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P.I.E.N.O.

***P**etrol-filling **I**tinerary **E**stmation a**N**d **O**ptimization*

Website: pieno.dev

Agenda



Motivation

The idea behind P.I.E.NO and its benefits

Functioning

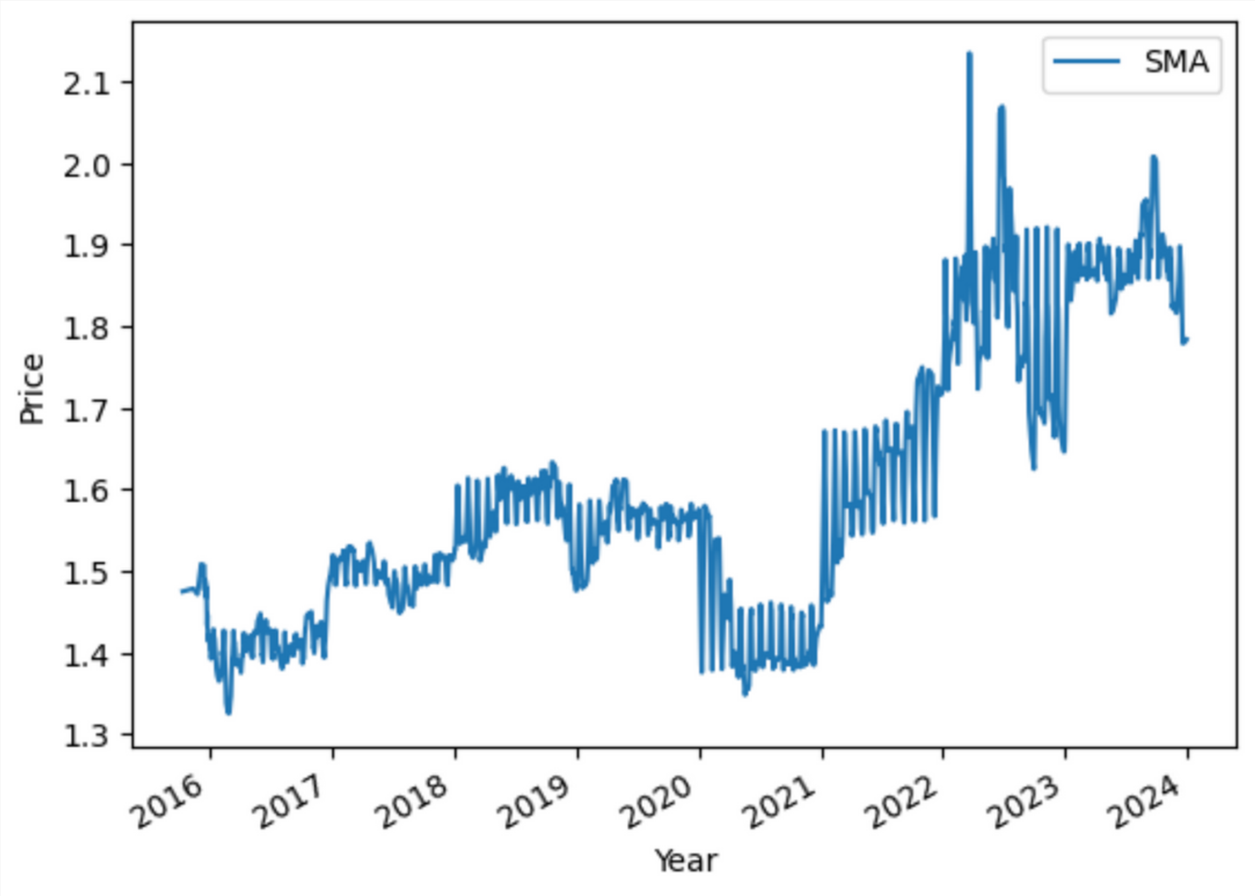
An overview of all the features

Demo

A final demonstration of our work

Motivation

- Fuel price had a non linear increase in the last 8 years;
- Searching for the cheapest gas station can be a real challenge, even more when the car is in reserve;
- We have to take into consideration a lot of different parameters.



Our Solution - P.I.E.NO

- An IoT solution with real-time fuel level monitoring;
- Automatically alerts the user when the car is in reserve;
- “Identifies the best fuel station for any situation”;
- Optimal fueling cost calculation;
- An user-friendly mobile app;
- Machine Learning Prediction for price trend.



Benefits

- Reduces significantly fuel expenses;
- Increases efficiency in refueling;
- Easy to use and practical;
- Fully customizable.

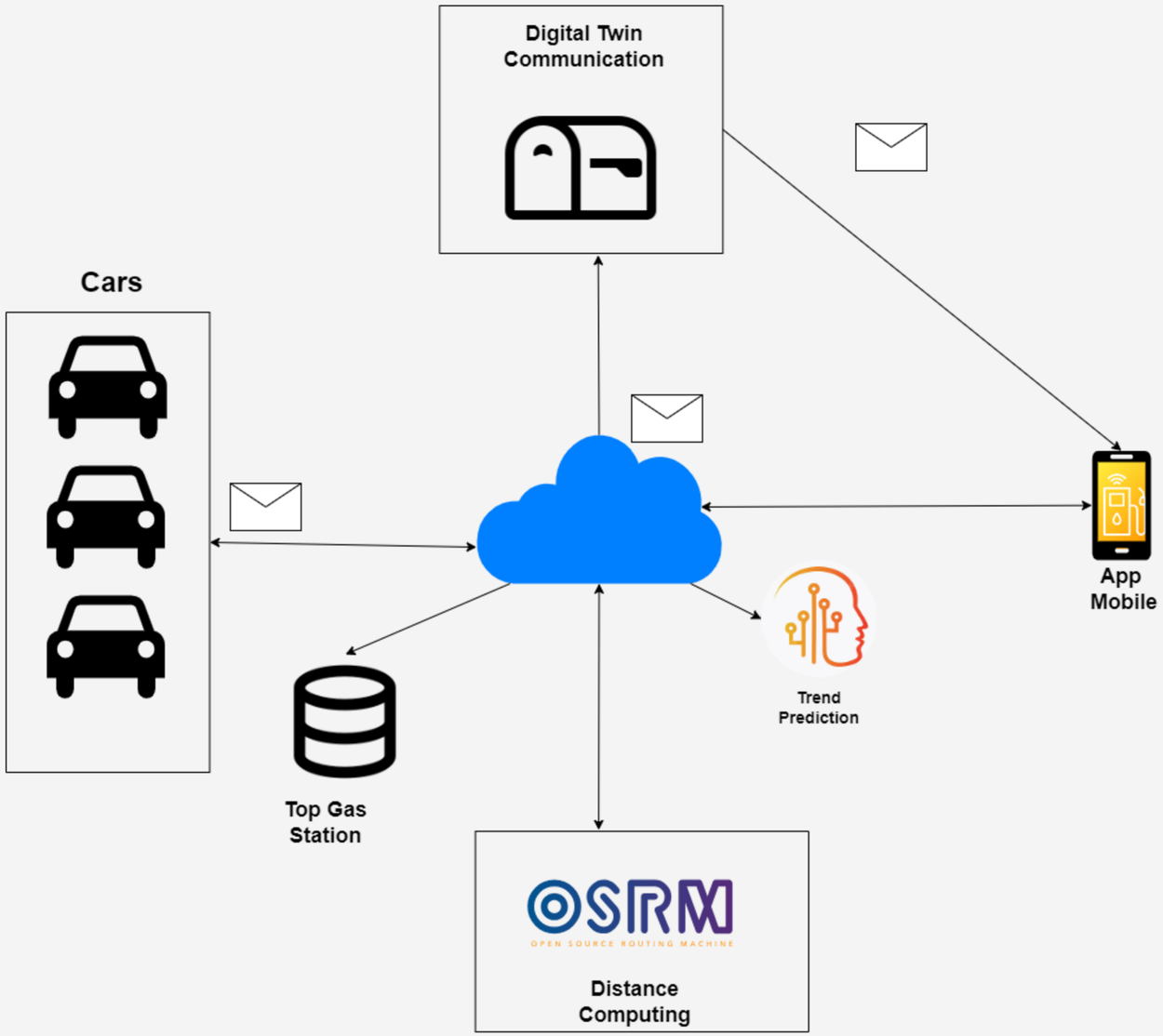


Possible customers

- Transport companies;
- Supermarkets;
- Public transportation;
- Regular people.



Overview


Digital Twin
Communication
Cars
App
Mobile
Trend
Prediction
Top Gas
Station
OSRM
OPEN SOURCE ROUTING MACHINE
Distance
Computing

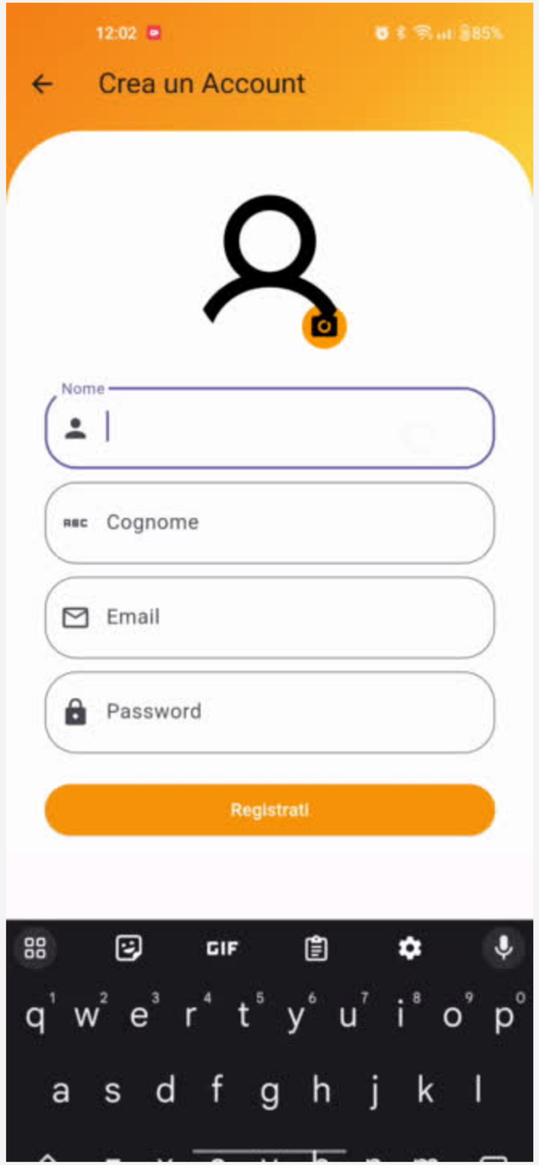
Mobile Application

- Login and Registration;
- Homepage;
- Personalized experience;
- Gas station research features.



Login and Registration

- Email and password authentication;
- Associates the cars to a specific owner;
- Once the user is logged, they can access to the application.



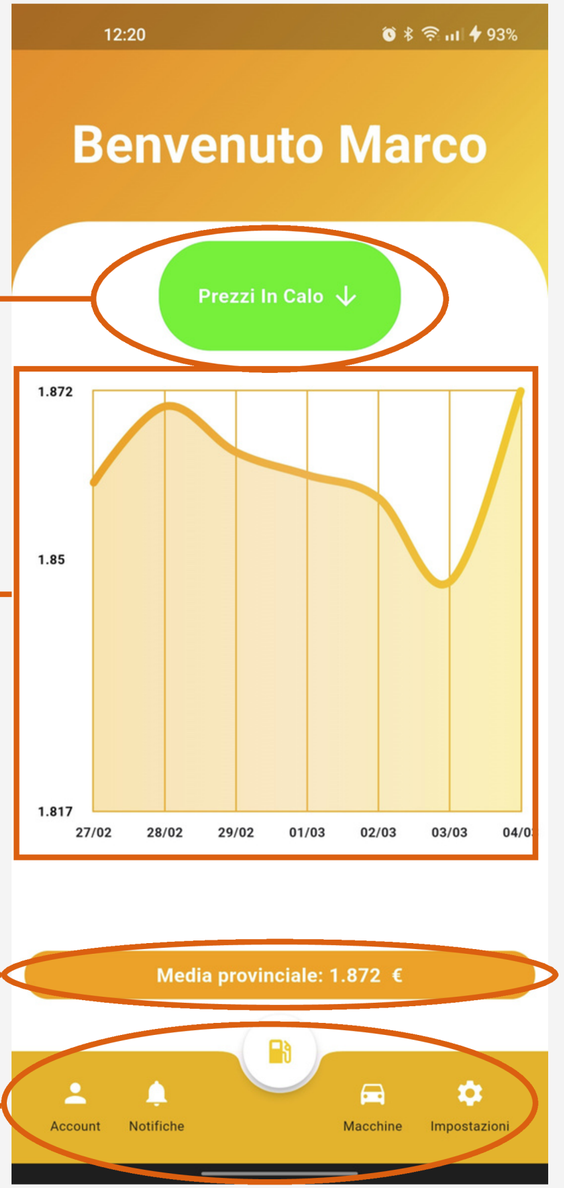
Homepage

Price trend prediction

Current trend graph

Provincial price average

Bottom bar



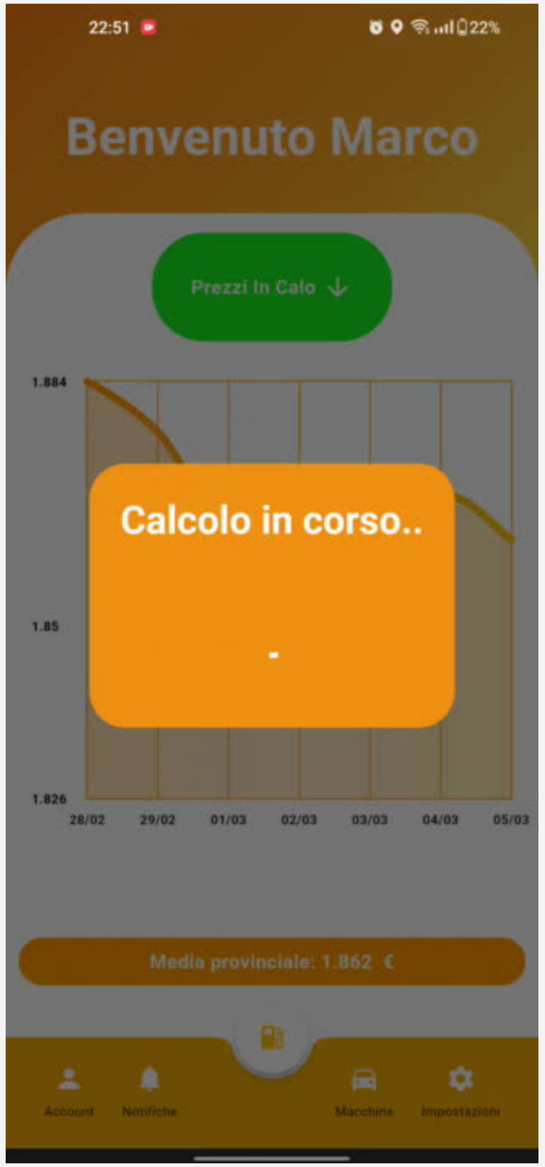
Car page

- Add your car(s);
- Specify all the needed information;
- Token association.



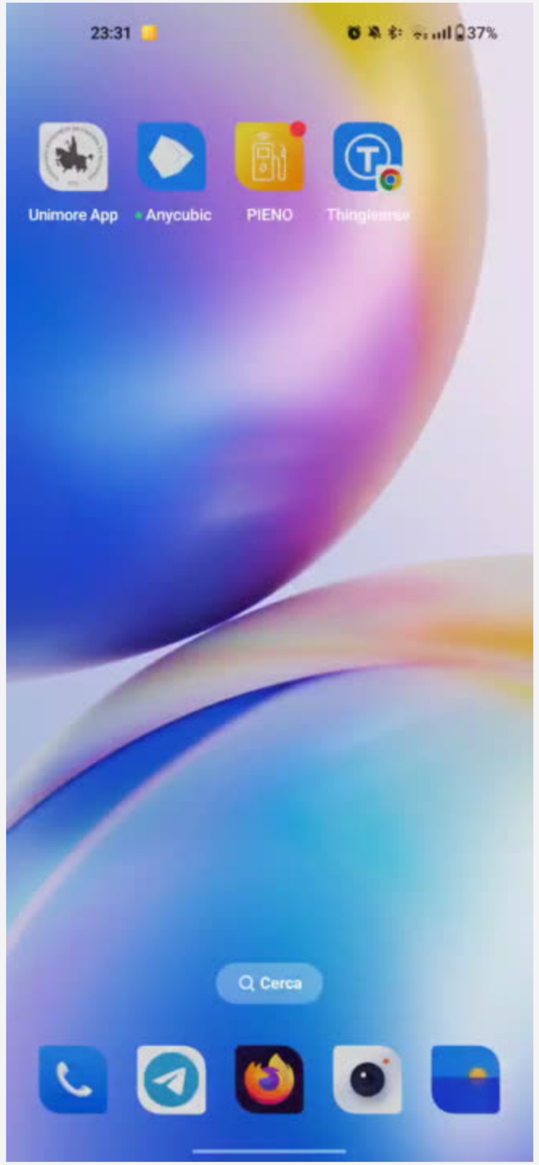
Gas station research

- Searches the best gas station around;
- Precise calculuation thanks to all the informations in the car page;
- Starts navigation once the gas station is found.

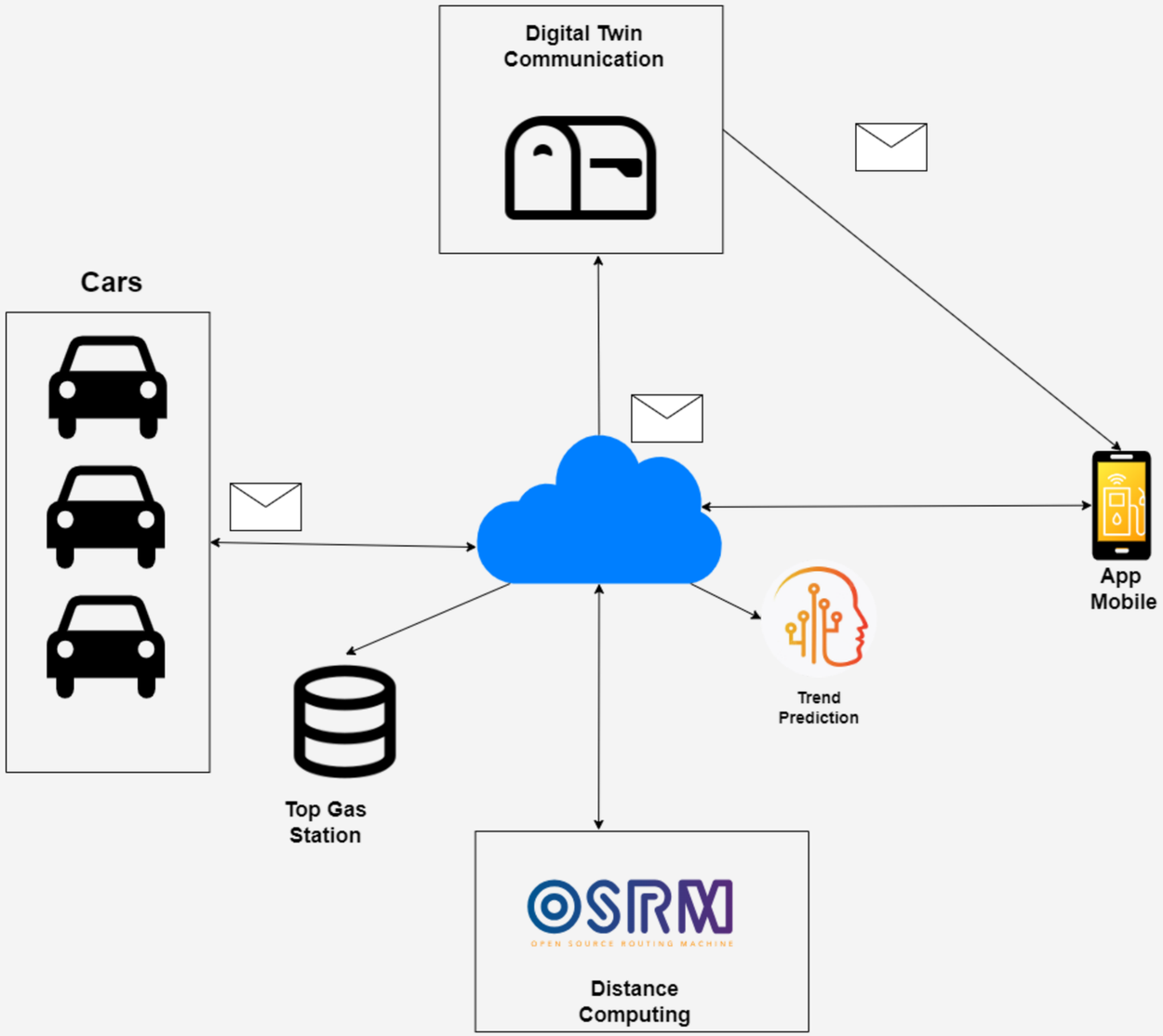


Reserve notification

- Notifies the user if the active car is in reserve;
- Faster way to open the app and obtain the best gas station.

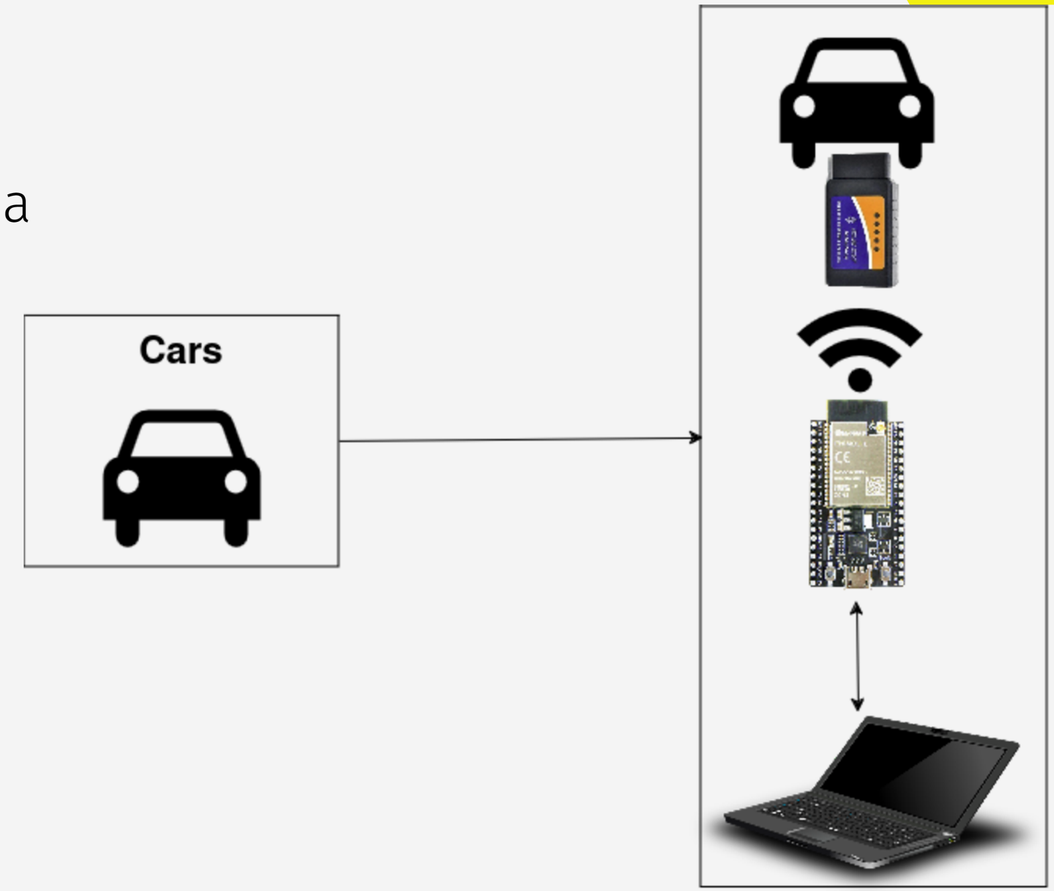


Overview

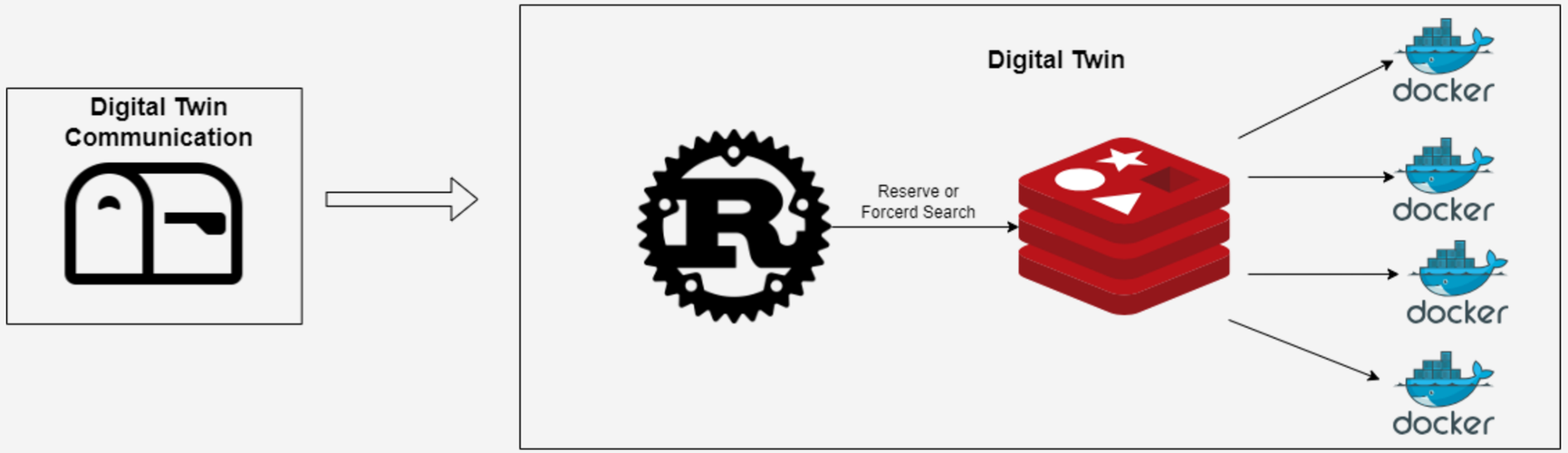

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Car connectivity

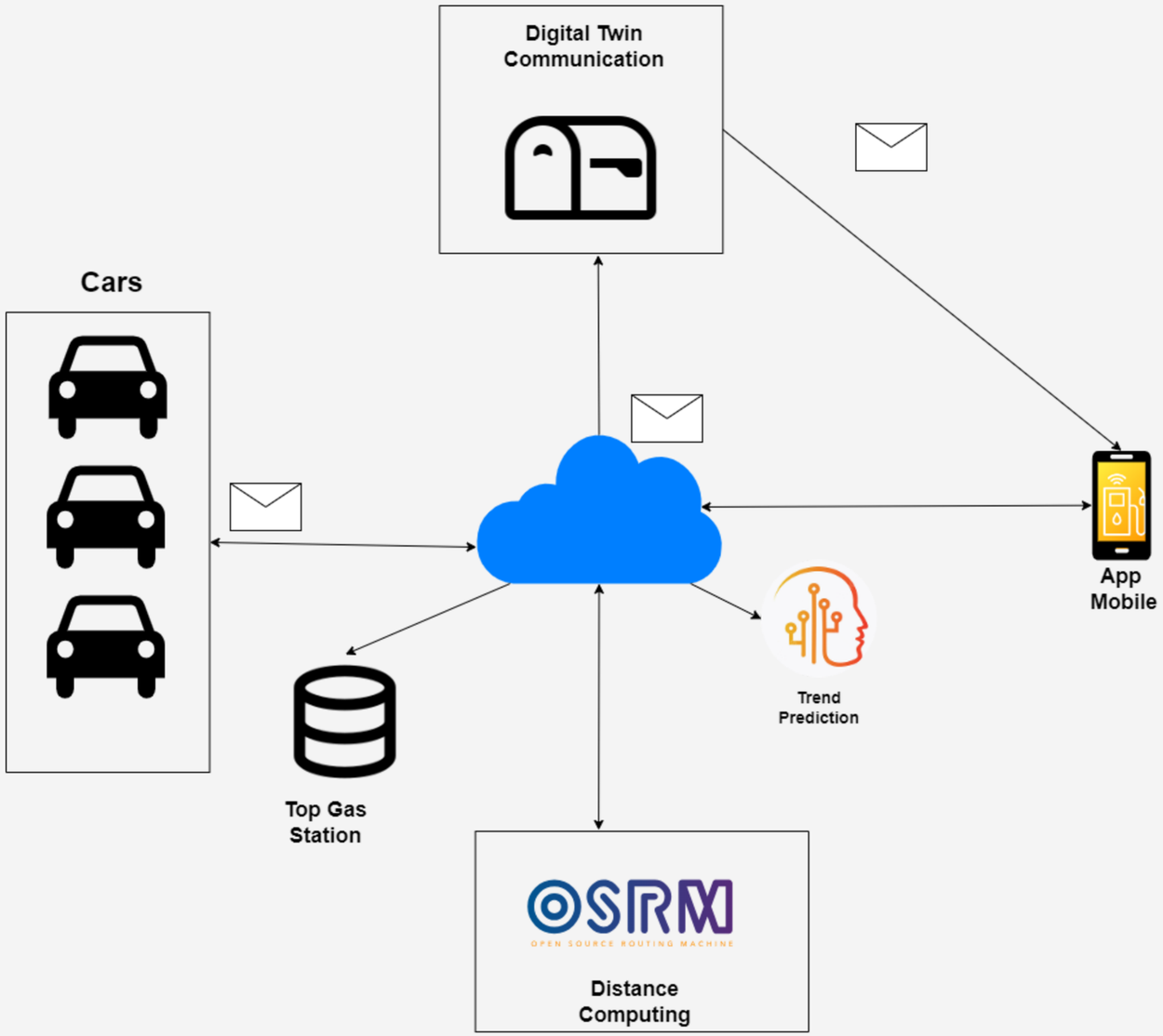
- Why a microcontroller?
- Retrieve information about gasoline percentage via CAN Standard;
- Wireless OBDII interface.



Digital Twin



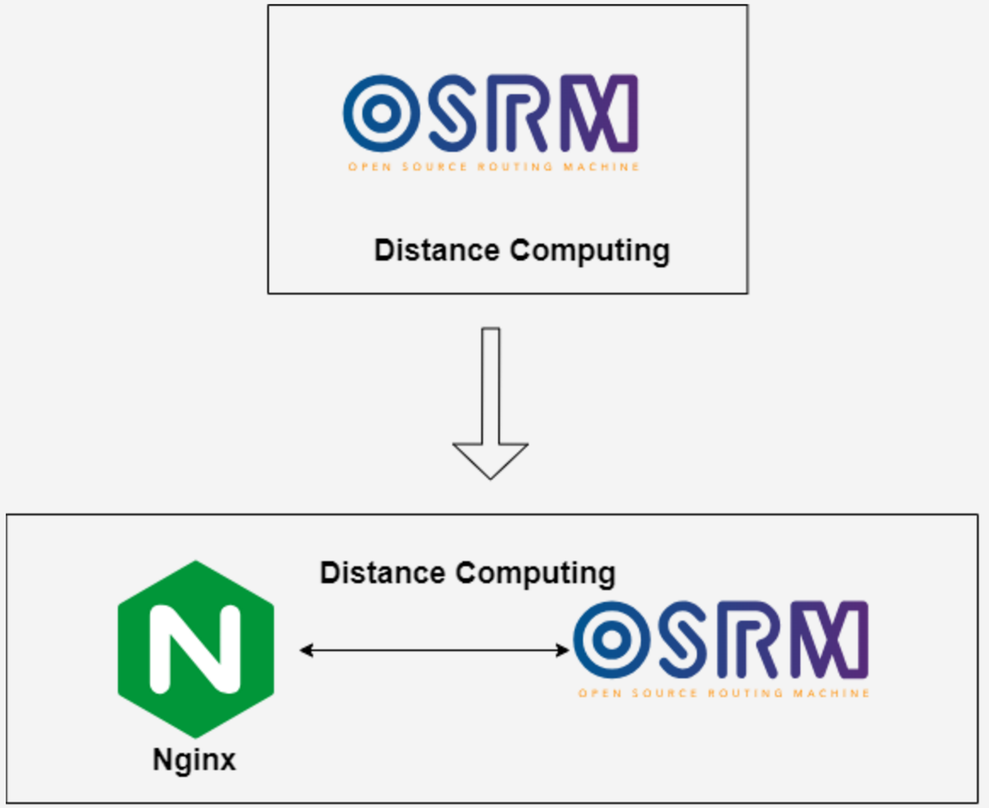
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Data retrieve

Distance calculation

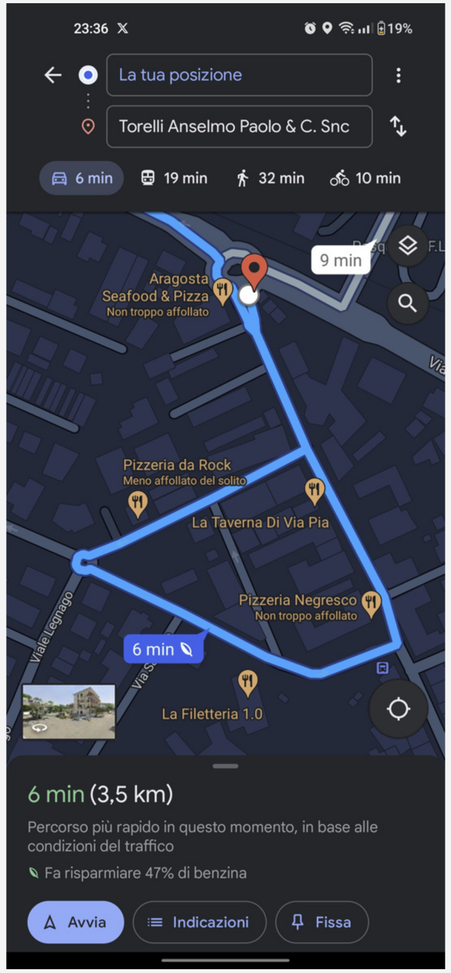
- Nginx authentication for security;
- Why OSRM? Fast, Open Source, Reliable

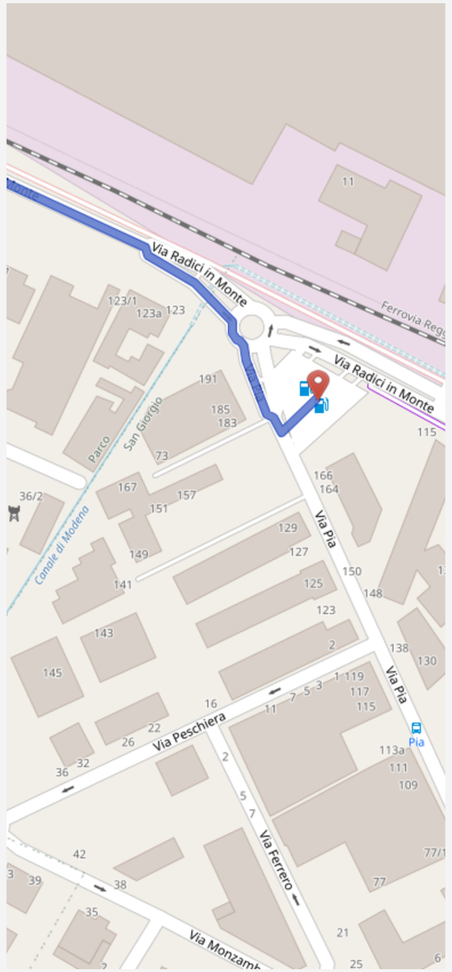


Google Maps

VS

OSRM





Data retrieve

Trend prediction

- Retrieve data for training from the end of 2015 to the end of 2023
- Every day, at 9 a.m. retrieves fuel price data from the Italian government website;
- Uses this data to calculate the average price for each day;
- Uses AI to predict the next day price trend.



Data retrieve

Trend prediction

ACCURACY	
OUR MODEL	OTHER TIME SERIES PREDICTIONS
0.67	~ 0.58



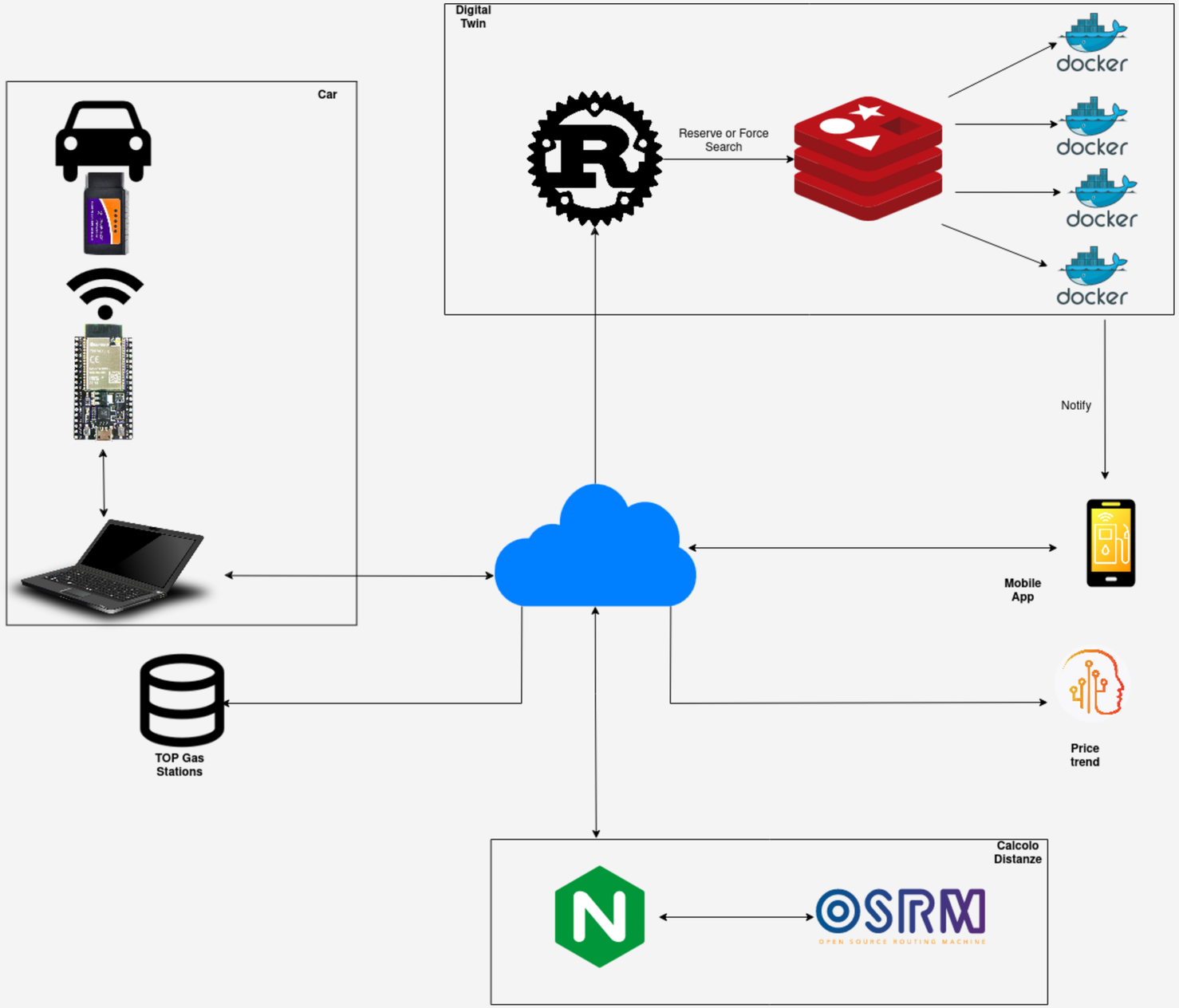
Data retrieve

Top gas station

- Every time a best pump is find, it becomes a “top” pump;
- Every car in the area will search in this DB before searching by itself;
- Cooperation between cars.



Complete Overview

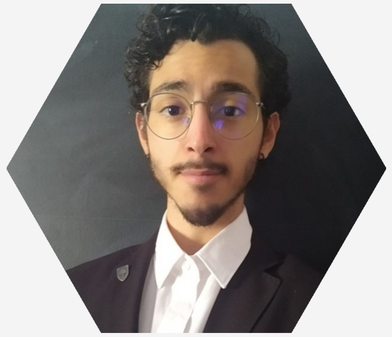


Thank you for the Attention



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