NIST Mobility and Manipulation Project Needs and Plans

The NIST Mobility and Manipulation (MM) Project is seeking government, industry and/or academia collaboration for several projects related to performance measurement and standards. These efforts currently include:

- ANSI/ITSDF B56.5 Safety Standard for Guided Industrial Vehicles: Testing and data analysis aimed at improvements to the standard, particularly for non-contact safety sensors.
- Navigation of Automated Guided Vehicles (AGVs) in the neighborhood of robot arms, obstacles, and humans including standard test pieces that resemble human legs and bodies and flats resembling facility obstacles.
- Exploring the use of advanced sensors, such as flash LIDARs, for detection of overhanging obstacles in the path of a vehicle.
- Developing performance measures for robot arms for use in autonomous assembly including standard performance tests based on RIA and ISO standards. The project testbed includes an industrial robot mounted on a linear rail.

The MM Project also plans to conduct performance measurements and standards research on real world, high risk, high impact manufacturing areas, targeted at fully- and semi-autonomous assembly tasks including, for example:

- Using AGVs to deliver parts to robot arms or in the vicinity of robot arms, with the goal of advancing current robot and vehicle standards
- Detecting humans and other obstacles within manufacturing and assembly areas, with the goal of enabling closer collaboration between humans and robots in the workplace.
- Autonomous vehicle navigation around stopped vehicles to improve manufacturing process efficiencies and continuous parts/assembly flow.
- Developing methods and metrics for evaluating the performance of assembly tasks for robot arms with and without human support

The project is seeking challenge tasks from and opportunities to interact with organizations outside NIST who have unmet measurement and standards needs. The MM Project is currently characterizing components of the new NIST robot testbed, which includes a six-axis industrial robot arm under-slung on a linear rail. Other components include a surrogate AGV with safety sensors and sensors for navigation, and a variety of ranging and imaging sensors for parts location and inspection. The robot is controlled by a standard industrial controller, but the AGV and the testbed as a whole use an experimental open-source controller largely developed at NIST. Workers in the vicinity of the testbed and AGV are protected by industrial safety sensors.

Industry can benefit from the validated testbed by collaborating with NIST researchers to evaluate components in the testbed environment and to help with the development of

generic test methods and performance standards. Input from real-world users and developers is crucial for the project's success because it ensures that work is carried out on those measurements and standards problems that are of concern to industry. Real world applications are also highly beneficial for developing and evaluating generic measurement methods. NIST researchers will use the testbed to collaborate with outside organizations on problems of mutual value. The project can also benefit from loans or components such as robot vehicles, arms, controllers, grippers, sensors, tools, and other equipment, as well as typical parts to use in experiments.