



The Future of Mobility

Knight Riders

Smarter, safer cars designed to be proactive lead the world to an ultimate future where personal ownership may become obsolete

Ten years ago, cars with built-in Bluetooth, GPS, and parking sensors were the domain of luxury vehicles. Now, even the most affordable economy level car has these features. The next 10 years in auto-tech promise to make the last few decades look like a warm-up.

Going Autonomous

Self-driving cars have been on our minds for a while and the question of when there will be a fully autonomous car is still debatable. Waymo's CEO, John Krafcik, said that while self-driving cars are here, he does not know if fully automated cars (what's usually called a Level 5 autonomous vehicle) that can drive in any condition will ever be here. Other manufacturers like BMW say they could be selling completely self-driving cars by as early as 2021.

That said, many cars already feature some level of autonomous capabilities like automatic emergency braking, adaptive cruise control, and lane-keeping assist systems. Tesla's Autopilot, Nissan ProPILOT Assist, and Audi's traffic jam assist are already compliant with Levels 2 and 3 of autonomous driving (driver assistance and partial automation). The race for autonomous driving tech, software and hardware alike, is on.



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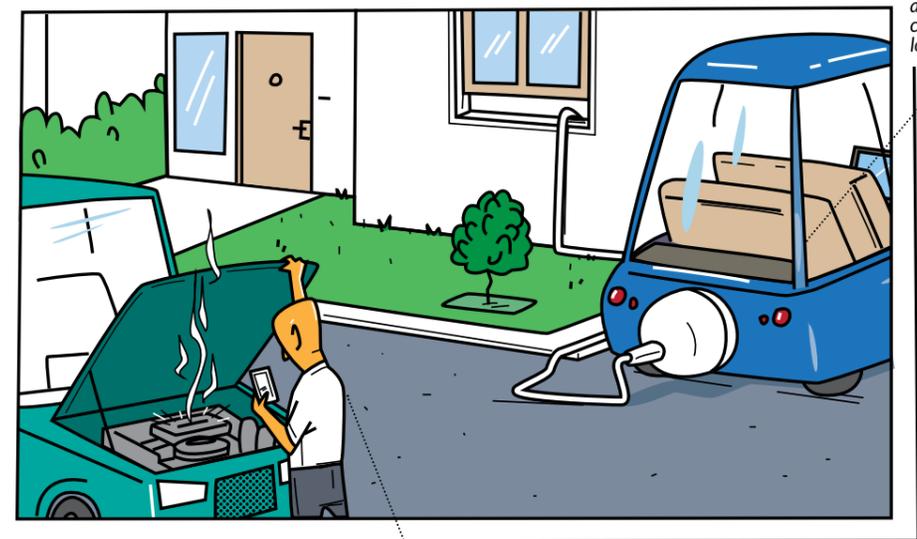
A myriad of sensors
cars can fully understand their driving environment, some going fully autonomous

Alternative mobility
The world moves to car sharing, electric scooters and bicycles, and new modes of public transport

Always connected
Vehicle to Everything (V2X) communication warns the driver of other vehicles

AI Companion
A human voice personalizes the driving experience and offers support services

Going electric
Electric cars are capable of longer ranges and faster charging at lower costs



In 10 years, cars will make use of a myriad of sensors in order to understand their driving environment. Each type of sensor has its own strengths and weaknesses in terms of range, detection capabilities, and reliability. A fusion of technologies is required to provide the redundancy needed to sense the environment safely. LIDAR and Radar are two such sensors that supplement cameras.

LIDAR systems emit rapid laser signals, sometimes up to 150,000 pulses per second at eye-safe levels. The beams hit objects in the environment, bounce back to a photodetector, and eventually create a three-dimensional image of the environment. The Radar system works in much the same way but uses radio waves instead of laser beams.

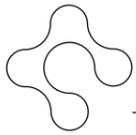
Both LIDAR and Radar sensors are costly and have many

moving parts that require timely maintenance. But there are companies working on features that will allow new cars to "see" further and better. **Innoviz** is developing Solid State LIDAR sensors which are cheaper, smaller, and capable of ranges of up to 250 meters. **Arbe** is building real-time 4D imaging Radar on a chip for all environments and conditions, minimizing the cost and eliminating moving parts.

More reliable
Advanced diagnostics and maintenance alerts make breakdowns exceedingly rare

In the backend, making sense of all the sensor outputs, the use of sensor fusion software is crucial for a car's decision-making process. **Vayavision** is a developer of one such technology, fusing different sensors' raw outputs into one accurate 3D environmental model.

As we move up the autonomous chain, cars need to handle substantially more data. Depending on the



sensor setup, the total amount of data generated can vary substantially and processing that data in a fast and seamless way is one of the main challenges for OEMs (Original Equipment Manufacturer). **Hailo** and **Brodmann17** are attacking this challenge from two different angles. Hailo is developing a proprietary chip for AI and machine learning in edge devices. In other words, data would no longer be uploaded to a cloud to be processed, but would operate in real time, using a fraction of the power consumption and at a fraction of the cost and size of the current standard. Brodmann17 has developed a software-only solution that can lower the required computing power for various AI/deep learning tasks by a factor of 20.

Tying it all together is the training and verification process which cars need to undergo before being allowed to drive on open roads. Alongside the use of simulators for this task, **Foretellix** has developed a scenario description language that can provide ultra-fast verification for hundreds of millions of critical driving scenarios.

The Electric Effect

Electric cars are already here, with the majority of OEMs offering at least one model. The coming decade will bring vehicles capable of longer ranges and faster charging at a lower costs. Addionics uses proprietary 3D printing of electronics, allowing a complete redesign of the architecture of batteries at the microscopic level.

Cars That Talk

No, this is not about Knight Rider, but rather about a car being able to “speak” with its



skyTran's new test track in Texas. Passenger pods are propelled on mono rails to their destinations

In 10 years, many people will not own a personal vehicle and switch to mobility as a Service solutions

surroundings. By now it's pretty clear that vehicles are becoming increasingly connected to the outside world, and in 10 years, most vehicles will be connected to other vehicles, surrounding infrastructure, and even pedestrians, allowing them to support driverless cars, trucks, and SUVs. Vehicle to everything (V2X) communication warns the driver about other vehicles, road hazards, and pedestrians. These alerts help reduce traffic injuries and fatalities and optimize traffic flow, reducing traffic congestion and lessening the environmental impact of transportation.

Vizablezone has gone so far as to transform mobile phones into accident prevention devices. The company's unique protocol and algorithms allow it to use existing transceivers and sensors in mobile phones and cars to provide alerts to pedestrians and drivers before an accident occurs through a simple firmware update.

These and other connected features like telematics, WiFi hotspots, and car links are essentially transforming cars into computers on wheels that are open to many possible vectors of attack. While there is no silver bullet to protect

against all possible cyberattacks, companies like **C2A** offer a full suite of solutions to detect and mitigate attacks, preventing them from taking control of vehicles cruising down the highway.

Siri Gets Proactive

While today's in-car agents like Google Assistant and Siri are mostly passive, responding to your command, next generation cars will see a shift from AI agents to AI companions. **Intuition Robotics** offers OEMs the ability to create a customised multimodal persona-based agent that can be deployed in both traditional and autonomous vehicles. This AI companion will personalize the driver's experience, increase productivity, and assist with car maintenance, and other support services. The companion would proactively suggest music, podcasts, activities, or even cracking a window — all customized according to user preferences after a quick learning phase.

Just imagine driving alone in your car, when all of a sudden you hear, “Hey, it seems like you've been driving for an hour, would you like to stop for coffee

or a restroom? There's a gas station one minute off your route.”

The Mechanic Gets A Second Opinion

According to the National Highway Traffic Safety Administration (NHTSA), consumers lose tens of billions of dollars each year due to faulty or unnecessary car repairs. According to a survey conducted by AAA, 66 percent

of drivers do not trust car repair shops. Luckily, the influx of connected technologies will aid in maintenance soon enough. Several startups, like **Engie**, offer maintenance alerts and engine diagnostic information, including how severe a potential mechanical problem might be and mechanic price quotes for fixing it — all before you or your vehicle even set foot (or tire) in a repair shop. If it's a software fix, there will be an upgrade. If the car needs a mechanic, it will research options, book an appointment and renew its own insurance while shopping for a bargain.

People Ditch Their Cars

In 10 years, many people may not own a personal vehicle. Different platforms offering shared mobility and the proliferation of Mobility as a Service (MaaS) is on the rise, so people may use electric bikes or scooters for city trips from companies like **Jump** and **Bird**, or hail a ride from companies like **Lyft** and **Uber**. For longer trips people already turn to car sharing

services like **Car2Go** or **Zoomcar**, and in the next decade we might even see the public debut of new modes of public transport like **skyTran**, using maglev technology to propel pods on monorails to their destinations.

These technologies have already made it into daily life — or are at least making their way there. While automotive companies are capable of innovating from within, a close connection with active innovation ecosystems provides them with an edge. As the war against road fatalities and congestion rages on, greater implementation of MaaS, reducing the number of human drivers, and ultimately reducing vehicles on the road will become possible with the next generation of vehicles; those that are connected, autonomous, shared, and electric.

The Volvo 360C autonomous car concept. A fusion of technologies is required to provide the redundancy needed to sense the environment safely.

