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LOCATION, LOCATION, LOCATION

GPS RESEARCHERS TRY TO ZERO IN ON PINPOINT ACCURACY

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Ancient navigators once looked to the stars to find out where they were. Today, people are still looking to the skies for the same purpose, but they're getting the information from satellites, not the stars.

A group of Stanford University academics wants to make such navigation so accurate that it could tell whether you are in your car or standing next to it.

Since the government first launched a satellite navigation system known as the global positioning system in 1978, the system's ability to pinpoint the location of an object has steadily improved.

GPS receivers used to be bigger than a brick a decade ago and were accurate to within about 100 meters. Today a handheld $100 GPS receiver can fix a point on the ground within five or 10 meters, while more expensive military systems can zero in on the receiver within five meters or less.

But the GPS system doesn't get much better than that, and it doesn't work indoors or in deep urban canyons where a target object isn't within the line of sight of two or more satellite. And it isn't that hard to jam GPS signals.

Such a system isn't good enough for James Spilker and Per Enge, who are among the founders of the Stanford Center for Position, Navigation and Time. Spilker, a founder of navigation chip start-up Rosum and one of the creators of GPS, believes satellite navigation is just in its infancy.

"Technologies are coming to the forefront that will impact billions of people and millions of businesses," Spilker said. "Our humble goal is to create the top-ranked university center in the world for this realm of technology."

The interdisciplinary research center wants to create a navigation system capable of locating objects within one centimeter, or less than half an inch. The center hopes to achieve that goal within the next 20 years.

It already has a lot of ideas on how to make navigation systems much more accurate, said Enge, the center's research director and professor of aeronautics and astronautics.

"There are a lot of exciting pieces that we're putting together," Enge said. "We want to make the system bulletproof."

Already, GPS navigation is being built into cars and cell phones to enable people to figure out where they can find the nearest restaurants or locate someone in need of 911 assistance. Tens of millions of people track their locations today. The business consulting firm Frost & Sullivan estimates that the market for GPS equipment sales could hit $10 billion by 2010, with consumers accounting for much of those sales.

The Stanford center has federal funding and is raising more money from commercial industry partners who could participate in the research effort. Matt Rabinowitz, chief technology officer at GPS-TV chip maker Rosum in Redwood City, said the goal of centimeter accuracy is extremely hard to nail down in environments that aren't traditionally friendly to GPS or sensors.

"If anyone can do it, it's the guys at Stanford," he said.

Sirf Technology, a San Jose GPS chip-design company, will probably join the effort.

"It's important to look ahead to the future while you're solving the problems of today," said Kanwar Chadha, founder of Sirf. "If they can get to centimeter accuracy in the open, then it means that in a

difficult environment, they could maybe have a meter or so accuracy. And for a lot of consumer applications, that's going to be enough. If they can work to make it instantaneously, then that is also going to be very important.''

Better satellite-based navigation technology is just one element of a system that could deliver pinpoint accuracy. Other elements come from a variety of disciplines and include inertial navigation, which is based on work by Stanford physicist Mark Kasevich. These sensors could be embedded in GPS receivers and detect tiny movements, broadcasting information about the object's location even when out of satellite detection.

Tom Kenny, a professor of mechanical engineering, also is working on silicon oscillators that could improve the reliability of a GPS device. And electrical engineering professors Umran Inan and Arogyaswami Paulraj are trying to create much smarter antennas to improve GPS reception in a variety of hard-to-locate places, even in the presence of jamming devices.

Spilker hopes that the system could be extended so it works both underwater and underground.

If they can pull it off, the technology could bring about some astounding advances with commercial and military applications. With centimeter accuracy, bombs and missiles will almost never miss. Aircraft could land on carriers without the need for a pilot's steady hand.

The task of finding land mines could become much easier as a metal detector could not only find a metal object accurately, but determine its shape underneath the ground so it can be safely tracked and removed. Enge believes the military could create a small robot helicopter with a one-yard rotor span that could fly over unexploded mines and map them for soldiers to see.

On the commercial front, Enge believes that something called ''geoencryption'' could become a reality. That's where someone logging into a computer would have to prove their location in order to access a computer. If someone logs in from the wrong location, a security alert could be sent.

Indoors, a better navigational system could sense and locate Alzheimer's patients inside their homes and track their movements. If the patients do something out of character, like failing to answer

the telephone or move from one spot for hours at a time, the system could send an alert to caregivers.

Katherine Albrecht, a privacy activist and founder of the anti-tracking group Caspian, says the center should also study the social implications of tracking technology.

"I would hate the idea of this being built into every Timex watch, and then they consider the implications for privacy," Albrecht said. "These applications have benign uses, but the same technologies can be used for sinister purposes. It would be fabulous if you could turn it off."

Enge acknowledged that with better location technology comes the responsibility of balancing privacy rights. Such systems could be abused in a wide variety of ways, but the founders believe the benefits outweigh the risks.

If the industry doesn't address the privacy concerns up front, consumer resistance could kill the technology altogether, Chadha said. "Most of the applications we foresee are in the non-military realm," Spilker said.

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STANFORD GPS GOAL
Locating objects within a centimeter. The center hopes to achieve that goal within the next 20 years.

Caption:
PHOTO ILLUSTRATION: TRACY COX -- MERCURY NEWS
[Man standing on target]
PHOTO: KAREN T. BORCHERS -- MERCURY NEWS
Stanford professors Per Enge, left, and James Spilker are leading an effort at the Stanford Center for Position, Navigation and Time to increase the accuracy of GPS navigation.Photos (2)

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