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Driving Innovation

Early Impact of Artificial Intelligence (AI) on Highway Transportation

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SAXTON LABORATORY

Outline

- Federal Highway Administration (FHWA) AI Research Overview.
- AI and FHWA Projects.
- Traffic Management.
- Sensor Detection.
- Pedestrian Accessibility.
- Automation.
- Early Benefits of AI.

FHWA AI Research

Overview

What is Artificial Intelligence?

- Rule-Based Systems.
- Machine Learning.
- Generalized Human Intelligence.

What's New in Artificial Intelligence Research?

- Traffic Signal Control.
- Transportation Network Services.
- Assistive Mobility.
- Cross-cutting Data Inference Tools.

FHWA AI Research

Overview

Traffic Management

- Using AI incident detection and data collection versus conventional algorithms.

Sensor Detection

- Datasets that offer continuous video and sensor reading data.

Pedestrian Accessibility

- Exploring AI machine learning to transform independent mobility for people with disabilities.

Automation

- Equip vehicles and infrastructure with the ability to enable the safer and more efficient movement of goods and services.

FHWA AI Research

Project

Traffic Management

- Delaware DOT.
- Exploratory Advanced Research (EAR) Program.
- Traffic Signal Control.
- Vehicle tracking by Loop Detectors.

Sensor Detection

- Strategic Highway Research Program (SHRP2).
- EAR optical sensor and image data processing

Pedestrian Accessibility

- Accessible Transportation Technologies Research Initiative (ATTRI).
- EAR Robotics.

Automation

- Cooperative Automation Research Mobility Applications (CARMA).

Traffic Management

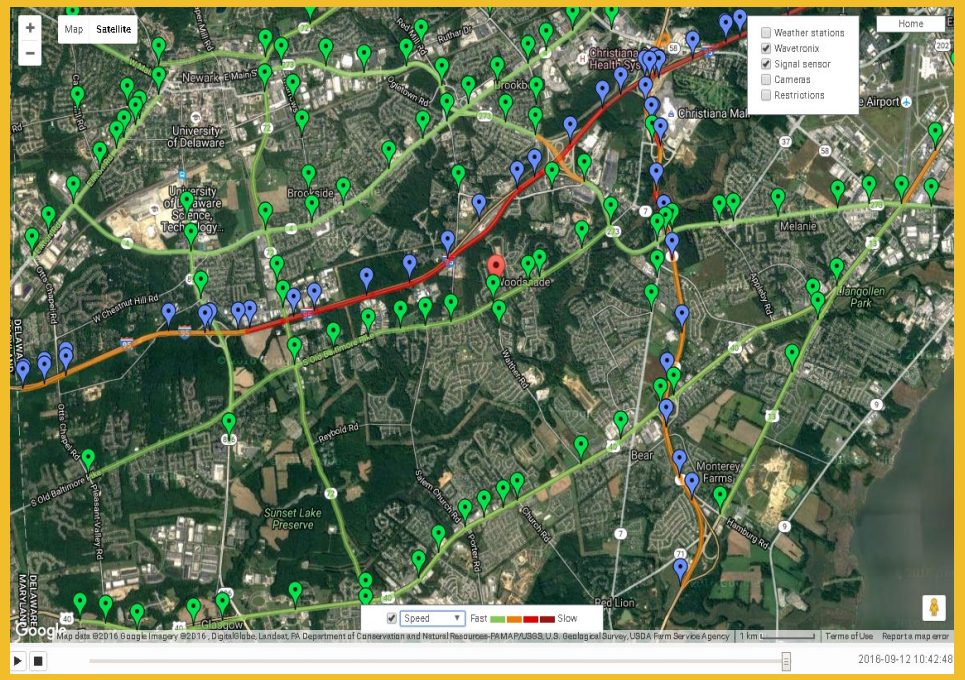
Projects

Delaware DOT

Artificial Intelligence Integrate Transportation Management System (AIITMS) Deployment Program and EAR Program.

Research Topics:

- Develop an AI Tool to support TMC operations and arterial corridors by collection information about better timing.
- Build a computer/AI based tool to enhance TMC operations.
- Build a foundation which can support the automation or semi-automation of the TMC operations in the near future.



Source: FHWA

Detection System

Blue: Digital Radar.

Green: Other Traffic Sensors.

AI Sensor Detection

Projects

Video Analytics

Safety Data Analysis Team

- Strategic Highway Research Program (SHRP2) datasets that offer continuous video and sensor reading data.
- Datasets that offer continuous video and sensor reading data.
- Use these data to better understand how crashes happen.
- Applying Machine Learning data from the Highway Safety Information System (HSIS) to break down huge amounts of information into “bite-sized chunks”.

Pedestrian Accessibility
Projects

Accessible Transportation Technologies Research Initiative (ATTRI)

- Support independent travel through transportation hubs, cloud-based autonomy and shared helper robots.

EAR Program

- Transform independent mobility for people with disabilities with machine intelligence.
- Research on human-machine interfaces and novel mobility platforms (personal vehicles).

Source: FHWA.

Automation
Projects

Cooperative Automation Research Mobility Applications (CARMA)

- Enables the testing and evaluation of cooperative automation concepts through open source software (OSS).
- Equips vehicles to interact and cooperate with infrastructure informing vehicles about what's ahead and what to expect.
- Supports Transportation Systems Management and Operations (TSMO) strategies.
- Encourages collaboration between researchers.

Source: FHWA.

Cooperative Automation USE CASES

TSMO PROOF OF CONCEPT TESTING AND EVALUATION

1 Basic Travel

Example scenarios:

- Engage in a platoon defined by a geofence.
- Leader maintains safe time gap.
- Followers maintain interplatoon time gap.
- Platoon size in one lane reduced from 5 to 2 cars.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

2 Traffic Incident Management

Example scenarios:

- Reduced command speed entering traffic incident event.
- Determined by infield geofence.
- Lane change to provide space for first responders.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

3 Weather

Example scenarios:

- Reduced command speed entering an area with low visibility.
- Defined by a dynamic geofence.
- Engage in larger time gap.
- Maintain lane guidance.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

4 Work Zones

Example scenarios:

- Reduced command speed entering work zone.
- Defined by a stationary geofence.
- Lane change assignment prior to entering work zone.
- Maintain safe time gap thought the work zone.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

Source: FHWA.

Artificial Intelligence

Early Benefits

- AI enables computers to collect and analyze large amounts of data and form conclusions.
- Improve traffic flow at intersections and specific routes.
- Support human decision making at TMCs.
- Incident detection and management.
- Traffic demand prediction.
- Traffic signal control.
- Real-time traffic and weather conditions.
- Trip planning and increasing situational awareness while traveling.

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