AUTONOMOUS CAR FUTURE

Transportation progress and issues

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OUTLINE

- Automation Levels in transportation
- Autonomous Systems
    – Companies: Waymo, Uber, Tesla, Cruise/GM
    - Technologies: Lidar / Cameras / Radar
- Exception handling – Uber, Nissan, Tesla
- Future of Transportation
    – Parking, Communication, Awareness, Ride-sharing
- New way of transportation
    – Hyperloop, Tunnels, Air-Taxi

AUTOMATION LEVELS

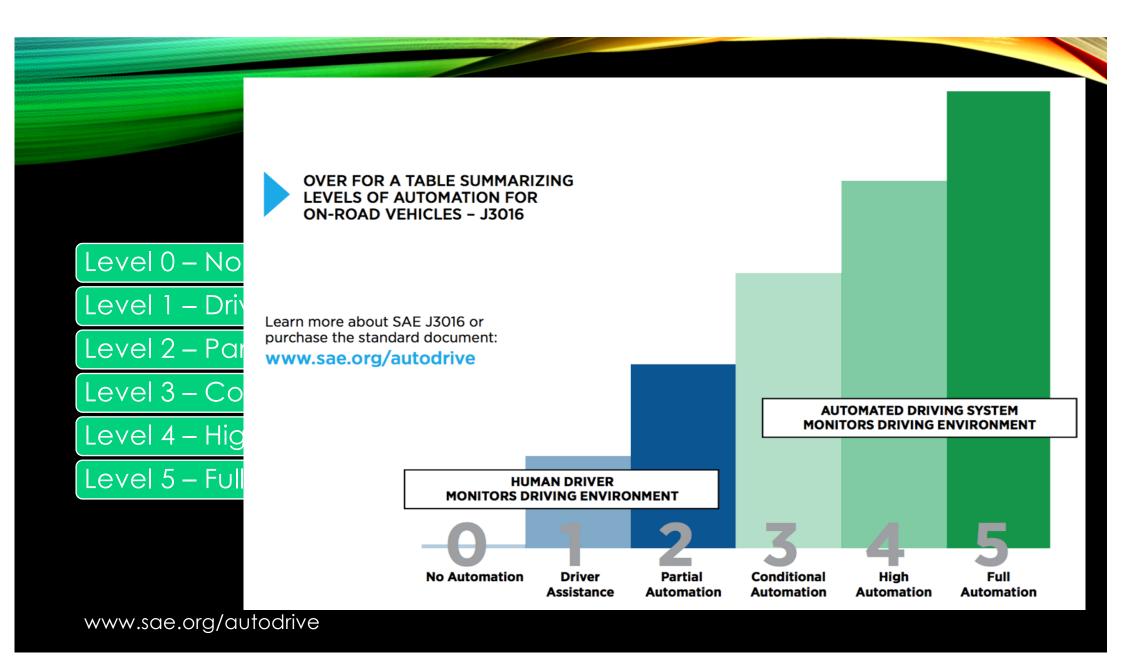|	
Level 0 – No Automation	Human driver monitor environment
Level 1 – Driver Assistance - hands on	
Level 2 – Partial Automation - hands off	
Level 3 – Conditional Automation – eyes off	Automated driving system monitor environment
Level 4 – High Automation – mind off	
Level 5 – Full Automation – steering wheel opt	

www.sae.org/autodrive

WAYMO

- Waymo has run self-driving cars over [5 million road miles](#) in 25 cities and done billions of miles in computer simulation
- Collisions: three over more than 350k miles
- Lowest rate of disengagement
- Commercial operation in Phoenix, TX
- Operating in pre-maped environment
- Using expensive Lidar

GM / CRUISE

- Cost ~ 200k USD an autonomous Bolt version
- Cost ~ 35k USD an electric Bolt version
- Cruise had 22 of the 27 accidents in the state involving driverless cars
- Trying to use cheaper Lidar's
- Collisions: 22 over 132k miles
- Drive speed limited to 25 miles/hour

TESLA

- Building ride sharing platform Tesla Network
- Uses mainly Cameras for Driving
- Uses Radar for long distance view
- Level 4 expected in 2020

UBER

- Fatal accident March 2018 – Killed pedestrian
- In 2016 Uber bought Self-driving trucking startup Otto
- Focusing on ride-sharing

https://www.bloomberg.com/hyperdrive

EXCEPTION HANDLING

- Nissan Automated Driving
  - Stop in case of parked car in street
  - https://youtu.be/cfRqNAhAe6c?t=519
- Tesla crashes
  - Environment aware of automation
  - https://youtu.be/P8CQ6pShc0I?t=240
  - https://youtu.be/--xITOqIBCM
- Uber accident
  - https://youtu.be/0Za_L_fbg2w

EXCEPTION HANDLING - CONT

- Emergency braking
  - https://youtu.be/QJQOFS4YIfw?t=3 – fail to brake

- Emergency vehicles – right to go
  - https://youtu.be/R88hhpUA6SI?t=106

- ACC with Line assistant issues
  - https://youtu.be/qQkx-4pFjus - crash
  - https://youtu.be/eB7fr2s_I9M?t=305 – cannot stay in the line

FUTURE – PARKING

- With automation you do not need to spend time to search for parking space and park close to your place where go
- Car will drop you off and continue with driving
- You can call car to pick you up.
- Big parking lots in Malls or Stadiums might not be needed
- Saving Time and Money. The car can be utilized by anyone else.
- **Less traffic in the urban areas**

FUTURE - AUTOMATED DRIVING

- Automated driving increase the flow of the traffic by reducing reactions of accelerating and distance between cars
- Intersection management – more intelligent car network cause less traffic and eliminate congestion time

- **Shorter commute time - no congestion**

FUTURE - AWARENESS

- Cars will communicate to each other
- Obstacle or Accident will be reported to other cars to adjust the route
- Reduce stress on the driver and potential accident due to lack of concentration
- When cars will be automated people can actively spend time during commuting.
- **No accidents - *More convenient commuting***

FUTURE – RIDE SHARING

- Due to constraints it will be suggested to use ride sharing
- New ways of ridesharing – better planning, choose company you like to ride with
- Separated sections within car for privacy
- Owning car will be expensive and you will pay extra for parking

- **Less cars on the road – Cheaper Transportation**

FUTURE – NEW TRANSPORTS

- Hyperloop – fast intercity train
- 3D Tunnel network – more layers of roads
- Air-Traffic – Air-Taxi, Airbus, Gyrocopter /Gyroplane, Rocket Travel
  - https://youtu.be/zqE-uItsWt0
  - Lilium
    - https://youtu.be/BXyewsk-7aQ?t=23
  - Airbus
    - https://youtu.be/BXyewsk-7aQ?t=411

Q&A

Questions & Answers

THANK YOU FOR YOUR ATTENTION