AUTOMATED DRIVING PROGRESSED BY INTERNET OF THINGS
Unlocking the potential of the Internet of Things to take autonomous driving to the next level
AUTOPilot brings together relevant knowledge and technology from the automotive and the IoT value chains in order to develop IoT-architectures and platforms which will bring automated driving towards a new dimension.

WHAT IS OUR VISION

- Enhance the vehicle’s understanding of its environment with IoT sensors enabling safer highly automated driving
- Foster innovation in automotive, IoT and mobility services
- Use and evaluate advanced vehicle-to everything (V2X) connectivity technologies
- Involve users, public services, businesses to assess the IoT socio-economic benefits
- Contribute to the IoT standardisation and eco-system
HOW DOES IT WORK?

1. Objects provide data to IoT platform using IoT standardised protocols

2. Objects are created virtually in the IoT platform

3. AUTOPILOT IoT platform develops applications using data from IoT data sources

4. AUTOPILOT applications enable services that support autonomous driving

IoT PLATFORM is a platform of physical objects, which are capable of being identified and integrated into communication networks.
IoT ECOSYSTEM is interconnecting things based on existing and evolving interoperable information and communication technologies.
OVERVIEW

PROJECT DURATION
01.01.2017–31.12.2019

CONSORTIUM
43 beneficiaries,
coordinated by ERTICO

PROJECT COST
€25,425,252

EU CONTRIBUTION
€19,924,984 under Horizon 2020
Grant Agreement no 731993

Urban Driving
Valet Parking
Car Sharing
Highway Pilot
Platooning
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<tr>
<th></th>
<th>Brainport</th>
<th>Livorno</th>
<th>Tampere</th>
<th>Versailles</th>
<th>Vigo</th>
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Brainport Pilot Site
BRAINPORT PILOT SITE

Providing real-time car sharing with automated driving functionalities

**DRIVING MODES**
- Urban Driving
- Car Sharing
- Valet Parking
- Highway Pilot
- Platooning

The Brainport permanent pilot site consists of three pilot areas: driverless car rebalancing service on the Eindhoven University campus, automated valet parking on the automotive campus parking and highway pilot and the platooning on the A270 motorway. We target users between two cities in the region of Brainport that are requesting car transport through different IoT enabled services. The user can select ride-sharing or car-sharing options, and can opt for different levels of automated driving.

**DRIVING SERVICES**
- Real-time Car Sharing
- Driverless Car Rebalancing

**KEY PERFORMANCE INDICATORS**

<table>
<thead>
<tr>
<th>Service</th>
<th>Indicator</th>
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<tbody>
<tr>
<td>Urban Driving</td>
<td>Large community Vulnerable road user (VRU) detection (&gt; 1000 persons)</td>
</tr>
<tr>
<td>Valet Parking</td>
<td>Three different vehicle types, variety of routes</td>
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<tr>
<td>Car Sharing</td>
<td>Waiting time less than 1 minute from reservation</td>
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<tr>
<td>Highway Pilot</td>
<td>Detection of 5 different road incidences</td>
</tr>
<tr>
<td>Platooning</td>
<td>Uninterrupted crossing of intersections</td>
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</table>
Extensive IoT Utilisation

A great variety of IoT sources are involved such as road-side cameras (e.g. from a270 test site), traffic lights, drones, Smartphones (VRU and legacy vehicles), automated vehicles and more.

Integrated Services

The Brainport site will provide various options for car travel. Road and traffic situations are assessed, resulting in route options for automated driving. Different automated driving vehicles can be on-route or be obtained from storage or through rebalancing.
Livorno Pilot Site
IoT assisted automated driving (AD) in “smart roads”

The Italian permanent Pilot Site is a testing infrastructure encompassing the Florence - Livorno highway together with road access to the Livorno sea port settlement. IoT enabled manoeuvres are demonstrated with AD cars traveling from Florence to Livorno. “Sixth sense” IoT devices are deployed in the car and along the roads in both the Highway and the urban area. The Traffic Control Centre with DATEX-II node and the oneM2M platform are preeminent actors in the operations.

**Driving Modes**
- Urban Driving
- Highway Pilot

**Driving Services**
- Sixth Sense Driving
- Connected E-Horizon

**Key Performance Indicators**

<table>
<thead>
<tr>
<th></th>
<th><strong>Urban Driving</strong></th>
<th><strong>Highway Pilot</strong></th>
<th><strong>Communication</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urban Driving</strong></td>
<td>2 km test track under real-life conditions</td>
<td>More than 100 hours in real traffic situations</td>
<td>3G/4G, LTE, NB-IoT, 6LoWPAN, ITS G5 and 802.11 b/g/n networks</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
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</table>
Highway scenario

The Highway SGC Fi-Pi-Li (Florence-Pisa-Livorno) has been adapted as “smart road” in order to allow the piloting activities:

• A DATEX II node has been deployed for real time traffic information;

• A pervasive sensing infrastructure has been deployed.

Urban scenario

A road circuit inside the free public area of Livorno Sea Port has been equipped in order to test vulnerable road users warnings at traffic light intersection.
Tampere Pilot Site
Traffic cameras assist in improving efficiency and safety of automated driving

The permanent Pilot site in Finland is located in Tampere, which is the second biggest urban region in Finland. The city has taken strategic movement to be one of the major urban area test hubs for automated and connected cars.

AUTOPILLOT explores how new Connectivity Technologies can support autonomous vehicles at intersections and parking places.

**Driving modes**

- Urban Driving
- Valet Parking

**Driving services**

- Parking Reservation
- Intersection Support

**Key performance indicators**

- **Valet Parking**
  - Improved efficiency through camera support
- **Intersection**
  - Improved safety through VRU detection by camera
- **Support**
  - VRU 3G/4G
- **Communication**
Traffic cameras

Assist in detecting objects and Vulnerable Road Users outside the range of the vehicle sensors. They hence provide valuable information for planning parking tasks incl. routing and for assuring the safety of all road users at intersections.

Parking space reservation

A parking space reservation application assures a place is available for the automated vehicle when arriving at the parking area.
Versailles Pilot Site
VERSAILLES PILOT SITE

Provide mobility services for touristic applications

AUTOPILOT enables tourists to explore the city of Versailles and the Castle’s gardens. Visitors pick up a ride in a connected and autonomous vehicle at one of the two car sharing stations via a smartphone application. While driving through the city, the vehicle alerts the tourist of interesting spots in their surroundings. At the Castle’s gardens, the user can switch to a fully automated driving mode before giving the car back at another station. AUTOPILOT will also evaluate the added value of IoT and AD technologies in a business model of fleet management (automated fleet rebalancing).

DRIVING MODES

- Urban Driving
- Platooning

DRIVING SERVICES

- In City Chauffeur Service for Tourists
- Driverless Car Rebalancing

KEY PERFORMANCE INDICATORS

<table>
<thead>
<tr>
<th>Platooning</th>
<th>3 identical vehicles, 20 km/h</th>
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<tbody>
<tr>
<td>Urban Driving</td>
<td>10 km of urban driving including 2 km of autonomous driving</td>
</tr>
<tr>
<td>VRU</td>
<td>3G/4G, LTE V2X and 802.11 OCB networks</td>
</tr>
<tr>
<td>Communication</td>
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</tbody>
</table>
Point of Interest Notification

The pilot cars are equipped to generate announcements for local touristic points of interest based on close-range detection (Bluetooth Low Energy beacons).

Sensoric Equipment

Collaborative perception considers information exchange among VRUs and the AD car in order to enhance its perception and improve the VRUs safety. To be part of the IoT, the VRUs will be equipped with smart devices.
Vigo Pilot Site
To offer new services for autonomous vehicle through IoT and connectivity technologies in urban and indoor parking scenarios

The permanent Spanish test site is located in Vigo, Galicia, in the north west of the country. As a result of the participation in European Compass4D & CO-GISTICS and through local initiatives, the city integrates the urban part of SISCOGA corridor (120km). AUTOPILOT will explore how new Connectivity Technologies will enhance the perception and the functional behaviour of autonomous vehicles in complex scenarios.

**DRIVING MODES**
- Urban Driving
- Valet Parking

**DRIVING SERVICES**
- Vulnerable Road User Sensing
- HD Maps for Automated Vehicle

**KEY PERFORMANCE INDICATORS**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Indicator</th>
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<tbody>
<tr>
<td>Urban Driving</td>
<td>Improved safety, user acceptance and fuel efficiency</td>
</tr>
<tr>
<td>Valet Parking</td>
<td>Enhanced comfortability, safer parking and time saving autonomous driving</td>
</tr>
<tr>
<td>VRU</td>
<td>IoT, 3G/4G, ITS G5, C-V2X</td>
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<td>Communication</td>
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Urban area

Automated vehicles receive data about VRU crossing the street (through smart cameras), traffic light status and road hazard warnings (provided by Traffic Management Centre), following a cooperative security approach.

Parking area

Parking Control Centre sends to the vehicle information about the parking map and route to follow inside. AVP app receives in “real time” the status of the vehicle.

PILOT LEADER

CTAG

PILOT PARTNERS

PSA GROUPE

CONCELLO DE VIGO
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731993.