MobMan is equipped with the Siemens Navigation System for Autonomous Service Robots (SINAS), which is considered to be the world’s most advanced robotic navigation system (see *Pictures of the Future*, Fall 2002, p. 59). Robots equipped with this technology can find their way around even in a changing environment.

MobMan’s gripper arm is fitted with laser-controlled proximity sensors that guide it unerringly toward an object. Similarly, tactile sensors calculate the exact pressure required for the gripper to firmly hold an object without crushing it.

Gisbert Lawitzky, who is in charge of the Siemens Robotics team, refuses to speculate whether warehouses will one day be populated by hundreds of MobMen. “Whether it makes economic sense to use one of these sophisticated pieces of equipment is ultimately a question of cost,” he admits. But where price is not the decisive factor, such as in wealthy private households, a simpler version of the robot could eventually be put to use as a kind of electronic butler.

**Digital agents** could be used to negotiate conditions and track thousands of goods.

**Logistics Agents.** Michael Berger, project manager for Intelligent Autonomous Systems at CT in Munich, is also interested in digital assistants. Unlike MobMan, however, Berger’s inventions consist of bits and bytes rather than metal and cables. Berger specializes in so-called digital agents — computer programs that manage limited tasks for humans. The digital agent concept is already used by Internet auction houses such as eBay. The prospective buyer merely names a price, and the software then handles the negotiations.

In the world of warehousing, such agents could one day help to ensure smooth and prompt deliveries. For example, they might be used to negotiate conditions with shipping companies and look around for the best deal on the market. Some people might still hesitate at the idea of placing so much trust in a computer. However, Berger is certain that agent technology will move in this direction.

“We’re currently involved in a project with a software producer that is designed to improve how individual orders are tracked,” says Berger. “Such a program will make it easy to determine quickly and precisely whether goods have been lost, stolen, or are simply late.” Goods are scanned in at the manufacturer, at the shipping company, at the warehouse and at the customer’s location. So in theory it would be possible to determine the precise location of an item at any given time.

The problem at the moment, however, is that not everyone in the logistics chain uses the same data-processing system. The result is often a muddle of faxes, phone calls and e-mails. Thus, the primary task of a digital agent would be to communicate with these various systems and extract the relevant data. Today, it’s impossible for a shipping clerk to track thousands of orders at once, but that’s exactly what a digital agent would do. For the warehouse clerk, the resulting information would make a crucial difference, allowing contingency plans to be made in case a delivery fails to arrive on time.

In the future, digital agents could even take over planning for crisis measures and shipping alternatives. After all, the ultimate aim is to optimize procedures along the entire logistics chain. This means minimizing inventory, for example, to ensure that capital isn’t tied up unnecessarily, while also ensuring that shelves are well stocked.

The future will determine whether warehouses will one day be managed and operated exclusively by an intelligent combination of virtual agents and robots.

**Boom in Worldwide Product Shipments**

Even though the world’s economy remains generally sluggish, logistics is still a growth market, with Asia serving as a strong driving force. At the moment, 98 percent of all goods transported between continents are moved by ship. Furthermore, according to a 2002 transportation & logistics analysis conducted by HVB Equity Research, this logistics segment is expected to grow by 5.6 percent annually worldwide until 2010. Starting in 2005, a new generation of mega-container ships capable of carrying 12,000 TEU containers (Twenty-foot Equivalent Unit, about 6.1 x 2.4 x 2.6 meters) will be ready to enter service. By comparison, today’s biggest container ships can carry “only” 7,500 TEU containers.

The air freight segment is expected to register a 5.9 percent annual increase worldwide through 2010, according to HVB Equity Research’s data. Reacting to this boom, European aircraft manufacturer Airbus is planning to produce a freight version of the huge A380 jetliner, which will be known as the A380 Freighter. By 2008, this plane will be transporting payloads of 150 tons nonstop over distances of more than 10,000 kilometers — a dramatic advance over the A300F transporter in use today. This aircraft is capable of hauling a maximum of 51 tons of cargo over a distance of nearly 4,800 kilometers, nonstop.

Overland freight transport is realized with trains, barges and trucks. Annual growth expectations for road transports are 3.3 percent within Europe through 2010. According to a forecast for the year 2015 made by the German Ministry of Transport, Building and Housing, the goods transported on roads will
DEVELOPMENT OF WORLDWIDE CONTAINER TRANSPORT

Growing globalization is reflected in the growth rate of sea freight transport. Since 1980, transport volume worldwide has increased nearly sevenfold. Sea freight will also remain a growth market in the future.

The world market for electronic logistics will triple through 2012, according to forecasts.

DEVELOPMENT OF WORLDWIDE AIR FREIGHT

Since 1980, the market for air freight has increased fivefold. Following the terrorist attacks in the United States in 2001, the market temporarily slumped, but is expected to recover by 2004. Growth will continue, although at a slower rate than in the past (based on estimates made since 2002).

DEVELOPMENT OF ROAD TRANSPORT VOLUME IN EUROPE

Compared with sea and air freight transport, overland shipments in Europe have grown rather slowly — a trend that is expected to continue in the future. Nonetheless, by 2010, ton-kilometers of goods transported overland in Europe will have grown by about one-third compared with 2000.

In order to cut costs and accelerate processes, increasing numbers of companies are employing electronic logistics systems. These include end-to-end tracking systems, technology for highly automated warehouses and software solutions for the logistics sector. The global market for electronic logistics is forecast to triple in the medium term — from $26 billion in 2002 to $78 billion in 2012.

A real boom is expected for end-to-end tracking systems, which make it possible to follow a product’s entire path all the way from supplier to customer. Forecasters predict annual growth rates of 20 percent for end-to-end tracking systems, and a sixfold increase to a total of $10 billion in 2012, as compared with a global market volume of $1.6 billion in 2002.

The global market for automated technologies for warehouses is expected to nearly double. Software solutions for logistics accounted for a total market volume of $8.2 billion worldwide last year. Market researchers from AMR Research and Siemens expect the annual growth rate for such solutions to reach 17 percent by 2012. Accordingly, their market volume could increase to as much as $38 billion within the next ten years.

— Sebastian Moser, Ulrike Zechbauer