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Driverless cars just around the corner

By GREG HACK
The Kansas City Star

America's love affair with cars has been going on for more than a century. But if you're one of those people who really hate driving, the future could belong to you.

Thanks to advances in sensors, GPS systems, electronic steering and computerized braking, cars have been developed that drive themselves. Researchers around the world — and in Kansas City — are working to make everyday use of driverless cars a reality.

"This is not futuristic," Vijay Kumar, a professor of computer science at the University of Missouri-Kansas City, said in a recent interview. "We have the technology. We have the talent" to make it happen.

Automotive systems have advanced to the point that current driverless projects include an Italy-to-China trek and a high-speed run up Pikes Peak — testing in extreme conditions to root out weaknesses and improve the systems' reliability. Other research involves figuring out the best way to put the vehicles into widespread use.

For example, Kumar said his work involved "not a driverless car" but a "self-synchronizing moving objects" system. He wants to go beyond cars that simply avoid crashing, to vehicles whose computers communicate with one another. In his scenario, vehicles will be able to move in harmony, maximizing efficiency and even eliminating the need for traffic lights or other outside controls.

"Initially, a voice-activated system will give commands to the driver," he said. "Later, a fully automatic system will be developed in which the driver would not have any role to play."

Under a fellowship this summer, Kumar has been developing his system on computers at the U.S. Air Force Research Laboratory's site in Rome, N.Y. Later this week, he will be back in Kansas City, ready for the next phase of his project if funding comes through from the Air Force lab and some other sources. By the end of the year, he hopes to have a prototype system working, using programmed model cars.

"This is a complicated decision making process," he said in an interview from the research site. "It is more effective if people can see a system work."

Existing systems

Driverless cars — or autonomous vehicles, as researchers often call them — seem like science fiction to most people. But basically they enhance and integrate technology that many vehicles already have. Imagine a computer and GPS system, equipped with advanced sensing devices, that tells the steering, braking and acceleration systems what to do, instead of telling you where to drive.

Cruise control and antilock brakes have been around for years, but some models on the market today also have systems that will park your car for you, or warn you if there's a car in your blind spot, you're crossing a lane line without signaling, or closing in on another car too fast. "Adaptive" or "dynamic" cruise control will slow your car down to keep a safe distance for the vehicle ahead of you. Still other systems will tighten seatbelts, alert airbags and prime the brakes for maximum power and sensitivity if they sense a crash is coming.

BMW even offers a system that can fully stop a car in slow traffic and speed it up again when the car in front of it starts moving again.

"You can buy a car today that I'd like to say is 90 percent driverless," said Randal O'Toole, a senior fellow at the libertarian Cato Institute whose books include "The Vanishing Automobile and Other Urban Myths" and "Gridlock: Why We're Stuck in Traffic and What to Do About It."

In an interview last week, O'Toole noted that a top-of-the-line 2010 Toyota Prius with its advanced technology package — for an additional $5,180 on the sticker price — has a sophisticated GPS navigation system, adaptive cruise control and systems for parking, staying in lanes and avoiding collisions.

"Basically, turning that into a fully driverless car is nothing more than a software upgrade," he said.

Are we there yet?

One person familiar with that “software upgrade” is Chris Gerdes, a professor in Stanford University’s mechanical engineering department. He is leading the team that wants to race a converted Audi TTS up Pikes Peak.

Even though he’s confident that will happen, he wrote in an e-mail last week: “There are a lot of factors involved with self-driving cars getting on the road. … A lot has been accomplished, but more remains to be done.”

Both O’Toole and Gerdes referred to the 1939 New York World’s Fair, when futurist Norman Bel Geddes designed a popular exhibit for General Motors called Futurama. Bel Geddes promised “a new kind of driverless car that is controlled by the push of a button.”

But in the seven decades since, “Driverless cars have been consistently 20 years in the future,” Gerdes said.

Safety systems that bypass the driver have picked up substantially since 1990, and they took a big step forward in 2007, O’Toole said.

That was the year of the DARPA Urban Challenge, the third driverless-vehicle contest sponsored by the Defense Advanced Research Projects Agency. The Defense Department is interested in the technology — imagine a driverless truck delivering supplies in a war zone — and the research agency’s first two challenges asked driverless vehicles to negotiate courses in the desert.

After five vehicles met the second challenge in 2005, the agency decided it was time to raise the bar and require the vehicles to drive in traffic.

For safety’s sake, the Urban Challenge wasn’t conducted on public streets but a course resembling city streets was mapped out at a former air base in California. A series of tests involving parking, merging, weaving through obstacles and negotiating four-way-stop intersections winnowed 35 entrants to 11 finalists.

Two days before the final event, each of the 11 teams got a computerized map of the course. Five minutes before the event, each got a “mission file” of checkpoints to hit along the route. Besides the finalists, 30 cars with drivers were on the course to add to the traffic.

One car was removed from the competition after it almost crashed into a building, and one minor accident occurred when two vehicles bumped sides at low speed. But six vehicles completed the challenge — with no drivers and no communication from outside the vehicles.

Moving ahead

The defense agency isn’t planning another driverless-car challenge at this time, but that hasn’t seemed to slow research and testing.

Two weeks ago, two pairs of electric-engine orange vans set out from Milan on an 8,000-mile journey, hoping to arrive in Shanghai by the end of October.

The pairs are alternating driving and riding along on an accompanying truck. In the pair that is active, a lead van with a driver is being followed by another van programmed to stay behind it without any human intervention. Two engineers in the following van will be able to take over, if needed.

To add to the challenge, the vehicles have rechargeable electric motors, a top speed of 37 mph, and solar panels on their roofs to power their navigation equipment. They can travel only two two-hour shifts a day because their batteries take a long time to recharge.

“What we are trying to do is stress our systems and see if they can work in a real environment, with real weather, real traffic and crazy people who cross the road in front of you and a vehicle that cuts you off,” project leader Alberto Broggi told reporters before the journey started.

Back in the U.S., Gerdes has been in Utah testing the autonomous Audi for its 14,000-foot run up Pikes Peak. Gerdes, who answered some questions by e-mail, wrote last Tuesday: “Today in the Bonneville salt flats we ran a ‘flattened’ version of the hill climb route with no one in the car and everything went smoothly.”

In September, the Audi will drive itself up the mountain’s treacherous curves, though at slower speeds on much of the route. If all goes well, a full-speed run could come in 2011 — a white-knuckle ride, if there were a driver.

Gerdes also said that although his team’s focus was “to get a single car to be able to drive at the limits of handling,” he liked Kumar’s research because “multiple cars with this capability could cooperate to avoid an even larger number of accidents.”

Kumar, 64, doesn’t fit the profile of the young, high-tech researcher. But he has been teaching at UMKC since 1986, and his decades of work could make him the right person to assemble the pieces of such a big puzzle.

The list of his research projects and interests includes “mobile and wireless computing,” “mobile database systems,” “sensor technology” and “data dissemination on wireless channels” — the sorts of functions that must be conquered and integrated if cars are to communicate with one another rapidly and seamlessly.

Kumar also has the type of mind that loves new, big ideas, said Amol Khedkar, who is working on his computer science doctorate at UMKC.

Khedkar, 32, said Kumar was open for all the “thinking and all the talking that come with new ideas.” Besides enjoying and encouraging innovative thinking, the professor “can find the good ideas” in a wide-ranging discussion, Khedkar said.

Expansive thinking also figures into Khedkar’s work, which will include taking the self-synchronizing vehicle system and adapting it for flight — something else the Defense Department is interested in.

Making it happen

So, when will we see driverless cars on our streets? Estimates are all over the place, from a few years to the ever-moving 20-year horizon. But before the vehicles become common, changes in laws and driving regulations will be needed.

At the Urban Challenge in 2007, Lawrence Burns, then a General Motors vice president, said he expected driverless cars to be on the market by 2018, and the main obstacles to be governmental and institutional, rather than technological.

Burns, now a University of Michigan professor and a vice chairman of Kansas City’s Midwest Research Institute, said last week that he is even more optimistic that any technological problems can be solved in the next few years.

O’Toole agrees with Burns that governmental obstacles, such as liability laws, are likely to be the biggest problem. But he and Burns observed that the technology’s rapid advance could lessen the need for government help and create momentum to make any necessary legal changes.

O’Toole, Burns and Gerdes said they could foresee a continuing increase in use of more automatic safety features. As more people saw the systems working — and, presumably, the country’s 30,000-plus annual traffic fatalities decreasing — their acceptance would reach a tipping point.

“I have a friend who says he would have a hard time giving up his testosterone rush from driving,” O’Toole said.

But when he reminds his friend of other things he could be doing in his car instead of driving, O’Toole said, “his eyes light up.”

Similarly, Burns said increased problems with texting and phone use while driving told him that many people “see driving as the distraction” and would welcome automatic assistance. Gradual adoption of the technology would work for Kumar’s system, too.

“You would still be the owner and controller of your automobile,” he said. “It will be your choice to use or not use the system. But I think people will enjoy the system and see that it is to their advantage to use it.”

ON THE WEB
For links to see a Lexus park itself, follow the Italian vans across Europe and Asia, learn more about the Audi that will conquer Pikes Peak, and read about the three DARPA Challenge events, go to this story at KansasCity.com/business.

SAFETY FIRST
Here are some advanced safety systems on the market today:

•Self-parking systems. Ford, Lincoln, Mercury, Toyota and Lexus offer models that will park themselves, according to Edmunds.com. BMW plans a 2011 model with the feature.

•Adaptive cruise control. Besides keeping a steady speed, this system will slow a vehicle to keep a safe distance when coming up on a slower-moving car or truck.

•Lane departure warning and prevention. A camera or radar recognizes lane stripes. When a driver starts to cross a line without activating a turn signal, the system gives a warning, such as making the steering wheel vibrate. If the vehicle drifts over a line, the system applies brakes on the opposite side of the drift to pull the car back over the line.

•Blind spot warnings. Much like the lane departure system, this one “sees” when another vehicle is in your blind spot and activates a warning light.

•Crash warnings. These systems tell you if your vehicle is approaching another too fast, and they can tighten

seatbelts, heighten the brakes' sensitivity and prepare the airbags for activation.

•Stop-and-go driving. BMW offers "Active Cruise Control with Stop & Go," which can stop a car in slow traffic and speed it up when the car in front of it starts moving again.

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