# Autonomous Vehicle Safety Analysis and Assessment (NTPS)

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# Overview

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# Introduction

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## What is an Autonomous Vehicle:

- A self-driving vehicle is capable of sensing and perceiving the environment and thereby planning and controlling the vehicle in the most optimized way to achieve the target.
- Has been in development from as early as the 1920s.
- Upto Level 3 automation has been achieved, but Level 4 and Level 5 are still in the testing and validation state.

# Introduction

## Safety and Security of Autonomous Vehicles:

- Mass deployment of the autonomous vehicle can only be done when the safety and security of autonomous vehicles have been achieved.
- Testing and validation have to follow the defined standards that also match the rapidly changing technology behind AVs.
- Concern related to reliability, dependability, liability and optimality regarding AVs has to be addressed.

# Levels of Autonomy

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## Degree of automation Defined by SAE J3061 standards:

- Six levels of Autonomy have been defined with no automation to full automation.
- From Level 0 to Level 3, the driver has to drive with the help of driving assistance functionalities and take full responsibility.
- Level 4 and Level 5, the driver doesn't have to drive and take responsibility. *beamerarticle*

# Figures


Figure: SAE J3061: Level of Autonomy

# Autonomous Vehicle Architecture

# Autonomous Vehicle Architecture

There are four major modules in AV architecture:

- Perception
- Mapping and Localization
- Planning
- Control

# Autonomous Vehicle Architecture

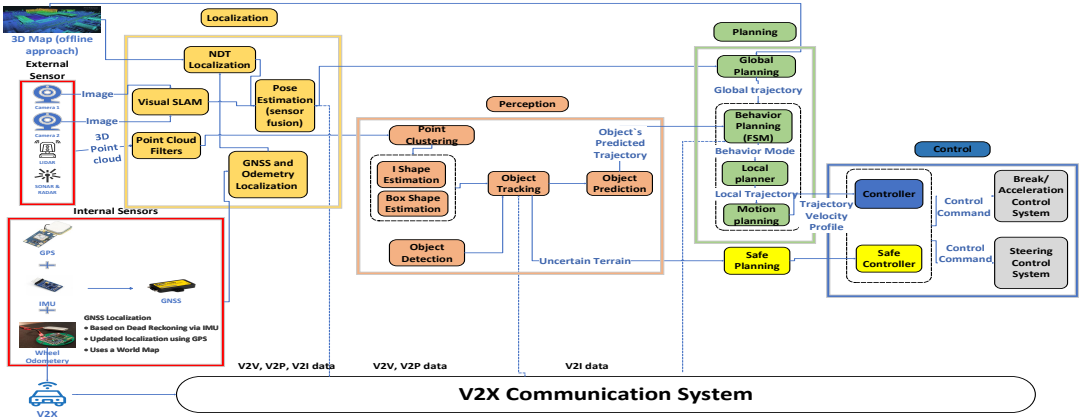


Figure: Autonomous Vehicle Architecture

# Safety and Security Standards for AVs

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| Standard | Title | Organization |
|---|---|---|
| ISO 21448 | Road Vehicles - Safety of the Intended Functionality (SOTIF) | International Organization for Standardization (ISO) |
| ISO 26262 | Road Vehicles - Functional Safety | International Organization for Standardization (ISO) |
| SAE J3016 | Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles | Society of Automotive Engineers (SAE) |
| SAE J3061 | Cybersecurity Guidebook for Cyber-Physical Vehicle Systems | Society of Automotive Engineers (SAE) |
| UL 4600 | Standard for Safety for the Evaluation of Autonomous Products | Underwriters Laboratories (UL) |
| IEEE 2846 | Standard for Safety and Testing Requirements for Highly Automated Vehicles | Institute of Electrical and Electronics Engineers (IEEE) |
| EN 303 645 | Cyber Security for Consumer Internet of Things | European Committee for Standardization (CEN) |

# Safety and Security Standards for AVs

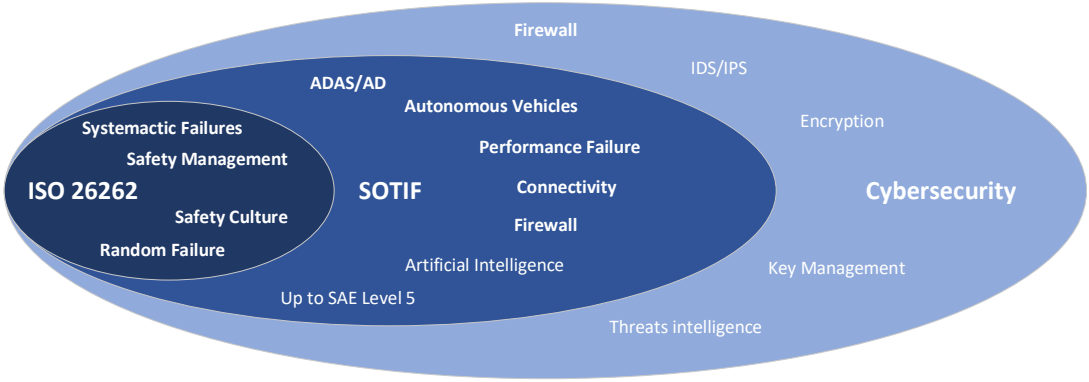


Figure: Autonomous Vehicle Safety and Security Standard

# Conclusion

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## Challenges in Achieving Safety and Security:

- Cybersecurity & Data Privacy
- Complex software and hardware
- Human-machine interaction
- Environmental conditions & Infrastructure readiness
- Ethical considerations and dilemmas
- Safety certification and Regulatory hurdles
- Public trust and acceptance
- Liability and insurance
- Limited testing environments & Cost

# Conclusion

## State-of-the-Art Purposed Solution:

- Redundant, Diverse and Advance sensors
- Machine Learning and Artificial Intelligence (Data Driven Control)
- Blockchain technology & Cybersecurity solutions
- Communication Standards (V2X)
- Secure Intra-Communication Network
- Test and validation frameworks
- Standards and regulations
- Human Factors

Thanks for your attention!

Are there questions?