easyToll

Automatic toll payment based on *iota*

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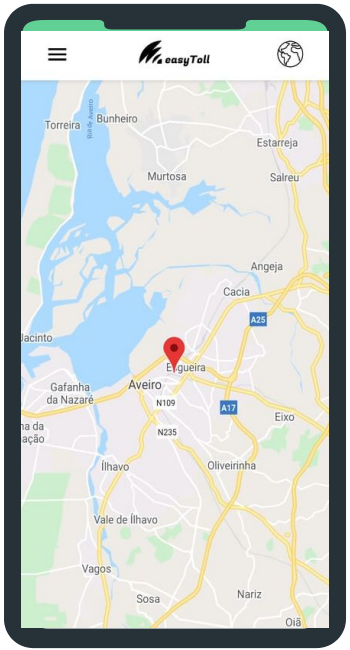
Introduction



Context

- 

  (Open Platform for development and experimentation of Mobility Solutions)

  Smart Mobility, Intelligent Transportation Systems and Vehicular Communications

- Emergence and evolution of cryptocurrencies like ***Iota***

Problem / Objective

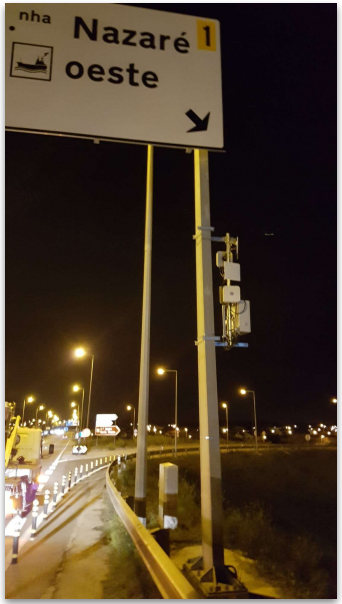
- Real time **Toll payment** via smartphone
- Mobile interface that implements **Iota-based** transactions
- Monitoring transaction data in a Web Platform

Possible Clients / Stakeholders

- Common user
- Highway infrastructure concession

RSU

Road-Side Unit



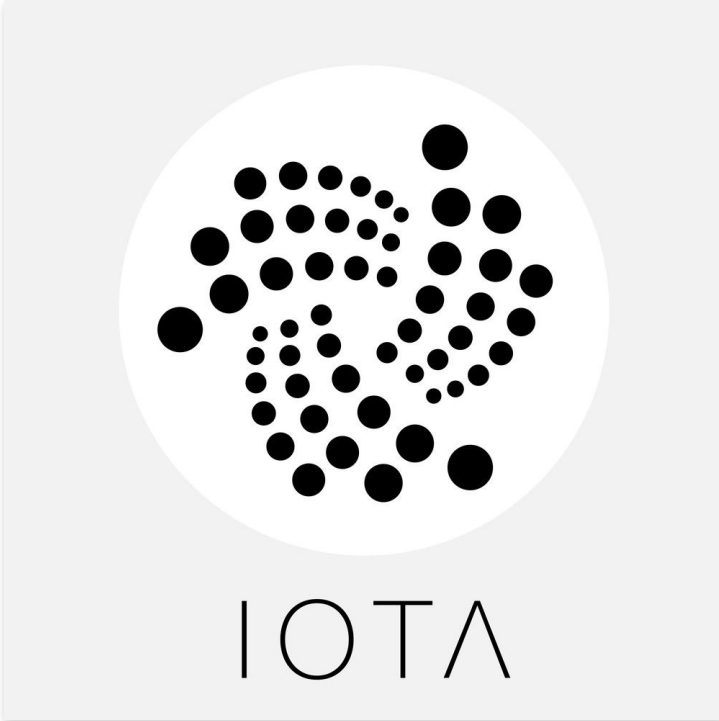
Station ID: 5; Gafanha, Aveiro

Station ID: 4; IT, Aveiro

- Enables real-time broadcasting of traffic information
- **Wireless Communications Device**
  - Receives and transmits data through an antenna
- **GPS Receiver**
  - Provides position and time

IOTA

- IOTA is a cryptocurrency
- Its architecture is called the IOTA Tangle
- Tangle uses a proof-of-work (PoW) system for authenticating transactions on a distributed ledger



Features

Web app

- Ability to monitor the status of each RSU all over the country
- Ability to display details of all transactions made to certain RSU
  - Passage date
  - UserID (email)
  - Vehicle plate
  - Amount to pay
  - Transaction state

Features

Mobile app

- See all RSU on the map
- See pending and done payments
- Pay a pending transaction
- See IOTA balance of the account

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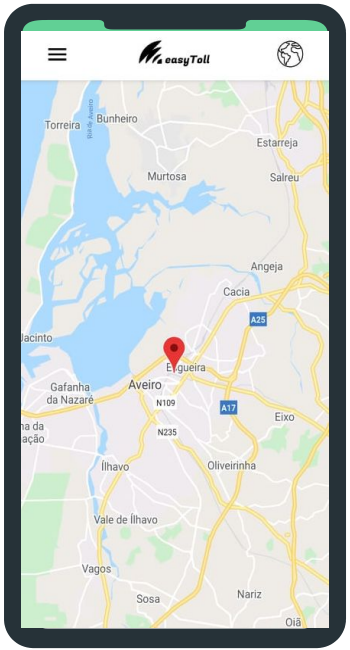
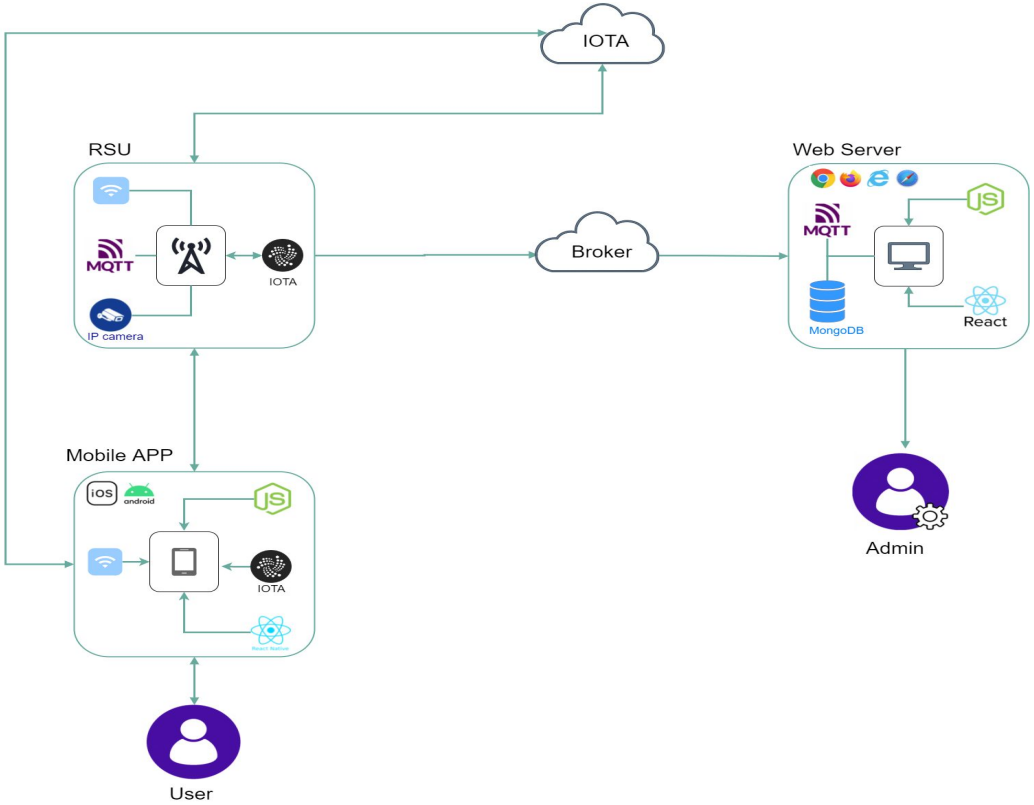
The System



System Architecture and Used Tools



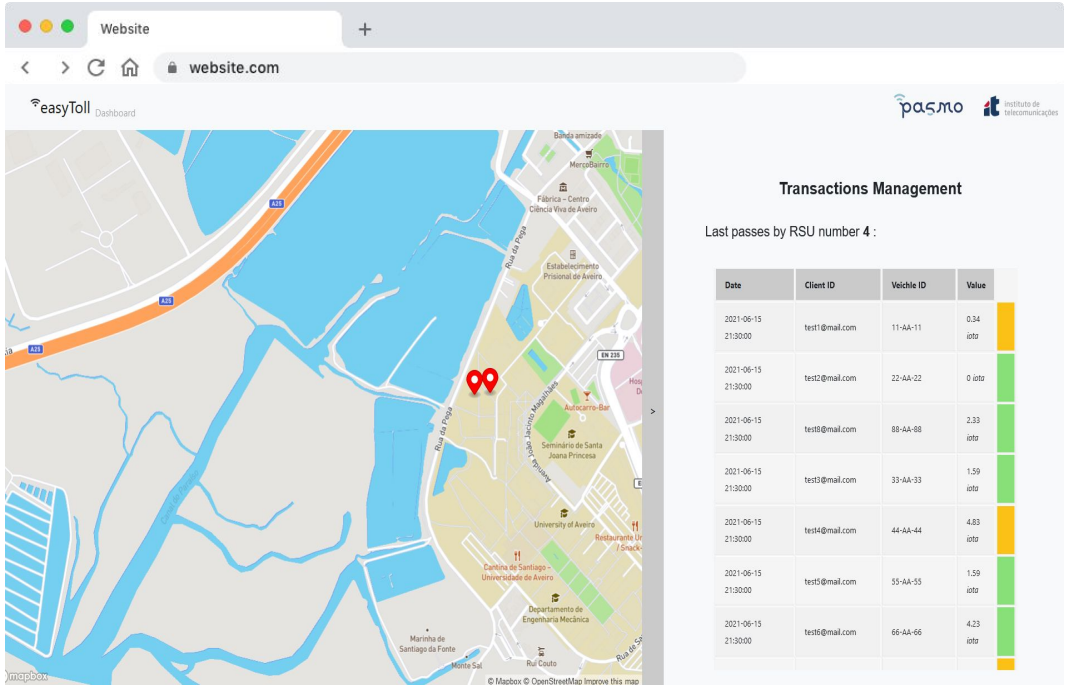
Mobile App

- React Native
- Expo

Web App

- React and NodeJS
- MQTT Protocol
- MongoDB and Mongoose

Demo


Website
website.com
easyToll Dashboard
pasmo
instituto de telecomunicações
Transactions Management
Last passes by RSU number 4 :
Date
Client ID
Veichle ID
Value
2021-06-15 21:30:00
test1@mail.com
11-AA-11
0.34 iota
2021-06-15 21:30:00
test2@mail.com
22-AA-22
0 iota
2021-06-15 21:30:00
test8@mail.com
88-AA-88
2.33 iota
2021-06-15 21:30:00
test3@mail.com
33-AA-33
1.59 iota
2021-06-15 21:30:00
test4@mail.com
44-AA-44
4.83 iota
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55-AA-55
1.59 iota
2021-06-15 21:30:00
test6@mail.com
66-AA-66
4.23 iota


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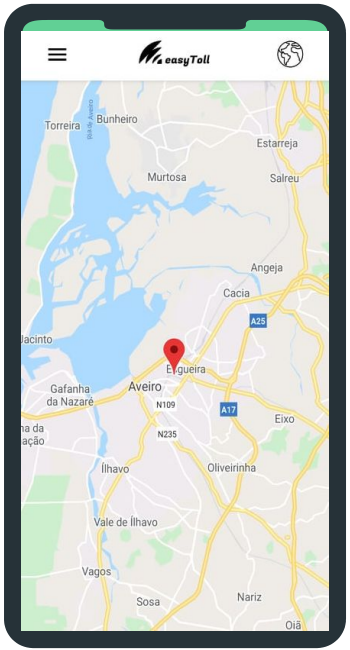
Conclusion



Requirements Revision

Functional Requirements

- Guarantee DLT transactions visualization with the mobile and web app
- Perform IOTA payments (mobile needs to be updated to new iota network)
- Establish wireless connection with the RSUs
- Establish geolocation of the mobile device and RSUs
- Establish communication between itself and a central database
- Guarantee mobile app user's identity
- Allow admin to check RSUs locations and all transactions made to a RSU
- Allow user to check balance
- Allow user to check payment history

Requirements Revision

Non-Functional Requirements

- **Usability** : Easy to learn, easy to use
- **Interoperability** : Communication between modules
- **Security** : Blockchain technology
- **Implementation** : Correlation between frameworks
- **Robustness** : Deal with communication problems
- **Efficiency** : Manage resource consumption
- **Performance** : Good response time
- **Portability** : Compatibility with different smartphones and browsers

Challenges

- Social confinement
- Occasional RSU malfunctions
- Learning curve of new technologies
- Compatibility issues between iota packages and expo running react native

Future Improvements

- Possibility of login in the dashboard platform by the common user
- Enforce payments if the client doesn’t pay