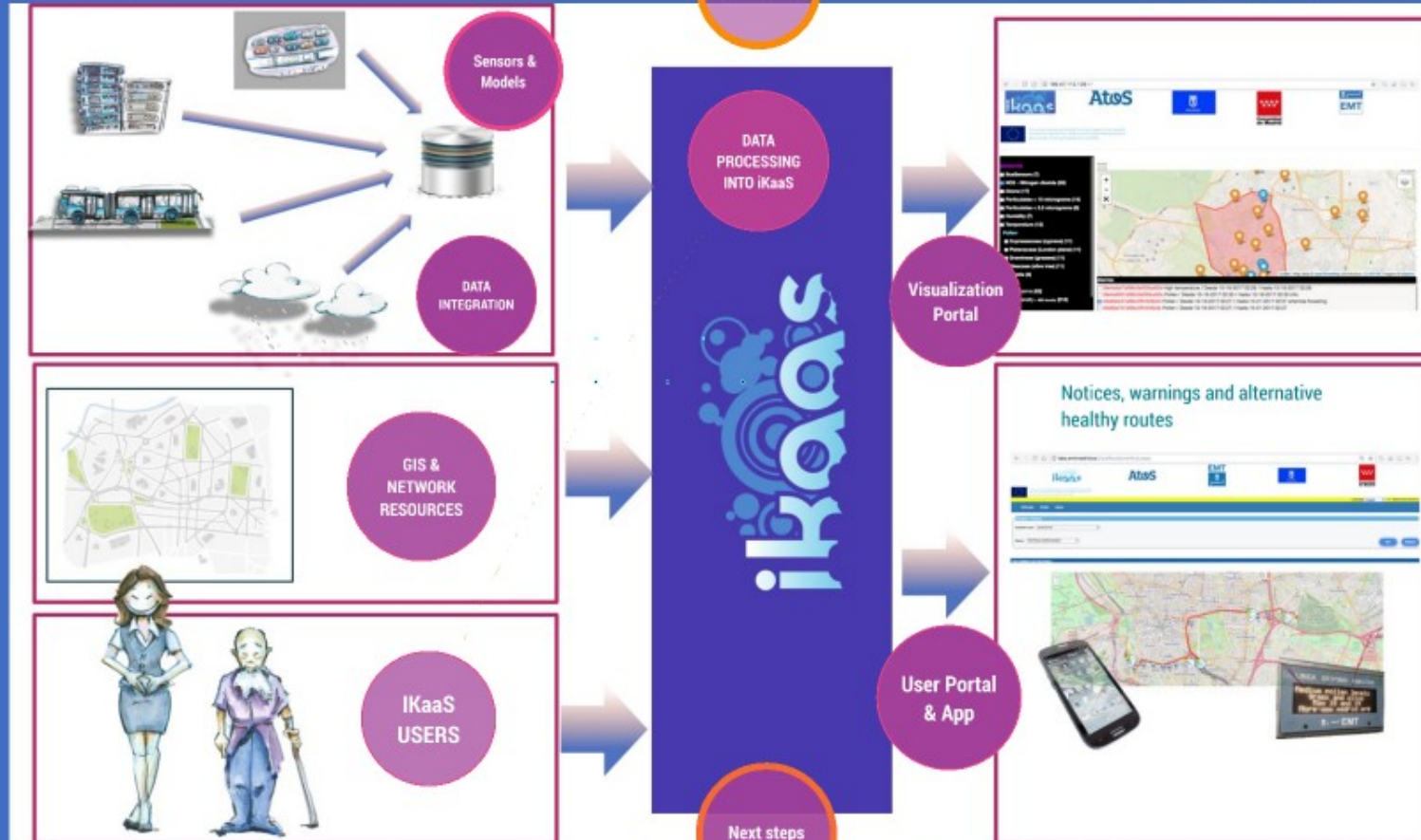


INTRODUCTION



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 641262

POLIS AC, Brussels, December 6th, 2017

What is iKaaS?



SENSORS & MODELS



New sensors, Forecasting
Models for iKaaS
infrastructure

Innovation:
New sensors ...

...to improve the
interpolation
values...

... for NO₂
Forecasting
Model

Innovation: New sensors ...

Sensors: statics vs mobile



AIRBORNE POLLEN SENSORS

- Integration volumetric spore trap
- Web services implementation
- On-line daily airborne pollen information

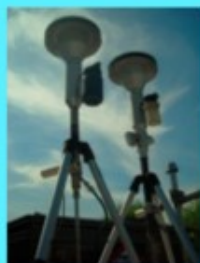


NEW methodology

Scattering method

New sensors on bus

Minute, hourly, daily data



AIR QUALITY SENSORS

- Integration different static sensors
- Pollutants network
- On- line pollutants



NEW methodology

Micro-sensors on bus

Minute, hourly, daily data



...to improve the interpolation values...

HAVE BEEN ADQUIRED DEVICES FOR iKaaS infrastructure:

3 KUNAK: GASES (NO2, CO2, O3, PM2.5 PM10)

5 SHINYEI: POLLEN

5 LIBELIUM: GASES (NO2, CO2, O3)

LOCATION	Type of sensor	Brand	Number of devices
Bus (providing Service in bus line number 44)	Gases (pollutants)	Libelium	1
	Gases (pollutants)	Kunak	1
Bus (providing Service in bus line number 27)	Gases (pollutants)	Libelium	1
	Pollen	Shinyei	1
Madrid City Council	Pollen	Shinyei	1
Farmacy faculty	Pollen	Shinyei	1
Las Rozas	Pollen	Shinyei	1
EMT central office (C/Cerro de la Plata 4)	Pollen	Shinyei	1
EMT central office laboratory (C/Cerro de la Plata 4)	Location	Libelium	1
Arganzuela district hall	Gases (pollutants)	Libelium	1
Escuelas Aguirre	Gases (pollutants)	Kunak	1
	Gases (pollutants)	Libelium	1
Atos building	Gases (pollutants)	Kunak	1





The diagram illustrates the architecture of the NO2 Forecasting Model. A large cyan circle in the center contains the title and description. To its right, two smaller cyan circles are stacked vertically, labeled 'MODEL CREATOR' and 'Warnings Generator'. The background features abstract geometric shapes in shades of purple, pink, and blue.

... for NO2 Forecasting Model

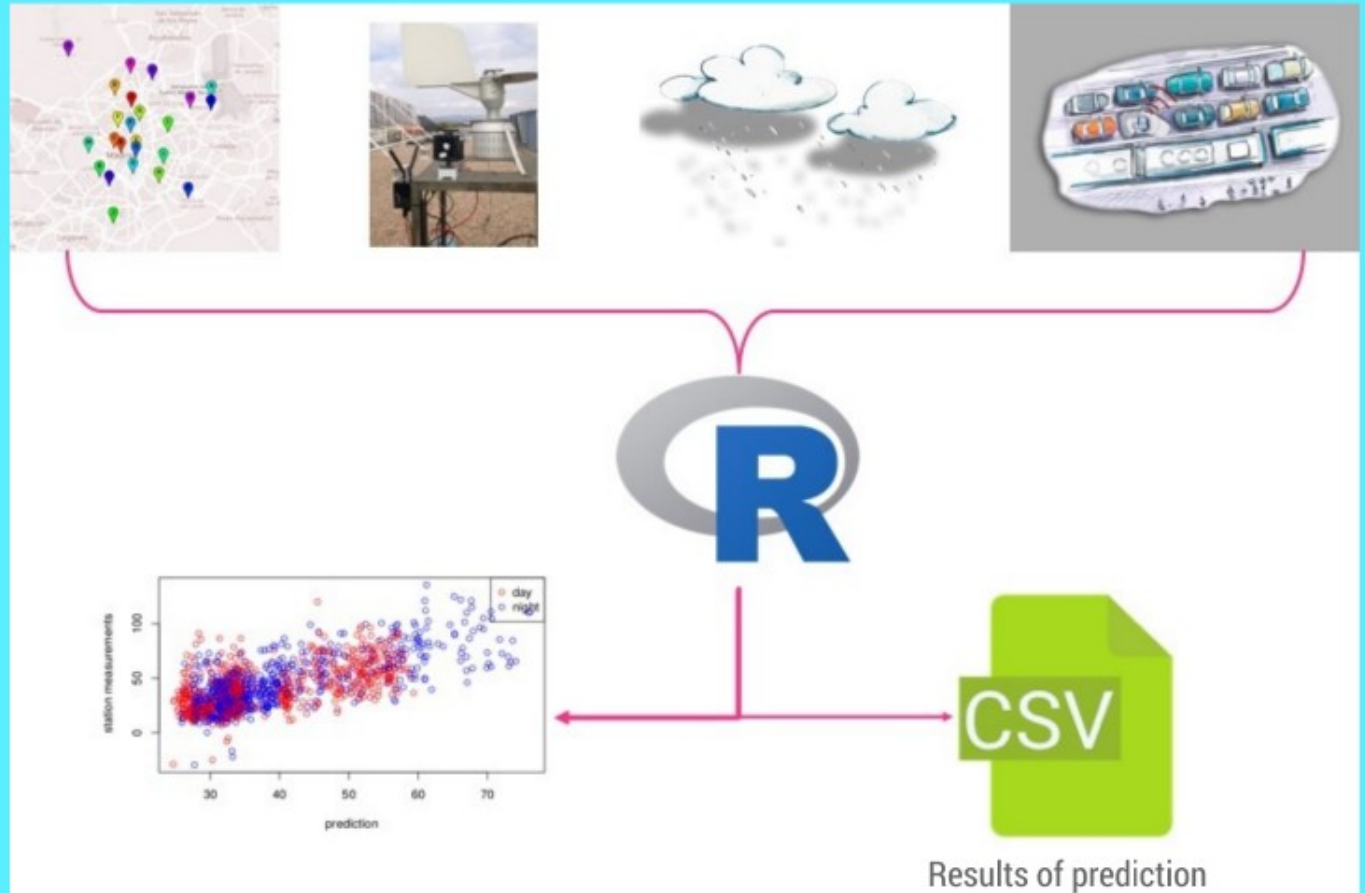
Model to forecast Nitrogen Dioxide concentrations

**MODEL
CREATOR**

**Warnings
Generator**

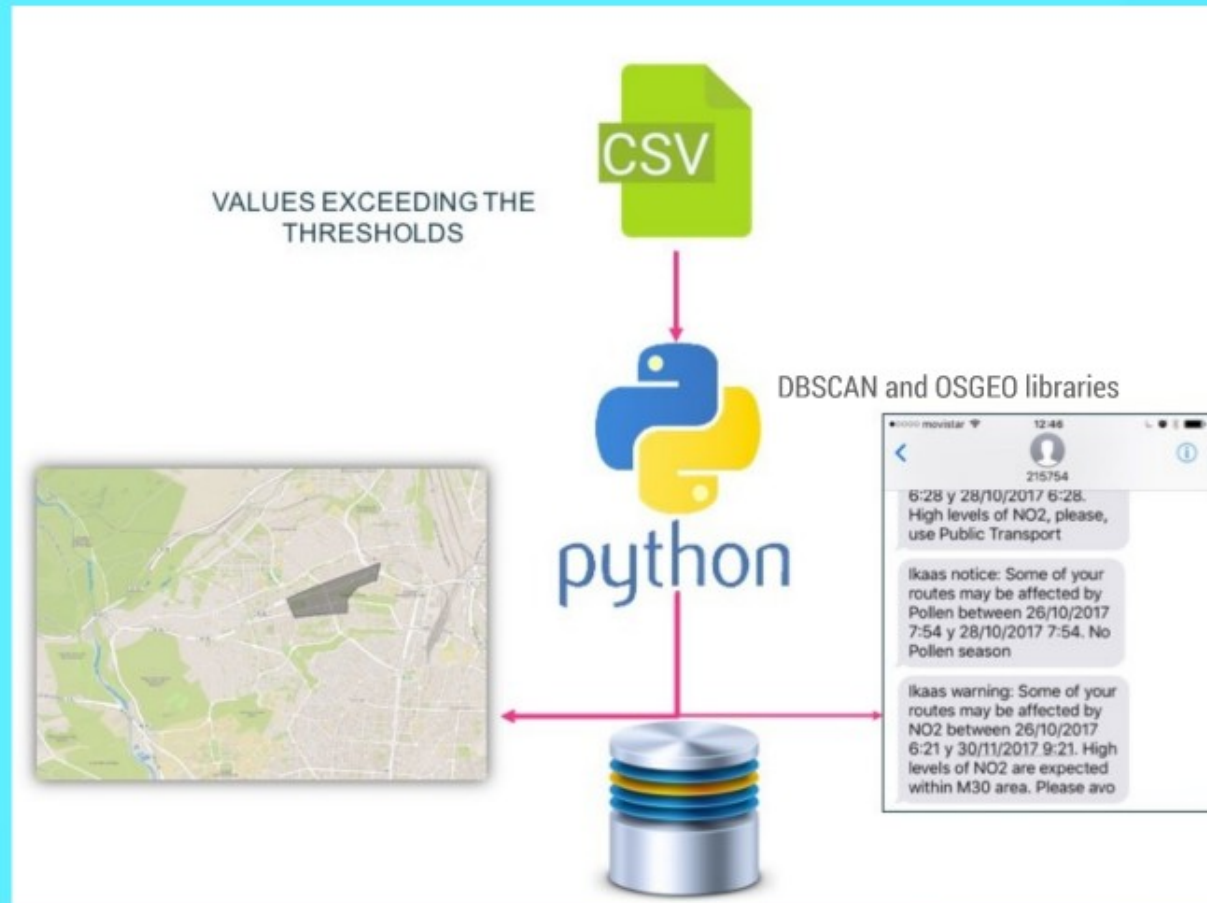
MODEL CREATOR

- Spatio-temporal modelling: 24 fixed monitoring stations, hourly data, from 2001 to present.
- Model: numerical pollution predictions based on regression-kriging.
- Exploit spatio-temporal characteristics of the data: forecasts in time and space (future concentrations in arbitrary locations-grid).



Warnings Generator

- For each of the groups (cluster) obtained, a list of points (longitude, latitude) is created with the smallest convex polygon.
- These polygons are converted on Warnings in the database
- This allows to launch messages related to favorite routes and routes on demand.



Data Ingestion and Integrator Architecture



Process developed to integrate
captators and devices

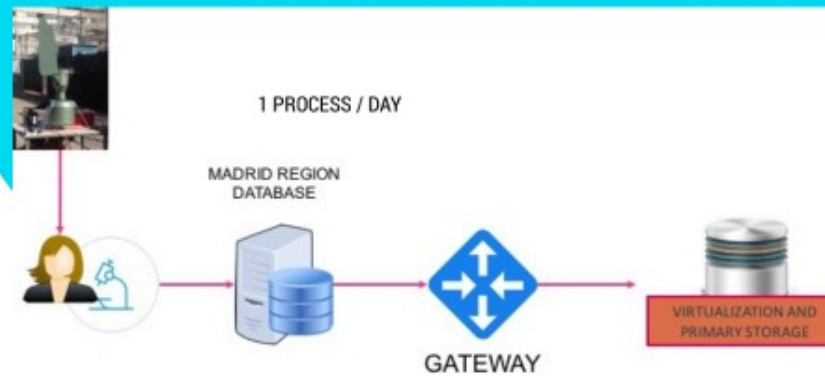
FROM EXISTING
INFRASTRUCTURE

FROM NEW
MOBILE
SENSORS

DEVELOPED API REST FOR GETTING AND STORING DATA
FROM OPEN DATASHEET OF POLLUTANTS AND METEOROLOGIC
INFORMATION OF MADRID CITY COUNCIL



DEVELOPED API REST FOR GETTING AND STORING DATA
FROM INTERNAL POLLEN DATABASE OF MADRID REGION



INGESTING DATA FROM NEW SENSORS

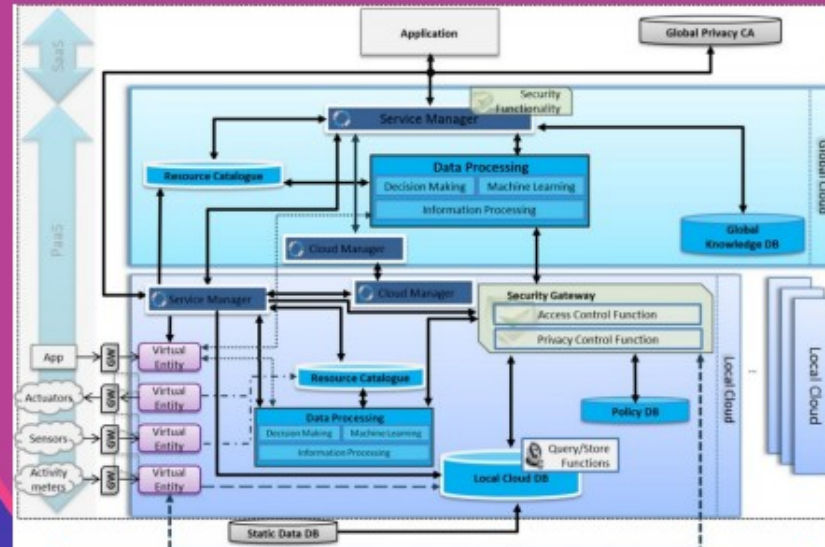


EVERY 5 MINUTES



DATA PROCESSING INTO iKaaS

Assuring stability of data



Data integration
Data processing
Learning function

GIS & NETWORK RESOURCES

New routes engine for public transport (Bike sharing,
Urban Bus) and Walking

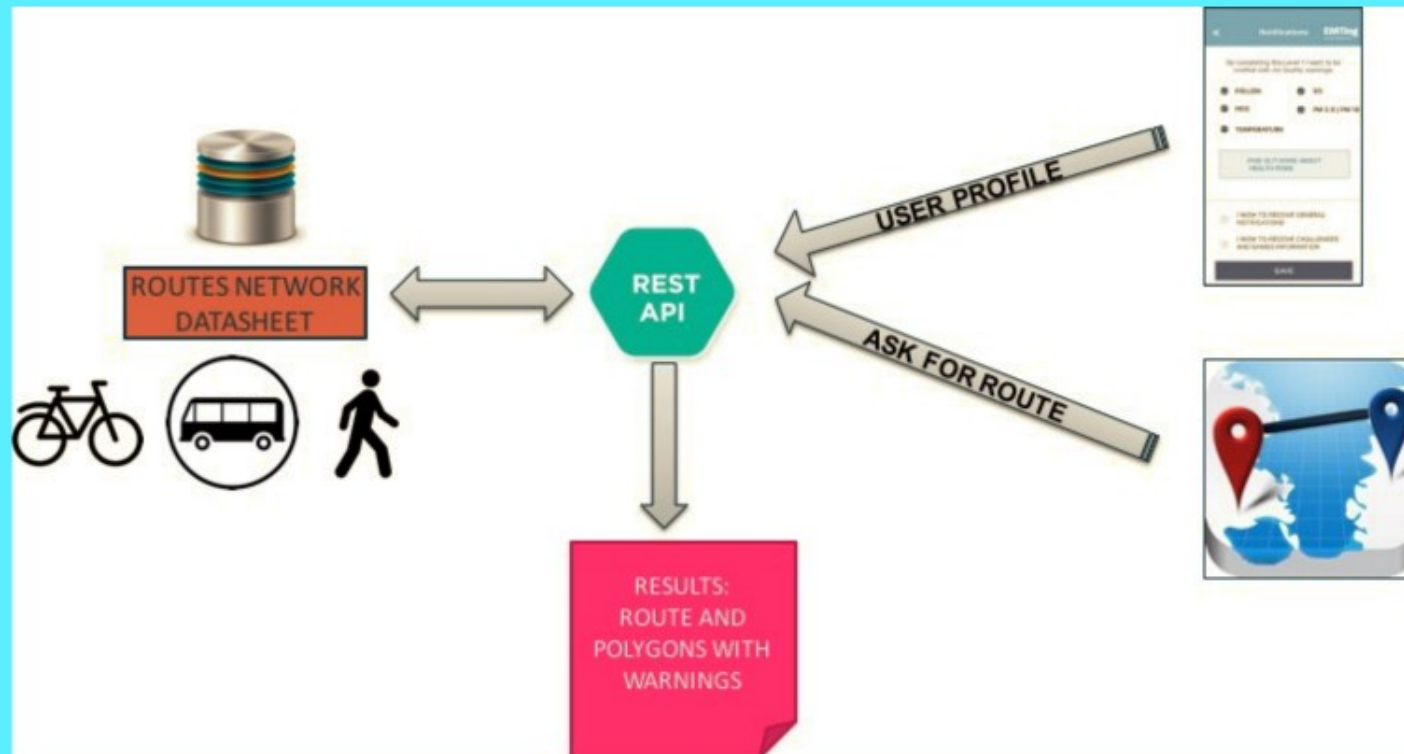


Opendata API
REST for
Routes (Part I)

Opendata API
REST. Alternative
Routes (Part II)

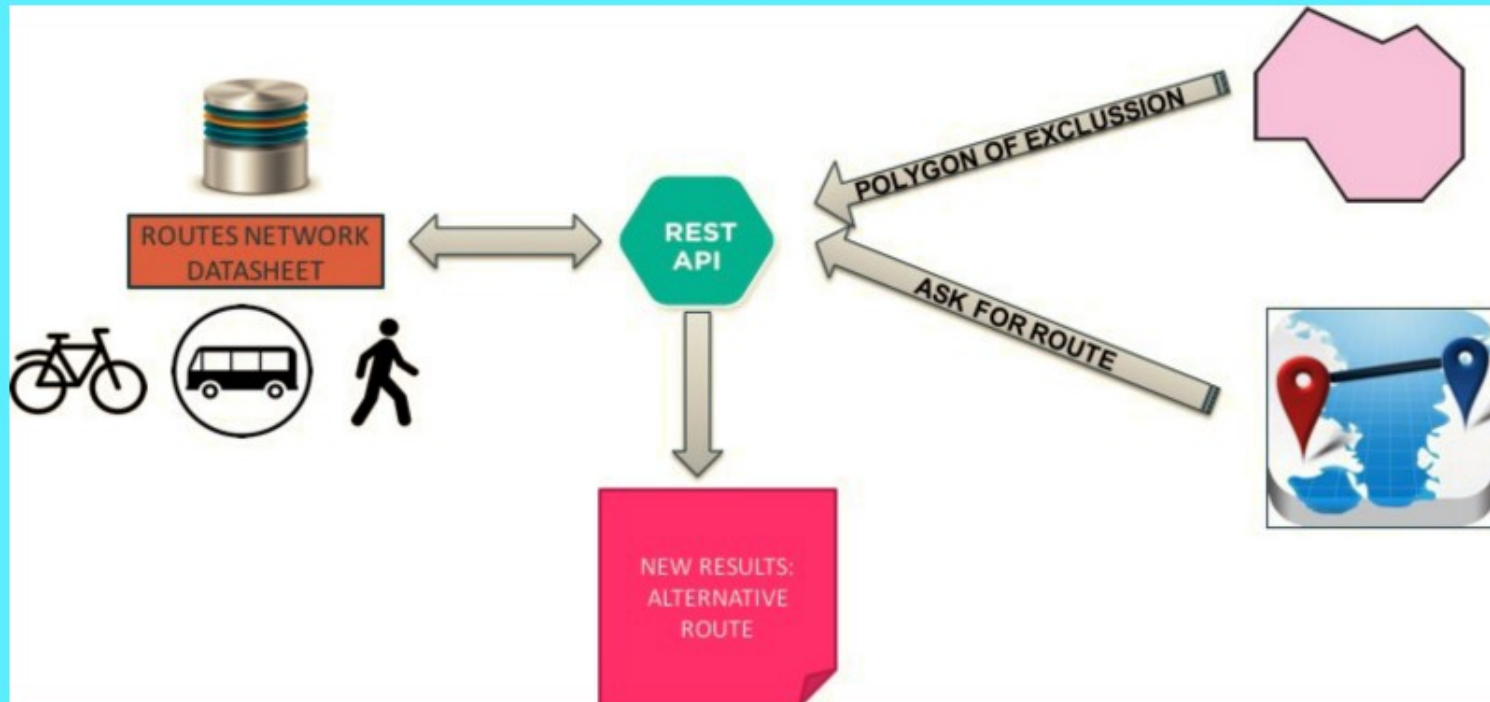
Opendata API REST for Routes (Part I)

Opendata API (WebService) has been developed to provide personalized Warnings related to the user profile and to cross check routes affected by environmental risk areas (polygons)



Opendata API REST. Alternative Routes (Part II)

Opendata API (WebService) has been developed to ask for alternative routes when existing any Polygon with some warning related to health preferences.



iKaaS USERS



**User
Profiles**

**Cooperating
with users**

User Profiles

TYPES OF POLLUTANTS

Pollen
Ozone
Nitrogen dioxide
Particles
High Temperatures

ADMINISTRATION



ZONES

1 (Inside M30)
2 SE
3 NE
4 NW
5 SW
ON DEMAND

**Madrid Environmental
Health service**

NOTICE SERVICE (Informative)

Pollen and pollution values

WARNING SERVICE

High level of Pollen and Pollutants
Health routes
Health recommendations

Cooperating with users

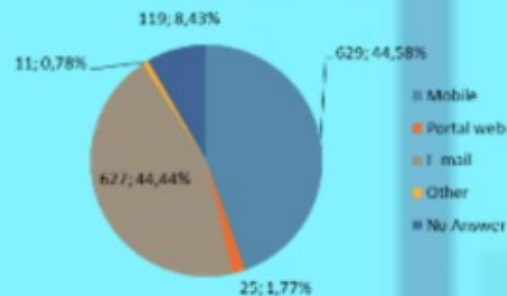
**Survey: user
feedback**

**Y3 Field
test**

Survey: user feedback

1411 participants / 99%
wants to get this kind of
information

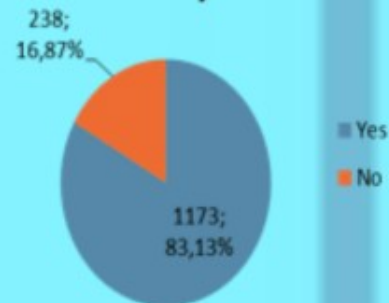
Information preferences



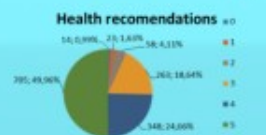
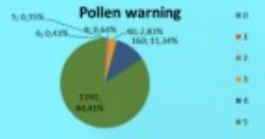
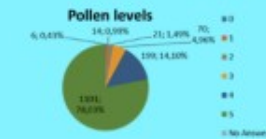
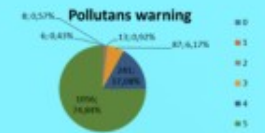
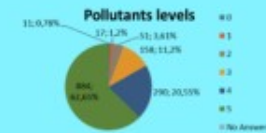
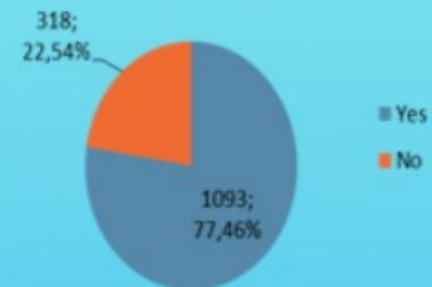
Enviromental health information service



Healthy routes



Health profile



Y3 Field test

- Field testing with selected population
- Start: September 9th / End: November 7th
- Results:

Number of users: 44

Number of routes: 77

Messages sent:

By sms: 389

By email: 250

Notices: 592

Pollen: 212

NO2: 190

PM: 56

O3: 102

Temperature: 32

Warnings: 47

Pollen: 19

NO2: 9

PM: 5

O3: 6

Temperature: 8



Visualization Portal

To visualize in Real Time all the integrated environmental (Pollutants, Meteorology, Airborne Pollen) and traffic information.

<http://195.57.112.129:81>

How does it work?

- Data are observed from Madrid Local Cloud using DDP Protocol (Reactive Server).
- Panels selector allows to check what kind of pollutants does user wants to view.
- Different active warnings are showed in the bottom area.
- Data is offering in Opendata mode.



User Portal & App

<http://labs.emtmadrid.es/CareRoutes/>
Managing Warnings, Routes and Subscriptions

The Madrid iKaaS Use Case Storyline

Ms Akiko arrives in Madrid for a meeting

Ms Akiko, aged 33, is a Japanese worker, that is now in Madrid for business, she has to stay in the city for several days. She is going to stay in a hotel in the centre of the city and one of her hobbies is to practice running at least half an hour every day, and she's planning to go to Retiro's park for practicing it. Ms Akiko suffers pollinosis and asthma, so she is very interested in air quality in each city when she has to travel.



iKaaS PORTAL
SANITARY SERVICES
HEALTH WARNINGS
OTHER USER INFORMATION



Registry process

The environment

Setting preferences

Creating "my Favourites routes"

Admin UI - Launch notices and warnings

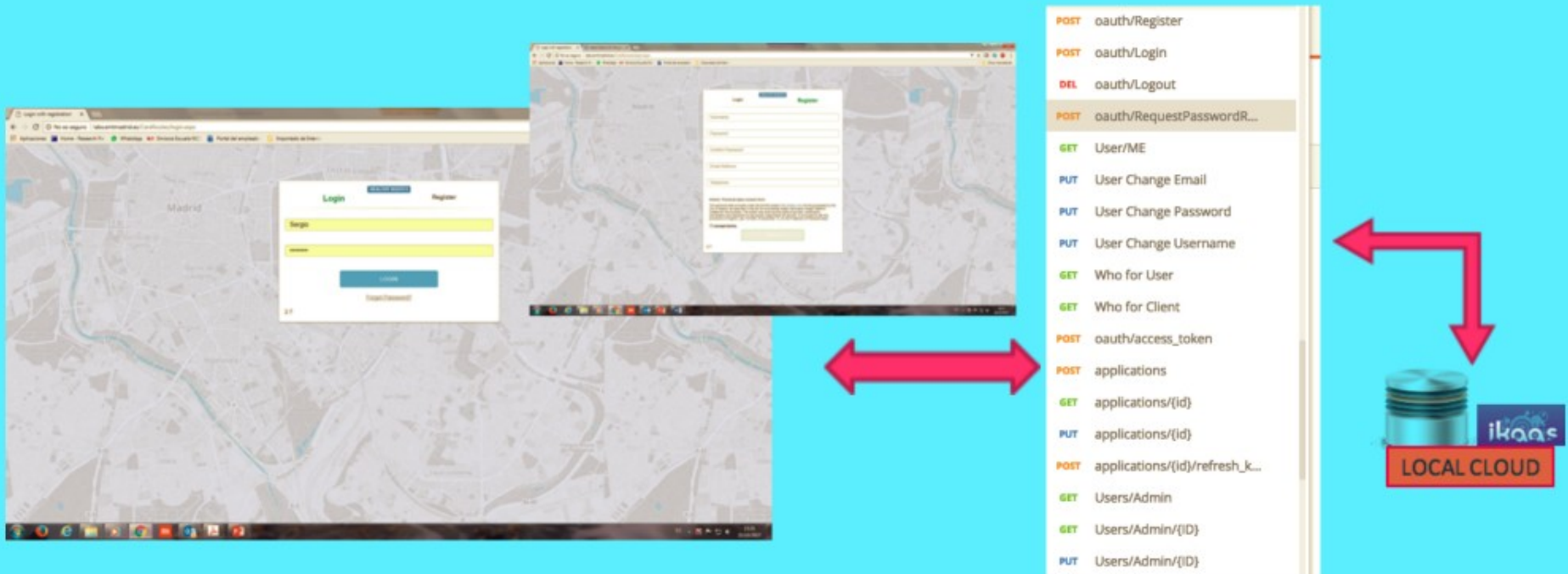
Android App User Interface

Service Warnings



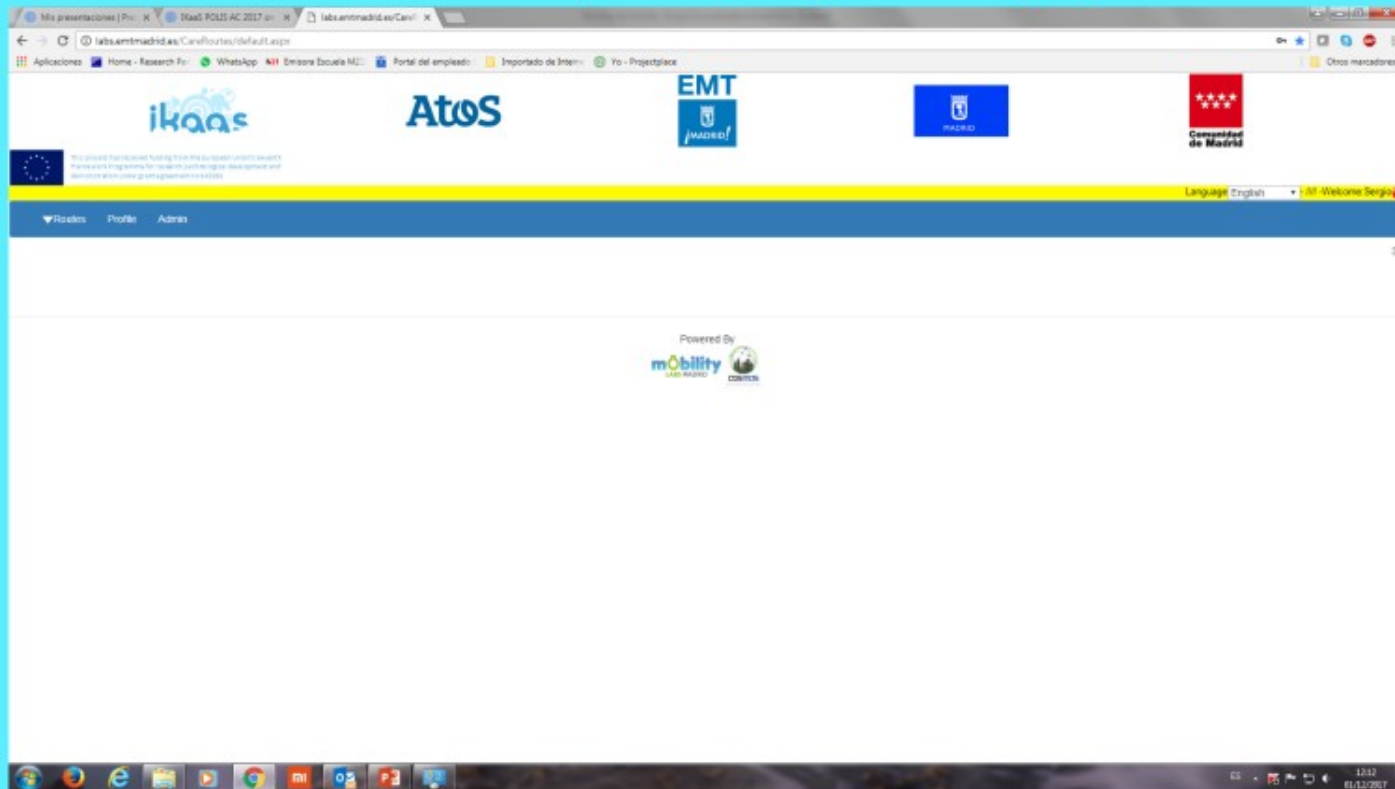
Registry process

System allows a Local Registry using oAuth. The repository of APIs contains methods for interchange of profiles between with Global Cloud Security Datamodel and Madrid Local Cloud



The environment

Three tabs: Routes / Profile/ Admin (this one, only for managers)



Setting preferences

Choose pollutants / pollen information to receive

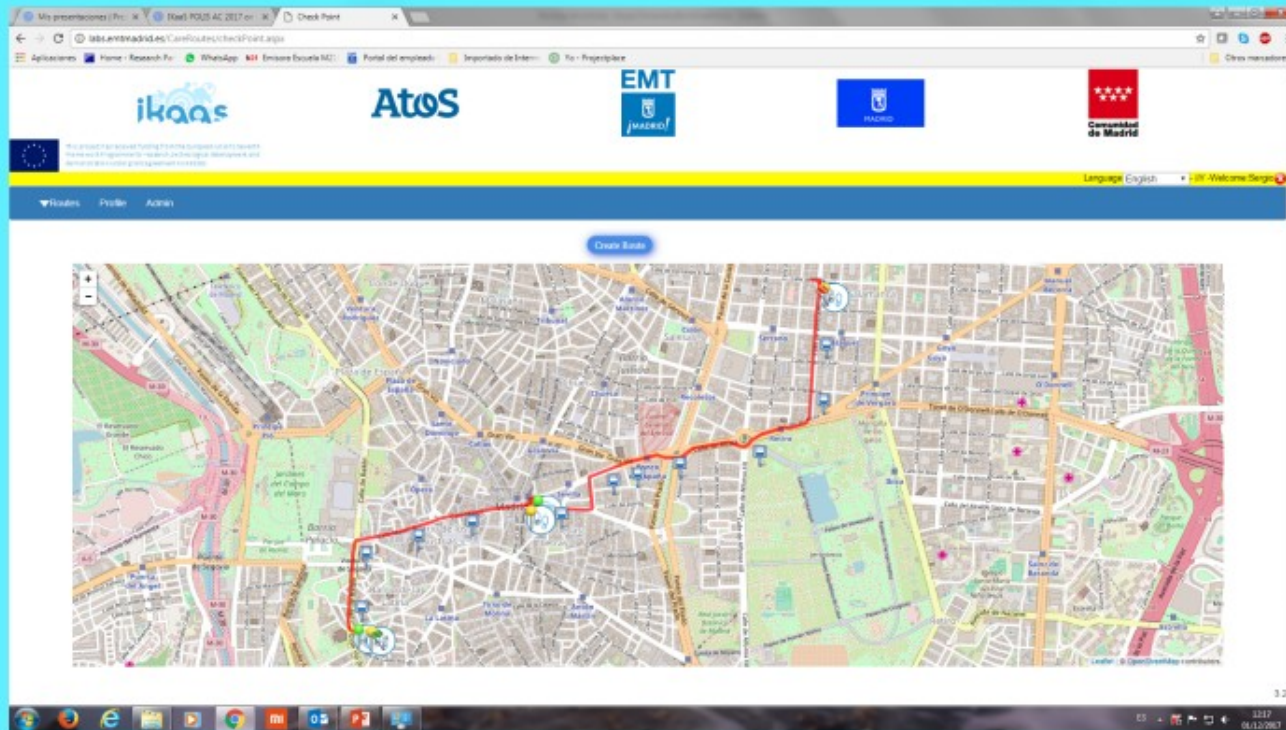
Fill with your phone number / email

Learn more about health risks <http://labs.emtmadrid.es/CareRoutes/aboutHealthRisks.html>

The screenshot shows a web browser window displaying the 'My profile' section of the EMT Madrid website. The page has a blue header with logos for 'ikaas', 'Atos', 'EMT MADRID', and 'Comunidad de Madrid'. Below the header, there is a navigation bar with 'Routes', 'Profile', and 'Admin' tabs. The 'Profile' tab is active, showing two main sections: 'My profile' and 'Change of password'. The 'My profile' section includes a list of pollutants to receive: Pollen, O3, NO2, PM10, and High temperature, all of which are checked. Below this list are input fields for 'Telephone' (containing '629602715') and 'Email' (containing 'jorge.fernandez@emtmadrid.es'). A 'Learn more about health risks' link is also present. The 'Change of password' section has fields for 'Password' and 'Repeat Password', with an 'Update' button. The page is powered by 'mobility' and the browser's taskbar is visible at the bottom.

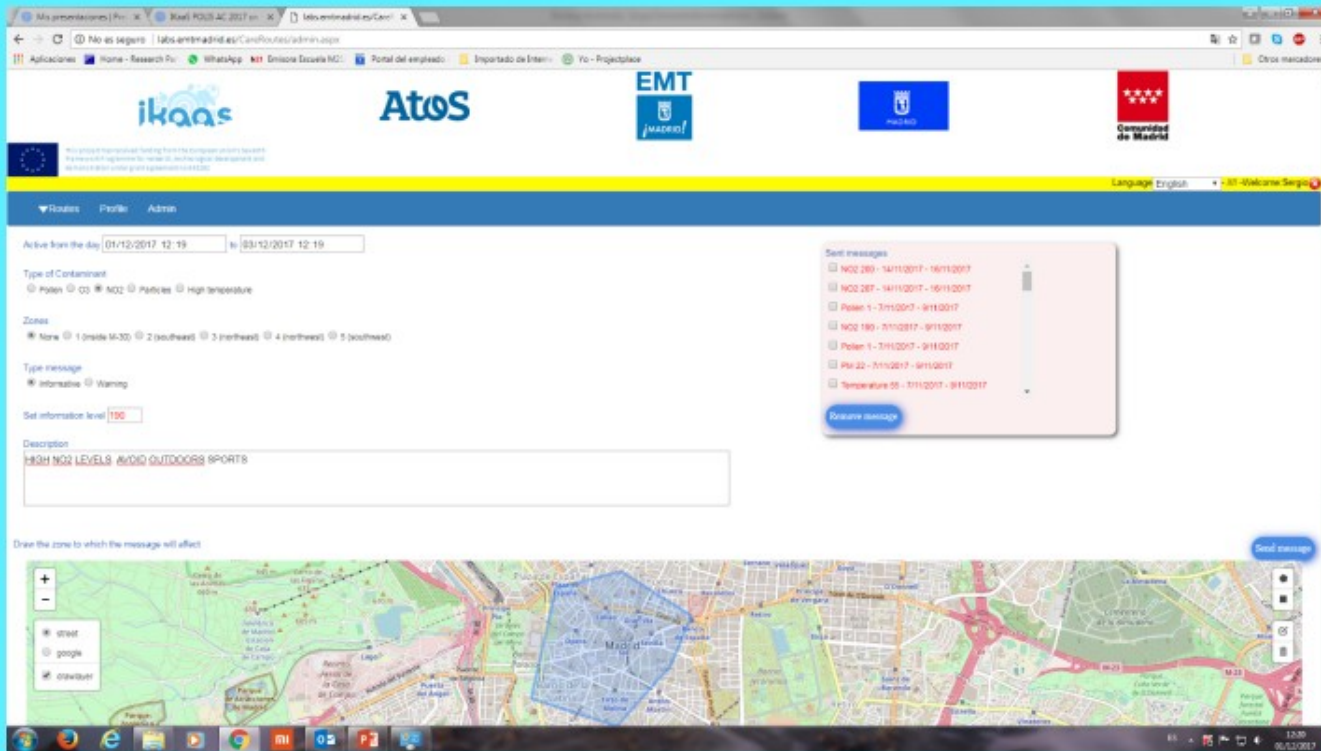
Creating "my Favourites routes"

Option used for define "usual" routes. Allows to system to anticipate messages (warnings) before the user is "on route".



Admin UI - Launch notices and warnings

Support definitions of polygons of pollutants, categorization, managing and launching warnings. Contains engine for sending eMails, SMS and Telegram bots.



Android App User Interface

Used for route planning and healthy alternative routes in Real Time

Download the app at this link <https://drive.google.com/open?id=0BxV35hOe6bHLYXUxbFc5VFVfdUk>



User
Registry

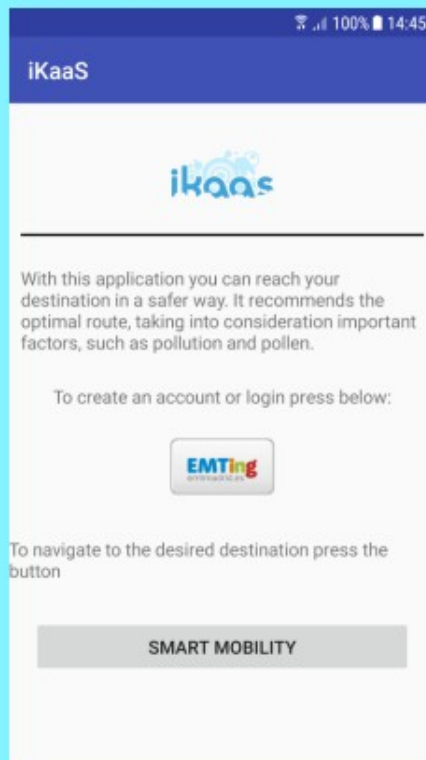
Choosing
parameters

Selecting
Origin and
Destination

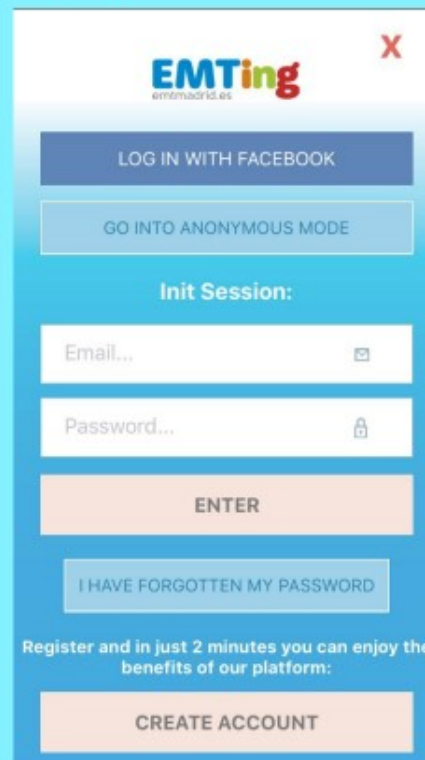
Selecting
alternative
routes

User Registry

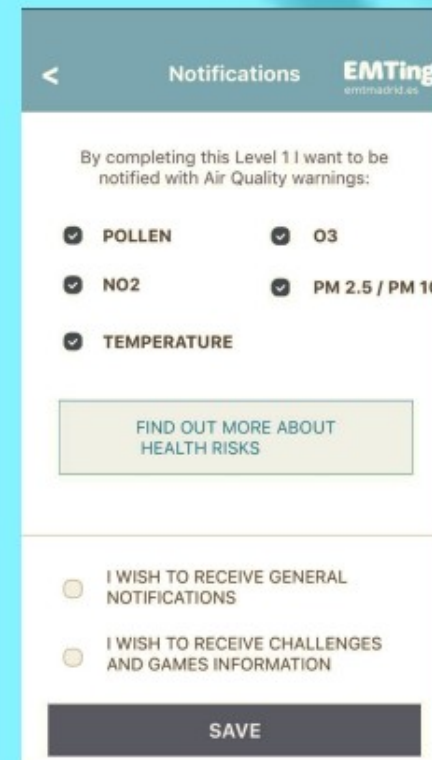
Implementation of iKaaS User preferences has been integrate into a special SDK for transport named EMTING. Achivement: Healthy user preferences and warnings now belongs as part of estable Madrid Transport Infraestructure



The iKaaS app interface features a blue header with the 'iKaaS' logo. Below the header, there is a description of the app's functionality: 'With this application you can reach your destination in a safer way. It recommends the optimal route, taking into consideration important factors, such as pollution and pollen.' This is followed by a prompt to 'To create an account or login press below:' and a button labeled 'EMTING'. At the bottom, there is a button labeled 'SMART MOBILITY'.



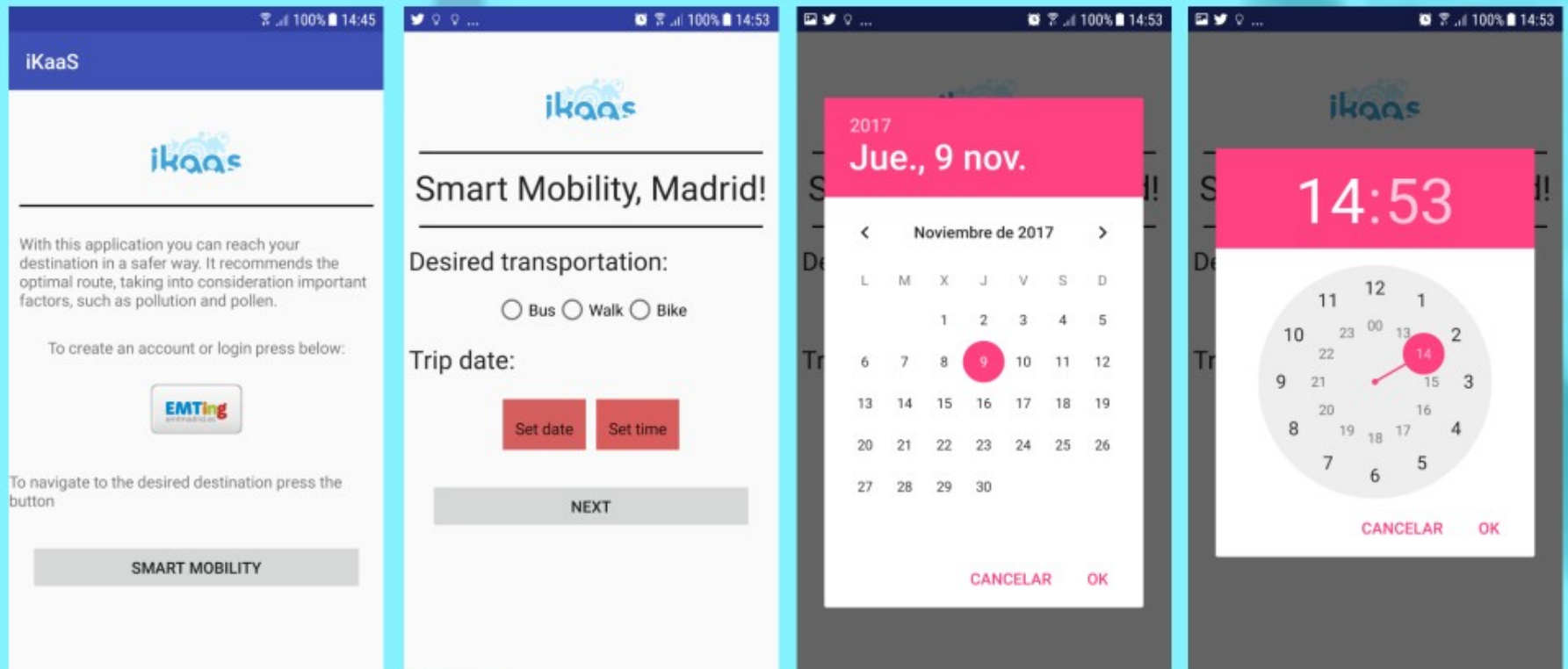
The EMTing app interface has a white header with the 'EMTING' logo and a red 'X' icon. It offers two options: 'LOG IN WITH FACEBOOK' and 'GO INTO ANONYMOUS MODE'. Below these is a section titled 'Init Session:' with input fields for 'Email...' and 'Password...', followed by an 'ENTER' button. A link 'I HAVE FORGOTTEN MY PASSWORD' is also present. At the bottom, a message states 'Register and in just 2 minutes you can enjoy the benefits of our platform:' followed by a 'CREATE ACCOUNT' button.



The EMTing app notifications interface has a grey header with a back arrow, the title 'Notifications', and the 'EMTING' logo. The main content area states 'By completing this Level 1 I want to be notified with Air Quality warnings:' and lists several notification categories with checkboxes: 'POLLEN', 'NO2', 'TEMPERATURE', 'O3', and 'PM 2.5 / PM 10'. A button 'FIND OUT MORE ABOUT HEALTH RISKS' is located below the list. At the bottom, there are two radio button options: 'I WISH TO RECEIVE GENERAL NOTIFICATIONS' and 'I WISH TO RECEIVE CHALLENGES AND GAMES INFORMATION', followed by a 'SAVE' button.

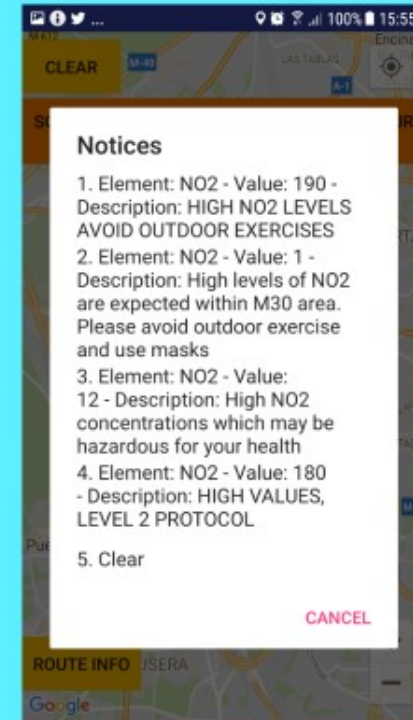
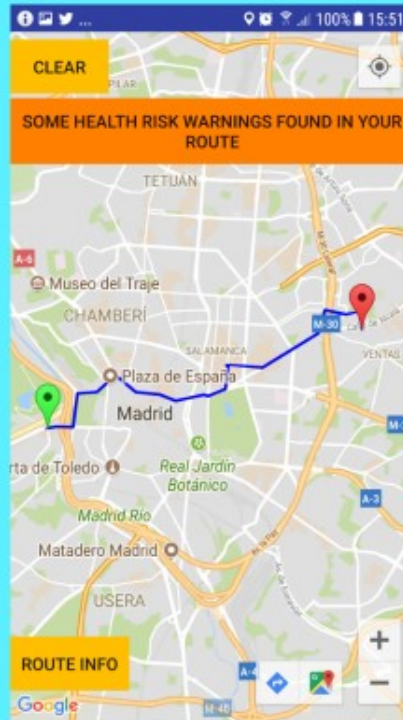
Choosing parameters

Mode of transport, then date and time



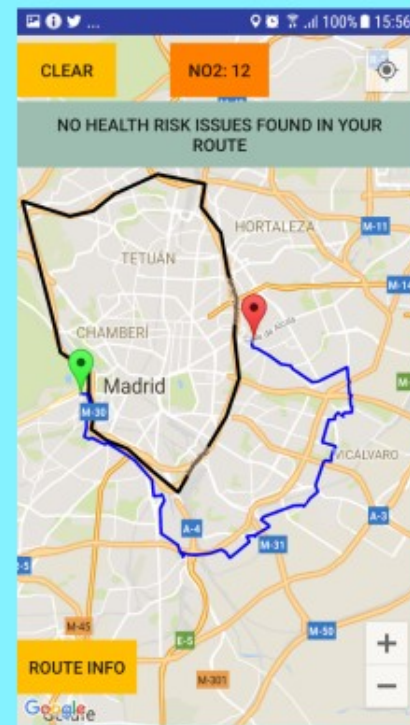
Selecting Origin and Destination

By clicking on the screen, set origin and destination. If the route is affected by any environmental parameter, the "choose risk warning" option will activate, and by clicking on it we can see the active notices and choose anyone



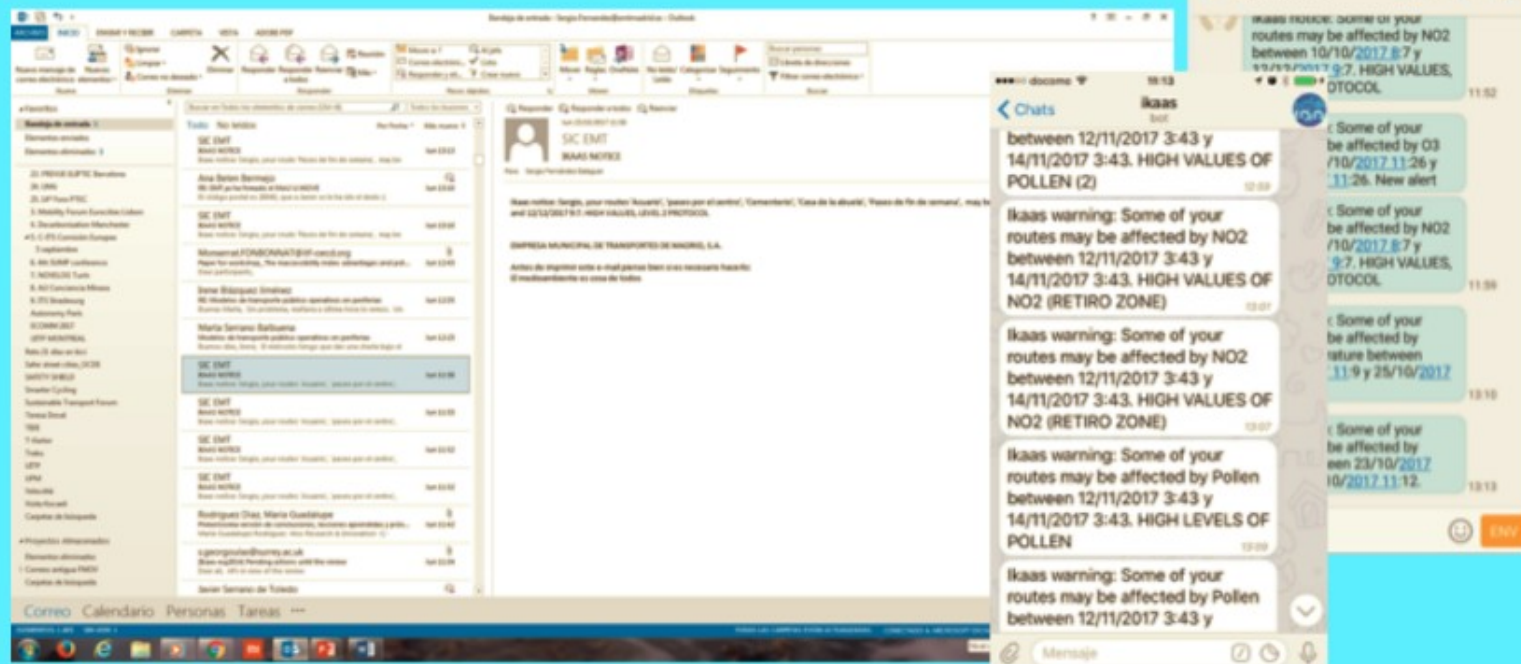
Selecting alternative routes

Once we have chosen the notice, we can visualize that our route crosses the polygon in which the notice is active. By clicking on "alternative route" the app will show us the alternative healthy route



Service Warnings

Whenever any of your routes is affected by any notice or warning, you may get the info via email, Telegram Bot or Sms.





WHAT'S NEXT

