

Emerging Technologies

Emerging technologies present new and varied opportunities to support improved mobility and transform the future of transportation. Imagine your latest online order arriving at your door in a small, automated vehicle (AV), the size of a cooler. Imagine a public safety vehicle talking to traffic signals, asking for a few extra seconds of green time; or vehicles communicating with each other in real-time at an intersection, coordinating whose turn it is to go at the four-way stop, or communicating that there's ice on the road in 500 feet. Imagine technologies, such as a smart cane, that can help enable individuals with low vision to travel more safely. Think of the wide range of emerging mobile applications that allow travelers to share and access information on new modes, traffic, parking, and trip prices to aid informed trip planning and real-time transportation decision-making.

As tools to create, collect, analyze, and leverage data advance, there may be new ways to optimize traffic flow, manage transportation services and infrastructure, and improve mobility for all. Below are a few technology-spotlights highlighting emerging technologies and the potential value of these tools for enhancing transportation safety, equity, and efficiency.

Artificial Intelligence

Artificial intelligence (AI), as defined by [USDOT](#), refers to the processes that enable systems to augment routine human tasks or enable new capabilities that humans cannot perform. AI can improve a system's ability to sense or perceive its surroundings, analyze data, make decisions, share information, and/or perform an action in response. AI is efficient in sifting through large databases, identifying anomalies, and bringing them to the attention of decision-makers for further analysis. AI development for the transportation sector is generating interest, particularly as it connects to the development of AVs.

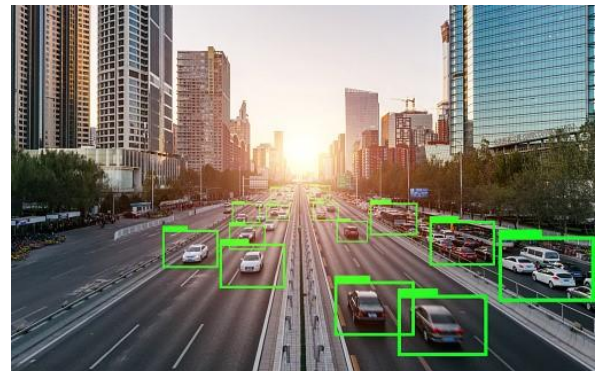


Figure 1: AI can be used, for example, to provide real-time traffic counts and incident monitoring. Source: [Getty](#)

USDOT's vision of AI for Intelligent Transportation Systems (AI for [ITS](#)) is to advance next-generation transportation systems and services by leveraging trustworthy, ethical AI and machine learning (ML) for safer, more efficient, and more accessible movement of people and goods.

Within the transportation sector, AI can provide support and augment a wide variety of tasks, including:

- Informing decision strategies within a traffic operations center
- Managing large fleets of vehicles, such as those associated with transit operators, trucking fleets, and airport operations
- Assisting decision-makers in long-term planning and emergency response
- Finding routing for travelers that is more efficient, equitable, and safe

Infrastructure Health Monitoring

Emerging technologies present potential to help improve infrastructure health monitoring, such as road and bridge maintenance. For instance, the advent of smaller sensors fueled by Internet of Things (IoT) technology, combined

with the growth of wireless networks, has reduced the costs associated with remote sensing and the monitoring of existing infrastructure. In addition, replacing some elements of in-person visual bridge inspection with more regular inspection by drone could further improve maintenance outcomes while making the process safer for inspectors.

Further, wireless sensors mounted onto bridge structures and installed within the roadway, used in conjunction with solar panels and compact battery packs, can provide dense, low-cost sensor coverage. These sensors can send data wirelessly to centralized servers for analysis. Studying the large dataset generated by these sensors, both for real-time monitoring and long-term analysis, could help to detect damage and assess maintenance and repair priorities. Identifying maintenance issues or damage early could, for instance, reduce the cost to repair a bridge.



Figure 2: IoT can be leveraged, for instance, to help identify and address system changes and needs. Source: [Getty](#)

Smart Communities

A “[smart community](#)” is a community that uses innovative technologies, data, and analytics to improve the community and address local challenges. Smart communities combine advanced information and communications technologies to inform new ways to solve common challenges like infrastructure maintenance, pollution, and traffic congestion. These communities create an intelligent, integrated information network by applying sensors and wireless communications technologies to infrastructure, vehicles, wearables, and other physical devices. Communities use this network to receive, analyze, and share data in real time to make better decisions and provide more responsive, efficient, data-driven services. Looking forward, as new technologies emerge and our ability to collect, leverage, and disseminate information continues to advance, there may be increasing opportunities to utilize emerging tools for improved community planning and decision-making.

Vehicle-to-Everything (V2X)

Technology enabling vehicles to communicate in real-time with traffic signals, work zones, and even other vehicles is advancing as well. This technology can allow the broadcast of alerts (such as those regarding reduced vehicle speed, if a vehicle in front of you is hard braking, collisions ahead, ice on the roads, work zones, and more) to be instantly received by vehicles, by enabling communication between vehicles, as well as to infrastructure and pedestrians. The potential safety improvements of utilizing V2X are massive – one NHTSA study, for example, estimates that V2X could reduce or prevent up to 80% of all crashes involving non-impaired drivers.

Future-facing Considerations

Looking forward, some of the key topics associated with the advancement of emerging technologies include:

- **Policy and standards:** developing guidance, supporting standards development, and funding grant programs to support effective and safe deployment of emerging technologies (promoting interoperability, navigating how new tools and associated expectations translate across jurisdictional lines, etc.)
- **Information security and reliability:** ensuring that personal, financial, and other sensitive data is protected and that information provided to end-users can be effectively leveraged for associated decision-making.
- **Equity and Accessibility:** expanding efforts to ensure that emerging technologies are accessible to the full range of travelers and that the data leveraged in these tools accounts for and mitigates potential bias.

About the UTC Speaker Program: The mission of the speaker program is to connect transportation industry leaders and innovators with university and college students in the classroom. In this way students will hear directly from transportation professionals their personal experiences, challenges, and successes, and learn about how to better prepare for entering the Intelligent Transportation Systems (ITS) workforce.

To learn more about the UTC Program please visit the [University Transportation Centers](#) website.