Digital Transformation NETWORK

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Automotive

Digital Tools Help Drive the Next Era of Transportation

Much like when Henry Ford's Model-T first rolled off the assembly line in the early 1900s, the automotive industry is in the midst of a great transformation. From lower emissions to self-driving vehicles, digital tools are reshaping all aspects of the automotive experience and ecosystem.

To continue the legacy of innovation, automakers are working toward important objectives, including lowered emissions, improved safety features, and enhanced connectivity.

Sustainability, through digital transformation, is a major focus for the industry. Software is being used to lessen the environmental impact by modernizing manufacturing and enabling electric vehicles, decreasing traffic congestion, and improving air quality.

Safety on the roadways continues to be a leading concern. Digital transformation introduces new tools that are helping reduce human error.

Connectivity among autos and the cloud is advancing at a rapid pace, fueling rapid innovations in driver experience, safety, security, service, sustainability, and more.

Fueling these innovations, the industry is embracing digital technologies such as the cloud, artificial intelligence (AI), data analytics, machine learning, the Internet of Things (IoT), and 5G. These software tools will propel the automotive industry into the next area of mobility with the ability to more accurately design, test, plan, and iterate quickly, transforming the industry.

It's important to acknowledge that today's complex world also presents certain challenges for the automotive sector. The geopolitical events over the past few years—such as the COVID-19 pandemic, rising gas prices, and supply chain disruptions causing a shortage in semiconductors—have made it even more pressing for automakers to integrate digital solutions.

Automakers are also embracing digital transformation on the factory floor, leading to more efficient and sustainable processes. These advancements also present new workforce and skills needs for automakers. Because auto production remains the largest manufacturing sector in the US, these needs are profound and critical to maintaining global competitiveness.

→ The auto industry supports a total of 10.3 million American jobs.[1]

Sustainability & Energy Efficiency

The auto industry has shifted away from internal combustion engines and large-scale manufacturing to more energy-efficient electric vehicles. As leaders in innovation, automakers and suppliers are rising to the challenge to develop cleaner-running vehicles and factories. The path forward will require the industry to integrate the arsenal of digital tools, such as AI, digital simulations, additive manufacturing, IoT, and data analytics, as well as streamline supply chain and logistical issues.

There continues to be sustained progress and investment in the electric vehicles (EV) market. EV technologies include fully electric and plug-in hybrid electric models and are two to four times more efficient than conventional internal combustion engine models. They reduce dependency on petroleum-based fuels and significantly help reduce greenhouse gas emissions when running on low-carbon power. Battery technologies are key components in EVs and continue to improve performance and become more affordable, which ushers in greater possibilities for clean energy sources and efficiency.

To meet the growing demand for EVs, most major automakers are investing in electric fleets. In January 2021, General Motors announced that it aims to have a complete portfolio of zero-emission vehicles by 2035 and Ford is investing more than $50 billion globally through 2026 to develop EVs and bring them to market.

Despite supply chain issues related to the pandemic, EV production and sales have remained strong.

→ Two million EVs were sold worldwide in the first quarter of 2022, an increase of three-quarters from the same period in 2021.[2]

With more EVs on the road, the infrastructure to support EVs is also developing. Charging stations are spreading and software solutions are being created to support this growing infrastructure.

> Global sales of electric cars hit 6.6 million in 2021. And by 2030, EVs could range from 10 percent to 50 percent of new vehicle sales. The number of charging stations will also increase from 850,000 in 2021 to nearly 12 million by 2030.[3]

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AI Breakthroughs in Battery Testing

Battery performance is a key indicator of a well-run EV. In an effort to dramatically reduce charging time and maximize the battery's overall lifetime, a group of researchers from Stanford, MIT, and Toyota collaborated to speed innovation by optimizing testing times, which has typically been a long and labor intensive pursuit. Using machine learning, they slashed battery testing times by 98 percent. AI allowed them to streamline the complicated, multifaceted process of battery testing, thereby making it less laborious and far more efficient. Researchers believe these methods will have broader applications within the battery development pipeline.

SIEMENS
Ingenuity for life

Simulation Software Reduces Cost and Time

Designing hybrid-electric vehicles is no easy feat; the configuration needs for each vehicle is a complex process. **Siemens Digital Industries Software** worked with Hyundai to reduce EV testing by 40 percent. Hardware in the loop testing—an industry standard—simulates vehicle and environmental inputs so the car behaves in a realistic manner. Because cars are becoming more like computers, this form of optimized, automated testing reduces cost and time. The simulation is able to aggregate various factors such as performance needs and outcomes before creating a physical prototype.

SAP

Digital Solutions Advance EV Charging Infrastructure

To address the burgeoning demand for EV charging, **SAP** created an E-mobility solution that helps companies to operate EV charging infrastructures at scale. Companies can use this integrated cloud-based software to build, run, and monitor their EV charging networks from end to end on one platform, helping to maximize energy efficiency and sustainability.

Safety & Advanced Manufacturing

The overall manufacturing process is also undergoing an evolution. The advancements unfolding are being supported by new software tools that allow cars to be designed, made, and tested in novel ways. From 3D prototyping and additive manufacturing to digital twins virtual reality, there is an entire ecosystem of different tools that support businesses at every stage in the car making process.

Cars are no longer just modes of transportation. They have become intelligent, connected supercomputers on wheels. The end result is a more personalized and interconnected experience that also has the impact to improve road safety and reduce congestion. Safety is a top priority for the industry and software solutions help make the driving experience safer. Research estimates[4] that connected solutions could save lives due to as high as an 80 percent reduction in the number of non-impaired, multi-vehicle crashes.

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AUTODESK

Digital Planning for Factories

New zero-impact factories are being built using digital planning tools. Recently, Porsch used **Autodesk**'s digital factory planning to create a zero-impact facility where driverless transport systems help maximize flexibility. This factory will manufacture its first electric sports vehicle. The project had to incorporate various constraints, including the location of the new factory on a hill between orchards and creating an assembly line that would work more quickly than is typical. All this was done and approved digitally—down to the placement of the garbage cans and robots.

Unity

XR Tests for Safety

Volvo partnered with **Unity** and Varjo to use groundbreaking extended reality (XR) headsets. XR technology allows engineers to add virtual objects to realistically simulate the driver and car's sensors. The chief benefit of using XR is to test safety mechanisms. The technology also provides an array of data on driver behavior. This technology extends to testing other elements of future cars—such as heads-up displays, new materials, and user interfaces for infotainment systems—inside the actual car while driving on a real test track.

Advanced Driver Assistance Systems & Autonomous Vehicles

Automakers are investing in new ways to make the car experience safer. Advanced driver assistance systems (ADAS) and autonomous vehicles (AVs) are two significant pieces to the puzzle. Tremendous progress is being made to support these new innovations.

ADAS are new features that increase vehicle and road safety by simplifying the driving process and reducing vehicle accidents. With ADAS, the driver is in charge and monitoring the roadway at all times. These automated systems include a range of driver assist technologies, including adaptive cruise control, parking assist, lane centering or traffic jam assist and are becoming more prevalent in new vehicles. In fact, at least one ADAS feature is available in about 93 percent of new vehicles available in the US.

Initial data shows that driver-assisted technologies like blind spot monitoring and lane departure warnings can help avoid crashes, and automotive emergency braking will reduce rear-end collisions.

Forward Collision Warning has been shown to lower the incidence of front-to-rear crashes by 27 percent. Active software-enabled solutions like Automatic Emergency Braking reduces crashes by 50 percent, resulting in 56 percent fewer injuries.[5]

Moving beyond ADAS, the path toward AVs presents significant opportunities to increase safety along with addressing valid safety concerns. Views differ on the pace of change and when AVs will be ready for widespread use. According to Mckinsey & Co., once technological and regulatory issues have been resolved, up to 15 percent of new cars sold in 2030 could be fully autonomous.[6] Cruise, Waymo, and Zoox are among those with test fleets operating in the US, as well as other startups and veterans like Ford and Volkswagen. The industry will need to continue investing in safe and proven digital systems to run AVs.

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intel

Testing AVs Around the World

Intel's Mobileye is testing AVs in real-world environments across countries and continents. Testing AVs in a controlled setting is one thing, but getting them to work safely in a densely populated place is another. Each location poses fresh challenges for Mobileye's technology to solve. It uses its Road Experience Management (REM™) mapping system, which crowdsources data from the cameras in around 1.5 million REM-enabled vehicles. The results have shown that using a combination of cost-effective cameras and the power of the crowd can create efficient and scalable innovations that power AVs.

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A Walking Mobile Vehicle

Hyundai Motor Group is pushing the limits of how vehicles are made, reimagining the car concept into one that can walk and drive. The Horizons Studio team at Hyundai developed an entirely new vehicle idea, known as the Ultimate Mobility Vehicle, named Elevate. To develop Elevate, the company used **Autodesk**'s generative design solutions. Elevate looks like a mobile car with legs. It is both a four-wheeled vehicle and a four-legged walking machine, with the ability to transform depending on the terrain. Using generative design, the team is able to tackle complex problems digitally, put it into a physical form, and then iterate quickly. Elevate plans on moving from prototype to a mobile first responder vehicle able to help people.

IBM

Machine Learning Tackles Safety and Affordability

AVs rely on expensive sensors to help navigate road networks. The path toward more affordable and safer cars will come with more testing and innovation. One example of transformation is the partnership between Lunewave and **IBM**. Lunewave is combining its 3D-printed sensor technology with IBM's machine learning tools to develop powerful sensors that improve the accuracy of object detection in driverless vehicles.

Connected Cars

Automakers are creating more sophisticated infotainment systems that provide a combination of information and entertainment to improve the in-car experience. The systems operate via hand and voice gestures and include navigation apps, wi-fi network connection, apps that mirror the smartphone, access to external digital platforms like Apple Car Pay, and ability to seamlessly run multimedia or gaming applications for all riders. Some automakers also imagine the connected car to be an extension of work, allowing for hybrid work solutions.

And over time, a third wave of connectivity will emerge using embedded sensors that help the vehicle detect and respond to the surrounding environment. Embedded sensors in the car as well as on the roadways will allow stop signs, stop lights, and other road sensors to communicate with vehicles. Work is also underway so vehicles can "talk" to one another.

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Cars Become Hybrid Offices

The workplace was significantly impacted by the pandemic with many people working from home. Many companies are adopting hybrid work policies. Ford is working with Webex by **Cisco** to create an immersive experience in the car with solutions that allow drivers to work from anywhere. This next generation workplace includes a 15.5 inch screen and entertainment system, and uses HTML-5 so features can be updated when they are released. This system will connect with Webex and incorporate enhanced audio intelligence and safety features.

Real-time Traffic Management Systems

According to The Ray, more than 105 million connected vehicles are expected to be on the roads by 2022, producing more than 150 petabytes of data annually. **Panasonic** is working with its partners on this connected future with solutions that help prevent crashes and congestion. Cirrus by Panasonic V2X platform offers drivers a secure and open digital architecture for traffic issues. Through this effort, Panasonic is working with transportation agencies across the country to monitor and share real-time traffic and roadway conditions. A more connected transportation system can act as an "internet of vehicles" providing drivers with more updated road conditions from delays to icy conditions.

Cloud-Based Safety Analytics Tap into Connected Car Insights

Today's data and analytics professionals are shaping the future of smart cities. **General Motors**' vision to create zero crashes, zero emissions, and zero congestion is accelerating the company's focus on innovative solutions that amplify the positive impact of software. Safety View by GM Future Roads and INRIX is one example of this work in action. The first product of the GM Future Roads platform, Safety View, is a cloud-based application that provides transportation officials with critical insights using crash, vehicle, and vulnerable road user (VRU) information, in addition to US Census data. The tool is especially important following the passage of the Infrastructure Investment and Jobs Act, which prioritize data-driven projects that help improve road safety and equity, enabling greater public-private sector collaboration.

Digital Technologies Fuel Rapid Growth and Transformation

It is an exciting time for the automotive industry as it undergoes massive change. Digital solutions are fueling significant growth and innovation as new software tools are integrated across all operations and systems. Opportunities for enhanced sustainability, safety, and benefits from connectivity are only just being realized.

As the industry and products continue to innovate, new regulatory concerns will most certainly emerge. Opportunities for policymakers to support the evolving ecosystem will also become more evident—such as investing in smart and green infrastructure, cultivating a high-skilled workforce, improving supply chain conditions, and working in partnership with industry to allow innovation and the benefits of digital transformation to take shape.

Endnotes

1 Alliance for Automotive Innovation, 2022.

2 The International Energy Agency (May 2022).

3 Ibid.

4 United States Department of Transportation, Connected Vehicles Basics (June 2022).

5 Insurance Institute of Highway Safety, Highway Loss Data Institute (December 2022).

6 Von Paul Gao, Hans-Werner Kaas, Detlev Mohr & Dominik Wee, Automotive Revolution—Perspective Towards 2030, McKinsey & Company, January 1, 2016.

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