ARC EMERGING TECHNOLOGIES ROUNDTABLE

Transportation Technology and Artificial Intelligence

AI

Report One
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Members

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Initiated in 2021, the Atlanta Regional Commission assembled the Emerging Technologies Roundtable comprised of subject matter and issue experts from the Atlanta community to explore the impact of emerging technologies on how we will live, work and travel in our region over the coming decade and beyond. The inaugural meeting of the Emerging Technologies Roundtable (ETR) was held on November 19th, 2021. During the meeting, Roundtable members explored two Emerging Technology topics, **Transportation Technology** presented by Laura Rogers from The Ray, and **Artificial Intelligence** presented by Muhammed Ahmed from Opendoor.

Laura Rogers, Deputy Director at The Ray, presented an overview of The Ray's 'Zero Waste. Zero Carbon. Zero Deaths.' vision and the transportation technology work conducted on The Ray Highway, their 'publicly accessible living laboratory [and] proving ground for transportation infrastructure of the future'. Working with partners throughout the United States, The Ray is advancing the research and adoption of renewable energy through:

- » Analyzing and installing solar energy systems along DOT Rights of Way
- » Testing and delivery of fixed and in-lane EV charging systems including deploying the first public photovoltaic EV charging station in the Southeast
- » Conducting Fleet and Highway Electrification studies
- » Examining the energy transmission and distribution network required to achieve national fleet and highway electrification

Additionally, The Ray is exploring a variety of transportation-related technology and landscape approaches, including:

- » Truck stop hydrogen production and refueling systems
- » Developing connected roadway technology that increase safety and reduce crashes
- » Testing the use of rapidly deployed airborne drone platforms in response to highway emergencies
- » Making use of vegetation and pollinator programs on DOT Rights of Way as a 'landscape laboratory'

Muhammed Ahmed, Research Scientist at Opendoor, presented an overview of artificial intelligence (AI) by introducing the Roundtable to key concepts and by providing real-world examples of focus areas within the broader field of AI. Focus areas included:

- » Machine Learning algorithms: Discussed algorithms used to predict which Netflix shows to recommend viewers or Amazon purchases you may enjoy, predicting credit card fraud for banks and the prediction of stock and home prices
- » Natural Language Processing applications: Presented automated spelling and grammar suggestions, language translation and automated content creation
- » Computer Vision: Introduced examples in object detection, optical character recognition, pose estimation and image recoloring

» Generative Adversarial Networks, or GANs: Explained using websites like *This Person Does Not Exist*, where faces of 'fake' people are randomly generated using a GAN, or deepfake Tom Cruise examples demonstrating the ease and speed available to generate a fake (yet convincing) video of a person doing and saying things they never have

» Combining of physical and digital worlds: Showcased AI-related robotics applications, ranging from autonomous vehicles to the agile robotic platforms developed by Boston Dynamics

Key Insight #1

Decarbonization of the transportation sector is necessary to meet CO2 emissions goals and to potentially mitigate onset and/or impacts of extreme climate change events. To achieve this, adoption of electric vehicles (EV) powered by green renewable energy sources and investment in the necessary electrification infrastructure is critical. Additionally, the application of EV and electrification infrastructure will advance the transition to a clean, modern transportation sector and support a vibrant green economy across the Atlanta region. Exporting our low and no carbon solutions beyond our regional borders will also mitigate climate change globally.

Key Insight #2

An overwhelming majority of our regional residents interact with artificial intelligence (AI) daily when they use social media platforms, video streaming services, and automated spelling and grammar suggestion tools. Opportunities abound and are imminent for the adoption and advancement of AI systems in transportation, e-commerce, robotics, human resources, healthcare, gaming, finance, marketing, and other sectors. Thus, it is critical we understand the advantages, technical limitations, and ethical challenges society may face in both the positive use of AI or the misapplication of these technologies.

On the Horizon:
Future Scenarios with Transportation Technology and Artificial Intelligence

Following the first ETR meeting, Roundtable members were invited to participate in an online survey to synthesize and blend the presented information with their industry knowledge to shape and share a vision of possible futures for Metro Atlanta in the year 2030. The following future scenarios consist of ideas compiled from the survey responses and distilled into several overarching themes.

Scenario 1: AI-Optimized Transportation Systems

Connected and autonomous private, shared and fleet transportation platforms rely on artificial intelligence to optimize transportation routing, prioritize electric vehicle charging and manage logistics and system safety. Overall efficiency is further optimized through the digital twin modelling of transportation networks and real-time citizen and consumer feedback. Additionally, AI performs transportation audits by analyzing patterns of use, prioritizing infrastructure improvements, and identifying the least used or nuisance roadways for potential conversion into pedestrian-only use and/or photovoltaic solar streets.

Scenario 2: Affordable and Efficient Eco-Solutions

Equitable access to inexpensive and reliable green energy (including wind, geothermal, rooftop solar and roadway solar) is available across the United States, with the national distribution and transmission infrastructure supported by the public. Artificial intelligence-infused applications are ubiquitous and deployed to analyze the usage patterns and energy habits of every connected, smart system found in homes and buildings across the United States. By pinpointing patterns at the neighborhood level, energy loading schedules are efficiently personalized, resulting in a balanced demand on the energy grid. During peak energy demands, improved home and connected EV battery storage systems feed surplus energy back into the system and publicly accessible energy dashboards hold businesses and organizations accountable for their energy usage.

Scenario 3: Consumer Demand Drives EVs to the Next Level

Exploding popularity in the low-carbon transportation sector accelerates the transition from internal combustion engine (ICE)-powered light duty and passenger vehicles to the more affordable and efficient electric vehicles. Connected and efficient electric and autonomous systems are quickly surpassing interest in ICE-powered vehicles. This transition would prevent the arrival of the long-feared increases in road congestion possible should society delay the transition to EVs, resulting in an unmanageable mix of smart, connected EVs and non-connected, ICE vehicles on our roadways. EV passenger vehicles, combined with an improved and expanded passenger rail network extending deep into the suburbs, amplify last-mile micromobility and zero-carbon transportation options. Bus and fleet electrification efforts shift a previously noxious and undesirable location of services from a liability to an asset, as electric buses utilizing vehicle-to-grid technology provide energy resiliency for surrounding neighborhoods in times of emergency.

Scenario 4: New Ways of Working Lead to New Ways of Living

Nationally, shifts in attitudes around travel for work result in an end to commuting, with citizens choosing to remain in their communities for work, shopping, and leisure. A rise in co-housing development ushers in an era of affordable housing options. The associated increase in housing density yields closer-knit communities. These close-knit communities effectively combat marginalization and disconnection, replacing a lack of pride in community with a sense of mutual support. As small, tightly-knit communities blossom, a desire to manage vehicles shifts the primary usage of roads and streets from "vehicle first" to "people first". This change results in optimization of towns and cities for citizens rather than for automobiles. Benefits of improved health, reduced stress and an overall increase in wellbeing would flow from curtailing the work commute with diminished carbon emissions.

Quotations from ETR Members

"*Technology holds a…promise for improving wellbeing, equity, and the environment. …we must remember that technology is a tool and can be positive or negative depending on how we use it. It is especially important for policymakers to understand emerging technologies and work to strike the balance needed so that all citizens benefit…*"

Laura Rogers, *Deputy Director at The Ray*

"*The State of Georgia supports public research universities, like Georgia Tech, that are engaged with deep investigations of emerging technologies. A robustly funded initiative to investigate, strategize, and develop applications of emerging technologies for regional social, cultural, civic, and economic benefit would leverage our own local assets for the local benefit. [The] Atlanta [Region] should benefit from the innovations produced here.*"

Jessica Anderson, *Research Scientist and Director of DataWorks at Georgia Tech*

"*We may not attain the promise of electrification of the transportation sector [if we are] half in and half out. This may not be an either/or [question and] it may make sense to get this going in the cities first where one can scale quickly…and then take it out to the towns, villages, and countryside. Rural areas may still need fossil fuels for a while. The electric system may need to…use natural gas as we really don't know how long the bridge is. And what will it be? Hydrogen, small modular reactors, etc. [are] needed to provide… resilience and balancing in the electric power system.*"

Mark G. Lauby, *Senior VP and Chief Engineer at North American Electric Reliability Corporation*

Glossary

Artificial Intelligence (AI) It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable. *Source:* McCarthy, John. *What is Artificial Intelligence,* 2004, Stanford University, Stanford, CA.

Autonomous Vehicle (AV) Autonomous vehicles (AVs) use technology to partially or entirely replace the human driver in navigating a vehicle from an origin to a destination while avoiding road hazards and responding to traffic conditions. *Source:* Anderson, J., et al. *Autonomous Vehicle Technology: A Guide for Policymakers*, 2016, Rand Corporation, Santa Monica, CA.

Boston Dynamics Boston Dynamics' mission is to imagine and create exceptional robots that enrich people's lives. Building machines that can approximate the mobility, dexterity and agility of people and animals is a grand challenge…We see products derived from this work as the next step in the human history of building machines to reduce the danger, repetition and physically difficult aspects of work. *Source:* Boston Dynamics, *FAQS About Boston Dynamics,*www.bostondynamics.com/about. Accessed 27 January 2022.

Computer Vision (CV) Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe and understand. *Source:* IBM, *What is computer vision?,* www.ibm.com/topics/computer-vision. Accessed 27 January 2022.

Department of Transportation (DOT) The Department of Transportation is responsible for planning and coordinating federal transportation projects. It also sets safety regulations for all major modes of transportation. *Source:* USA.gov, *U.S. Department of Transportation,* https://www.usa.gov/federal-agencies/u-s-department-of-transportation. Accessed 27 January 2022.

Electric Vehicle (EV) Electric vehicles (EVs) have a battery instead of a gasoline tank, and an electric motor instead of an internal combustion engine. *Source:* United States Environmental Protection Agency, *Explaining Electric & Plug-In Hybrid Electric Vehicles,* www.epa.gov/greenvehicles/explaining-electric-plug-hybrid-electric-vehicles. Accessed 27 January 2022.

Emerging Technologies Emerging technologies are defined by five attributes: radical novelty, fast growth, coherence, prominent impact, and uncertainty and ambiguity. *Source:* Daniele Rotolo, Diana Hicks, Ben R. Martin, *What is an emerging technology?,* Research Policy, Volume 44, Issue 10, 2015, Pages 1827-1843, ISSN 0048-7333, doi.org/10.1016/j.respol.2015.06.006. Accessed 27 January 2022.

Generative Adversarial Network (GAN) A generative adversarial network, or GAN, is a deep neural network framework which is able to learn from a set of training data and generate new data with the same characteristics as the training data…Generative adversarial networks consist of two neural networks, the generator and the discriminator, which compete against each other. *Source:* Thomas Wood, *What is a Generative Adversarial Network?,* DeepAI.org, deepai.org/machine-learning-glossary-and-terms/generative-adversarial-network. Accessed 27 January 2022.

Internal Combustion Engine (ICE) An internal-combustion engine is a heat engine in that it converts energy from the heat of burning gasoline into mechanical work, or torque. *Source:* K.C. Colwell, *Here's How Your Car's Engine Works,* Car and Driver, caranddriver.com/features/a26962316/how-a-car-works/. Accessed 27 January 2022.

Machine Learning (ML) Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. *Source:* IBM, *What is machine learning?,* ibm.com/cloud/learn/machine-learning. Accessed 27 January 2022.

Micromobility Federal Highway Administration broadly defines micromobility as any small, low-speed, human- or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters (e-scooters), and other small, lightweight, wheeled conveyances. Other definitions of micromobility focus primarily on powered micromobility devices and characterize these devices as partially or fully motorized, low-speed (typically less than 30 miles [48 kilometers] per hour), and small size (typically less than 500 pounds [230 kilograms] and less than 3 feet [1 meter] wide) *Source:* Jeff Price, Danielle Blackshear, Wesley Blount, Jr., and Laura Sandt, *Micromobility: A Travel Mode Innovation,* Public Roads - Spring 2021, Vol. 85 No. 1, U.S. Department of Transportation Federal Highway Administration, highways.dot.gov/public-roads/spring-2021/micromobility-travel-mode-innovation. Accessed 27 January 2022.

Natural Language Processing (NLP) Natural language processing (NLP) refers to the branch of computer science—and more specifically, the branch of artificial intelligence or AI—concerned with giving computers the ability to understand text and spoken words in much the same way human beings can. NLP combines computational linguistics—rule-based modeling of human language—with statistical, machine learning, and deep learning models. Together, these technologies enable computers to process human language in the form of text or voice data and to 'understand' its full meaning, complete with the speaker or writer's intent and sentiment. *Source:* IBM, *What is natural language processing?,* www.ibm.com/cloud/learn/natural-language-processing. Accessed 27 January 2022.

Opendoor A leading digital platform for residential real estate…currently operates in a growing number of cities and neighborhoods across the country [and is] Headquartered in San Francisco. *Source:* Opendoor, *Our Story: The reimagined way to buy and sell your home*/www.opendoor.com/w/about. Accessed 27 January 2022.

The Ray The Ray is a proving ground for the evolving ideas and technologies that will transform the transportation infrastructure of the future, and it starts on 18 miles of West Georgia's I-85, and the land and communities surrounding it. *Source:* The Ray, *Welcome to the Ray*, theray.org/technology/. Accessed 27 January 2022.

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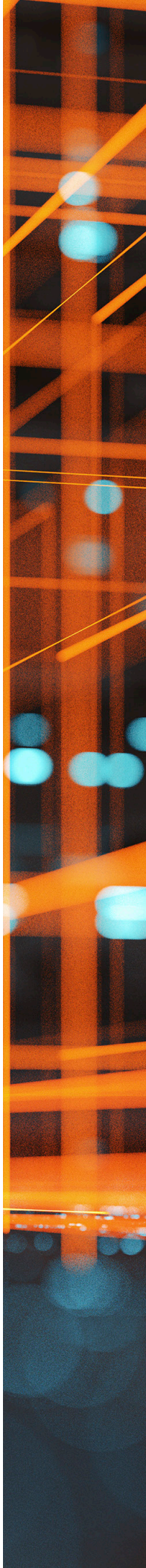
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