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# MEEN 432 –Automotive Engineering

Fall 2026

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Acknowledgement: Most of the material for this class was developed by Dr. Swami Gopalswamy

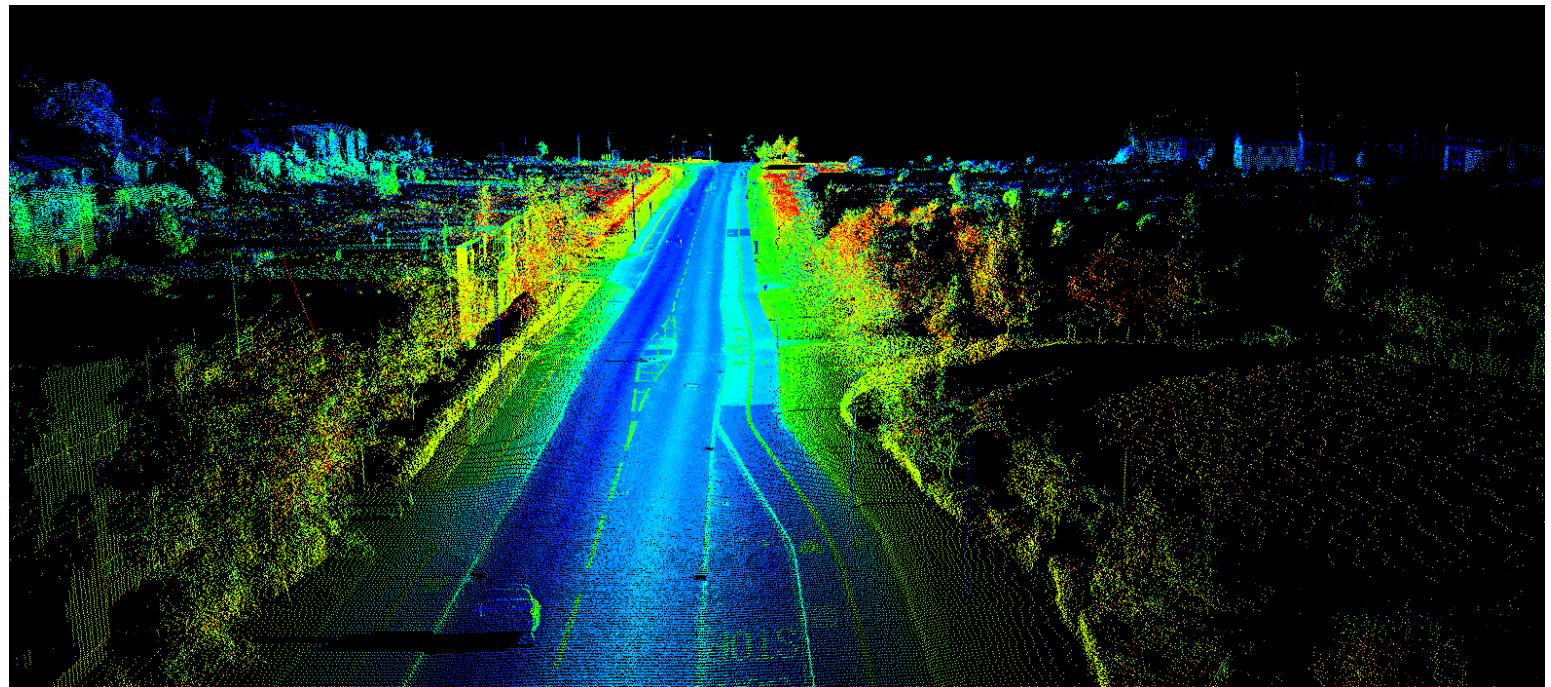
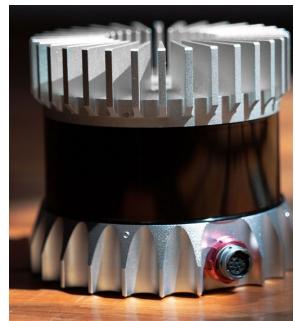
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# Lecture 18: Autonomous Vehicles

- Sensors
- Pure Pursuit
- Other Cool Videos!

# Autonomous Vehicles

- Drive-by-Wire (DBW) capability – allows for automatic control of vehicles (independent of a driver)
- Addition of sensors to “see” the outside world enables “autonomous” driving



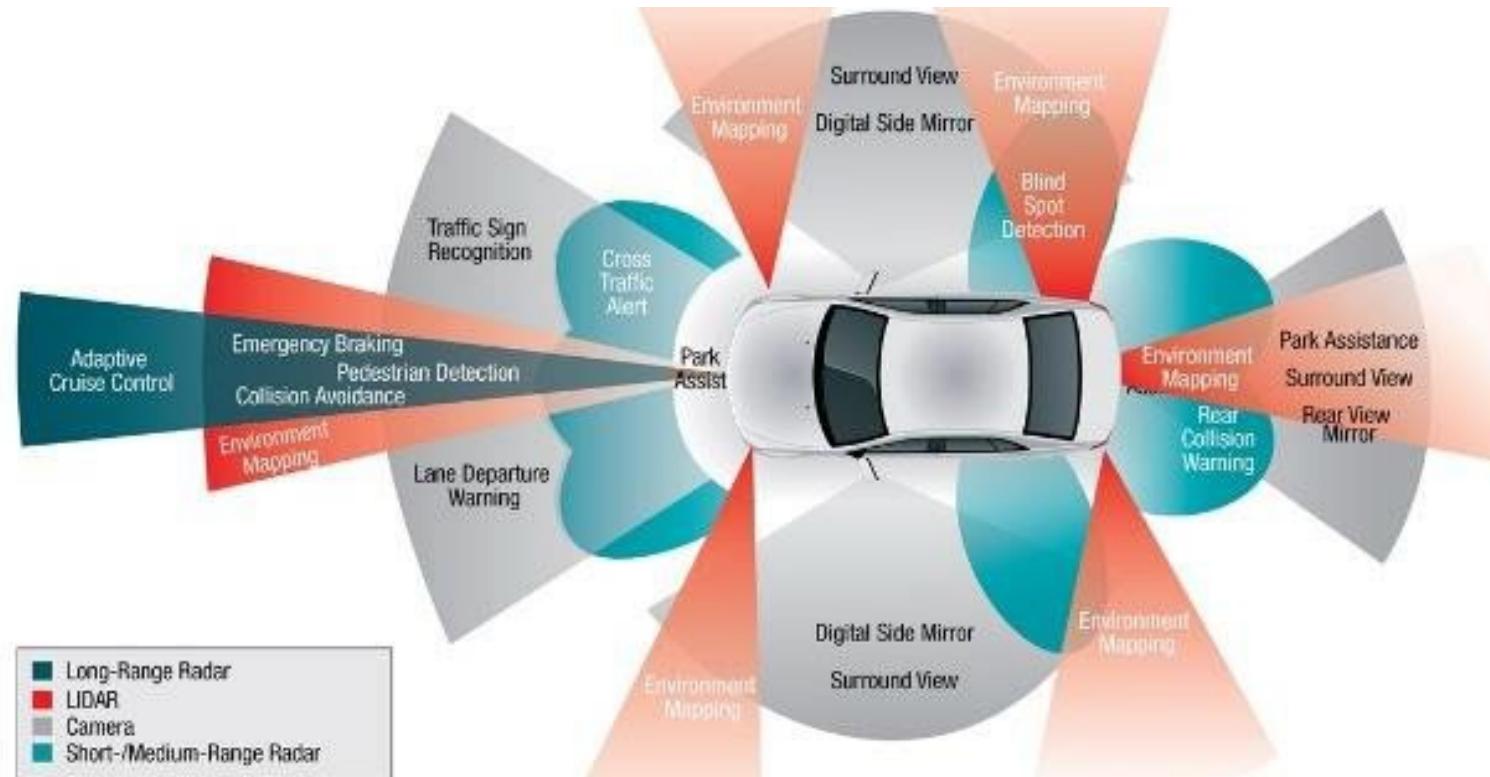
# Global Localization

- Global Navigation Satellite System (GNSS)
  - US: GPS (Russia – GLONASS, EU – Galileo, China – BeiDou, ...)
- Inertial Measurement Unit (IMU)
  - Accelerometers, Magnetometers, ...



# Autonomous Vehicles

- A key activity is “Sensor Fusion” to produce a coherent model of the world around



# Autonomous Vehicles



## SAE J3016™ LEVELS OF DRIVING AUTOMATION

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety		You are not driving when these automated driving features are engaged – even if you are seated in "the driver's seat"	When the feature requests, you must drive	These automated driving features will not require you to take over driving
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering OR • adaptive cruise control	• lane centering AND • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions

# Pure Pursuit on Off-Road Vehicle

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- Define "Desired Track" through a series of "Way Points" (locations using GPS)
- Control through accelerator pedal, brake pedal and steering automation!