Thessaloniki Smart Mobility Living Lab

Hellenic Institute of Transport

smartmlab.imet.gr/

Hellenic Institute of Transport

www.imet.gr

Who we are

The **Centre for Research and Technology-Hellas** is one of the leading research centers in Greece with important scientific and technological achievements in many areas.

No1 in the top list of research organizations in terms of EU Funding in Greece

No 17 in EU

Hellenic Institute of Transport-HIT , established in 2000, is part of the greater team of CERTH. HIT is a highly recognized research body offering specialized basic and applied research and highly technical services in all fields of transport. Scientific team: 80 members

Our Institute consists of 4+1 sectors

Vehicle - Human Factors - Vehicles

Infrastructure- Networks Mobility and Logistics

Transport Economics & Environment - Non-Land Transport

Transport & Tourism

Horizontal Activities

Initiatives

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Efficient member of the European Network of Living Labs ((https://enoll.org/)
Mobility Interest Group Leader

European Network of Living Labs

Core Member of EIT Urban Mobility

eit

Scientific coordinator of RIS Hub Greece

Moderator of Smart Mobility and Logistics Solutions Cluster

Smart Mobility & Logistics Solutions Cluster

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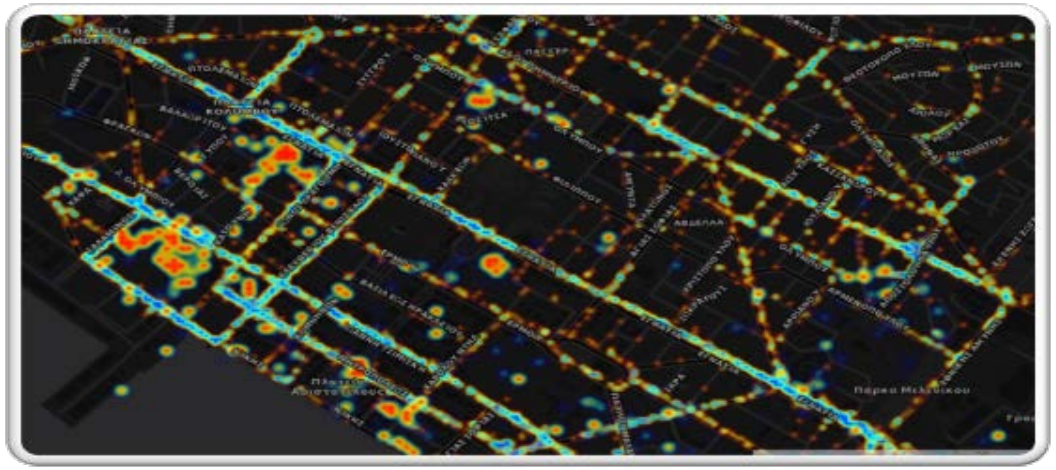
Thessaloniki Smart Mobility Living Lab



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The smart mobility living lab of Thessaloniki collects and analyze data to create value by extracting information and knowledge from it as well as by offering technological solutions and services.

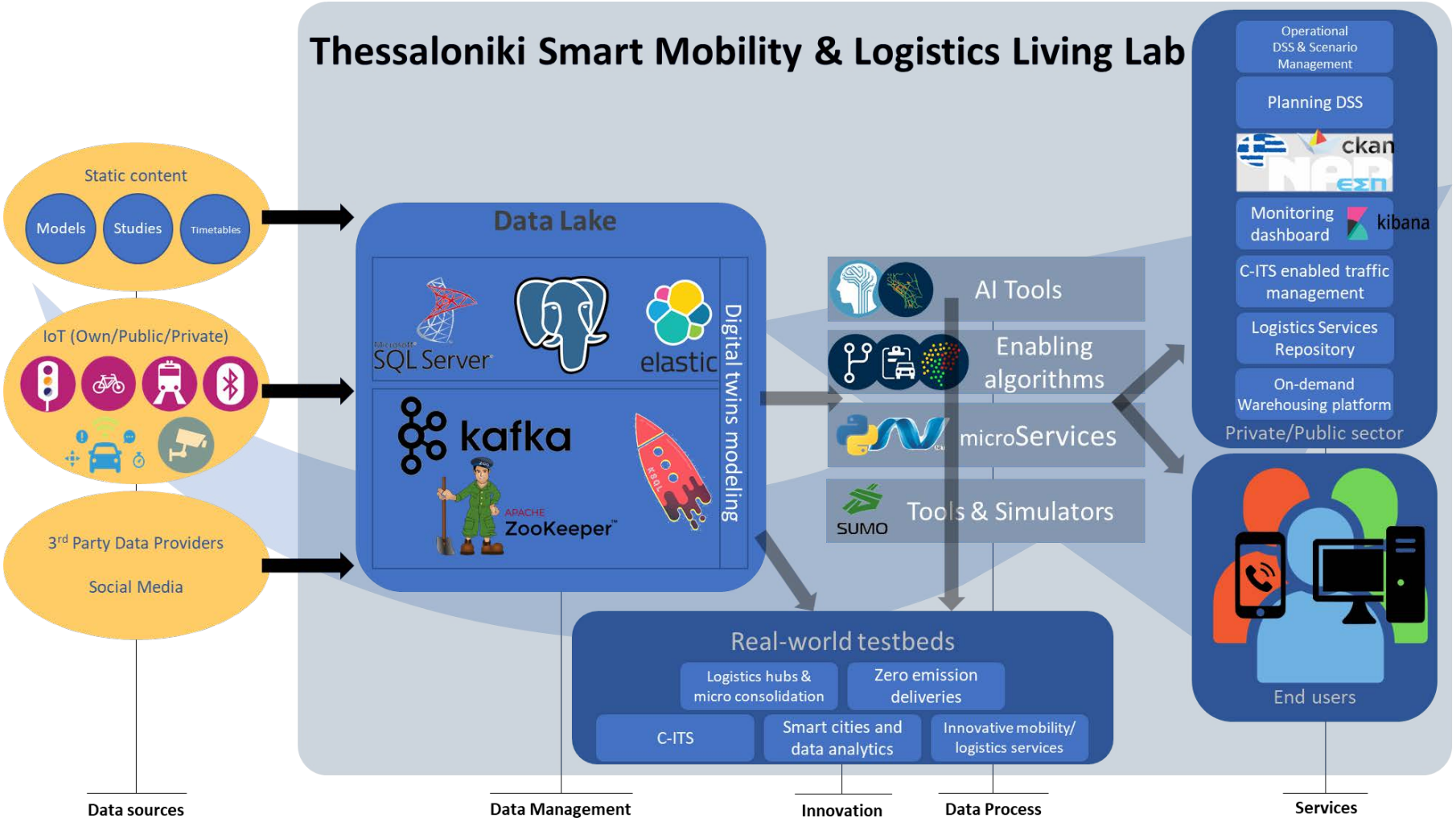
The data is provided by the mobility ecosystem of the city

- Passenger and freight transport including various transport modes
- Mobility, energy and environmental data
- Urban and peri-urban environments

Dedicated services and capabilities

- Big Data & AI tools to analyze, model and visualize data
- OR tools to optimize transport systems (planning and operation)
- Decission Support Systems
- Digital twins
- Open data portal

Smart Mobility & smart city Living Lab infrastructure



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European Network of Living Labs

Solutions

Thessaloniki Smart Mobility Living Lab

From data 2 knowledge

Simulation environments
Digital content aggregator
Data spaces

Living Lab infrastructure for transition acceleration

Dedicated resources

Competence center
Decision theater
Testbeds

Thessaloniki Mobility Living Lab is one example of the open innovation 2.0 ecosystem development (beyond traditional test beds that have usually been technology driven).

Since its start, the Living Lab has evolved from a space where technological innovations are tested directly by users to an innovation eco-system.

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Social innovation

Openness
Cross-collaboration
Speed up urban transitioning

Open Innovation Communities ecosystem enabler

Facilitating innovation

Clusters & Regional hubs
Digital twins
OR, AI and BD toolboxes

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Infrastructure

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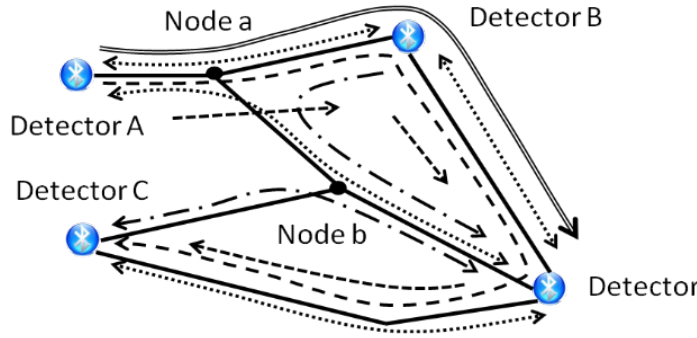
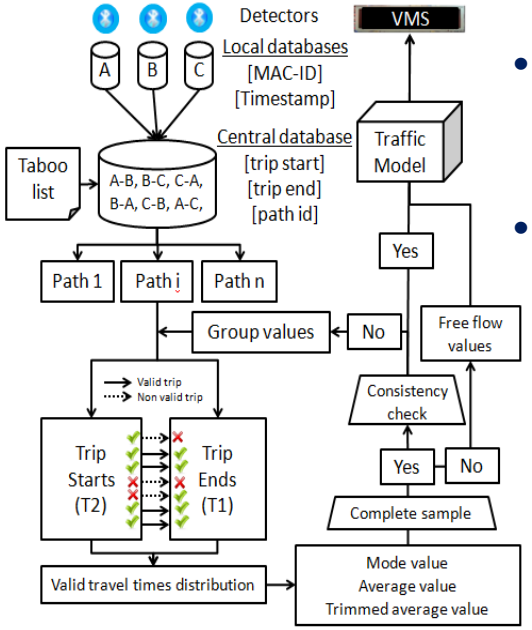
Infrastructure

Complex eco-system able to test innovative mobility solutions. It is composed of 3 main pillars:

✓ Physical infrastructure - hardware for sensing the city (data collection)
- Research infrastructure (owned by HIT)
- Public infrastructure open research



✓ Digital infrastructure -software for extracting knowledge from the data collected (value creation)



- Modeling and simulation environments
- Big data analytics tools

✓ Test beds for concrete implementations such as cooperative services, traffic predictions…

- C-ITS (COMPASS4D and C-Mobile projects)
- Big data analytics (Big Data Europe project)
- National Access Point
- Traffic Management Systems interoperability [on-going]
- i-mile [future]

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Ecosystem

Research Academia

- Hellenic Institute of Transport
  https://www.imet.gr/
- Aristotle University of Thessaloniki
  https://www.auth.gr/
- Open Knowledge Foundation Greece
  https://okfn.gr/

Transport Network Operators

- TaxiWay
  https://www.taxiway.gr/
- Transport Authority of Thessaloniki
  http://oseth.com.gr/
- Egnatia Odos S.A.
  http://www.egnatia.eu/
- Attiko Metro S.A.
  https://www.ametro.gr/
- Thessbike
  https://www.thessbike.gr
- Organization Of Urban Transportation Of Thessaloniki
  http://oasth.gr/
- TrainOSE
  http://www.trainose.gr/
- Thesi
  https://www.thesi.gr/
- Rise
  http://myrise.club/

Industry and Technology Providers

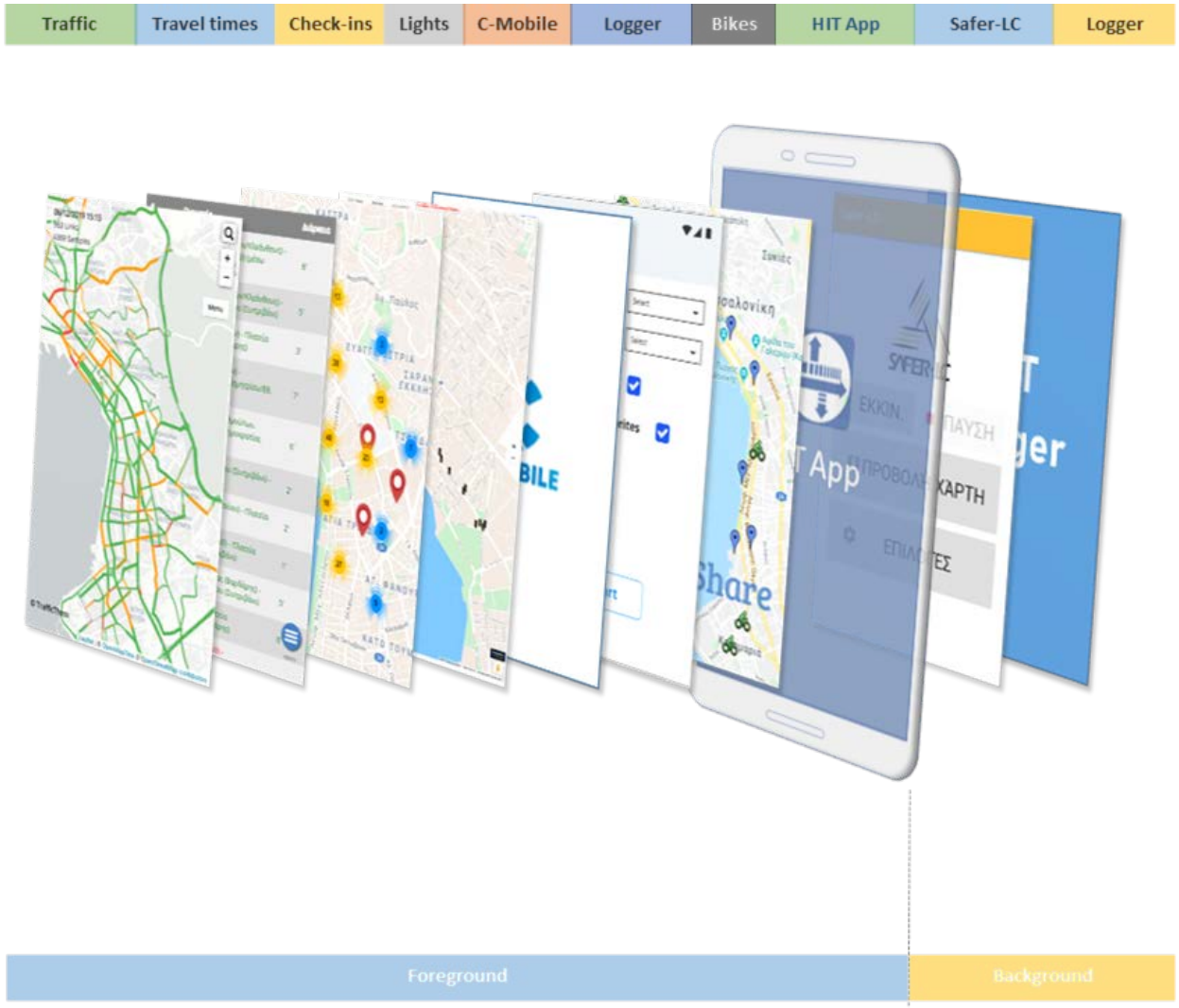
- Intelligent Transport Systems
  https://www.its-hellas.gr/gr/
- Swarco
  http://www.swarco.gr/
- Κυκλοφοριακή Τεχνική Α.Ε.
  http://www.traffictech.gr/
- DOTSOFT
  https://www.dotsoft.gr/
- SIEMENS
  https://new.siemens.com/global/en.html
- BRAINBOX
  http://www.brainbox.gr/
- Cisco
  https://www.cisco.com/
- Uni Systems
  https://www.unisystems.com/
- Space
  https://www.space.gr/

Public Administration

- Region of Central Macedonia
  http://www.pkm.gov.gr/
- City of Thessaloniki
  https://thessaloniki.gr/

Citizens’ engagement

- ✓ One HIT application combining the existing ones
- ✓ Citizens’ participation in data collection (crowdsourcing)
- ✓ Citizens' participation in the processes of understanding the needs and upgrading the transport sector of the city (co-design)
- ✓ Integration of gamification functions



Tools

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Modelling & Simulation

Software & Know-How

[A] Aimsun advanced edition (micro)
[S] SUMO
[V] VISUM
[v] VISSIM
[M] Matlab (agent-based)

[A] Thessaloniki multimodal urban and peri-urban arterial corridors (signalized)
[A] Thessaloniki's City Center and Ring Road
[S] Thessaloniki multimodal urban and periurban network
[S] Basic freeway with merge segment (hypothetical network)
[V] Detailed large-scale multimodal network of Thessaloniki
[V], [v], [M] other networks: Barcelona, Thessaloniki, Greece, Germany, Cyprus, Nicosia, Athens, Sioux Falls…
[A] & [v] 2nd generation bus lanes, bike lanes, pedestrianization
[A] & [S] C-ITS services (GLOSA…)
[S] Autonomous driving (transition: driver behaviour, traffic management, V2X communication protocols)
[V] 4-step model including (car, bus, taxi, bike, walk, P&R); SUMP
[M] agent-based taxi modelling (taxi operation, information sharing)

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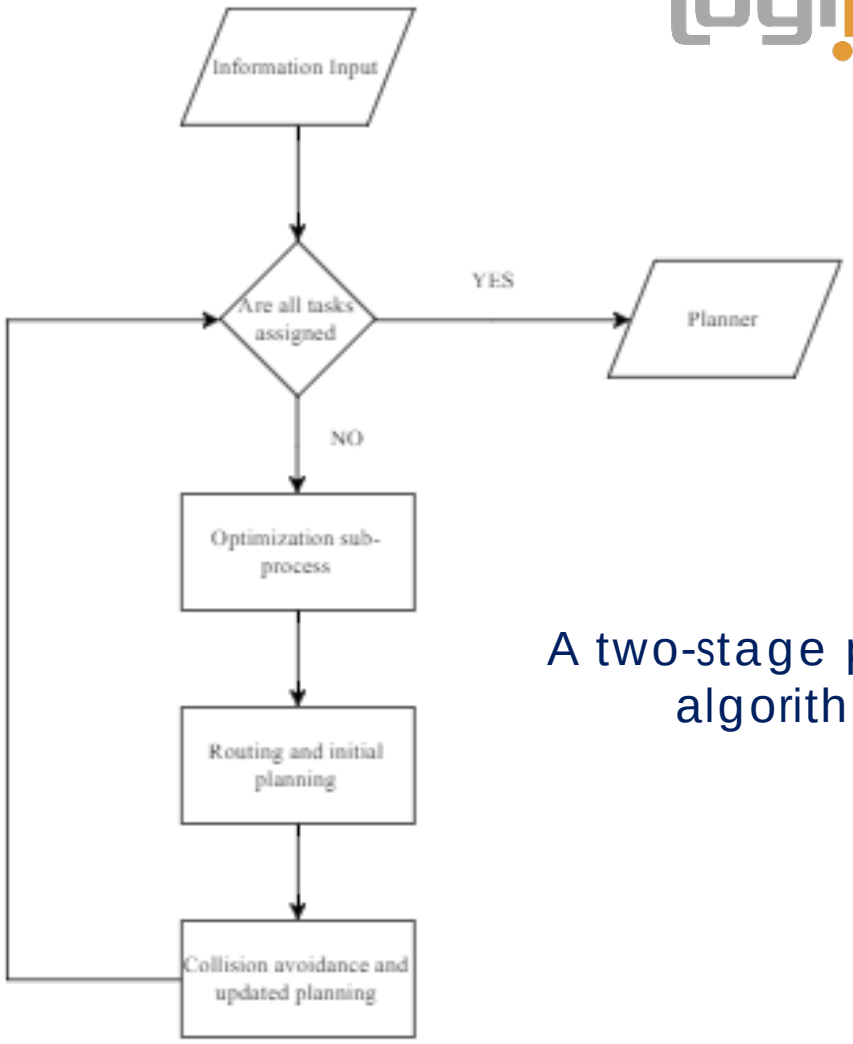
Algorithms

Fleet Management

LOGIMATIC addresses container handling automation in terminals through a GIS-based control module compatible with existing Terminal Operating Systems (TOS) for optimized global (yard level) route planning and secure fleet management of Automated Straddle Carriers (ASCs).



A two-stage process algorithm

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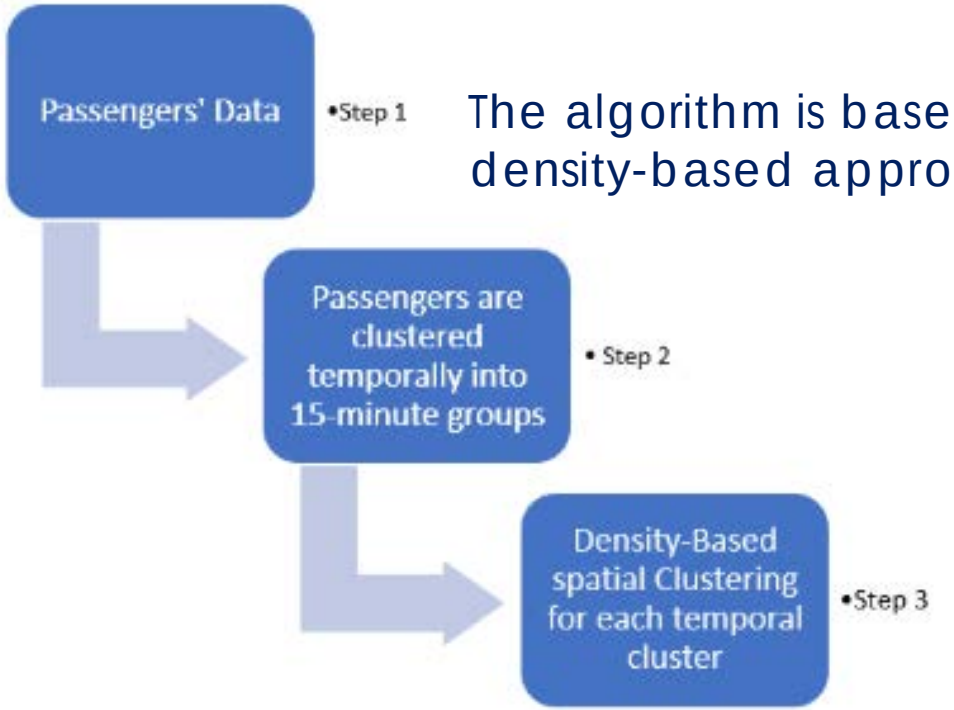
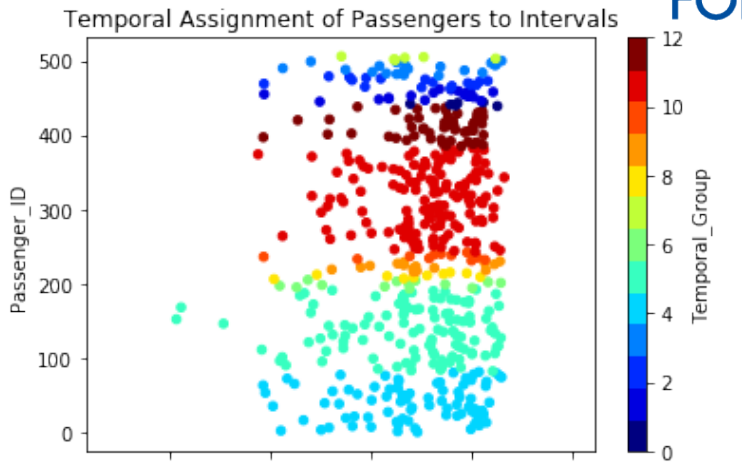
Algorithms

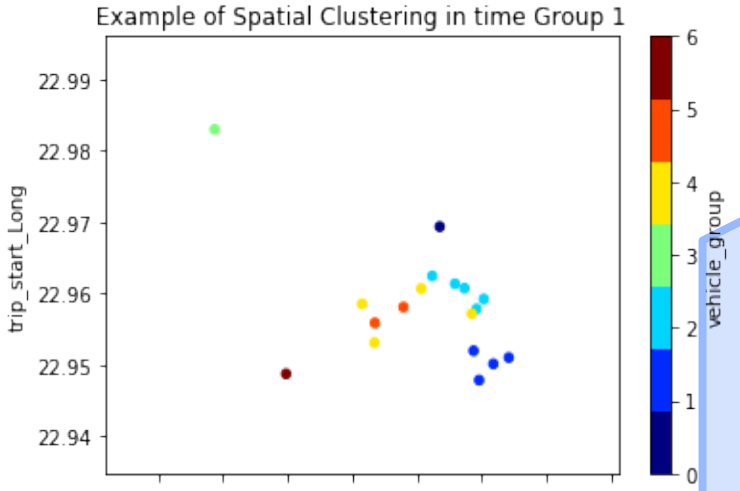
Clustering

The module aggregates round-trip requests by passengers and produces clusters that can be served by one taxi.



The algorithm is based on the density-based approach.





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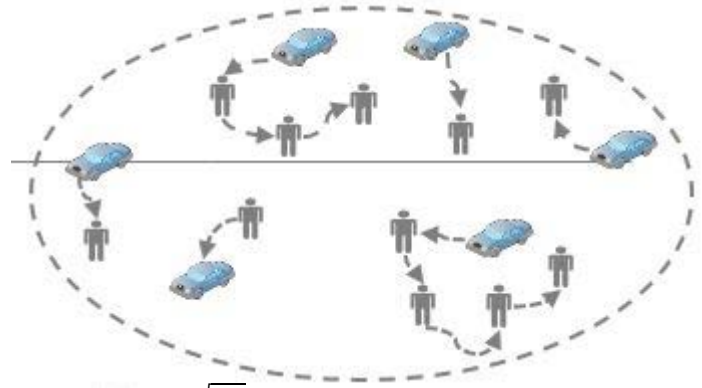
Algorithms

Mobility patterns

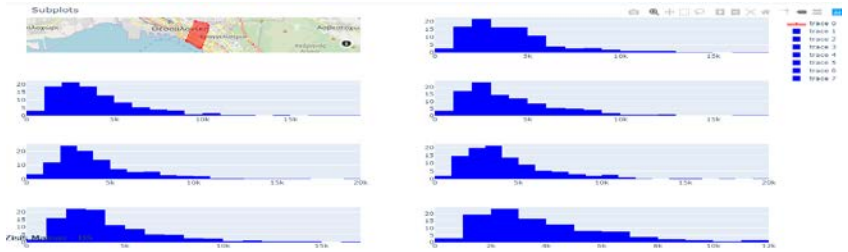
Understanding of demand and route destinations.

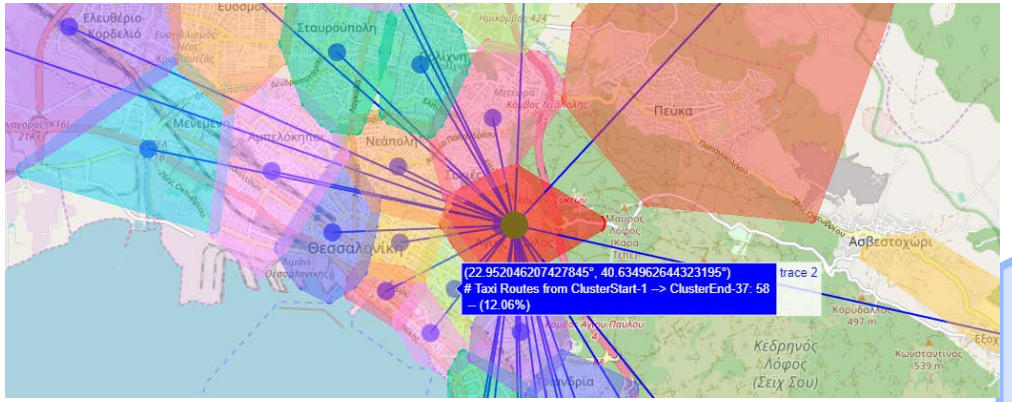
Detection of common itineraries for ride-sharing applications.

Detection of areas suitable for bike-sharing and scooter.



$$E(w_1) = \frac{\int_0^{\sqrt{\frac{\alpha}{n_m}}} y \cdot f_Y(y)dy}{v_m} = \frac{\int_0^{\sqrt{\frac{\alpha}{n_m}}} y \cdot n \cdot [1 - \frac{y^2}{\left(\sqrt{\frac{\alpha}{n_m}}\right)^2}]^{n-1} \cdot \frac{2y}{\left(\sqrt{\frac{\alpha}{n_m}}\right)^2} \cdot dy}{v_m}$$





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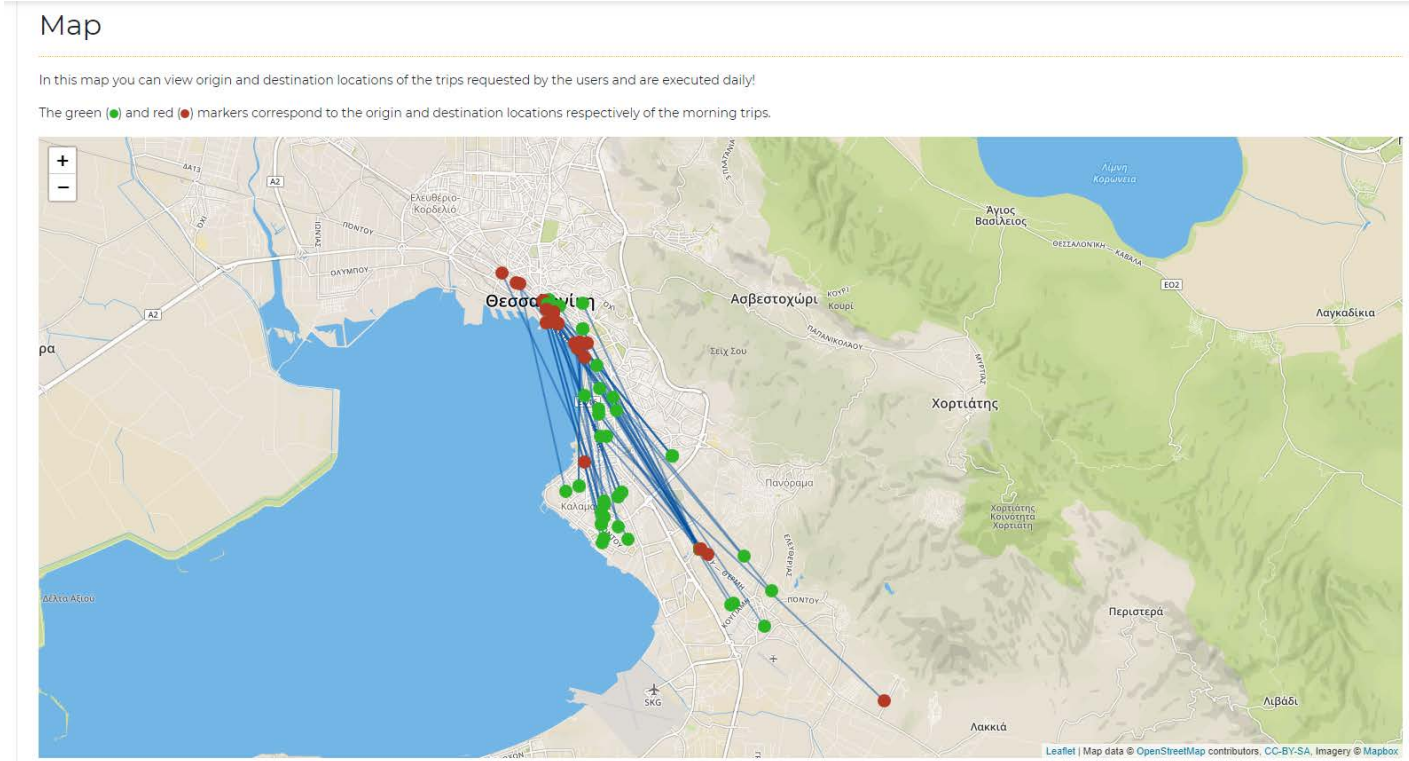
Dashboards for monitoring and decision making

Thessaloniki Mobility Dashboard https://www.thessmd.imet.gr/



A web-based data analytics dashboard was developed for efficient monitoring of the ride sharing system's operation and related metrics.

It is connected to the database and applies certain processing, filtering and aggregation procedures on raw data.

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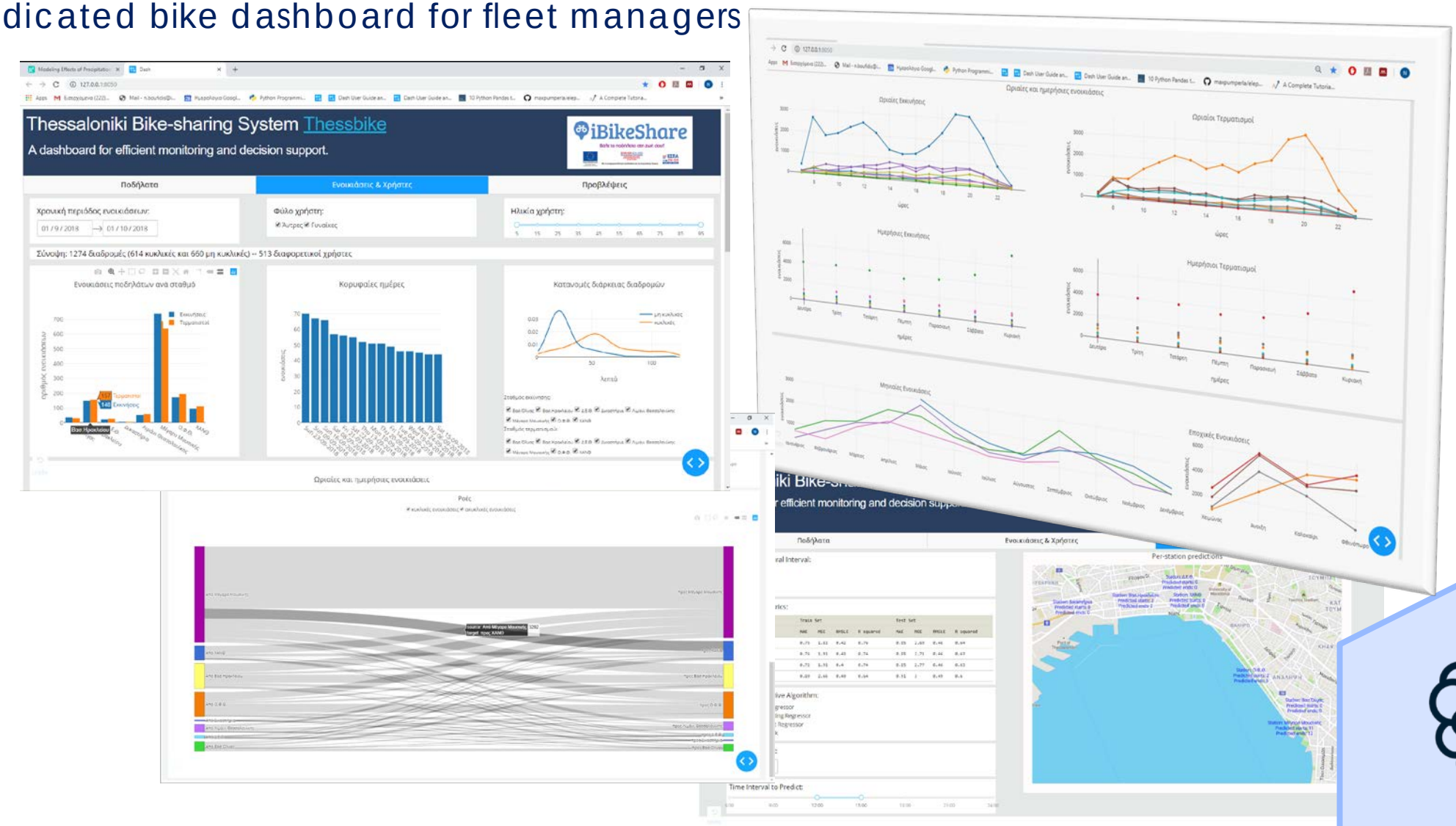
Dashboards for monitoring and decision making

Dedicated bike dashboard for fleet managers



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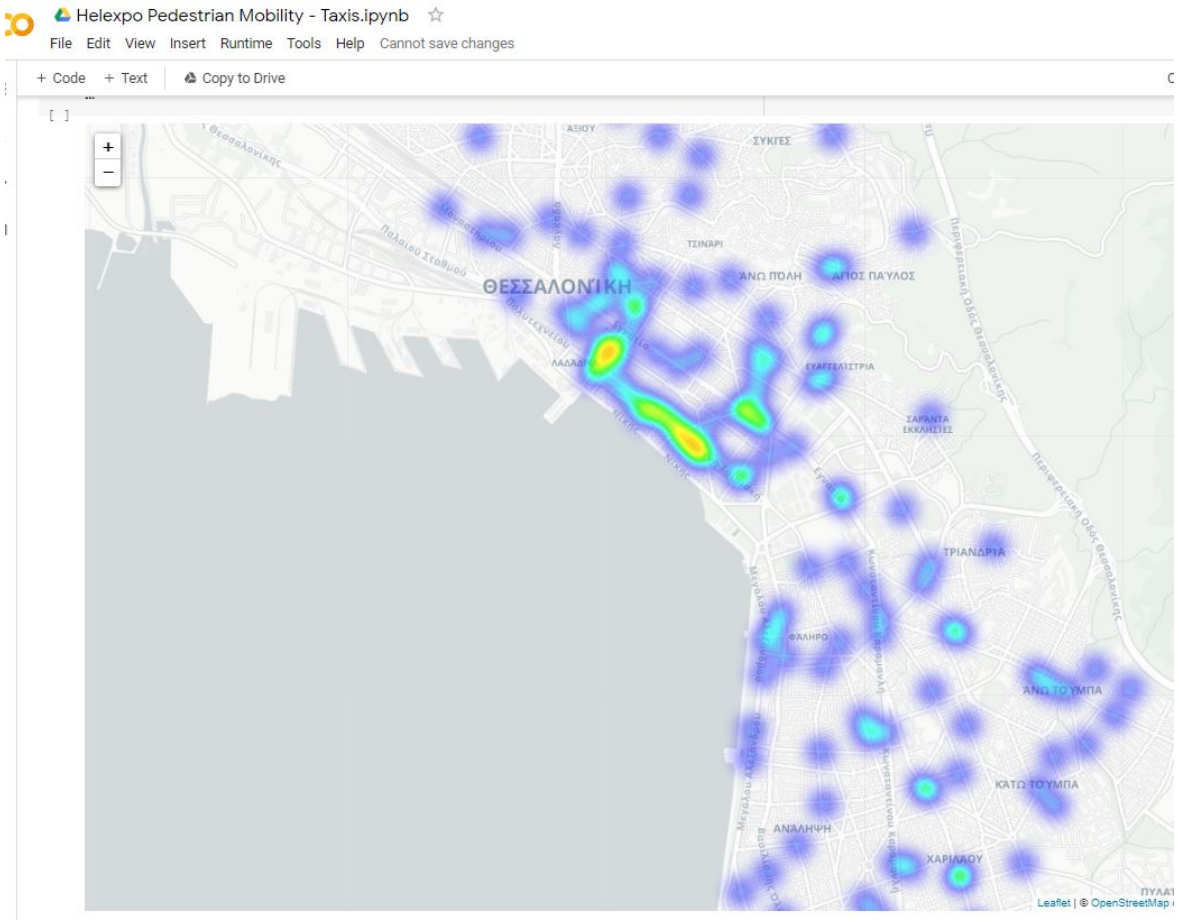
Dashboards for monitoring and decision making

Social activity in Thessaloniki



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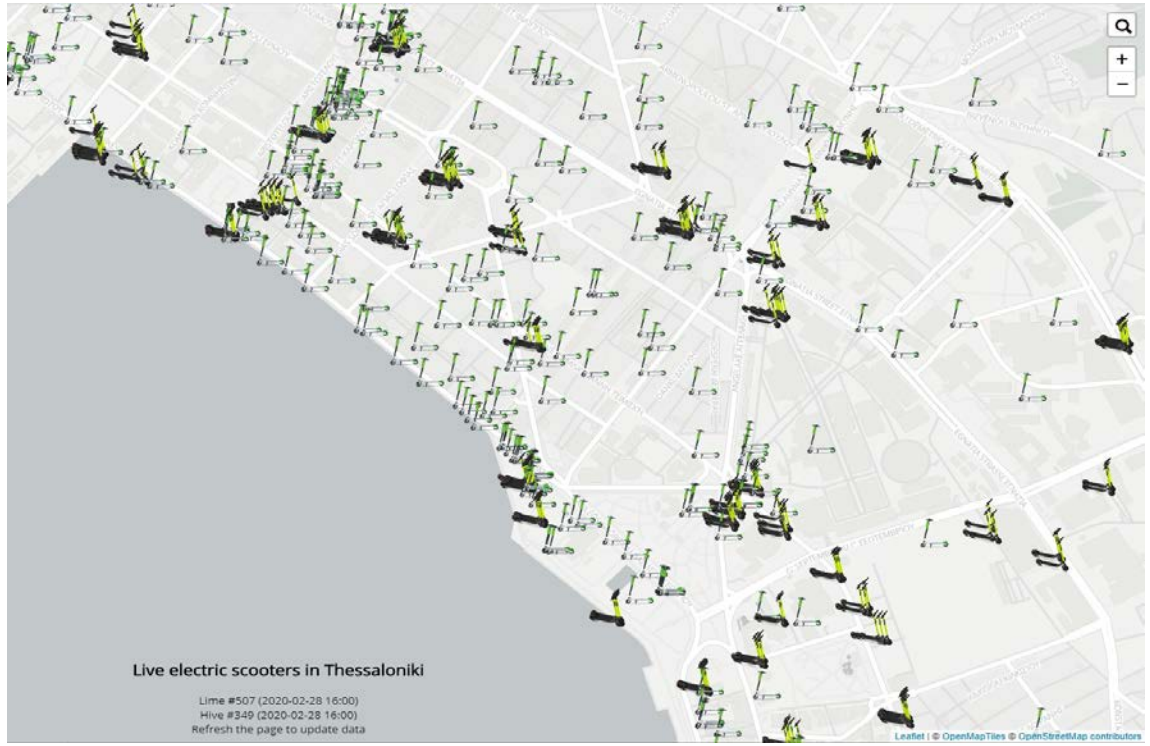
Dashboards for monitoring and decision making

Dedicated E-Scooter mobility dashboard



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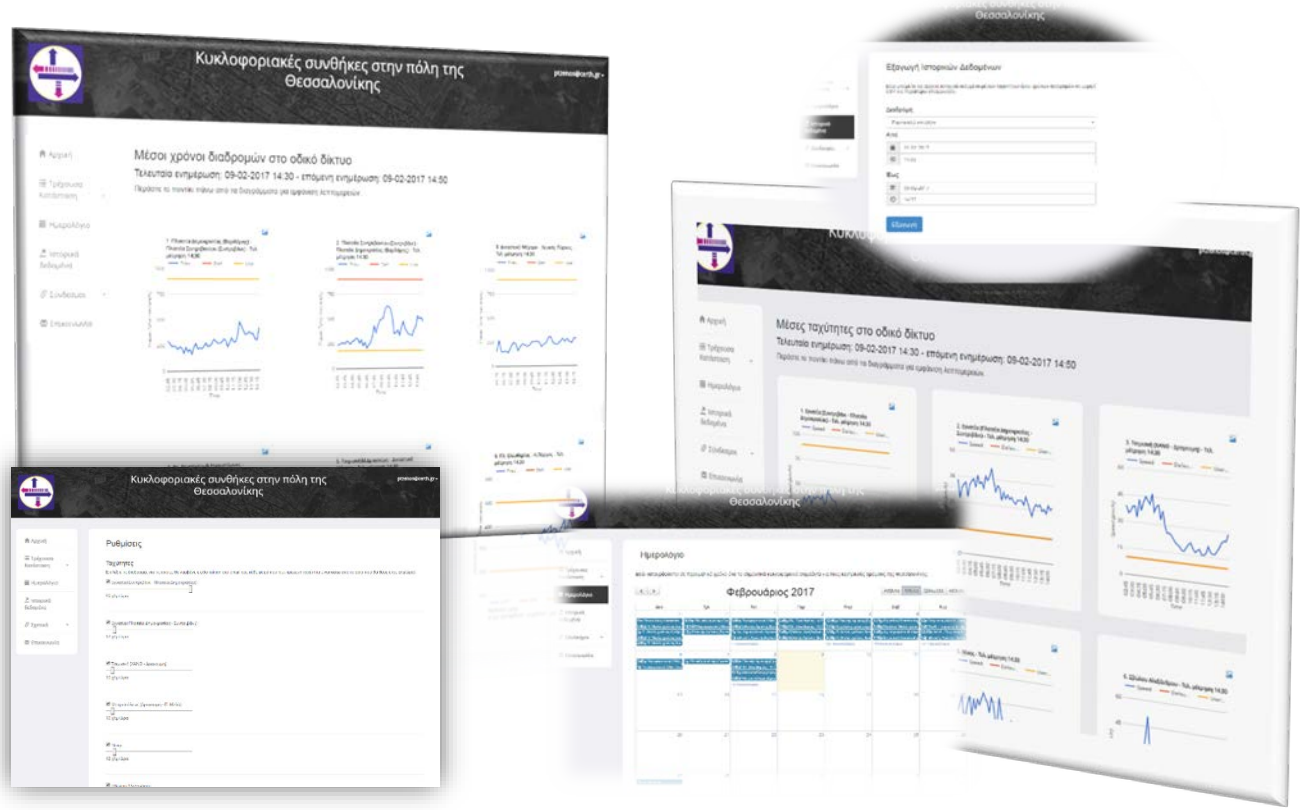
Dashboards for monitoring and decision making

TrafficThess Reports (http://www.trafficthessreports.imet.gr)
A personalized single point of access



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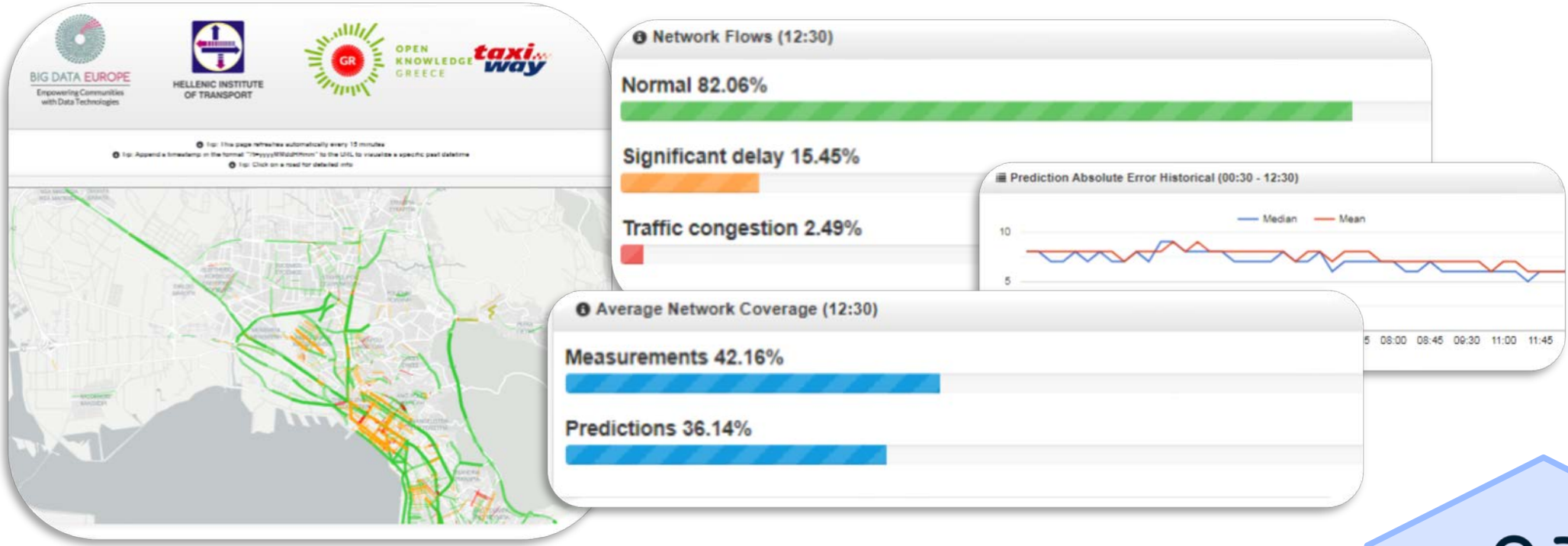
AI for prediction, knowledge extraction and value generation

Traffic status prediction & statistics in real time



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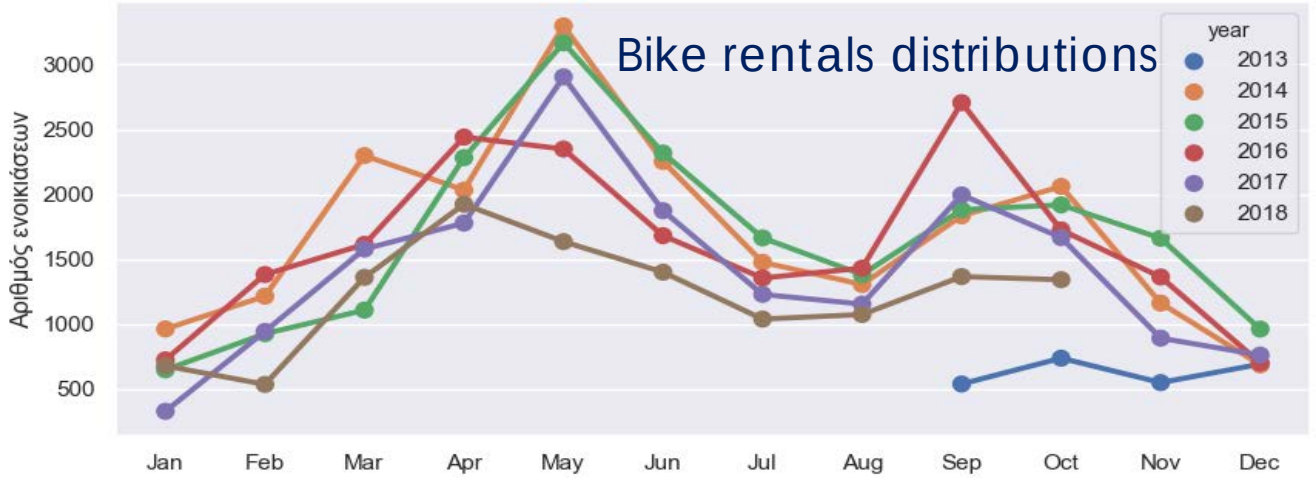
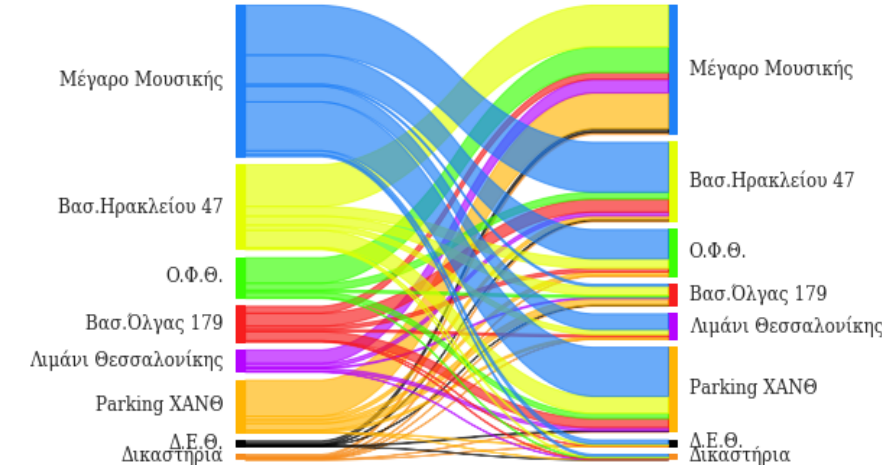
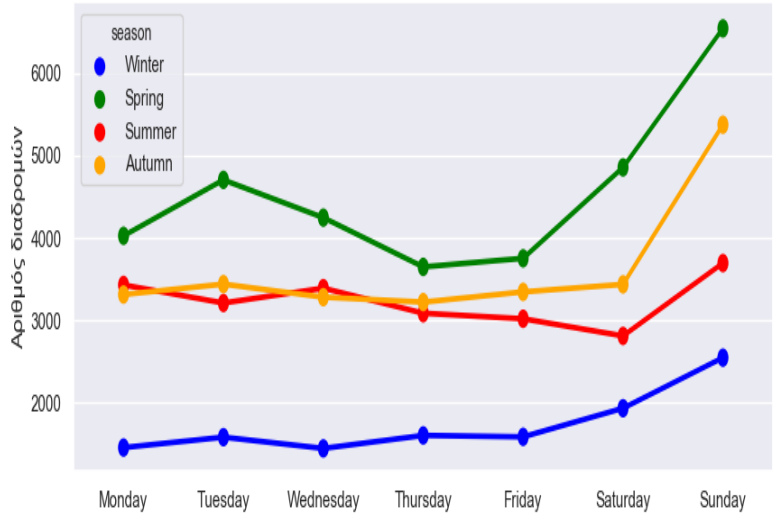
AI for prediction, knowledge extraction and value generation

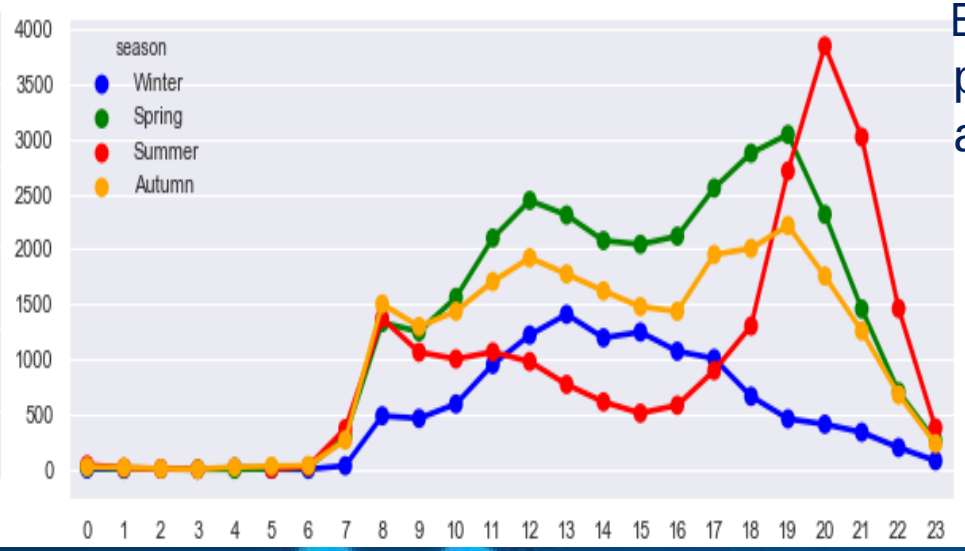
Mobility patterns identification



Bike flows amongst the stations







Bicycle optimal redistribution program considering needs and minimum cost

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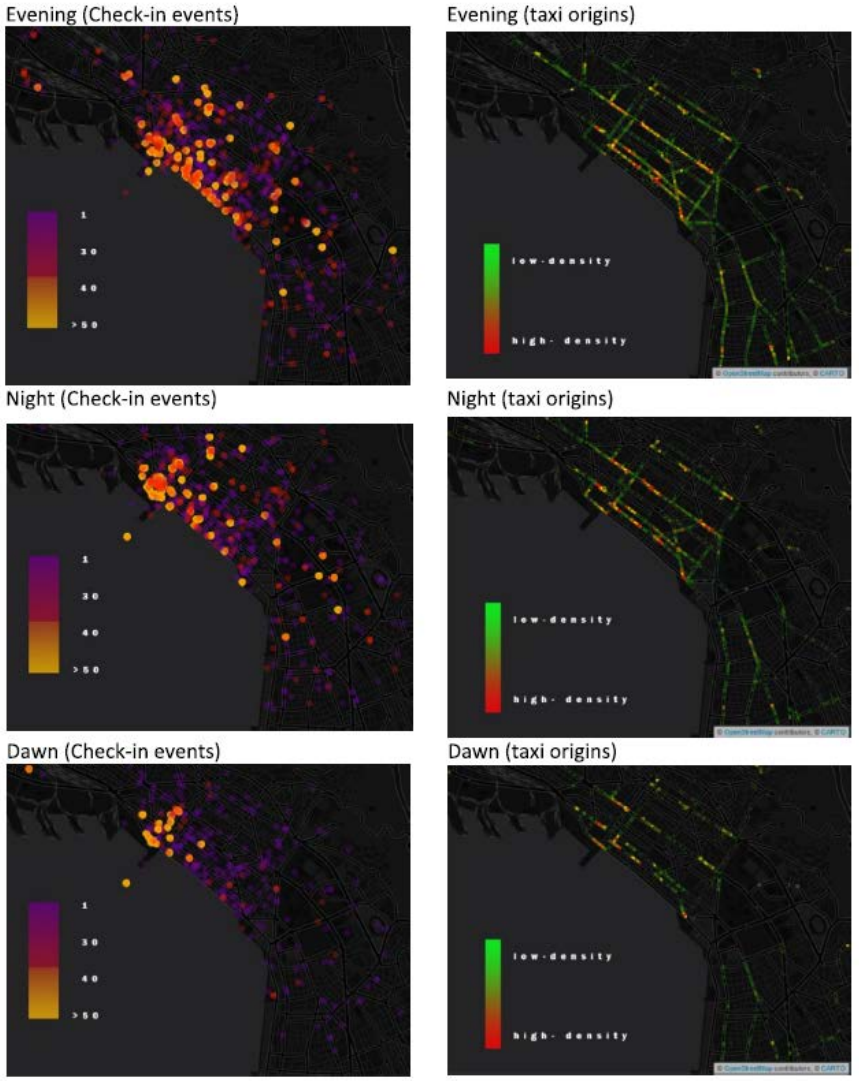
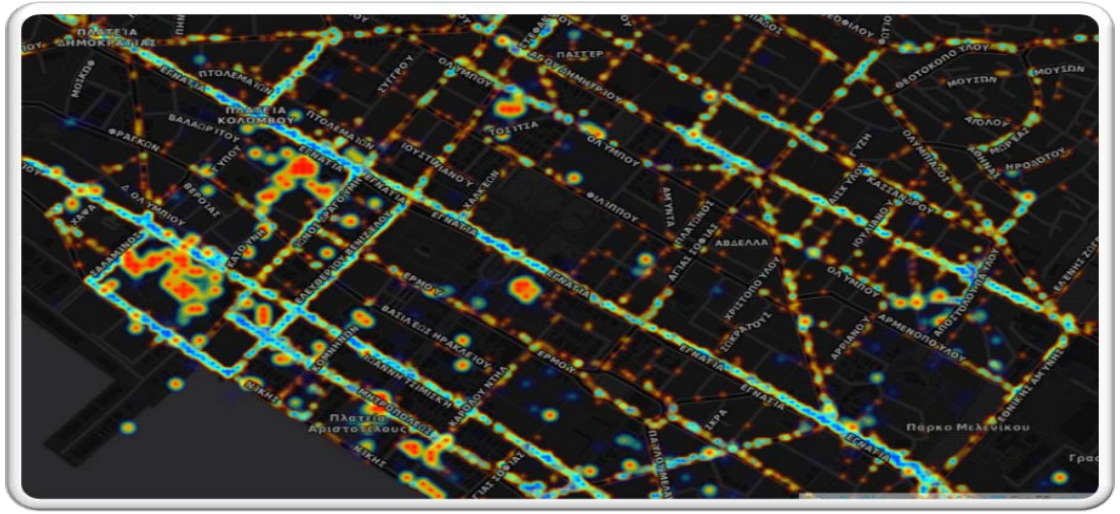
AI for prediction, knowledge extraction and value generation



Concentration of check-in events and taxi trips origins/destinations:



Fusion of heterogenous datasets to study the correlation between activity and transport patterns

Taxi demand prediction based on historical and real-time exogenous data

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Services

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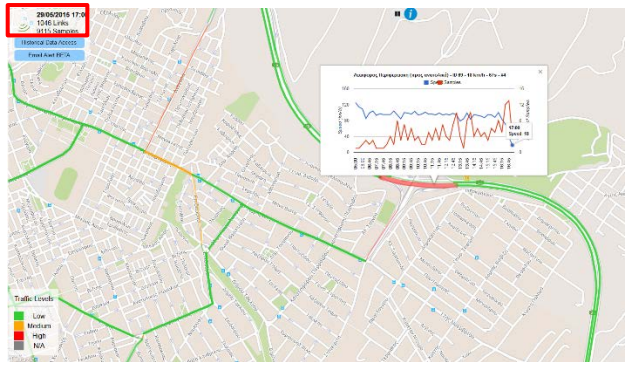
Traffic status and prediction

✓ TrafficThess (http://www.trafficthess.imet.gr)

Monitoring of reliable traffic conditions 24/7/365 basis

Traffic conditions in the city of Thessaloniki, Greece during snowfall on 10 & 11 Jan 2017:

https://youtu.be/2z12tUkuwaM
(credits to anmpout for helping out with the video)



Keep calm!
It's just another congestion on the ring road…

- Visual representation of the current as well as past speeds in Thessaloniki, Greece
- Email notifications
- Historical raw data export per link in open format

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Traffic status and prediction

✓ TrafficPaths (http://www.trafficpaths.imet.gr)
Calculation of travel times on a 24/7/365 basis

- Descriptive information of the current travel times whether available (Thessaloniki, Patras, Heraklion, Serres, Kavala)
- Mobile friendly web page

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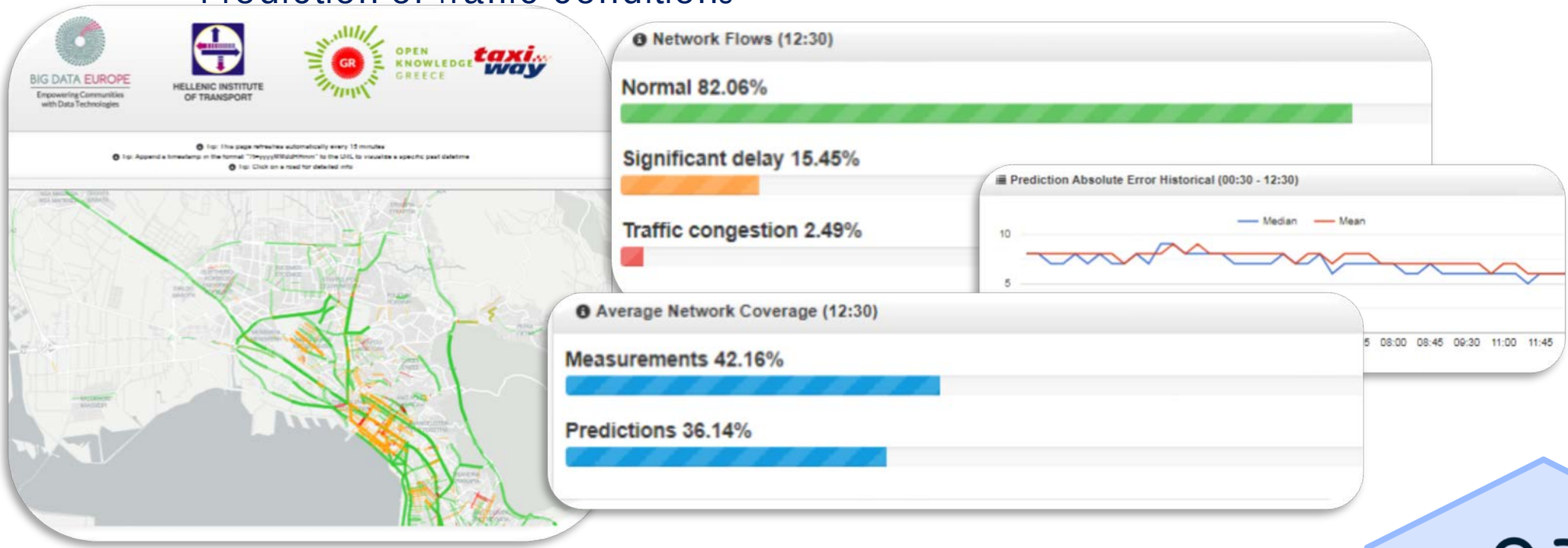
Traffic status and prediction

✓ Traffic Status Prediction (http://trafficstatusprediction.imet.gr/)
Prediction of Traffic conditions



- Visual representation of the current as well as prediction of traffic conditions in Thessaloniki, Greece
- Historical speed data in open format

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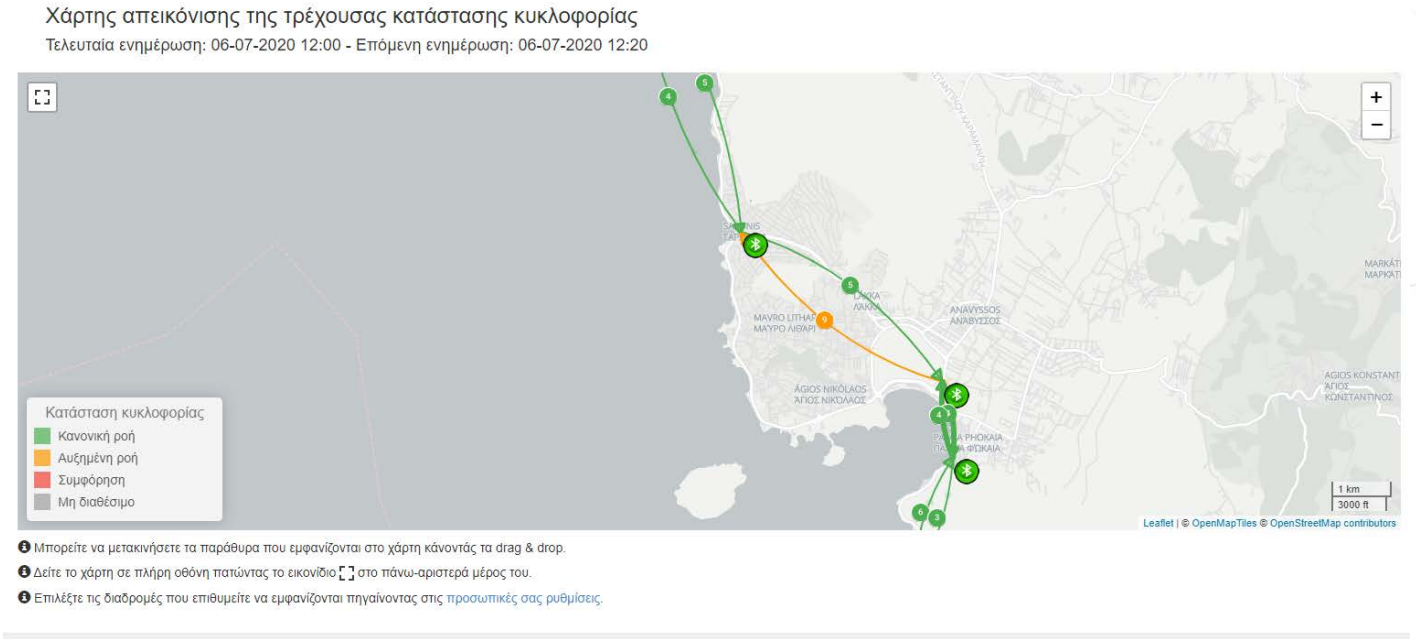
Traffic status and prediction

- ✓ Messini Traffic Conditions
- ✓ Saronikos Traffic Conditions



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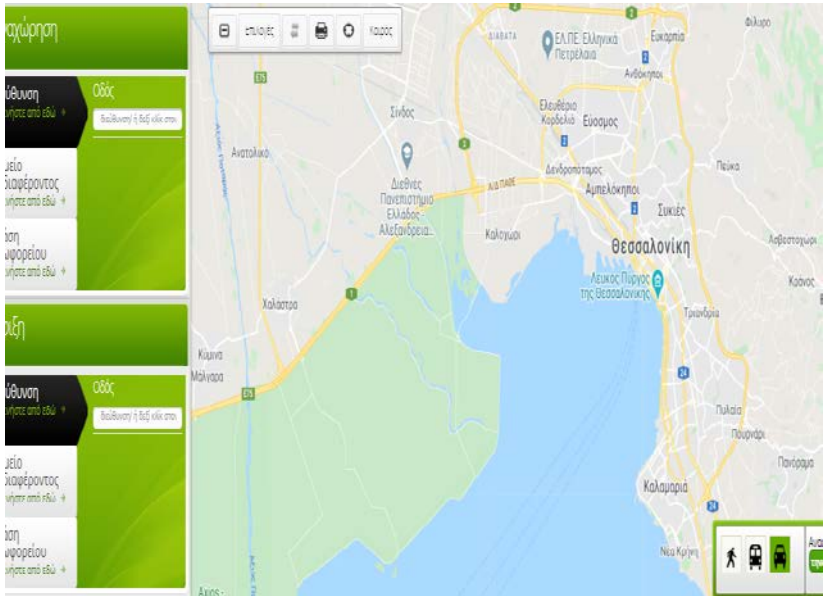
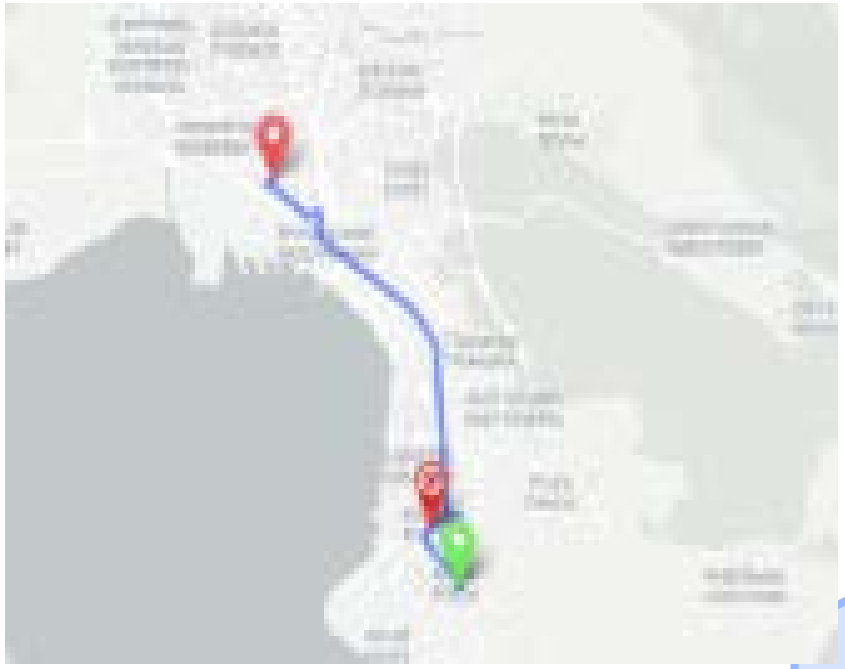
Routing and Navigation

MobiThess
(http:// mobithess.gr/)



Routing within Thessaloniki's road network using real-time traffic status data

TourEV
(https://www.kripis.imet.gr/EV-Routing)



Navigate the Thessaloniki's road network with your electric vehicle withour running out of power

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Routing and Navigation

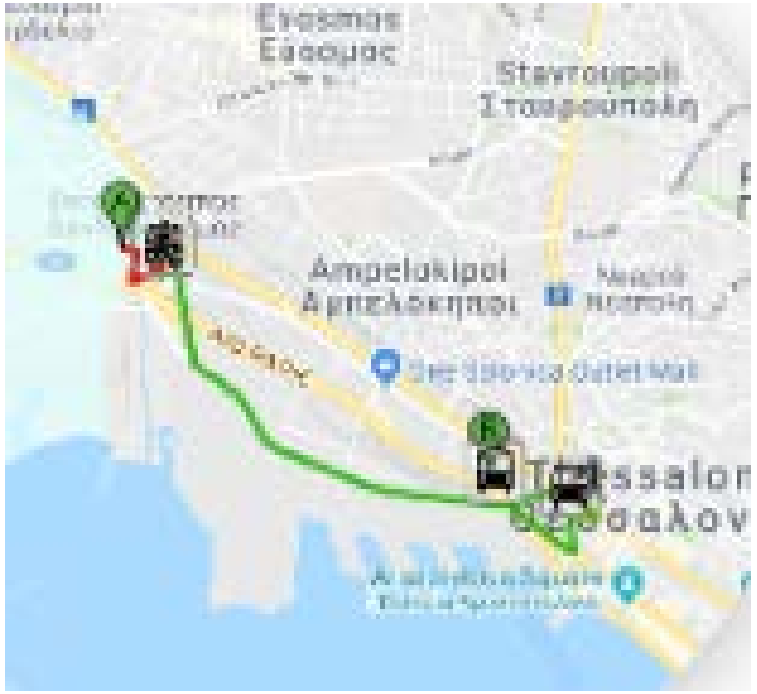
Interurban Public Transportation

http://www.easy-trip.eu/en-us/mobilityplanner.aspx?lang=en

Interurban and international public transportation services

Park & Ride

http://www.mobithess.gr/RoutingCombined.aspx



Multimodal routing in Thessaloniki

Routing and Navigation

Pedestrian routing

Bike sharing users

Citizens in leisure activities

Shortest route

Less crowded route

E-scooter trip ends

Shared bike trips ends

Keeping social distance while walking in Thessaloniki

Detection of congestion patterns

Registration of FCDs at the respective points of the road.

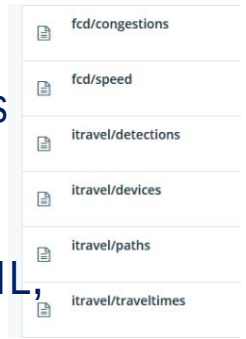
Monitoring and processing of vehicle speed and frequency data on various roads.

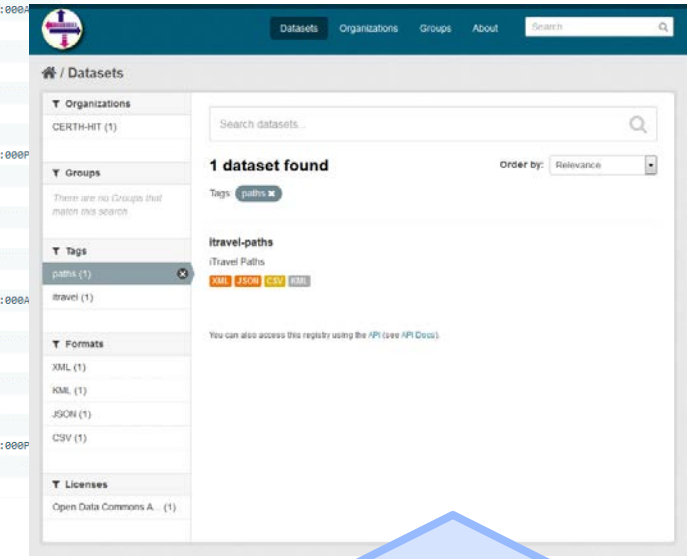
Machine learning methods to detect congestion.

Data platforms

The H.I.T. **Open Data portal** is intended to be a unique access point for open data on transport research in Greece.

- ✓ Historical datasets renewed on a monthly basis
- ✓ Powerful restful HTTP API (powered by “The Datatank”) which serves real-time datasets in different machine readable formats (JSON, XML, CSV, KML etc.)
- ✓ CKAN (front end)





The datasets are freely available to universities, companies and individual developers who are willing to use them for their research or to create relevant services, under the “Open Data Commons Open Database License (ODbL)”

http://opendata.imet.gr/dataset

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Data platforms

National Access Point-NAP

The National Access Point offers a variety of real-time data ranging from traffic congestion levels and vehicle speeds to travel time data.

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Value creation in COVID-era

COVID quarantine allowed for more detailed analysis…

Period 1:

Schools & coffeebars close

- Traffic reduced **20%**
- Travel time reduced **12%**
- Use of Bike sharing increases by 30%
- Taxis operating fleet reduced by 22%

Period 2 :

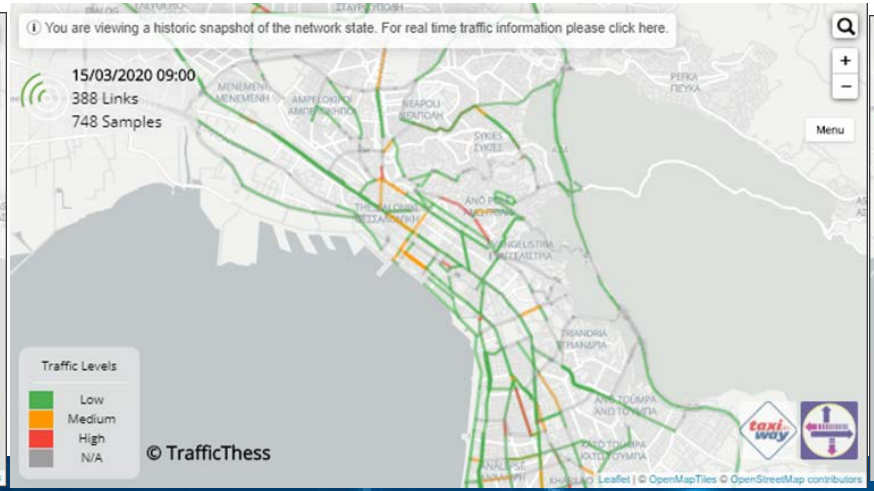
All shops close

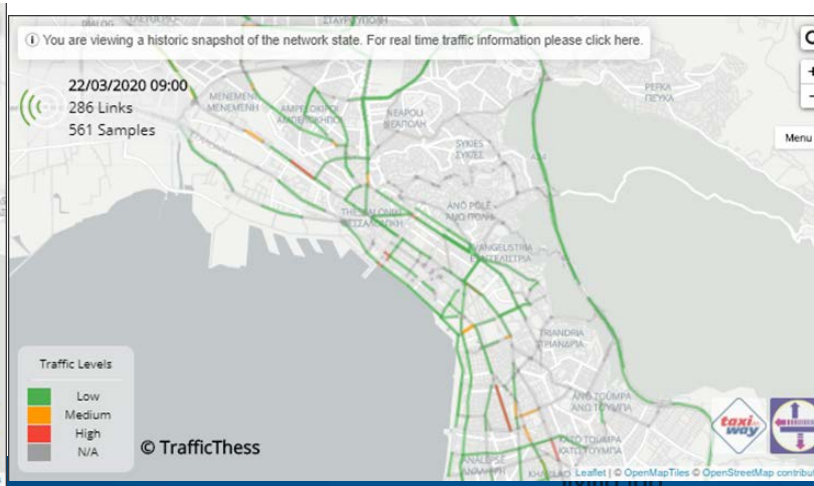
- Traffic reduced by **55%**
- Travel time reduced **43%**
- PT use reduced by **69%**
- Taxis operating fleet reduced by 82%
- "Check-in" in social media reduced by 46%

Period 3 :

Stay at home

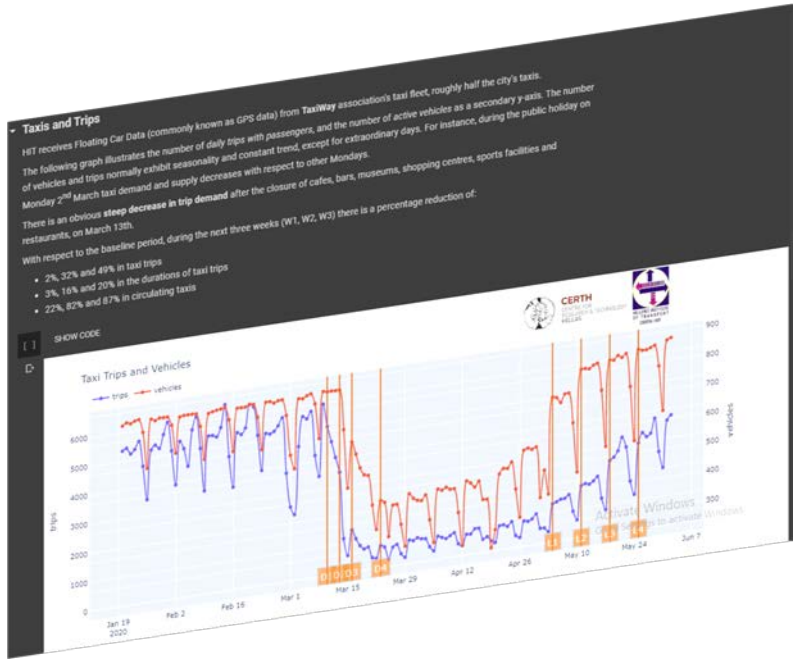
- Traffic reduced by **70%**
- Travel time reduced **52%**
- PT use reduced by **89%**
- Trips reduced by 80%
- "Check-in" in social media reduced by 54 %





Value creation in COVID-era

- Ability to support decision making for recovering period & agile planning
- New data fusion techniques are needed to maintain monitoring & resilience
- Urgently need for a city data sharing strategy & urban mobility observatories at city level



The above analysis results were presented by the Deputy Director of CERTH/HIT, Dr. Georgia Ayfantopoulou in the COVID-19 TALKS organized by EITUM

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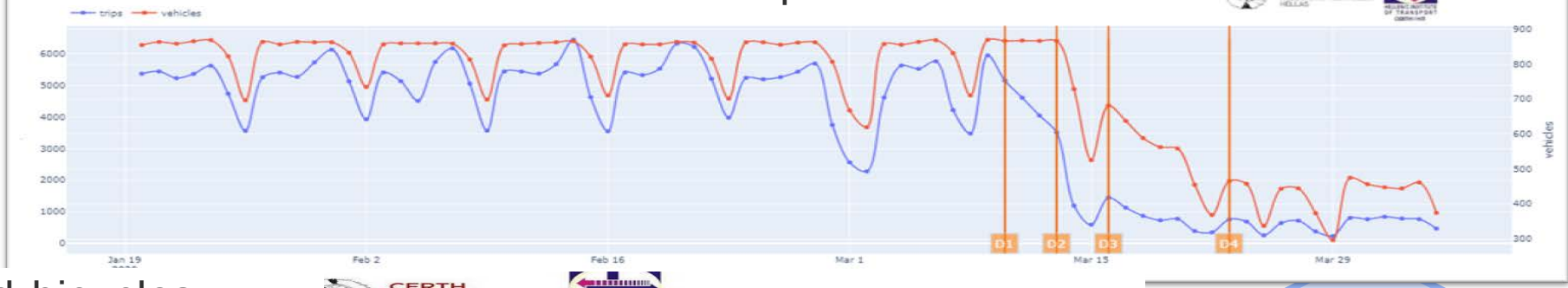
Value creation in COVID-era

- More evidence of users behavior
- Ability for influencing users choices in the after COVID period

Number of check-in events per venue category

Number of taxi fleet & number of trips



Number of rented bicycles

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Value creation in COVID-era

- CERTH/HIT leads CommINSAFE, one of the 11 projects out of 100 funded by EIT Urban Mobility within COVID-19 call
- **CommINSAFE** project aims at developing a mobile application for shared mobility services for ecosystems accompanied with a data management system of disinfection facilities.

CommINSAFE- CommutINg with ShAred mobility covid-FrEe

In a post-lockdown "new normal" world, mobility solutions must tackle critical aspects such as ensuring safety, healthy commuting modes used by people that trust each other and can easily be traced. Mass modes of transport, where social distancing is often an insurmountable obstacle - how can this be addressed. CommINSAFE develops and introduces to the market a technological solution consisting of a mobile application for shared mobility services accompanied with a data management system of disinfection facilities and users' profile. Car-pooling, ridesharing and demand responsive transport by shuttle buses are offered as suitable alternatives to public transport; as well as management of facilities for rapid disinfection of vehicles

Output

- Encourage commuters to share their ride using private cars, taxis and buses
- Improved mobility services provided to commuters combining the experience of private transport operators, the private car owners' intention to help and the knowhow of the UV disinfection technology providers
- Increased potential of expansion of car-pooling, ride-sharing and DRT

Project Partners

Municipality of Sant Cugat Del Vallès (Spain), Factual (Spain), Synetairismos (Greece), - Centre for Research & Technology Hellas - CERTH (Greece), KTH Royal Institute of Technology (Sweden), Groupito (France)

eit Urban Mobility

Shared Mobility

1-Jul-20 31-Dec-20

Lead:
CERTH

Cities
Sant Cugat del Vallès & Thessaloniki

Budget
€548,532

eit Urban Mobility

EIT Urban Mobility
COVID-19 Crisis Response call
Selected projects

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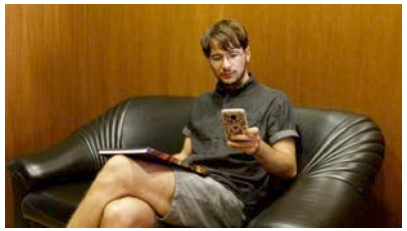
New mobility services

GALILEO FOR MOBILITY

2nd drop off

1st drop off

If you are tired of driving to the city center and back home every day, try the ride-sharing service offered by TaxiWay.



1st pick up

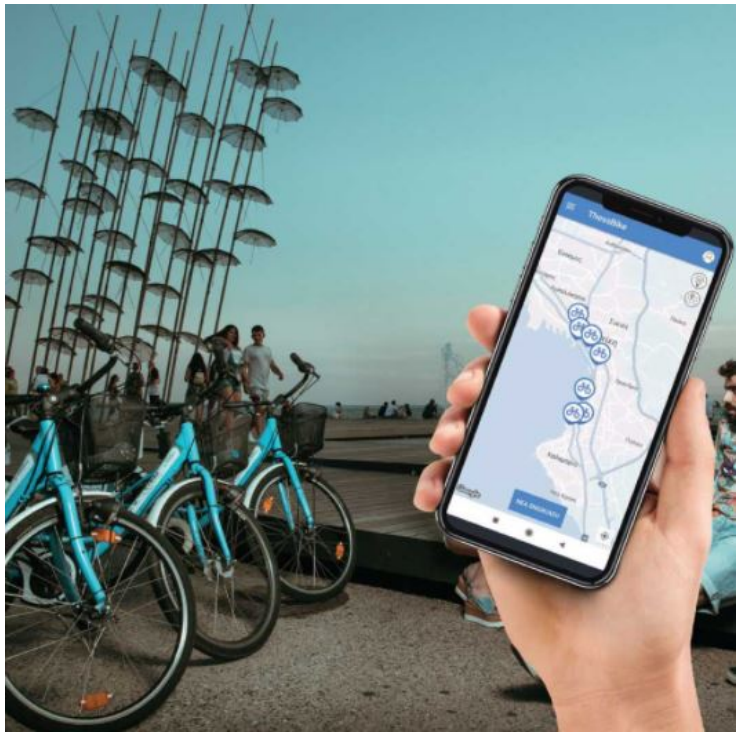
2nd pick up

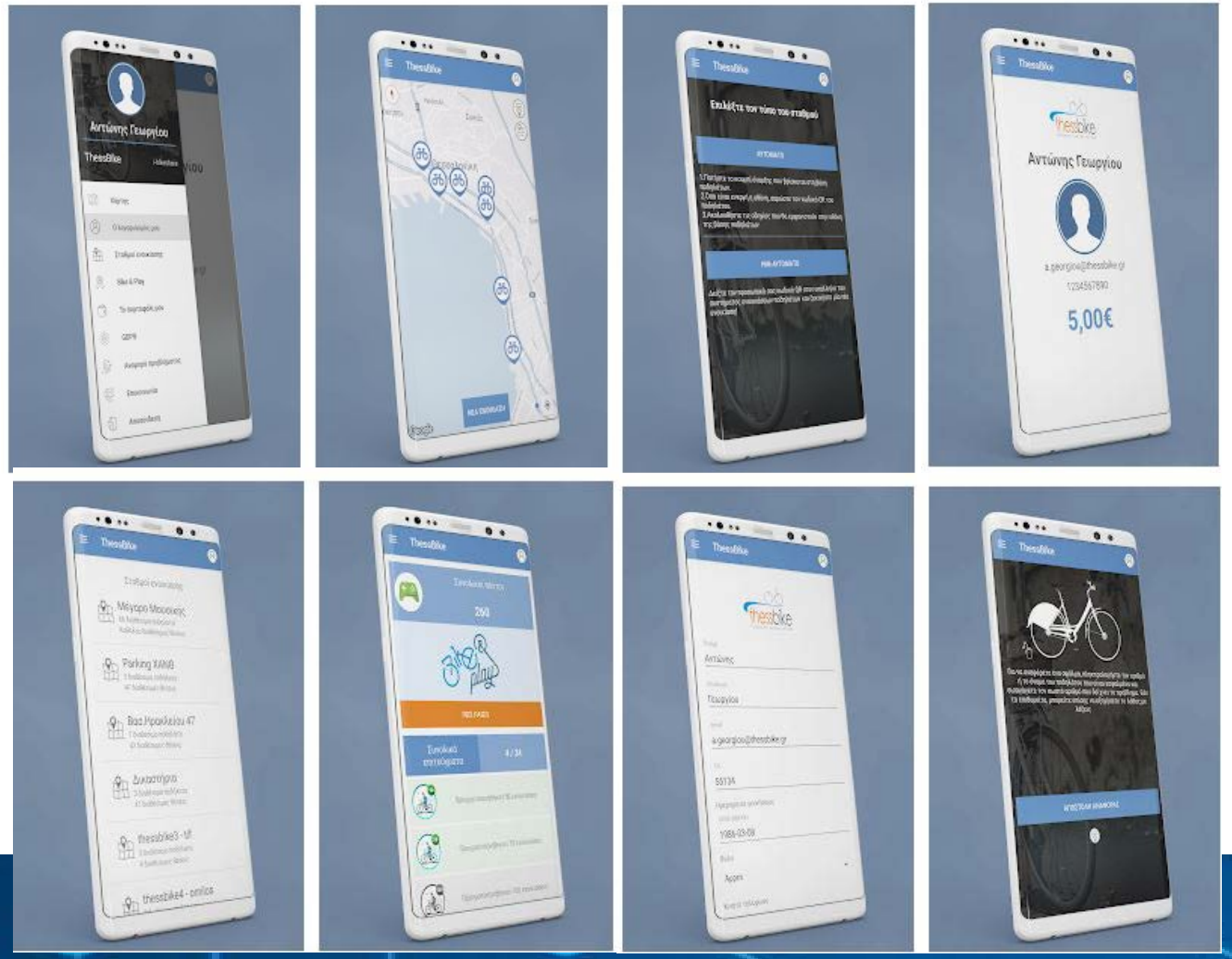
New mobility services

Moving around the city has never been easier.

iBikeShare

Create your Thessbike account and your daily transport will be a spinning wheel.

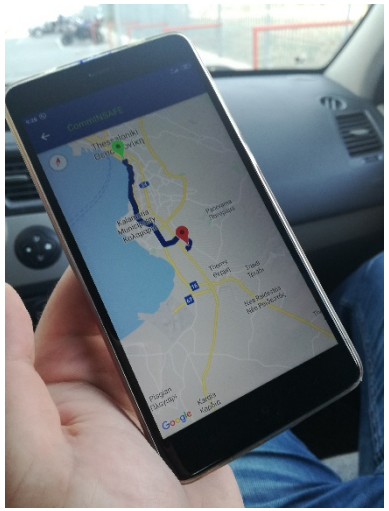


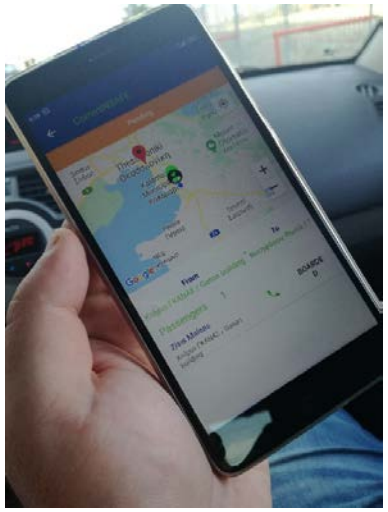


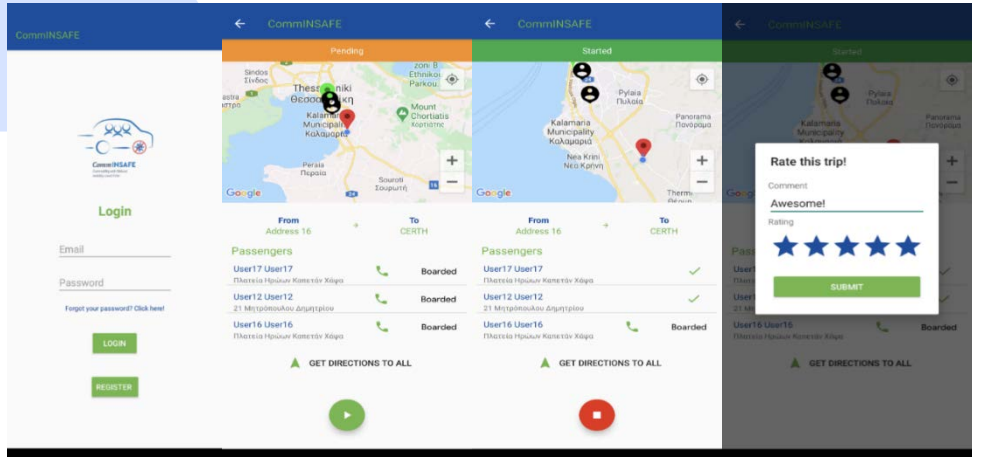
New mobility services

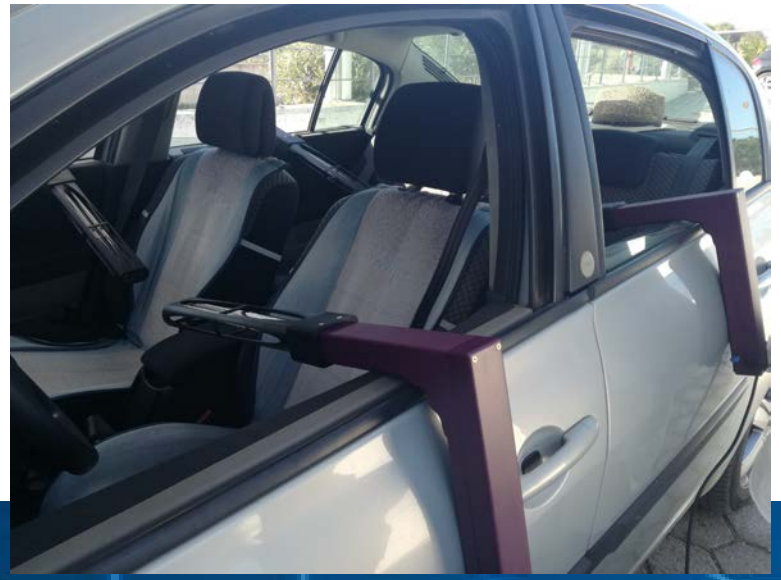
CommINSAFE
CommutiNg with ShAred mobility covid-FrEe

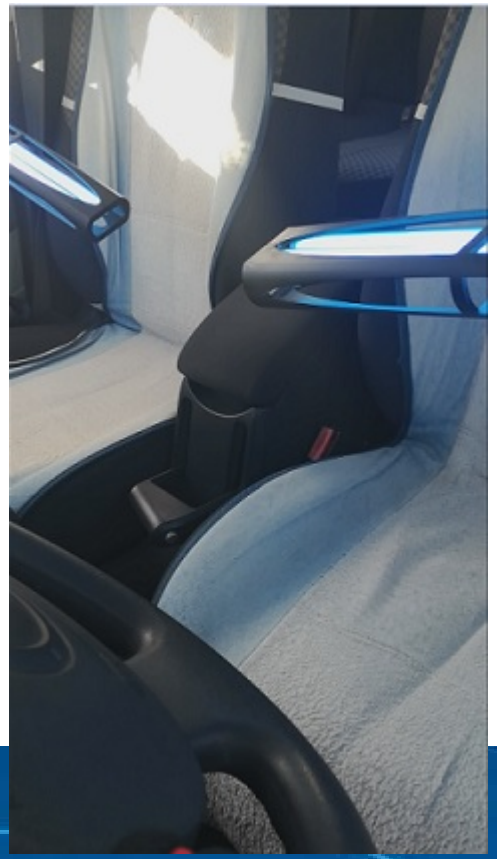
Car pooling service combined with disinfection systems











PROJECTS

smartmlab.imet.gr/

Projects

mobithess
A unified effort of the key players of the city dealing with urban mobility, transport and environment
(http://www.mobithess.gr/)

Momentum
Modelling Emerging Transport Solutions for Urban Mobility
(https://h2020-momentum.eu/)

CommINSAFE
CommutINg with ShAred mobility covid-FrEe
(https://comminsafe.imet.gr/)

SHOW
SHared automation Operating models for Worldwide adoption
(https://show-project.eu/)

Big Data Europe
- Re-design KOMVOS
- Big Data tools and knowledge
- New data-sets and services

(https://www.big-data-europe.eu/)

muLtiDEPART
A multi-operator tool for managing Demand rEsPonsive trAnspoRT

Logimatic
- Smart port vehicle management
- Tight integration of EGNSS and on-board sensors for port vehicle automation

(https://logimatic-project.eu/)

Projects

Bordeaux
Vigo
Copenhagen
Pilot sites
Verona
Helmond
Thessaloniki
Newcastle

compass4D

Cooperative Mobility Pilot on Safety and Sustainability Services for Deployment

Road Hazard Warning

Red Light Violation Warning

Energy Efficient Intersection

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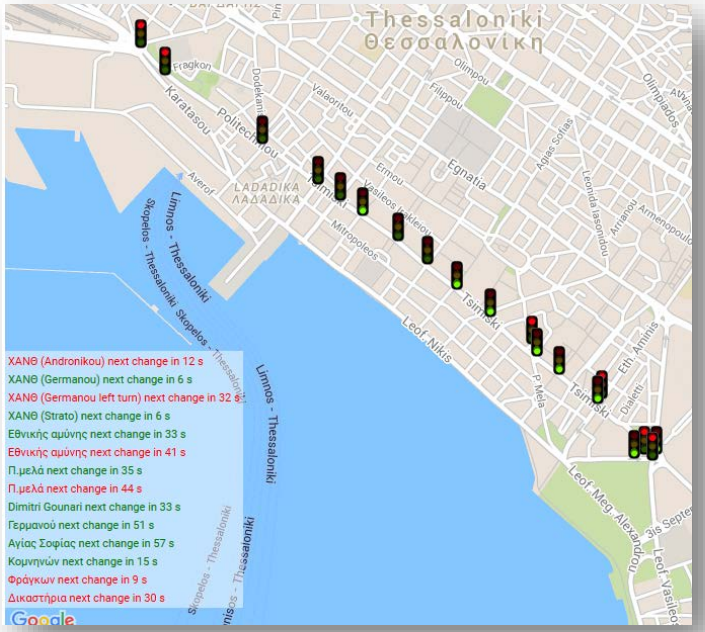
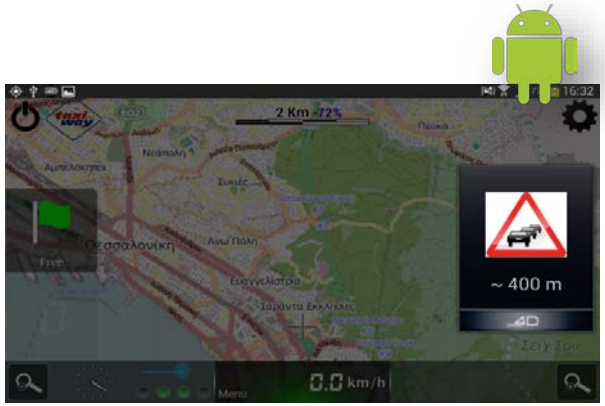
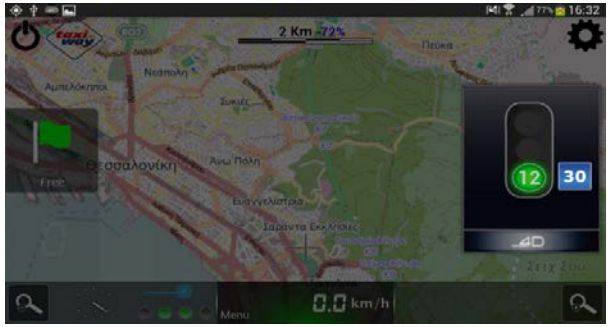
Pilots

compass 4D



API





Real time data along Tsimiski

- 12 controller / 14 intersections
- Expected time to change

150 taxis participating in the pilot

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Projects

Deploying Cooperative Logistics
CO-GISTICS

Cooperative logistics for sustainable mobility of goods

- Intelligent truck parking areas management
- CO2 footprint estimation and monitoring
- Eco-drive support
- Cargo Transport Optimisation
- Priority and Speed advice

http://cogistics.eu/

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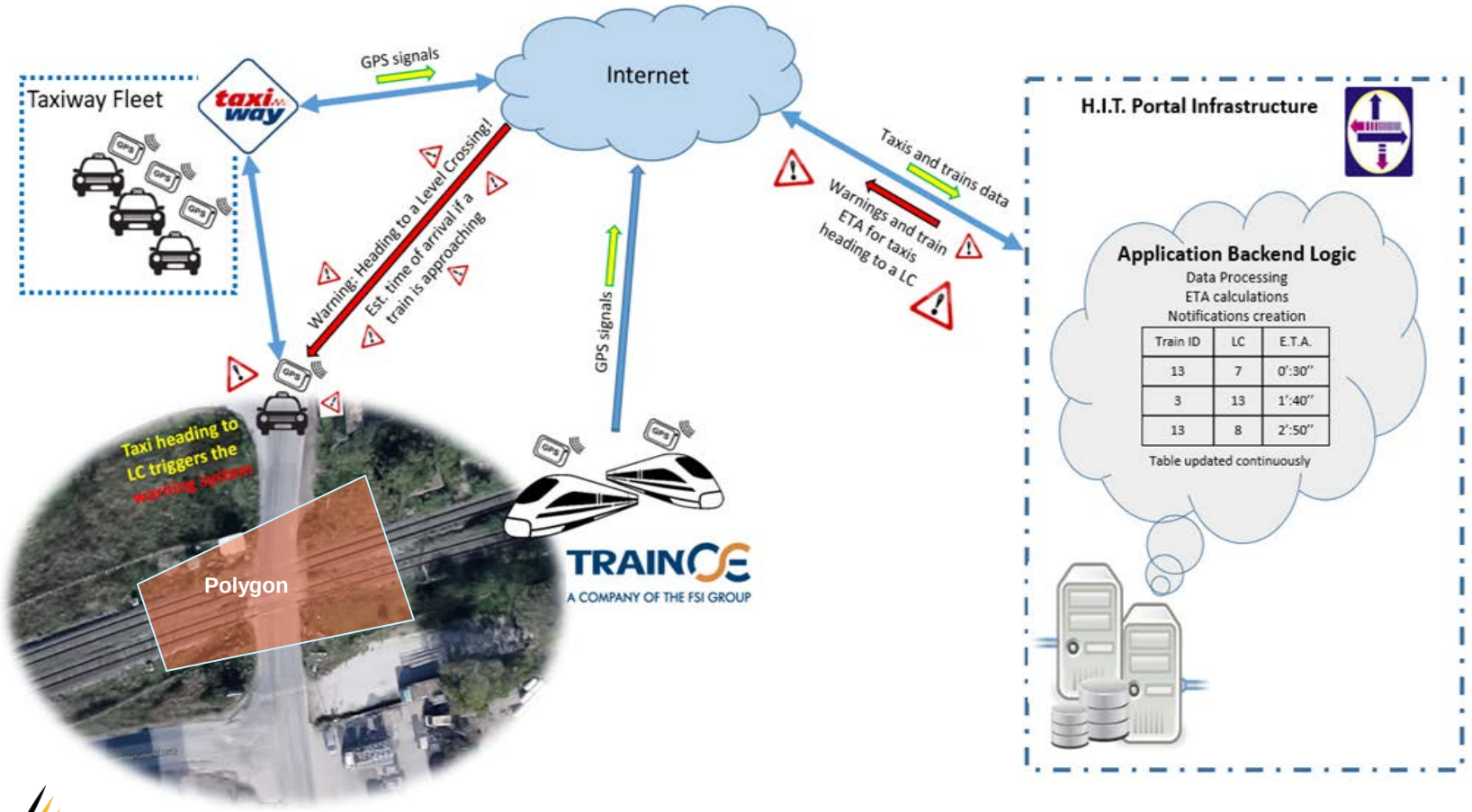
Projects



- Human behavior modeling
- Business model issues
- System development
- Pilot implementation, testing and reporting

SAFER-LC

https://safer-lc.eu/

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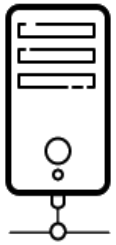
Projects

1. Taxi enters a LC polygon

2. Safer-LC app executes in the background and asks server for the ETA (if any)



3a. Server computes and sends the ETA to the app

3b. Taxi's GPS data sent and stored while in the polygon

4. App displays the alert along with a warning sound

SAFER-LC

FCD: Floating Car Data

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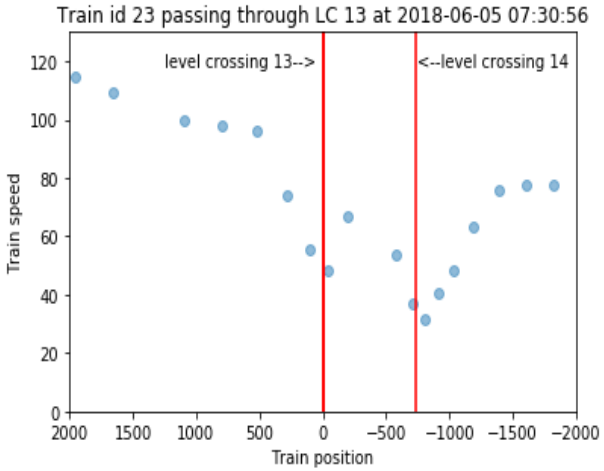
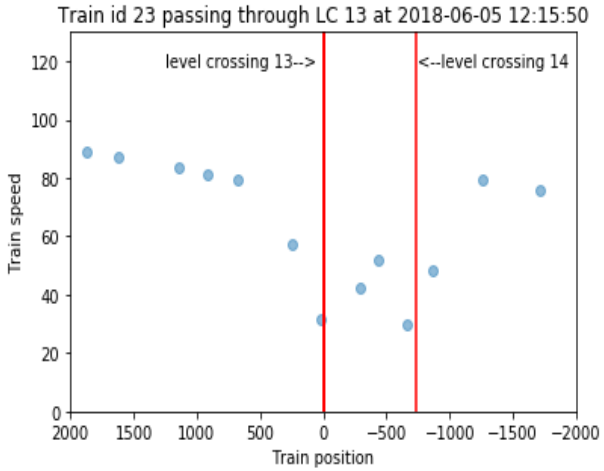
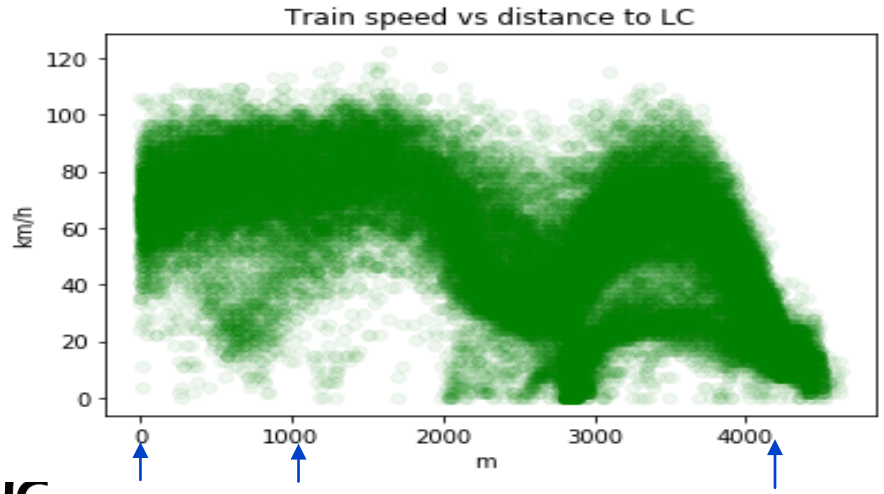
Projects

Typical train speed profiles around LCs



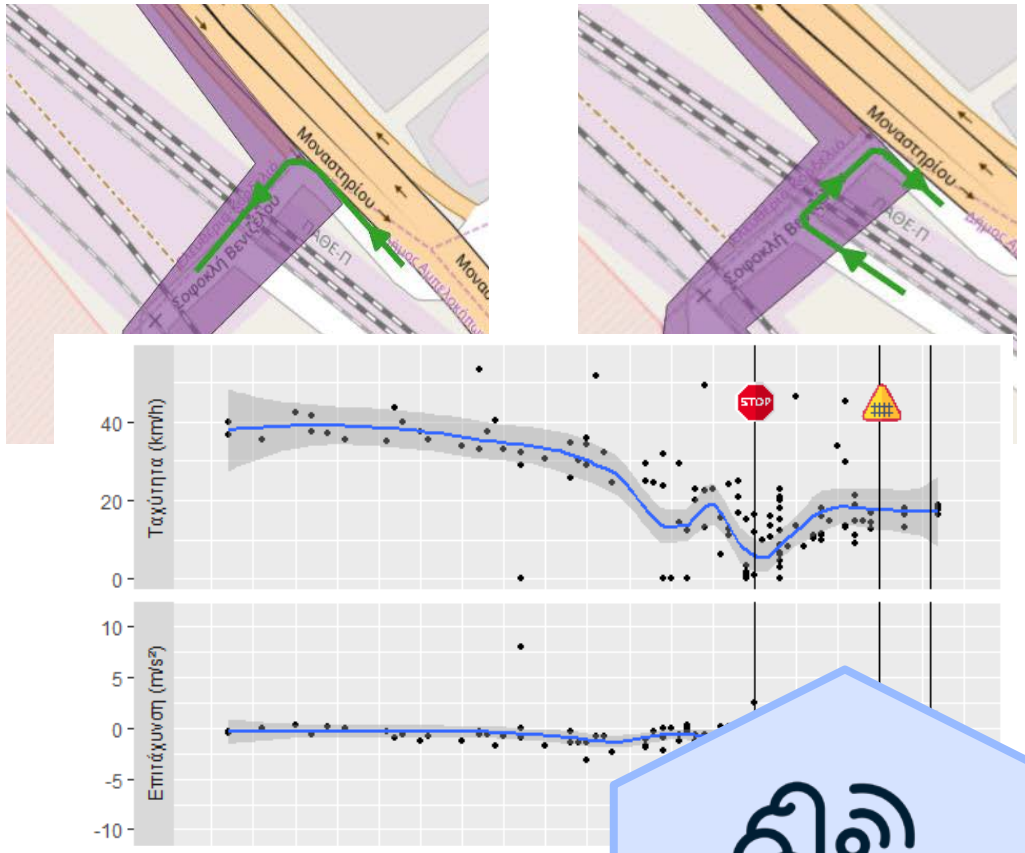




SAFER-LC

Analysis on trajectories of taxis around the level crossings.

Trajectory classification examples:



Analysis results

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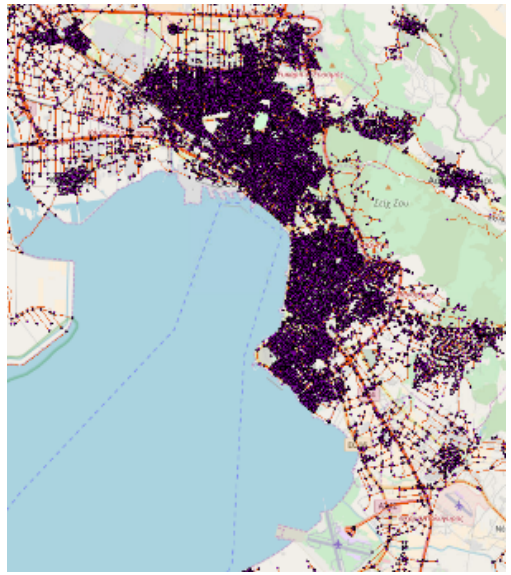
Projects

C-MOBILE

C-ITS Services

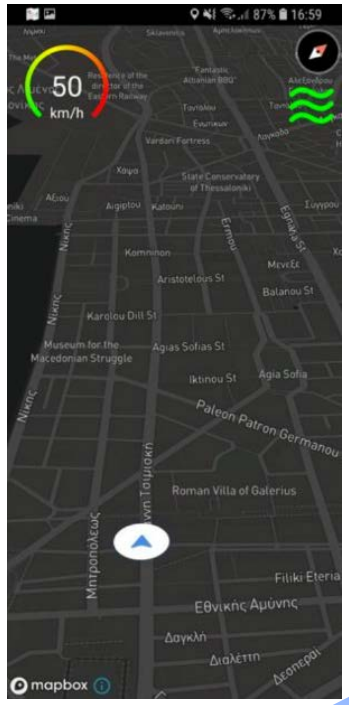
- **Large-scale real-life deployment**
  - Road Works Warning
  - Road Hazard Warning
  - GLOSA
  - Flexible Infrastructure
  - In-vehicle Signage
  - Mode and Trip Time Advice
  - Probe Vehicle Data
- **Limited scale real-life deployment**
  - Warning System for Pedestrians
- **Proof of Concept deployment**
  - Emergency Vehicle Warning
  - Signal Violation Warning
  - Green Priority
  - Cooperative Traffic Light for Pedestrian

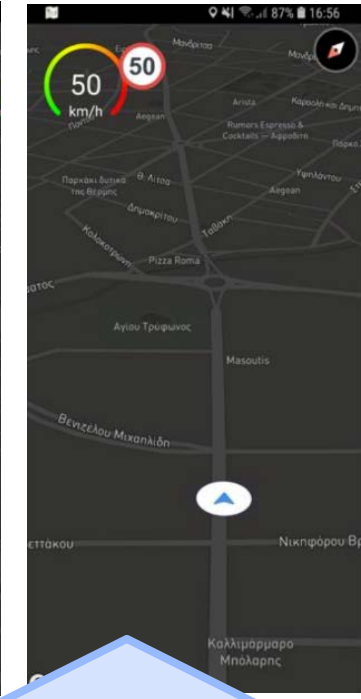
Geographical Coverage



CERTH App

Provision of multiple integrated C-ITS services





https://c-mobile-project.eu/

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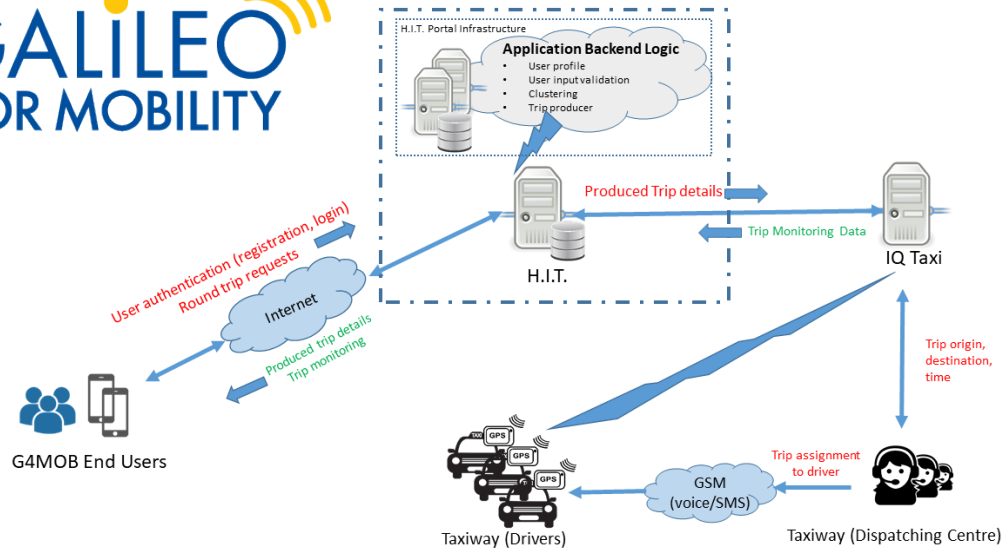
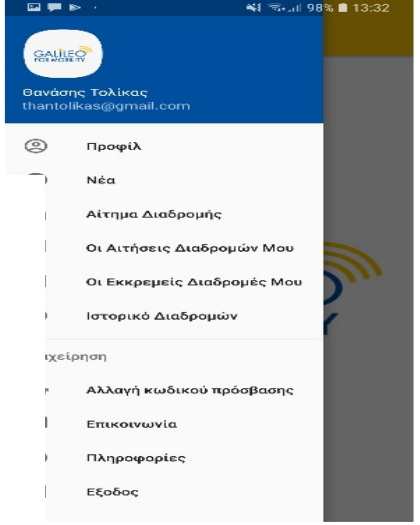
Projects

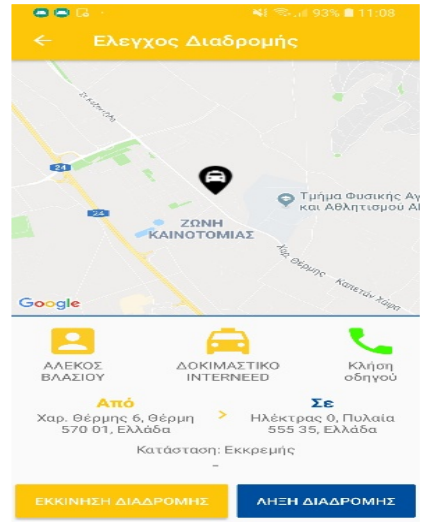
GALILEO FOR MOBILITY

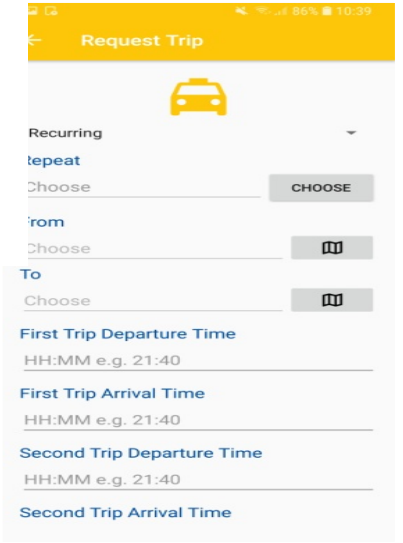


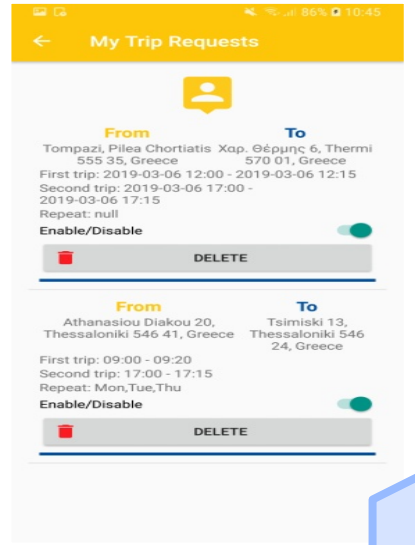
Overall System architecture

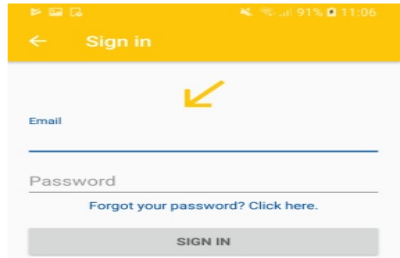
- MaaS algorithms development
- System Pilot implementation, testing and reporting
- Impact assessment Data analytics and Business intelligence











Mobile Application

http://www.galileo4mobility.eu/

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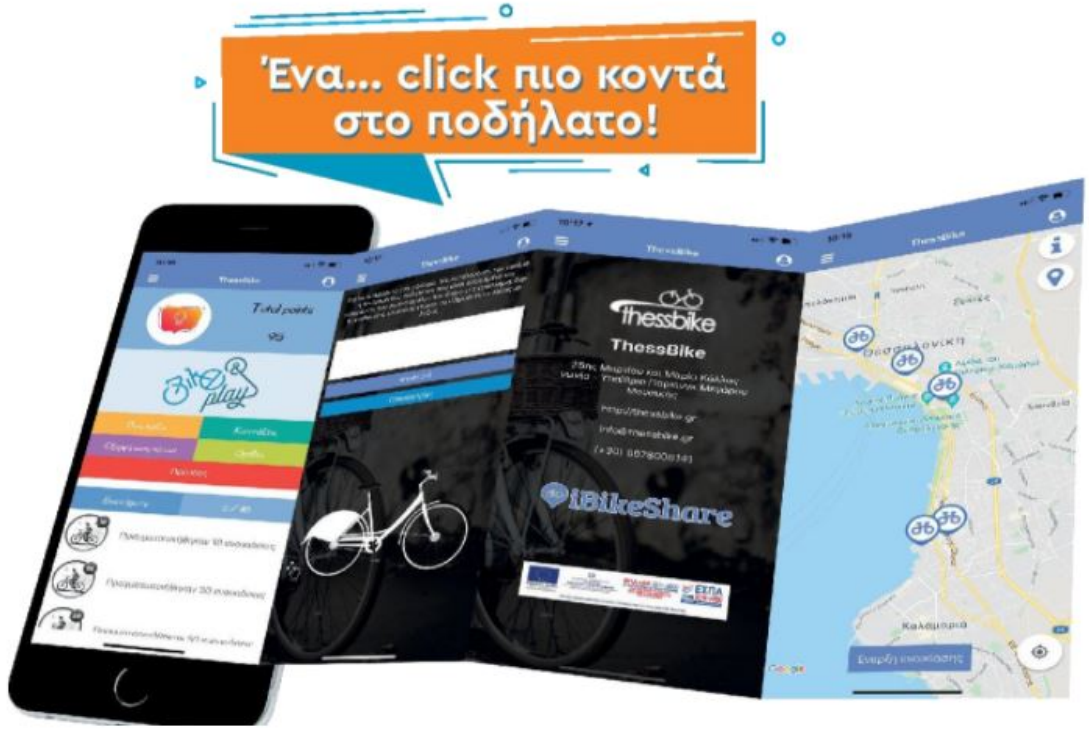
Projects

iBikeShare

- The deployment of an integrated service to support the design, management and use of shared-bikes systems to improve the services offered by shared-bikes systems and to attract new users

http://ibikeshare.gr/



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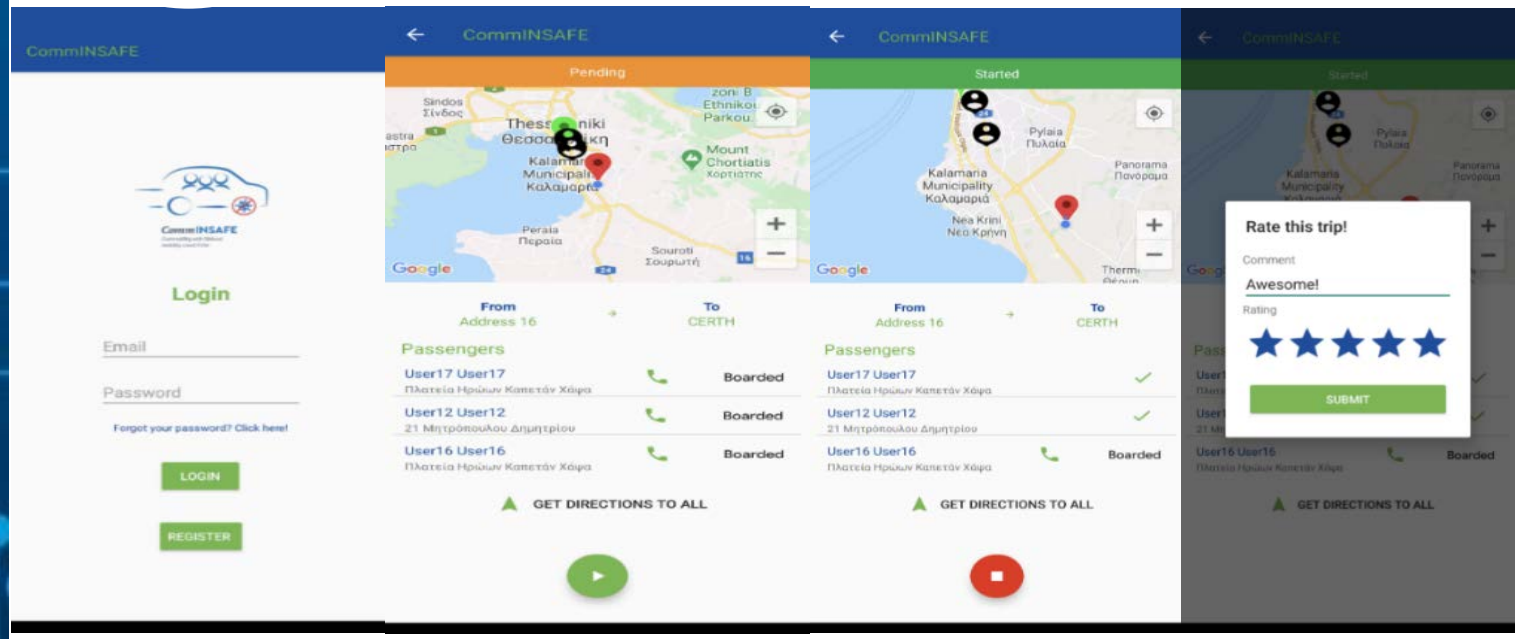
Projects

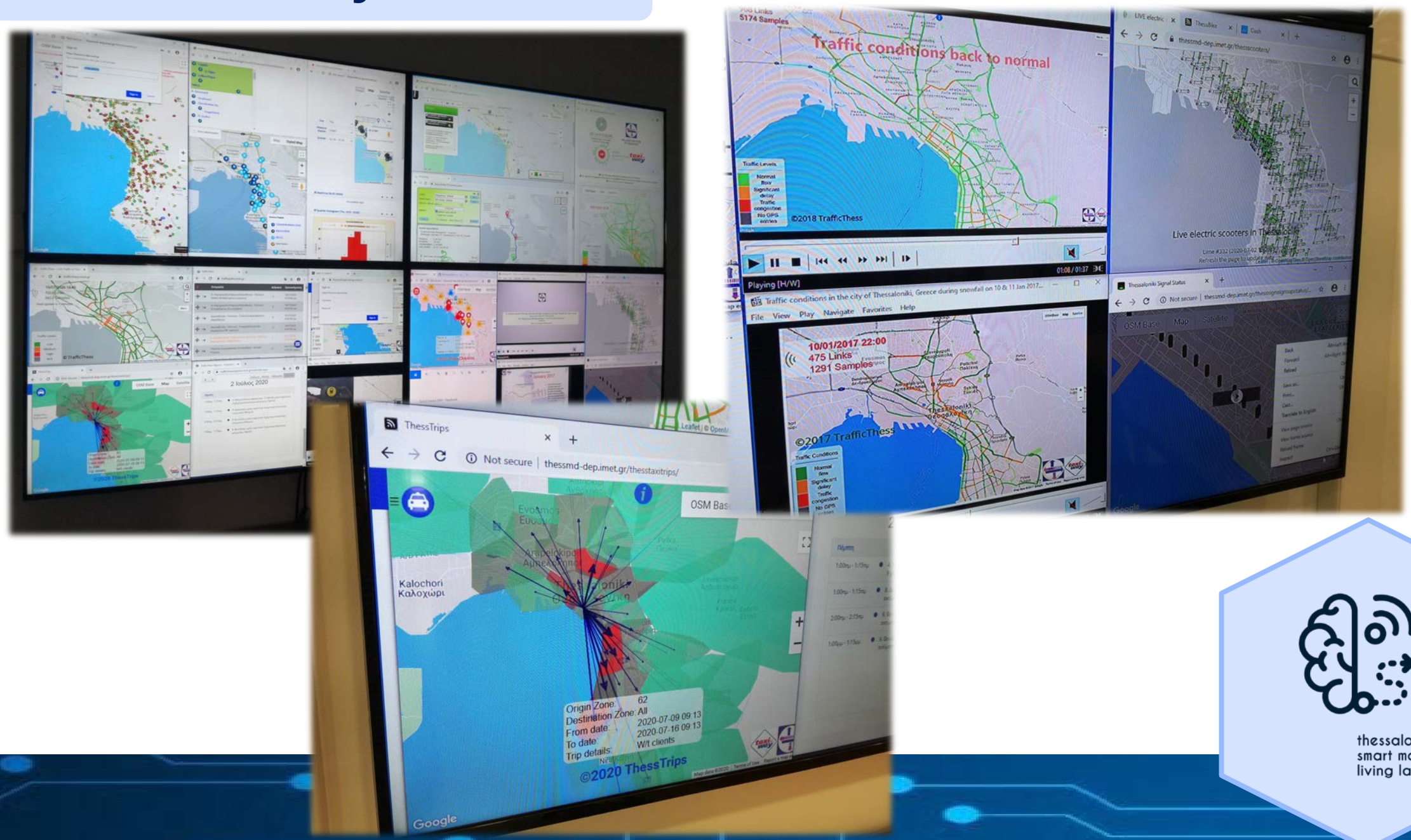
CommINSAFE
CommutiNg with ShAred mobility covid-FrEe

A car pooling service combined with disinfection systems



https://comminsafe.imet.gr/

Photos Gallery



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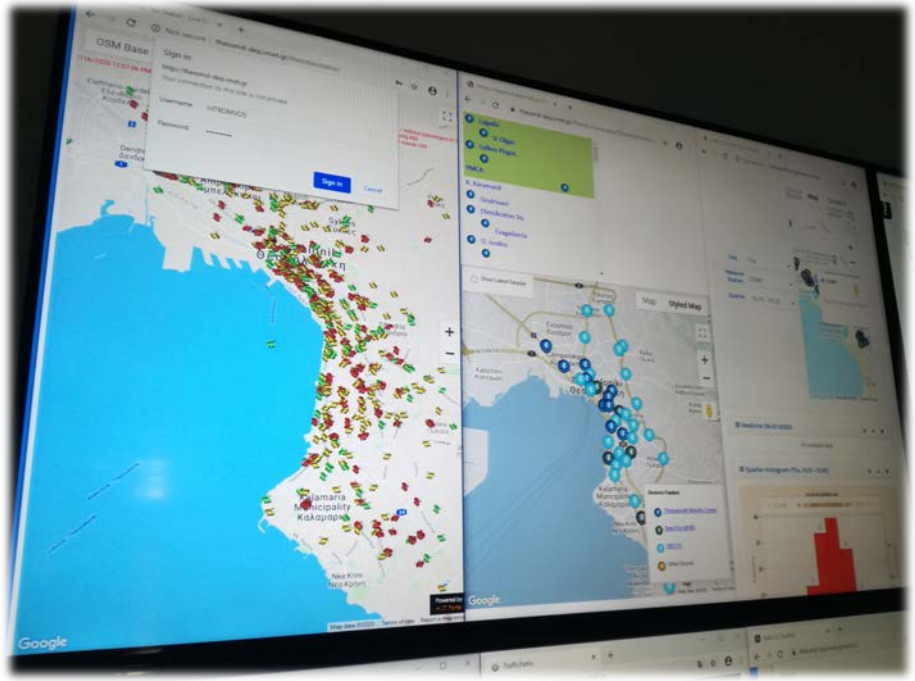
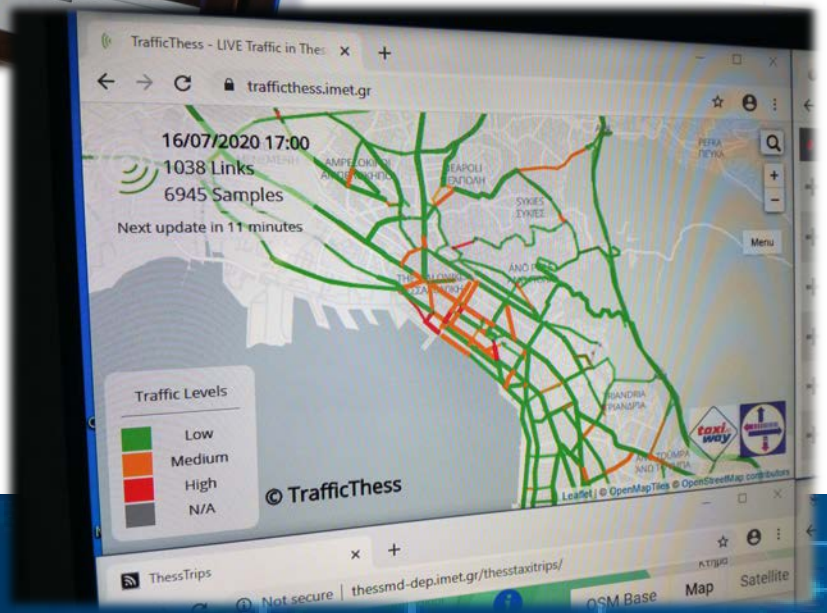
Photos Gallery





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- **HIT: imet.gr**
- **Lab: smartmlab.imet.gr/**
- **Dashboard: thessmd.imet.gr/**
- **Open data portal: opendata.imet.gr/**
- **COVID19 mobility report: bit.ly/Thess_Mob_Report**

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