# Intelligent Transportation Systems

## Algorithms and Formal Verification

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# Outline

# Intelligent Transportation Systems (ITS)

The main objective of ITS is to use the technology present to our advantage. It involves managing the transportation network using real-time information for applications such as:

- Traffic light management;
- Vehicle navigation;
- Emergency vehicle notification;
- Collision avoidance systems, etc.

Advancements in the sensing, wireless communication and computational technologies has led to the development of various ITS applications.

The induction of autonomous vehicles in transportation system will give rise to various new ITS applications.

# Autonomous Vehicle

An Autonomous Vehicle (AV) has an autonomous driver agent for the lateral and/or longitudinal control of the vehicle in some or all driving modes and conditions.

An AV makes use of various sensors for perception of the environment and localization. Lidar, Radar, Sonar, Camera, GPS, IMU (Inertial Measurement Unit), etc. are examples of AV sensors.

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Figure 1: Sensors used in an AV

# Autonomy Levels of AV

The level of autonomy an AV possess depends on:

- Autonomous control over lateral and/or longitudinal movement,
- Who performs the object and event detection and response functionality
- The operational design domain of the vehicle

Based on the above mentioned factors, 6 levels of autonomy are defined by the Socitey of Automotive Engineers (SAE) [1]

[1] SAE J3016: *Levels of Driving Automation*

# SAE Autonomy Levels


Figure 2: SAE autonomy levels (*image courtesy of SAE*)

# ITS for AV

The induction of AV in transportation system will give rise to whole new possibilities of ITS algorithms.

Along with the freedom AV offers to human drivers, it is expected to have a huge impact on today's traffic management system as well.

Qualities of an AV that makes it useful for ITS applications are:

- Obedience
- Precision
- Highly cooperative
- Less unpredictable

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# Thank You!