AUTOMOBILES with AUTONOMOUS FEATURES

Description:
According to the Federal Highway Administration, in 2008 there were 208.3 million licensed drivers in the United States; 22 per cent (46.7 million) of these drivers were aged 60 and over. As the baby boomers age and the population of older adults in the United States grows, significantly more seniors will be driving in the years to come. This demographic trend has stimulated increasing discussion, research, and product development devoted to issues related to older drivers—among a variety of disciplines, including the automotive industry, gerontologists, mobility and transportation professionals, caregivers, policy makers, and aging advocates.

Data about driving-related consequences associated with various age groups is sometimes reported in a way that is misleading. For example, while seniors over the age of 80 are more likely than any other age group to be involved in deadly car accidents, this does not mean that older adults are involved in more accidents, but that they are more susceptible to injury and death in these situations because of the increased frailty associated with the aging process. In addition to unclear reporting, imbalanced media coverage of isolated auto-accident events can muddy the discussions about drivers of all ages. Data provided by the Federal Highway Administration show that the negative consequences of driving behaviors and driving conditions have an impact across all age groups (Table 1), and a scan of the automotive industry’s efforts outlined in this article clearly demonstrates the industry’s realization that the technological advancements that grew out of the world’s aging phenomenon have major benefits for communities and for drivers of all ages and all functional abilities. As seniors are becoming significant consumers in the automobile market, auto industry engineers have dedicated more energy to designing cars that provide the entire population with a safer and less intensive ride.

Autonomous automotive technology:
Though important changes are being made in roadway design and signage that help compensate for driver frailties and impairments, increasing attention is being given to cars that are equipped to eliminate tasks that are too arduous for frail older

Table 1
United States Licensed Driver Statistics (Total Number Licensed Drivers: 186,284,071) 2007

<table>
<thead>
<tr>
<th>Licensed Driver Age Group</th>
<th>Age Group as a % of Total Licensed Drivers</th>
<th>% of Total Car-Accident Fatalities by Driver Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 - 29</td>
<td>22%</td>
<td>34%</td>
</tr>
<tr>
<td>30 - 44</td>
<td>33%</td>
<td>27%</td>
</tr>
<tr>
<td>45 - 59</td>
<td>25%</td>
<td>19%</td>
</tr>
<tr>
<td>60 - 79</td>
<td>17%</td>
<td>14%</td>
</tr>
<tr>
<td>80 - 84</td>
<td>1.7%</td>
<td>3%</td>
</tr>
<tr>
<td>85 and Over</td>
<td>.7%</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

people and for younger individuals with disabilities or other mobility impairments. Laboratories at major universities in the United States are even developing and testing driverless cars, which do not require the usual operating control of the driver. While driverless cars are still some decades away, automobiles with autonomous features are expected to become standard equipment in the near future. More currently available is automobile technology being developed that relies on autonomous devices, making way for a more self-directed vehicle while providing the driver with ease and safety. For example:

- **Lane-departure warning system**: Developed to decrease the incidence of accidents caused by driver distraction or drowsiness, a lane-departure warning system alerts the driver when it detects the car moving out of its lane on freeways and major roads; and the National Highway Traffic Safety Administration has even considered mandating these systems on automobiles.

In the past decade, some cars have come already equipped with a lane departure warning system that cautions the driver through a visual, audible, or vibrating mechanism. Others automatically maneuver the car back into the lane if the driver does not respond to the warning; however, if the driver turns on a turn signal, the system will not issue a warning. In 2009, Mercedes-Benz introduced a car that warns the driver through a vibrating steering wheel when it detects the vehicle leaving its lane; it is also able to ascertain whether the driver is intentionally trying to leave the lane, and reacts accordingly.

- **Automatic parking**: In the past decade, some cars, such as the Lexus, have included an automatic parking feature which performs parallel parking—an especially convenient feature for people who are unable to physically perform this function or who experience discomfort with the physical maneuvers required for parallel parking.

- **Driverless car**: Some of the world’s most prominent automakers are partnering with research universities to develop vehicles that have *fully* autonomous features—or, cars that drive themselves. In fact, these automakers note that completely autonomous vehicles are not too far into the future. For example, General Motors stated that it could have a driverless car on the market by 2018 and Volkswagen plans on releasing its own model in 2028, though many experts and other automakers believe that driverless cars will not make an appearance on the road until at least 2030.

The United States Department of Defense has created autonomous-type technology to develop driverless vehicles that engage in military operations, preventing harm to soldiers. The automaker, Audi (which is owned by Volkswagen), has teamed up with Stanford University to develop a driverless car named Shelley; Shelley has been fitted with a Global Positioning System (GPS) that can be programmed to travel any route. Additionally, automotive researchers have already developed prototype automobiles that can drive long distances and steer through city streets without the control of a driver.
• **Blind-Spot Detection System**: Blind spots refer to areas around an automobile that are blocked by certain structures in the car. Because drivers have physical constraints in eye movement and head and body rotation, some areas of the road are unseen by the driver. This is especially a concern for people who drive larger vehicles.

A blind-spot detection system belongs to a class of technology that uses mechanisms that provide accident avoidance. For example, the 2007 Volvo S80 includes a Blind Spot Information System (BLIS), which operates through the use of a camera placed under the car’s side mirrors, allowing a view of areas that are difficult for drivers to see in the side and rearview mirrors. When a car comes into a driver’s blind spot, a light on the door panel turns red; the light goes off once the area is clear.

• **Adaptive Cruise Control**: This function goes by different names (e.g., autonomous cruise control) and is designed to regulate a vehicle’s speed to maintain a safe distance from the vehicles ahead. This technology uses forward-looking radar positioned in the back of the vehicle and detects the speed and distance of the vehicle it is following. These more recent autonomous systems are related to conventional cruise control in that they maintain the vehicle’s predetermined speed, but are unique because they can automatically change the speed to maintain a safe distance between vehicles in the same lane. The 2010 Ford Taurus includes an adaptive cruise-control system that uses radar, allowing a driver to set a top speed so that he or she can maneuver while the car regulates its own velocity based on road traffic.

Certain driving-related tasks create hazardous situations—for example, making left-hand turns, keeping the car in an appropriate lane, and responding to unexpected situations. These difficulties are associated with drivers of all ages—because of increasing distractions while driving; driving while under the influence of drugs, alcohol, or prescription medications; increasing numbers of drivers with disabilities and impairments; and more complex roadway systems—but are noted to proportionately affect older drivers to a greater degree because of this population’s greater likelihood of experiencing limitations in mobility, vision, hearing, response time, and agility, all of which make vehicles a hazard to operate.

As the baby boomer population ages, growing concern about their safety on the road is reflected in: (1) automakers’ stepped-up efforts to build cars that are self-sufficient, allowing the driver to pay more attention to the road and saving lives in a health- or automobile-related emergency, and (2) advocacy organizations’ efforts in programming that will improve driver safety. For example:

• Auto engineers at the Ford Motor Company have gone as far as wearing padded jumpsuits that are said to make the test-driving experience similar to what some older drivers encounter on the road.

• In 2009, the American Automobile Association (AAA) partnered with a software developer of brain fitness programs to create a program called DriveSharp. The program seeks to help baby boomers lessen the impact of aging on the brain.
DriveSharp is made up of interactive exercises that are designed to improve concentration, reaction time, and improve memory. It also trains the user to engage in visual processing more quickly and improve the driver’s ability to track other cars on a busy road. Clinical studies, as well as the AAA, indicate that the DriveSharp program can cut crash risk by up to 50 per cent and that people who are already adequate drivers can improve on their driving.

Some researchers believe that cars will someday be equipped with technology that can monitor brain activity in order to assist both older and younger drivers. One professor has teamed up with Toyota to develop technology that can monitor and determine the driving patterns of drivers and prevent dangerous incidents. These advancements can result in cars that control their interior temperature in order to keep drivers alert, or can sense and slow down if the driver has made an error, such as mistakenly stepping on the gas pedal.

- New automobile technology provides promise for people of all ages with limited mobility. These individuals are often faced with the decision to give up driving, resulting in isolation, feelings of incompetence and loss of independence, and depression resulting from continual reliance upon others. Technology developed by Toyota, however, has led to the creation of a vehicle unveiled in 2005 called the "The WelCab," which provides assistance-free access to drivers who have a frailty or disability. The WelCab has electronic sliding doors, two seats that are built with custom-designed wheelchairs, and an electric lift that lifts the person into the seat. Both older and younger drivers with frailties or disabilities can control the car using a mouse-like controller with the right hand, and can brake or accelerate with the left hand, using a joy-stick-type device.

- German automaker, Bavarian Motor Works (BMW), recently introduced a vehicle with "emergency stop assistance." This feature was developed with the Federal Ministry of Education and Research in Germany through a program called "Smart Senior—intelligent services for seniors." The Emergency Stop Assistant has the potential to stop the car when it detects a health problem with the driver; detection is executed through two types of sensors that monitor vital signs. When the system detects a health problem with the driver, the emergency assistance system activates the car into autonomous driving mode, turns on the warning lights, and maneuvers and stops the car at the side of the road, all while remaining watchful of traffic as it strategizes. The system then sends an emergency signal to rescue services.

References:

2 Federal Highway Administration, "Fatalities by 100 Mil VMT by Age," Table NHTS 12.3.1. Washington, DC: U. S. Department of Transportation, Federal Highway
Administration, Policy Information, Highway Statistics 2007:

Benefits:
For policy makers:
• Cost Savings
  ▪ In 2004, the World Health Organization (WHO) reported that the United States spent $230 billion on automobile accidents (property damage, lost productivity, health, and other related costs), $32.6 billion of which was spent on health care costs. WHO predicts that, by 2020, car accidents will become the third largest killer throughout the world. The move toward more advanced technology with autonomous features is being designed to prevent collisions and allow drivers of all ages and abilities to pay more attention to other parts of the road. These efforts are expected to cut down on costs and the rate of auto accidents, which severely injure or kill many people each year.

For the community:
• Safety and Health Emergencies
  ▪ Collision avoidance technology has been touted to save more lives than airbags and seatbelts. European insurance companies have even offered a 30 per cent discount on premiums for the Volvo XC60, which includes collision assistance technology. Volvo has made collision avoidance a standard in its vehicles; its City Safety collision avoidance system senses if the car is in jeopardy of colliding with a car ahead of it. The system will take its own action by applying the brakes to avoid or curtail a crash if the driver does not respond in time. The Emergency Stop Assistant implemented by BMW is the first system to detect the health condition of the driver even if the car has not been involved in an accident. In the future, additional types of safety features will become more intricate. Automakers are looking to create a method of transmitting vital physiological data to emergency personnel.

For residents:
• Driverless cars can pose a significant convenience to people who feel overwhelmed by car controls and environmental stimuli. It is also of benefit to frail individuals with frequent doctor visits; the vehicles can restore a sense of independence, making the road less intimidating and dangerous.

• Autonomy & Independence
  ▪ A major advantage posed by future cars is the amount of autonomy and independence it provides drivers. Increasingly, cars are becoming more responsive to obstacles on the road, making them easier to maneuver. People who are homebound due to health, injury, or disability will have more options in terms of transporting themselves to their desired destinations, fostering a greater sense of self-determination. This independence could provide a better social outlook for people who otherwise feel isolated at home and who appreciate the freedom that driving provides.
• User-Friendly
  ▪ Cars that require less driver participation and that include controls that are easy to use make the driving experience less stressful and with fewer distractions. For people who are limited in the functions they can perform while simultaneously looking at the road, automated technologies can provide less mental and physical strain and more comfort.

**Barriers or impediments to development or implementation:**

• **Liability**
  ▪ The issue of liability has not been clarified. Some argue that American car companies will be wary of providing technologies with automated control because, if something were to go wrong on the road, one might be more inclined to blame it on the car and the technology. On the other hand, some companies are already being sued for not including adequate safety features.

• **Level of user-friendliness**
  ▪ In the early 2000’s, BMW released “iDrive,” which controlled the car’s radio, temperature, and other features; it included a knob in the middle of a console, similar to a computer mouse. Though it was designed to make the driving experience less intensive, many drivers found it much too complicated. If autonomous technology is to benefit everyone, it must be easy to use. Cars that require the use of multiple controllers, buttons, and wires, could result in drivers being distracted, frustrated, and performing poorly on the road.

• **Universal design**
  ▪ Manufacturers have a tendency to use a one-size-fits-all approach to car design, with many cars on the road poorly designed to accommodate people of varying heights and functional abilities.

• **Consumer unease**
  ▪ The concept of vehicles with autonomous features, or one that is completely independent, is still new enough as to be unfamiliar to most drivers. Vehicle autonomy can be unsettling for people accustomed to having control of the car, and some will have questions and concerns about lacking personal control in the event of vehicle-malfunction. Drivers may feel safer if the car is equipped with an over-ride feature (already part of most autonomous vehicles) so that they could take personal control should there be a failure in the system—for example, should the car automatically stop or perform an incorrect function in the middle of the road.

• **Physical activity and use of fossil fuels**
  ▪ Because cars will become more autonomous in the near future, people might find it convenient to use their cars often, resulting in less physical activity and more cars on the road, which counters current trends to promote physical fitness and to reduce the use of fossil fuels.
Resource—examples:


Resources—written and web:


- Terrence Chea (April 9, 2010), “Future tech: Driverless Audi set to climb curvy Pike’s Peak,” USA TODAY on line, Drive On—a conversation about cars and trucks. Chea writes about future developments in driverless cars, specifically the work of researchers at Stanford University, who have partnered with Audi to create a car that drives without human control. Also mentioned are previous efforts at building driverless cars and the challenges faced, such as financial expense and inadequate performance. The article notes that technology could be used to develop cars that assist drivers in avoiding collisions when driving too fast. http://www.usatoday.com/moneyautos/2010-04-09-driverless-car-pikes-peak_N.htm.

- ScienceDaily (June 19, 2006), “Car Crashes Are More Deadly For Seniors, Traffic Fatalities Expected To Rise,” ScienceDaily web site, Science News. This article brings attention to the fact that senior citizens will die in car accidents at a higher rate in the future as America’s 75 million baby boomers age, some of
whom will become too frail to drive. It is important to note that older adults—who are more apt to suffer fatalities when involved in vehicle accidents—are not getting into accidents at greater frequency than other age groups; their greater fatality rate is due to greater frailty that occurs during the aging process. Research that will result in the development of safer driving options for seniors is discussed.


- Tanya Mohn (July 17, 2009), “Helping the Elderly Keep Their Driving Skills,” *The New York Times* web site, *Automobiles, Wheels—the Nuts and Bolts of Whatever Moves You*. This article examines the baby boomer generation as it reaches retirement and how this statistic has implication on driving and safety. It notes that declining abilities can put older adults at risk on the road. A new computer program developed by AARP aims to assist baby boomers in driving safely by helping them retrain their brains and delay the influences of aging:

- NOVA (2005), “Cars That Drive Themselves,” *NOVA* web site, *The Great Robot Race: Dreamers Wanted*. A transcript of an interview with computer scientist, Sebastian Thrun, head of Stanford University’s Artificial Intelligence Lab, which has developed a robotic vehicle named Stanley; the interview includes discussions about the future of driverless automobiles.

- The American Automobile Association’s (AAA) Foundation for Traffic Safety partnered with Posit Science, a software developer of brain fitness programs, to create a software program called DriveSharp. AAA’s website also includes an evaluation assessment tool that determines an individual’s crash risk and allows one to try a DriveSharp exercise for free. Information on ordering the program is also provided. AAA Foundation web site: