Autonomous Driving
Are we there yet?

Hussein Hesham
R&D Manager Valeo Egypt
“When Henry Ford made cheap, reliable cars, people said, 'Nah, what's wrong with a horse?' That was a huge bet he made, and it worked.”

—Elon Musk, Tesla, Inc. CEO and founder
1925, everything has started by demonstrating a radio-controlled vehicle travelling up Broadway and down Fifth Avenue through the thick of the traffic jam.

**DARPA ALV Project**

1984, The ALV project achieved the first road-following demonstration that used lidar, computer vision and autonomous robotic control to direct a robotic vehicle at speeds of up to 19 miles per hour (31 km/h).

**DARPA first Grand Challenge**

2004, DARPA offered a $1 million prize to any team of robotic engineers which could create an autonomous car capable of finishing a 150-mile course. No team was successful in completing the course!

**Google began developing its self-driving cars in 2009**

2012, a Toyota Prius modified with Google's experimental driverless technology was licensed by the Nevada Department of Motor Vehicles (DMV).
Is it really hard to build an autonomous vehicle

What has been considered throughout this technology enablement?

Cars, intersections, traffic lights, pedestrians, traffic signs, cyclists, trees, road boundaries, lanes, ... etc
In order to understand how the self-driving cars operate, we need to observe our behavior as drivers!

“Observe and Perceive”

“Plan”

“Navigate and Control”
Autonomous driving stages!

1. Perception using sensors
   - LiDAR
   - Camera
   - Radar
   - Ultrasound

2. Environment modelling
   - Vehicles
   - Pedestrians
   - Lanes
   - Traffic signs

3. Path planning
   - The best path to follow at each moment

4. Navigation
   - Following a path towards a defined destination

5. Vehicle control
   - Driving wheel
   - Gas and brake pedals
Autonomous Driving Levels

- **No Automation**
  - Driver is continuously exercising longitudinal AND lateral control.

- **Driver Assistance**
  - Driver is continuously exercising longitudinal OR lateral control.

- **Partial Automation**
  - Driver has to monitor the system at all times.

- **Conditional Automation**
  - Driver does not have to monitor the system at all times, must always be in a position to resume control.

- **High Automation**
  - Driver is not required during defined use case.

- **Complete Automation**
  - System can cope with all situations automatically during the entire journey. No driver required.
Closer Look
Sensors used in autonomous driving are different in terms of nature and capabilities

“Camera”

“LiDAR”

“Segmentation”
Autonomous driving is an exclusive technology for automotive!
Video
Autonomous driving is an in-vehicle technology only!
Smart City
Public opinion about Autonomous Driving

55% The percentage of small business respondents to a survey who believe their fleets will be fully autonomous within 20 years.

61% The proportion of adult internet users who say they are not inclined to ride in a self-driving car, according to a survey by the Brookings Institution.

57% They are likely or very likely to support the use of autonomous vehicles to improve the independence of seniors and individuals with disabilities.

75% US voters that want Congress to apply the brakes on driverless cars, citing serious safety and privacy concerns when it comes to driverless car technology.

16% The percentage of drivers who think autonomous vehicles will eliminate the need for car insurance, according to a poll by Erie Insurance.
Should the car kill you to save others?

Who | What | Where | When | Why
Self-driving cars are the natural extension of active safety and obviously something we should do

—Elon Musk, Tesla, Inc. CEO and founder