flywheels are reliable (in spite of having moving parts) and energy efficient compared to batteries. Flywheels can endure hundreds of charge/discharge cycles while few batteries live beyond one thousand cycles. Laboratory tests of a prototype flywheel rotor and separate tests of an actuator indicate that the combination of a high efficiency brushless motor/alternator and a laminated steel rotor operating in a compact, hermetically sealed container with only electrical input and output can overcome the inefficiencies generally associated with mechanically geared devices. Electrical output energy divided by electrical input energy (round trip efficiency) approaches 95% at the duty cycle approaches 100%.

Ground Vehicle Convoying
Douglas W. Gage (Naval Ocean Systems Center, San Diego, CA 92152), J. Bryan Petrella (Sandia Corporation, Albuquerque, NM 87185)

Initial investigations into two different approaches for applying autonomous ground vehicle technology to the vehicle convoying application are described. A minimal capability system would maintain desired speed and vehicle spacing while a human driver provided steering control. A more advanced system would improve convoy performance and provide positive control at night and in inclement weather, but would not reduce manpower requirements. Such a system could be implemented in a modular and relatively low cost manner. A more advanced system would eliminate the human driver in following vehicles and reduce manpower requirements for the transportation of supplies. This technology could also be used to aid in the deployment of teleoperated vehicles in a battlefield environment. The needs, requirements, and several proposed solutions for such an Autonomous Robotic Convoy Capability (ARM) System are discussed. Included are a discussion of sensors, actuators, computers, communications, control systems, and safety issues. This advanced robotic convoy system will provide a much greater capability, but will be more difficult and expensive to implement.

Prolog-Based World Models for Mobile Robot Navigation
Mark B. Kadomoff (Deming Mobile Robotics, Inc., 3 Cummings Park, Woburn, MA 01801)

Model-based reasoning provides a powerful tool for intelligent robotics applications. Current mobile robot world models have been of limited use due to the static spatial relationships they maintain of their environment. Experience gained from configuring mobile security robots for several real-world applications has pointed out the difficulty of designing a general purpose feature-based world model.

An alternative approach is to develop an extensible world model that can be easily tailored for a particular environment. Features can be added or removed interpretively from the model as necessary. Navigation and position estimation algorithms are developed for each class of features. The application engine then declares features appropriate to a particular installation.

This paper will describe a prototype system constructed using a Prolog interpreter augmented with CoLinced sensed and control primitives, controlling an indoor mobile security robot.