UMD CATT Connected Autonomous Vehicle (CAV) Research

Smart Cities Symposium
September 2019
Connected Automated Vehicles

Autonomous Vehicle
Operates in isolation from other vehicles using internal sensors

Connected Vehicle
Communicates with nearby vehicles and infrastructure

Connected Automated Vehicle
Leverages autonomous and connected vehicle capabilities
# SAE Levels of Automation

## SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Details</th>
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<tbody>
<tr>
<td>0</td>
<td>No Automation</td>
<td>Zero autonomy; the driver performs all driving tasks.</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance</td>
<td>Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.</td>
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<tr>
<td>2</td>
<td>Partial Automation</td>
<td>Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.</td>
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<tr>
<td>3</td>
<td>Conditional Automation</td>
<td>Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.</td>
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<td>4</td>
<td>High Automation</td>
<td>The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.</td>
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<tr>
<td>5</td>
<td>Full Automation</td>
<td>The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.</td>
</tr>
</tbody>
</table>

...I AM APPROACHING FROM YOUR LEFT AND AM MAKING PRECAUTIONARY ADJUSTMENTS...

ACKNOWLEDGED. NOT A PROBLEM UNLESS THE SLAB OF MEAT IN HERE INTERFERES...

Intermediate stage en route to driverless cars.

IS SLAB-WATCHING DISTRACTED DRIVING?
Arterial Use Case

Source: USDOT, November 2013
Arterial Use Case

Automated vehicles may not require a driver to operate the vehicle or monitor roadway conditions. There are several levels of increasing automation.

Vehicles with connectivity are able to communicate automatically with other vehicles and infrastructure and also identify pedestrians and bicyclists in and around roadways.
UMD CATT CAV Research Areas

Pedestrian/Bike/Other Detection
• Intersection Object Detection
• Intersection Object Tracking
• Work Zone Identification
• Dilemma Zone Identification
• DSRC/Cellular Safety Message (BSM/PSM) Transmission

Vehicle Operation Guidance
• DSRC/Cellular Safety Message (BSM/PSM) Receipt
• Work zone messaging (Speed, Merging, etc.)
• Variable speed limits
Route 1 & Knox Road
Object Detection & Tracking and BSM Alert Generation & Receipt

1. Camera Views Pedestrian/Cyclist/Other in Crosswalk
2. Object Detection & Tracking Processes Video in Real-Time
3. CPU Generates Basic Safety Messages (BSM)
4. RSU Broadcasts BSM via Cellular/DSRC
5. OBU in Vehicle Receives BSM & Alerts Driver
6. Phone App Receives BSM for Supplemental Alerting
**RSU (infrastructure side) and OBUs (vehicle side)**
Camera, Comms, PC, etc., & Cobalt Controller (loaner)

**Kapsch sniffer (Danlaw OBU + eTrans Insight app)**
Used to independently verify the type, content, and quality of messages that are being broadcast
Current Work

• Continue Prototyping of Object/Pedestrian Detection Algorithms
• Continue Development of BSM/PSM Broadcast and Receipt Messaging, Including Leveraging DSRC & Cellular Technologies
• Prototype In-Vehicle and On-Infrastructure Alerting Solutions, Including Phone App Development
• Test Integration with Third-Party Commercial Technologies
• Coordinate Prototyping and Testing with State and Local Jurisdictions on and Around UMD College Park Campus – Includes Access to Control Signal Cabinet (Cobalt Preferred) & Iteris Camera Mount
Possible Smart Cities Route 1 Demo Corridor
Why a Demo Corridor?

The main goals of the testbed are to:

- Facilitate the development and implementation of advanced technologies
- Foster collaboration with industry wishing to test and further enhance their own technologies
- Improve mobility and safety on campus and around Gainesville
- Quantify the minimum criteria for operators to safely engage with automated vehicles
- To become a model nationally and internationally for the use of advanced technologies to enhance transportation.
Other related CAV Pilot - Olli

- Level 4 Automated Transit Vehicle
- Local Motors (MD Company in National Harbor)
- 3 month pilot funded by Clark School & MTI
- Currently negotiating agreement
Questions?