Driving in 2020:
Commuting Meets Computing

By Glen Hiemstra

Environmentally friendly smart cars of the future will be part chauffeur, part personal assistant, and part Web browser.

Computing while commuting. In this computer-equipped Ford Expedition, drivers can find the shortest route with voice-activated navigation, and passengers can play games, watch movies, or browse the Internet.

Imagine the following scene, circa 2020. You have taken manual control of your car, just for the fun of it, until you enter the Interstate Guideway. There you relinquish control to the autodriver, which takes your car up to high speed within inches of cars to the front and rear.

You survey the countryside. As you pass a billboard advertising a new sensor-equipped running shoe, you ask the car to contact the Web for more information. A Web page appears on the virtual heads-up display on the windshield. Using verbal prompts, you explore the information and call the vendor on your cell phone to place an order for the shoe.

As the trip continues, "augmented reality" advertising screens appear on the windshield, triggered by various landmarks that the car sensors see. One is for an amusement park 30 miles ahead. This virtual display knows the car is in autodriver mode and fills the entire front windshield with a virtual ride on the park's most popular roller coaster. The ad concludes with the offer of a special admission price for the next month, if ordered now.

An audible warning interrupts the trip. There is Guideway maintenance ahead. Your car asks whether you wish to view the slowdown. The Guideway, like most roads, is lined with thousands of cameras, each the size of a pinhead. You ask to see the slowdown and decide to take an alternate route.

You ask the car to identify good alternatives, and, after a few moments searching the Web, the car says the best alternative commences at Exit 94, which will take you to a manual-drive road. As the car approaches the exit, it smoothly moves right and

you take control. A directional arrow appears superimposed on the road ahead, and you follow the blinking arrow off the exit and onto the side road.

Fill 'er Up

While on the manual drive road, you decide to recharge your fuel cell. You ask the car for stations close by. You see no signs, but a virtual screen appears that lists three stations within a two-mile radius. You ask for comparison prices and select the station you prefer.

A virtual image of the station appears far in the distance. As you drive toward it, the image morphs into a blinking arrow pointing right. After turning the corner you see the actual station, and the virtual arrow changes into an ad for the "Slurpel" drink served in the station quick mart.

Meanwhile, in the back seat, one of your children has been using her mediatronic paper with its wireless Internet connection to call up videos

of her favorite musician. This signal is detected by a sensor on a land-based sign for Suny Records, which sends a small box message into the corner of the mediatronic paper asking politely whether she would like to see the video from the hottest Suny recording artist.

After recharging, you reenter the

Guideway and almost immediately come to a toll plaza. It is not really a plaza but a marked strip of road with readers built into the pavement, which scan the bar code on the car. You have paid for this bar code, which allows for 30 trips on this Guideway.

The Guideway has been built by a

Relevant Web Sites

More information can be found at the following Web sites:
- **Futurist.com (www.futurist.com)** for information on the author and links to the future.
- **Ballard Power Systems (www.ballard.com)** for information on fuel cells.
- **Toyota (www.toyota.com)** for information on the hybrid auto, the Prius.
- **ITS (www.its-network.com) and the U.S. Department of Transportation (www.its.dot.gov)** for information on Intelligent Transportation Systems.
- **Moller International (www.moller.com)** for information on the Skycar.

REUTERS PHOTOS

Hybrid auto: The Toyota Prius combines a small combustion engine with an electric generator. Such cars will usher in a "second automobile era," the author argues.

private–public partnership involving several companies. Participating companies purchase rights to sponsor the road and to display a certain amount of real signs as well as the augmented-reality advertising. Using credit-card databases, the companies develop profiles of road users and adjust their mediatronic and other outdoor displays to offer products and services of interest to drivers with these profiles.

A New Era for Autos

Does this scene seem real, or does it read more like a bad science-fiction movie? In fact, it is an entirely plausible scenario of transport and advertising in 2020, based on current technological trends.

There was a time when many believed that the days of the auto were numbered because of rising energy prices, a looming shortage of petroleum, and environmental concerns. It is far more plausible, however, that we are at the beginning of the second automobile era.

This second era will be ushered in by "hybrids," vehicles that combine a small internal combustion engine with an electric generator. The gasoline engine drives the generator and adds additional boost when needed, but the car drives primarily on electricity. A new model from Toyota, the Prius, gets more than 65 miles per gallon and generates only about 10% of the tailpipe emissions of conventional cars. The car never needs to be plugged in and can drive 850 miles without refueling.

The Battelle Institute forecasts that such hybrid cars will be a top-10 consumer product by about 2006. (However, many in the auto industry remain skeptical because past success with energy-efficient cars proved to be transitory.)

Following the hybrids by a few years will be cars driven by fuel cells. Fuel cells generate electricity through a chemical reaction between hydrogen and oxygen. They produce little waste except water. Practical fuel-cell technology could be available to the market as early as 2010.

With this development, the internal combustion engine can be completely eliminated, and we could see

A retractable in-dash screen, shown here at a consumer electronics show, can be used for navigation information in future "smart" cars.

a shift in the auto paradigm more sudden than most imagine. Hybrids and fuel-cell cars will extend the auto-based lifestyle far into the future.

Cars Will Get Smarter

But such a future is not assured by energy efficient and environmentally friendly cars only; it will also be created by high-tech, intelligent cars suitable for a highly technological world and an intelligent transportation system.

It has been frequently observed that the average car today has more computing power than the Apollo spacecraft. In fact, a 2000 model car is likely to have dozens of built-in computers that monitor transmission functions, fuel use, braking, air-bag deployment, and virtually all other functions. Yet, compared with the cars to come, today's car is a Model-T.

Computing power and speed continue to double on a nearly annual cycle, according to the well-known Moore's Law. This will continue for at least the next 10 years. Inexpensive computers will approach the intelligence of the human brain, as measured by density and speed, by the year 2020. Computer chips costing pennies will become integral parts of every manufactured item, including—and especially—automobiles.

The car itself will become intelligent. Built-in sensors will view the road in front, in the back, and on the side, and they will produce a 3-D view for the operator. These sensors will establish safe zones around the

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Flying cars aren't just for the Jetsons, the author says. This prototype Skycar may one day be sold for about the cost of a luxury automobile.

car and apply accelerator and brakes to maintain the zone.

Other computers will be tied to the Internet and to the Global Positioning System, enabling the car to know where it is at all times. By 2025, the car will be fully capable of driving itself, and it most certainly will do so on Interstate Guideways and perhaps on city streets as well.

In cities with concentrated work centers and good systems, mass transit provides as much as 40% of work-related trips. Still, the shift to environmentally friendly automobiles will keep mass transit marginal.

In a certain sense, we might actually witness the morphing of autos into quasi-trains. Intelligent, self-driving cars on a guideway, moving

stages.

One such vehicle, the Skycar, is being developed by Moller International. This flying machine features four redundant engines and complete computer control of flight. If you can drive a car, you will be able to fly this vehicle.

Purported to get 15 miles to a gallon of fuel at 350 miles per hour, the Skycar would be safe to fly because of the redundancy of the engines, any one of which could keep the vehicle aloft. Plans are to sell the Skycar for about the cost of a luxury automobile.

These scenarios, which indeed read like science fiction, are if anything likely to be far too modest compared with the real possibilities.

Even as I typed this article on my laptop, the person sitting next to me on the plane struck up a conversation. An IBM salesman, he told me he made his first big sale in the early 1970s, of a $1.5-million computing system, to a municipal government. The system he sold them, he explained, had about half the capacity of the $1,200 machine sitting on my lap. □

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Cars May "Morph" into Trains

The same kinds of technologies will be applied to trains and mass transit, yet their use as personal transportation is unlikely to grow much over the next 25 years. In the late 1990s, transit accounted for about 3% of work-related trips in the United States, despite many years of concerted policy effort to increase that number.

at high speeds and within inches of each other, form a kind of train. But this train is flexible, private, and personal, all of which Americans prefer.

Flying Cars: Pie in the Sky?

Yes, the Jetsons may have had it right all along: Personal transportation may one day take to the skies. Small, private flying vehicles suitable for short-haul personal transportation are in the experimental

About the Author

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