Oturum 1: Otonom Araçlar

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12.08.2015

Sunum İçeriği

- Otonom/İnsansız Araç Nedir?
- Uygulama Alanları
- İnsansız Arabalar ile ilgili kilometre taşı çalışmalar

Otonom/İnsansız Araç

İnsansız araç deyince?

- Uzaktan Kumanda ile kontrol edilen araç
  - İnsan Yok
- Otonom Kontrole sahip araç
  - İnsan yok
  - Uzaktan kumandasız!
  - kendi kararları kendisi üreten
  - → **Otonom Araçlar**

Otonom Araç Uygulamaları

Kara Uygulamaları/Mobile Robot:

Hasat

ilaçlama

Uzay Robotu:

Spirit, Opportunity, Sojouner

Otonom Hava Araçları

Anka

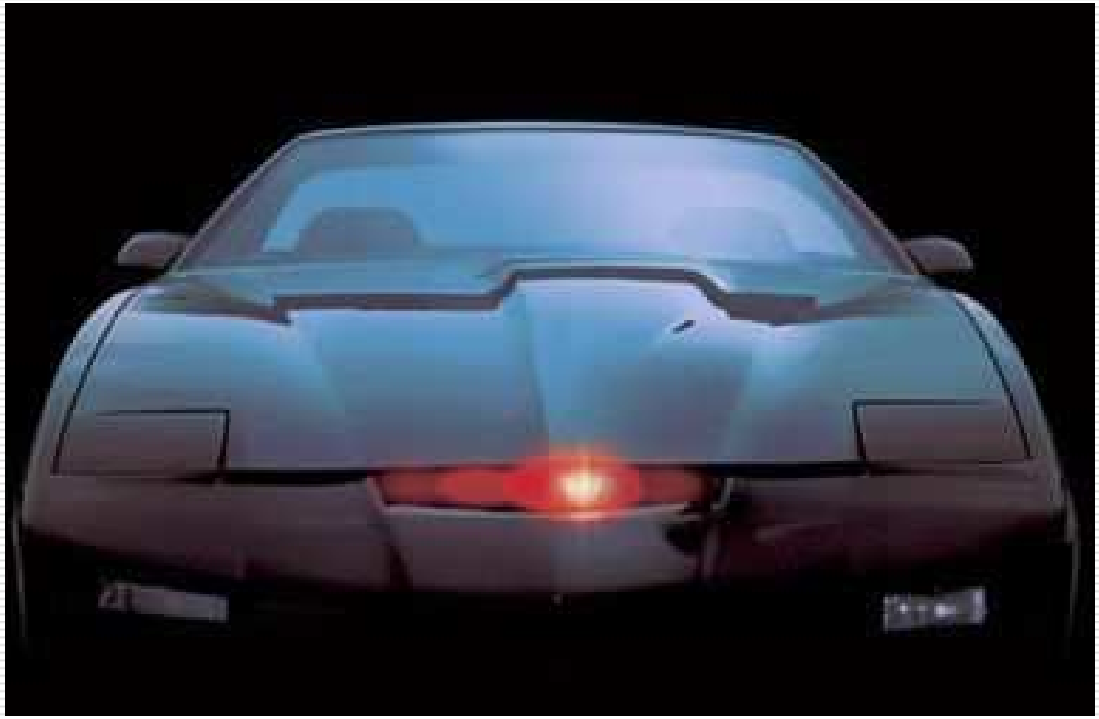
Helikopter

Hexakopter

Bayraktar Taktik İHA

Otonom Araç Çalışmaları Başlangıç Yıl?

- **Kara Şimşek, 1982**



OtonomAraç Testler

1994:CMU NavLab

- Pittsburgh to San Diego
  - 2897 miles total
  - 2849 autonomously

1997: Demo'97: San Diego, I-15 Otoyolunda

2004,2005: Çöl Yarışları
Çevre: highway, small lake, desert

2004,2005: Çöl Yarışları
Çevre:bridge, stony roads

2004,2005: Çöl Yarışları
Çevre: shadow on the road

2004,2005 Çöl Yarışları: Bazı Araçlar

OSU: Terramax

Team CIMAR

OSU: ION

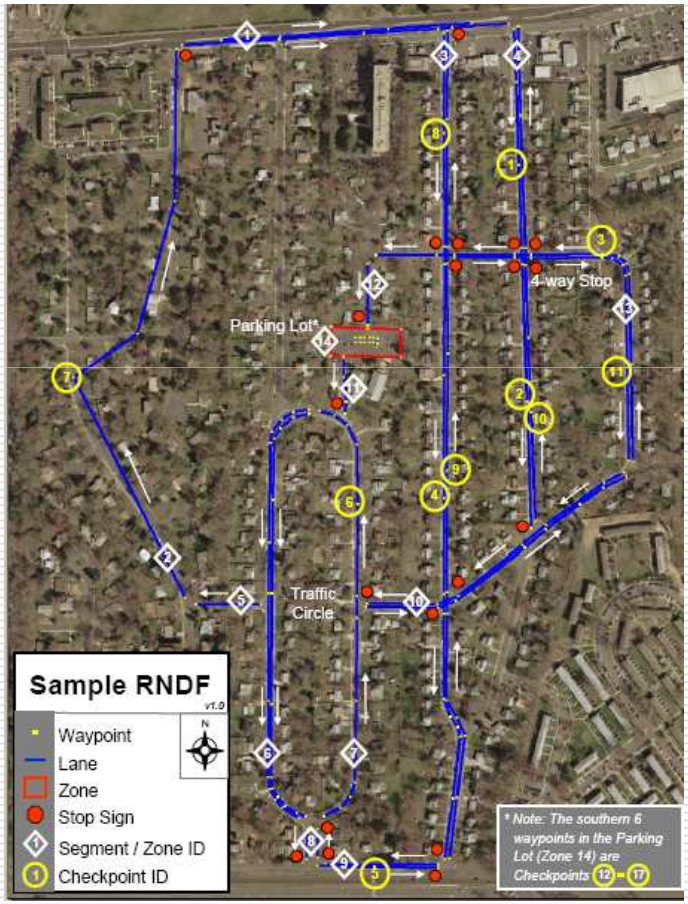
Stanford

2007-Darpa Urban Challenge

- DARPA Grand Challenge 2004, 2005 autonomous vehicle competition:
  - An off-road environment with only limited interaction with other vehicles.

- Urban Challenge extends this concept to autonomous vehicles that safely execute missions in a complex urban environment ***with moving traffic***.

Şehir içi Araba Yarışı Çevre



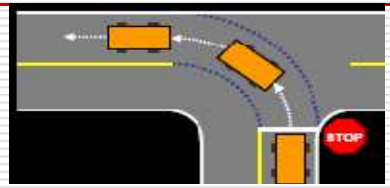
Complete a mission defined by an ordered series of checkpoints in a complex route network. The vehicle will have 5 minutes to process a mission description before attempting the course.

• Route network Definition File, RNDF
Mission definition file, MDF

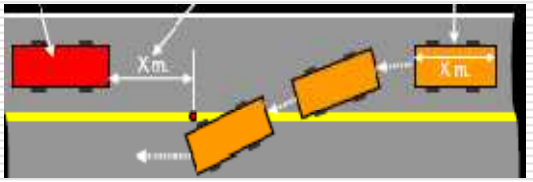
-2014: Google MAP Details? !!

Bazı Kurallar

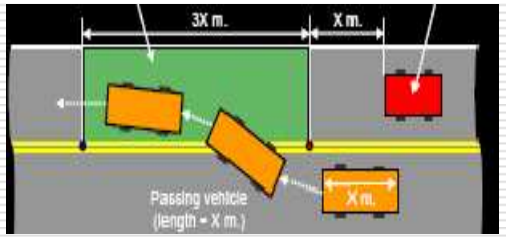
- Stay on the road through intersections



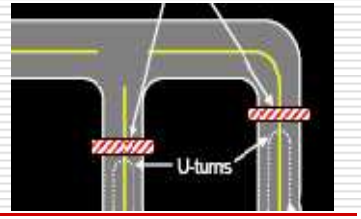
- Navigate safely in areas where GPS signals are partially or entirely blocked.



- Change lanes safely when legal and appropriate, such as when passing a vehicle or entering an opposing traffic lane to pass a stopped vehicle.



- Dynamically re-plan and execute the route to a destination if the primary route is blocked or impassable.



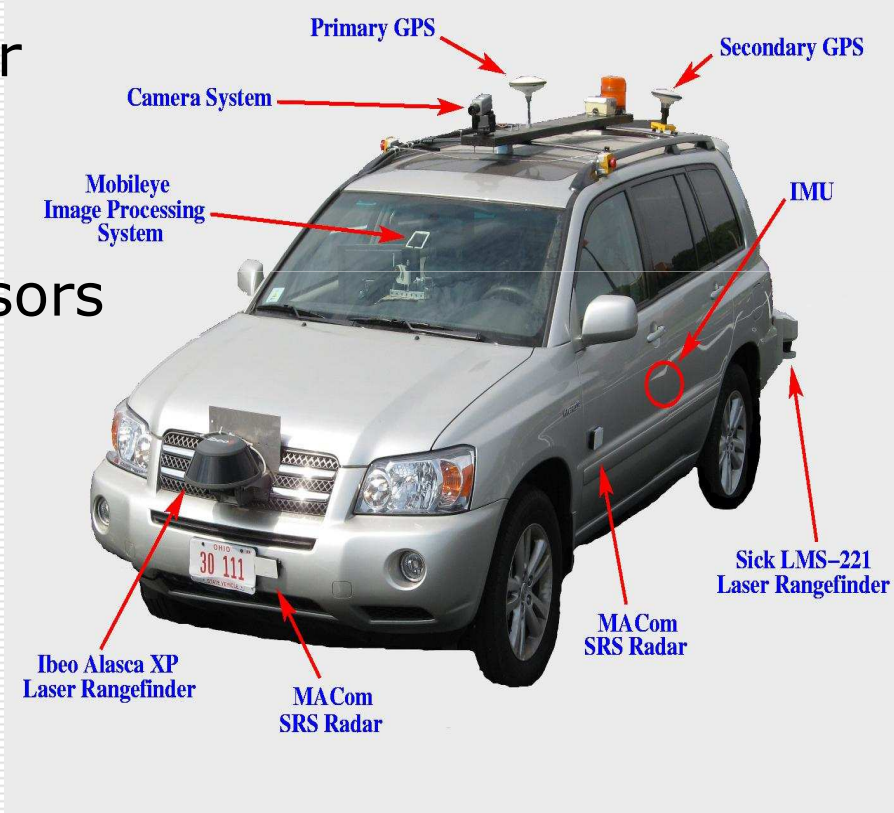
OSU-ACT:

Ohio State University- The Autonomous City Transport

Gerekli Teknolojiler:

- Drive-by-wire technology for competition vehicle
- Stable instrument platform
- GPS, maps and various sensors
- Computers
- Software
- Algorithms

Hibrid Toyota Highlander



OSU-ACT

- OSU-ACT

Ohio State Universitesi-

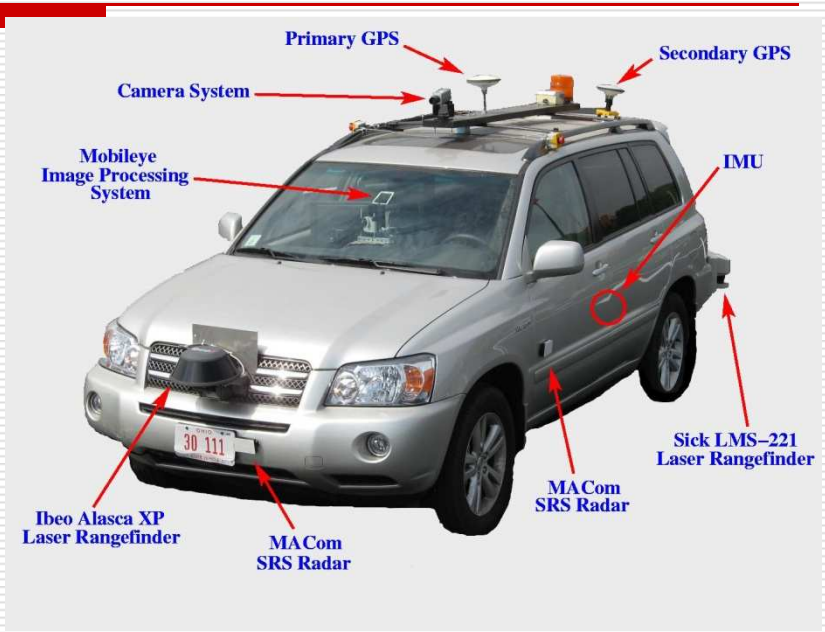
The Autonomous City Transport

  - Hibrid Toyota Highlander

- Technical Sponsor:

Eskişehir Osmangazi Üniversitesi

Yapay Zeka ve Robotik Laboratuarı



OSU-ACT Sensing System Components

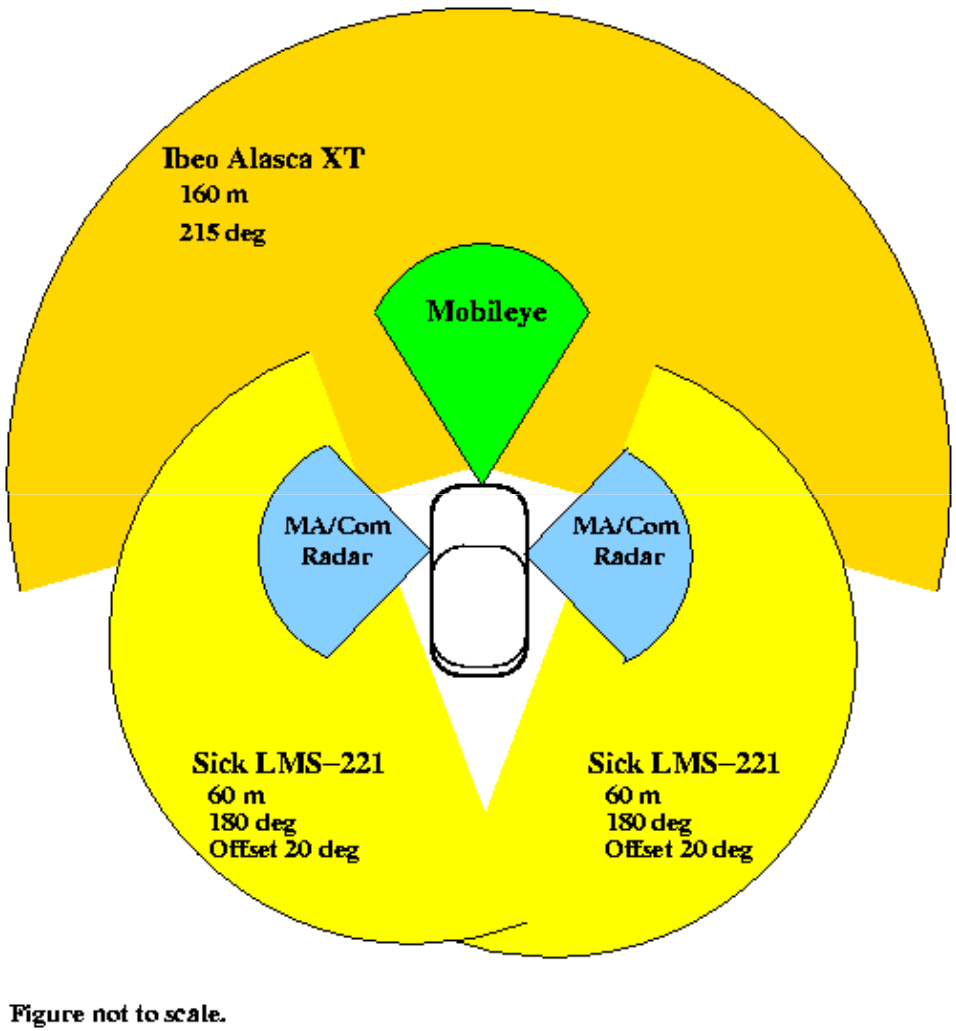


Figure not to scale.

Environment Sensing

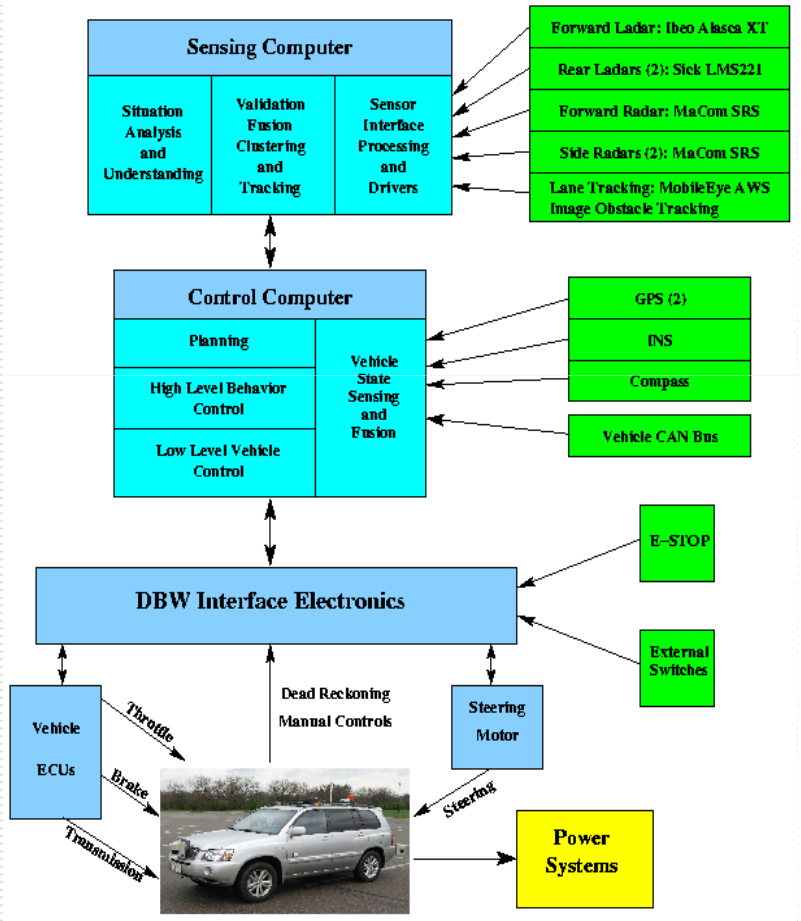
- Ibeo Alasca XT Scanning Laser Rangefinder (4 horizontal planes that converge on the sides)
- Sick LMS-221 180° Scanning Laser Rangefinders (2)
- MaCom/Tyco SRS Automotive Radar Systems (3)
- MobilEye Single Camera Vision System (Obstacles and Lane Markers)

Localization Sensing

- Novatel Propak-LB-L1/L2 GPS with Omnistar HP Corrections (2)
- Crossbow VG700 Vertical Gyroscope
- Honeywell Digital Compass
- Wheel Speed Sensors

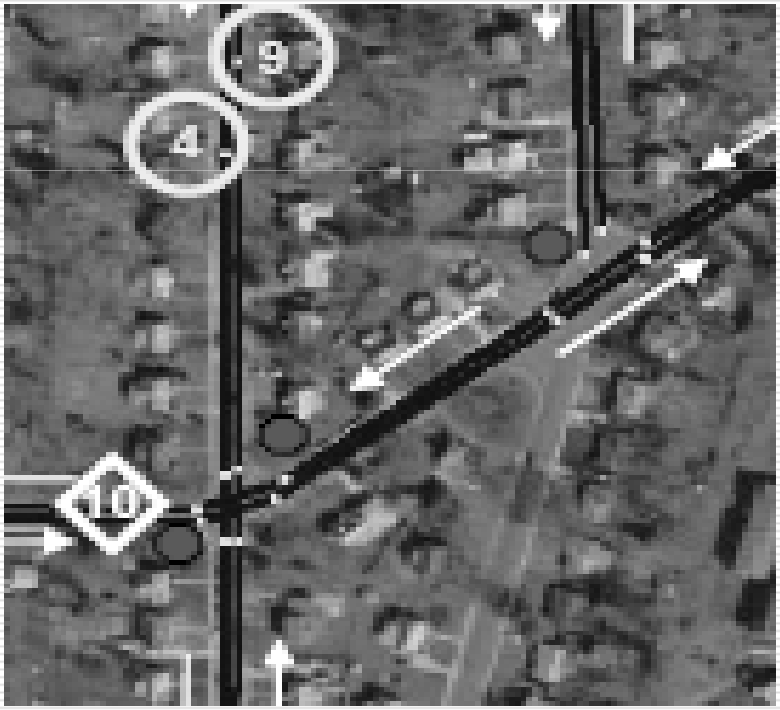
System Architecture

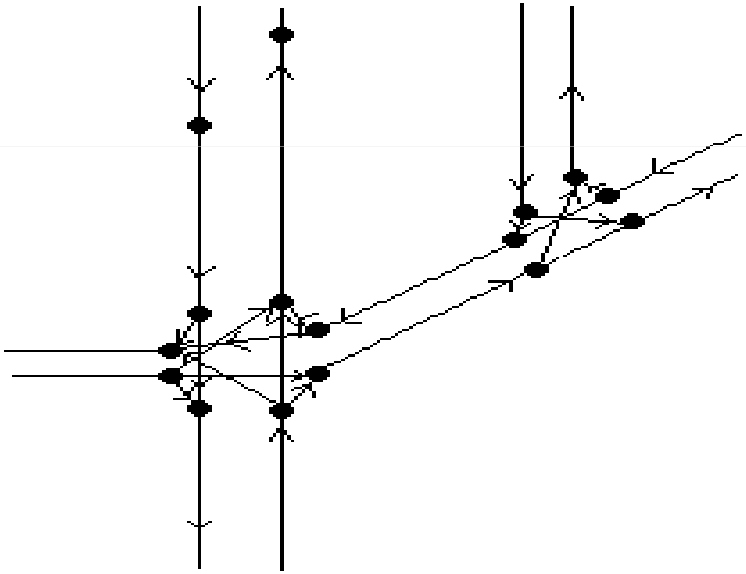
- Sensing computer
  - Sensor fusion
  - Fused sensor data processing and situation analysis
- Control computer
  - High-level control:
    - Situation-based decision making and behavior changes.
    - Low-level control commands.
  - Low-level control:
    - Short-distance path following
    - Speed, gear and steering control
  - GPS, INS and Compass fusion



Path Planning :
Modelling the environment

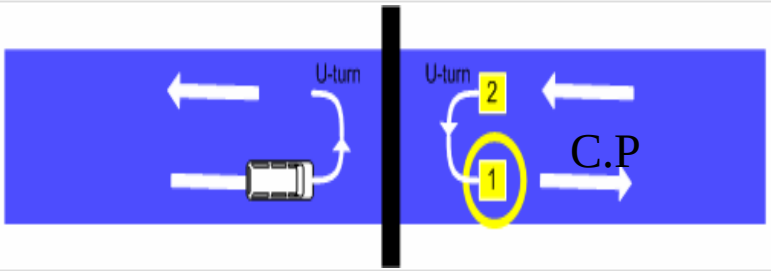
- RNDF ile verilen ortam haritası *N* düğüm ve *E* link olmak üzere *G(N,E)* şeklinde bir çizge ile modellenmiştir



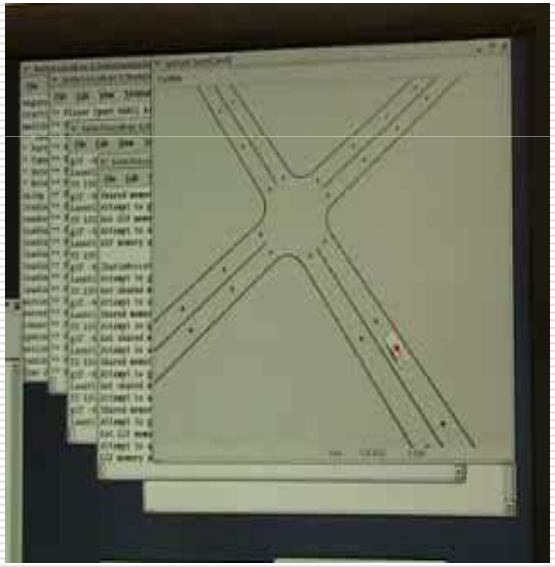


Route planning:
Updating the graph in dynamic cases

- one or more road segments may be blocked
  - placing obstacles, vehicles break down etc.
- The autonomous vehicle is expected to react to such scenarios and re-plan its route
- Update the nodes and edges in the graph. The cost of the related edges are increased to a pre-defined high value for a time period of T.
- special case: *the next checkpoint might be placed on the un-reachable part of the road !!!!*



Development

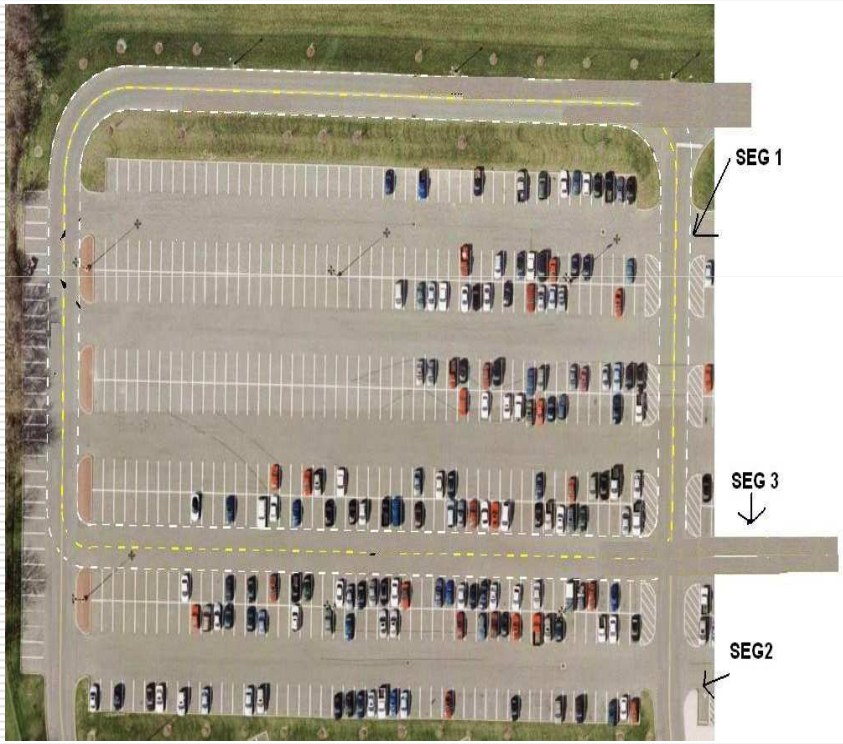


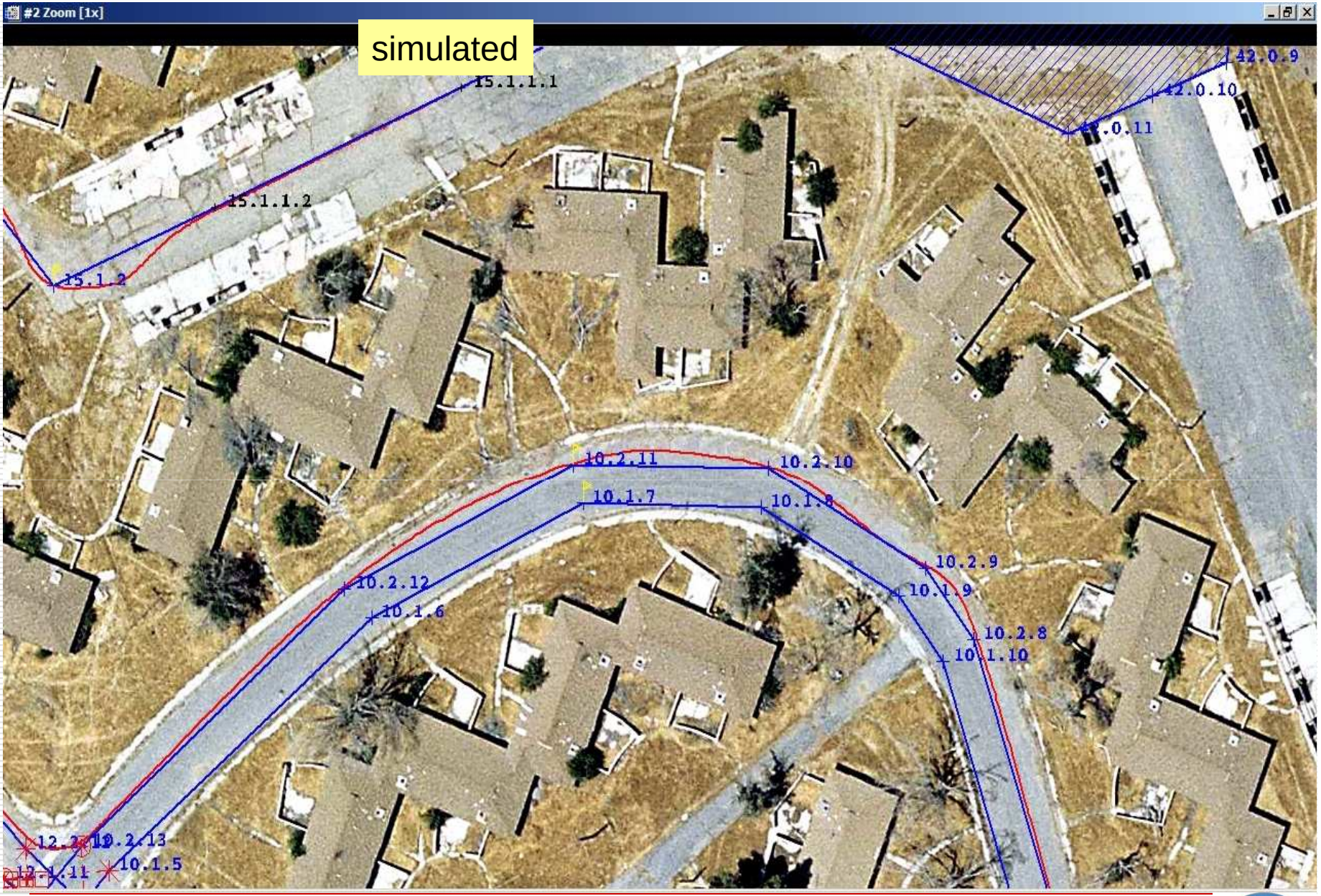
GAZEBO Simulator

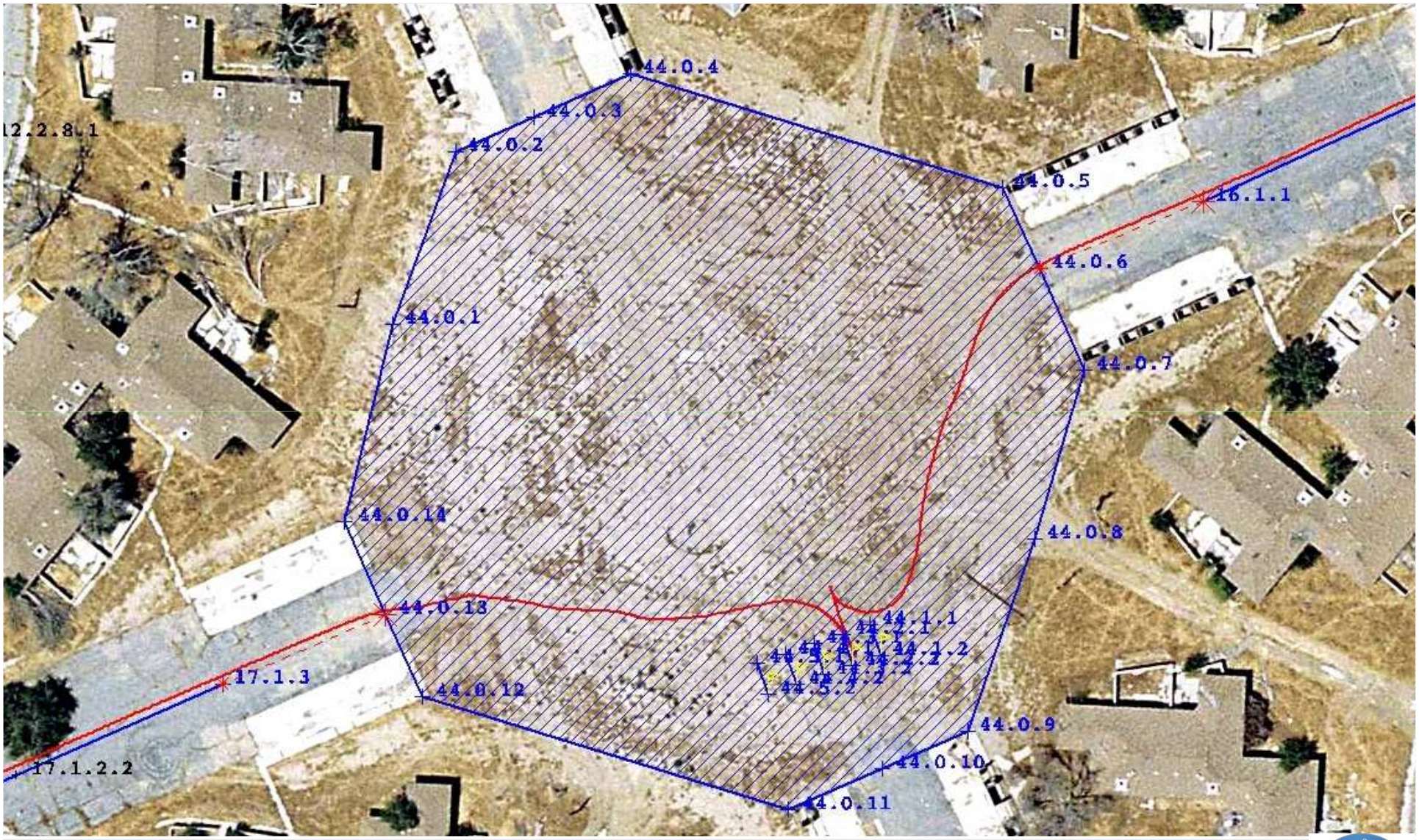
P3-AT Laboratory Tests

Vehicle Tests

Tests & Final Event Videos




#2 Zoom [1x]
simulated
15.1.1.1
15.1.1.2
15.1.2
42.0.9
42.0.10
42.0.11
10.2.11
10.2.10
10.1.7
10.1.8
10.2.9
10.2.12
10.1.6
10.1.9
10.2.8
10.1.10
10.2.13
10.1.5


44.0.4
44.0.3
44.0.2
44.0.5
16.1.1
44.0.6
44.0.1
44.0.7
44.0.14
44.0.8
44.0.13
44.0.12
17.1.3
44.0.9
44.0.10
44.0.11
17.1.2.2

Final Yarışı:

2007: AKILLI ŞEHİR İÇİ ARABA YARIŞI (DARPA Urban Challenge)

- **OSU-ACT(Son 20)**

Carnegie Mellon University' Tartan Racing (1.)

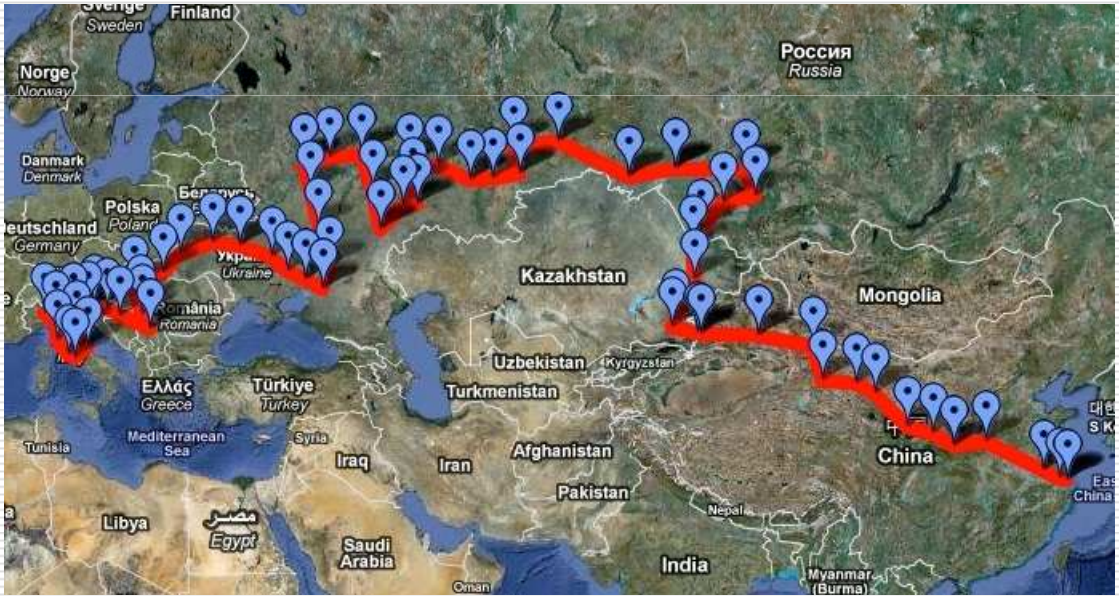
Google

- **Stanford:Junior (2.)**

http://sourceforge.net/projects/stanforddriving/

2010:İtalya'dan Çine

- 13.000km



2011: Grand Cooperative Driving Challenge (GCDC)

Okan Üniversitesi Aracı

2012 Mayıs: Otonom Araba ya ilk ehliyet

- Nevada eyaleti kendi kendine giden arabaya ilk ehliyet verildi
- Lasvegas'ta Kırmızı fon, sonsuz işareti ile araba görürseniz bu kendi başına gidiyor demektir.

Gelecek:

- 2014-Mayıs: Google CAB, Mayıs

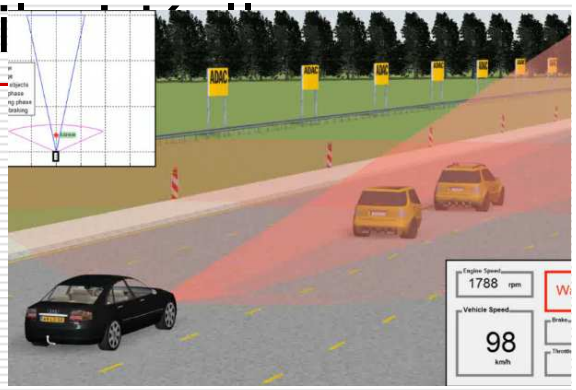
- 2015-Mayıs, 50 araç

- AB den Örnekler CityMobil

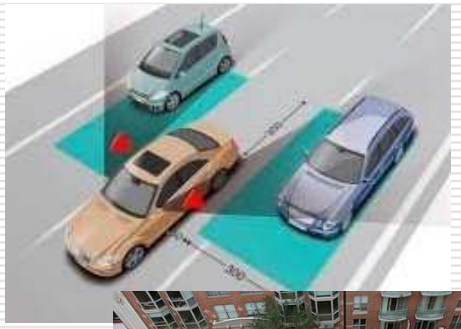
2023: Otomotivde rekabet edebilme!!:

1) Otomotiv Üzerinde Robotik teknoloji

- **İleri Sürüş Destek Sistemleri (Advanced Driver Assistance Systems, ADAS)**
  - Çarpışma Önleme Sistemi
  - Kör nokta uyarı sistemi
  - Uyarlamalı hız sabitleme sistemi (**ACC**)
  - Park destek sistemi
  - Şerit takip sistemi
  - Sürücü durum algılama sistemleri
  - Yaya Algılama sistem
  - .....
- **Algılayıcılar: 3D (çözünürlük, mesafe, çalışma koşulları)**
- **Araç-Araç/Altyapı Haberleşme Sistemleri**



Prescan

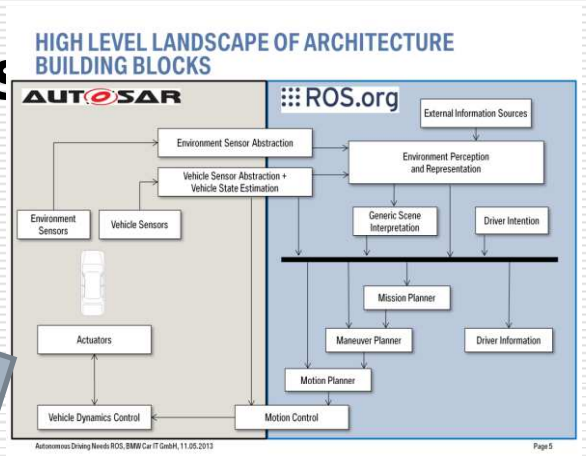


2023 Otomotivde rekabet edebilme!!:

2)Otomotivde Ar-Ge de Robotik teknolojileri Kullanımı

AUTOSAR & Robot Operating System(ROS) kesişim örneği

- 1)AUTOSAR tabanlı sistem geliştirme, 2)HARDWARE-In-the-loop benzetim Geliştirme 3)….
- BMW Car IT Planı, 2013:10-30 yıla kadar otonom sürüşün artacağı, otomotiv geliştirme de ROS kullanımı
- Türkiye Otonom Robotlar Konferansı (TORK) 2014: **Türkiye'de geliştirilen ROS uyumlu örnek Robotik Platformlar ve çalışmalar**



ROS.org

GAZEBO

Teşekkürler

- Sorular!

Bilgi ve iletişim için;

- E-mail: ayazici@ogu.edu.tr
- Kurum: Eskişehir Osmangazi Üniversitesi, Bilgisayar Mühendisliği Bölümü