
ARC
2019/20
PEI
DETI, Aveiro
18 Mar 2020
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Requirements gathering

To gather as many ideas as possible and identify viable solutions to our problem:

1. The team analyzed the method currently used to report the occurrence of an accident;
2. A brainstorm was performed;

As a result, decisions were made on the features to be developed:

- Identify the number of persons involved in the accident;
- Identify the number of vehicles that collided;
- Determine the location (coordinates) of the accident;
- Provide images and videos of the accident;

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Functional requirements

1. All the vehicles involved (crashed cars & gateway vehicle) must be equipped with a vehicular communication system;
2. A camera needs to be integrated on the gateway vehicle in order to record images of the accident;
3. To access the information that comes from the gateway vehicle a web app will be developed;
4. There will be a separation of information to be shown to each user. Therefore, each user must have an account;

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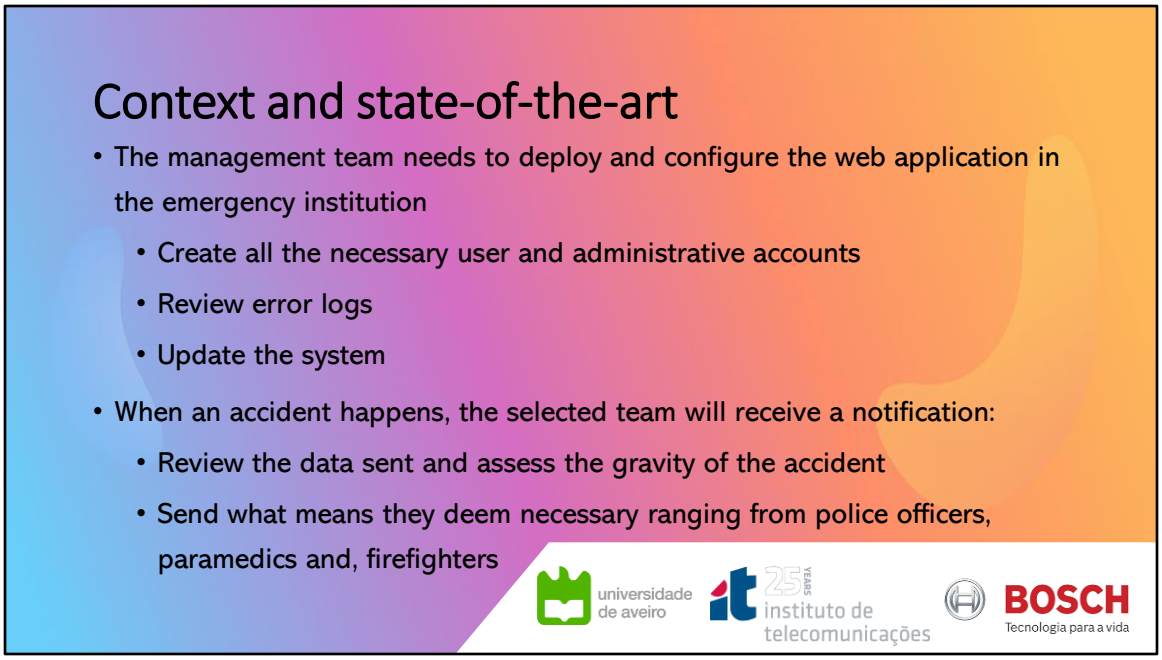
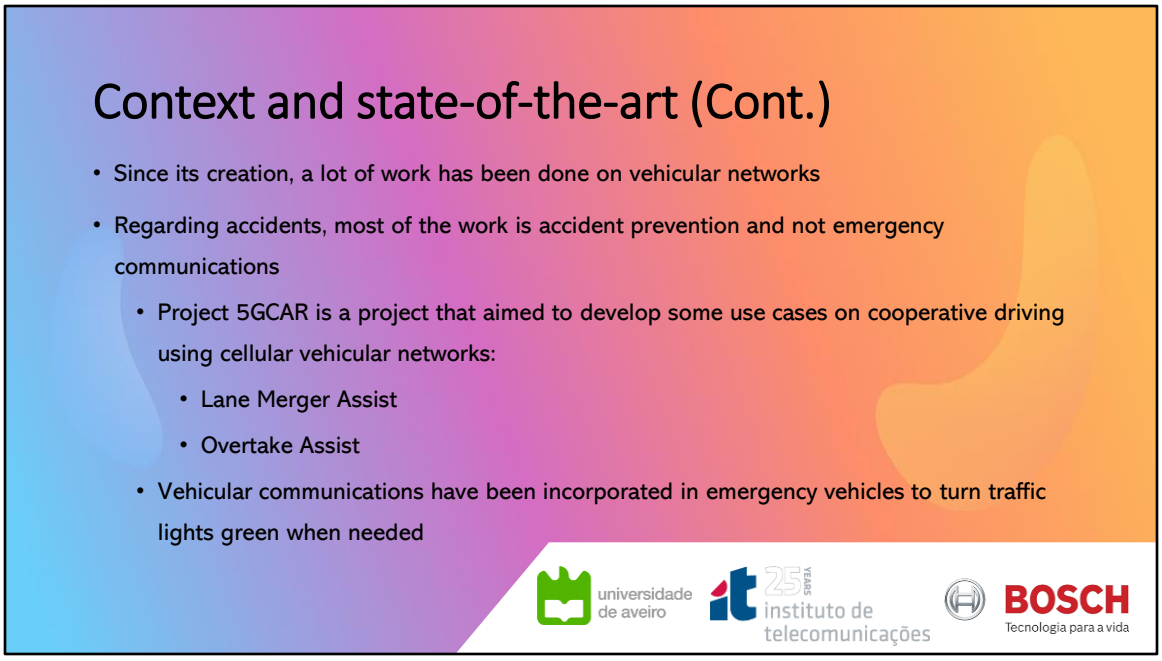


The administration team is in charge of deploying and maintaining the system throughout all the emergency institutions and will also handle the user management so that all the users have their own accounts and the right permissions on the system. This will occur when the system is first deployed on a new institution .After the system is deployed and configured, the team chosen by the emergency institution is capable of monitoring accidents that happen at the moment or visualize historical data. If a new accident happens, they can analyze the accident with the help of the data provided by the messages sent by the road side unit and deploy the means they think are necessary ranging between police officers and/or paramedics depending on who is using the web app.

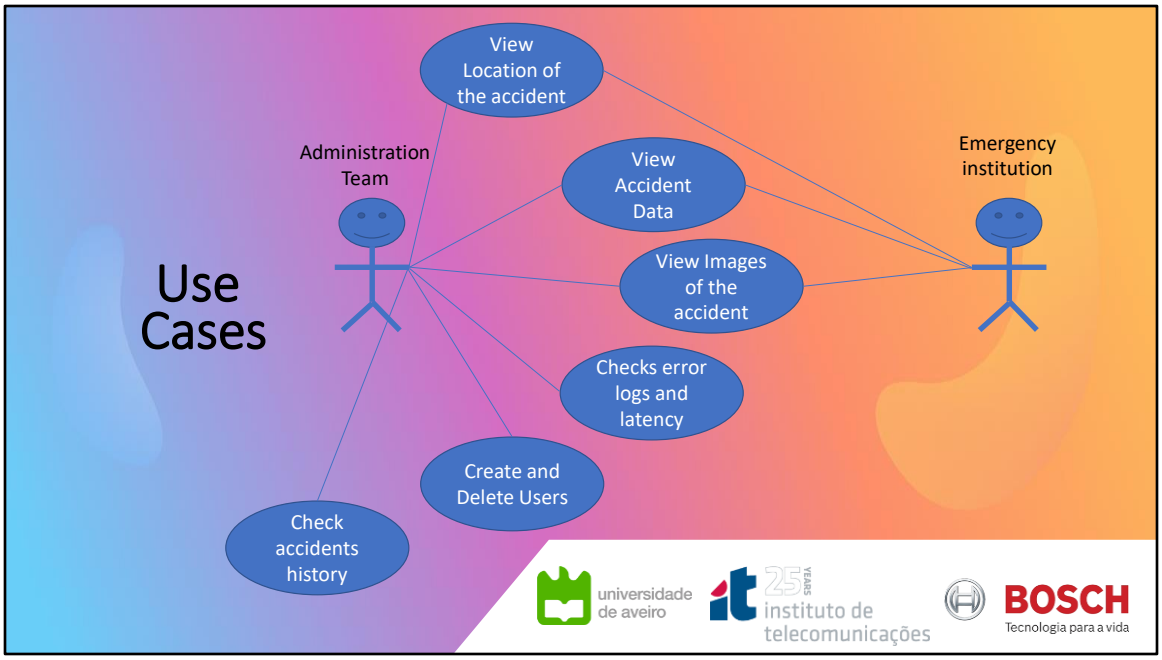


Although some work has been done on vehicular networks regarding road accidents, it is mainly focused on accident prevention. These projects use vehicular networks and the sensors of the car to help other cars understand their environment, such as pedestrians crossing the street on an intersection where the visibility is not ideal, road obstacles, traffic jams and situations where the driver needs to have extra awareness. An example of using vehicular networks in accident prevention is the European Union's 5GCAR project that aimed to develop low latency Vehicle-to-Everything services to improve road awareness.

Actors

The target users of our system are emergency institutions such as police, medical services and firefighters/paramedics. The main actors are:

- **Emergency Institution**: Emergency Institution Agents have access to all the information related to the emergency they are supporting.
- **Administration team**: The Administration team has access to all data, has permissions to change it, and has access to error logs for possible updates and fixes of the system.



View Location of the accident: Allows the user to see pinout in a map the location of the accident as well as its GPS coordinates
View accident data: Allows the user to see accident data in a table format that contains the following information:

- Number of cars involved;
- Number of people involved;
- Number of people injured and the gravity of the injuries;

View images of the accident: Shows the user a gallery of pictures of the car(s) involve in the accident;
Check accidents in the area: Allows the user to see the details of other accidents closed to the area of the present selected accident. Displays a list of accidents. After selecting an accident the user will be directed to the accident page
Check accidents history: Allows the user to see details of past accidents.
Checks error logs and latency: Shows the Administrator details of errors in the system for instance latency of the messages and errors in the data received. These details will be displayed as a list of errors.
Create and Delete Users: Allows the Administrator to add or removes policemen/paramedics or Emergency Control personnel in the database. The Administrator adds agent identifier, location of station/hospital, name and phone

number.

Non-functional requirements

- **Usability:** the web application must be easy enough to use so that training new users is efficient;
- **Efficiency:** the system must be able to process and display all the information from the accidented car to the web application in less than 10 seconds;
- **Capacity:** the web app must be able to analyze and keep records of several accidents at the same time;
- **Availability:** since the system is designed to help in emergency situations it must have at least 99% uptime so that no help request is lost;

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Non-functional requirements (cont.)

- **Security:** the web application and the roadside unit's internet interface must be secure and robust against attackers
- **Recoverability:** in the event of a crash or malfunction, resetting should be easy and painless;
- **Maintainability:** the system and the web application should be easy to maintain and upgrade.

Dependencies & Assumptions

- The cars' modem must have WAVE / C-V2X compatibility and run a Linux operating system.
- No damage to the hardware when an accident happens.
- Collecting the CAN's bus data is a standardized process throughout all the cars.
- LTE coverage throughout the roads.
  - In our intermediate architecture DSRC coverage is needed throughout the roads.
- A server capable enough of processing all the data received from the gateway car.
- A permanent internet connection is needed for the emergency services to access all the data.

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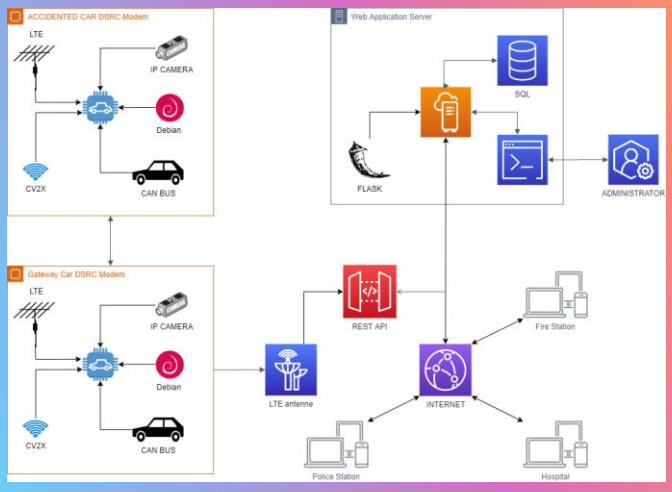

Deployment Diagram

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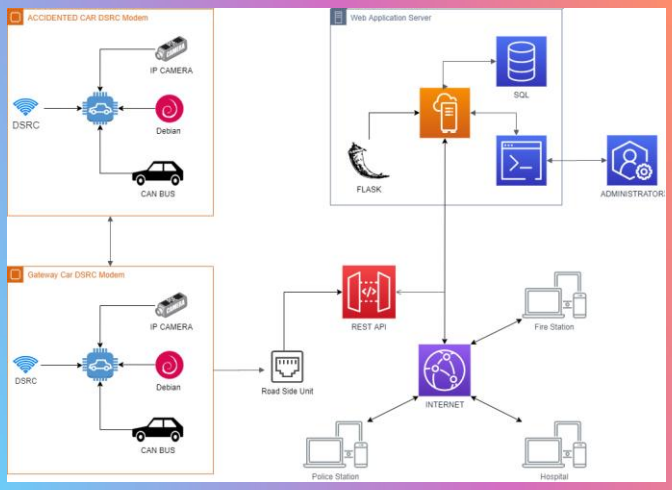

Deployment Diagram

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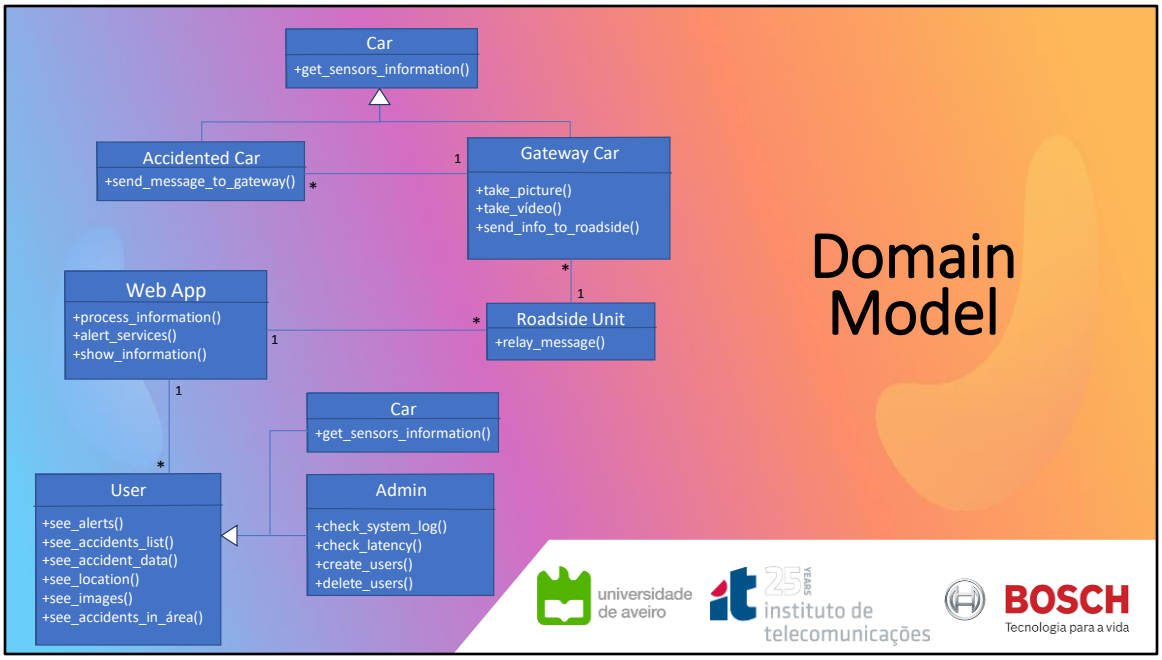
Car
+get_sensors_information()
Accidented Car
+send_message_to_gateway()
1
*
Gateway Car
+take_picture()
+take_vídeo()
+send_info_to_roadside()
*
1
Web App
+process_information()
+alert_services()
+show_information()
1
*
Roadside Unit
+relay_message()
1
*
Car
+get_sensors_information()
User
+see_alerts()
+see_accidents_list()
+see_accident_data()
+see_location()
+see_images()
+see_accidents_in_área()
Admin
+check_system_log()
+check_latency()
+create_users()
+delete_users()
Domain Model
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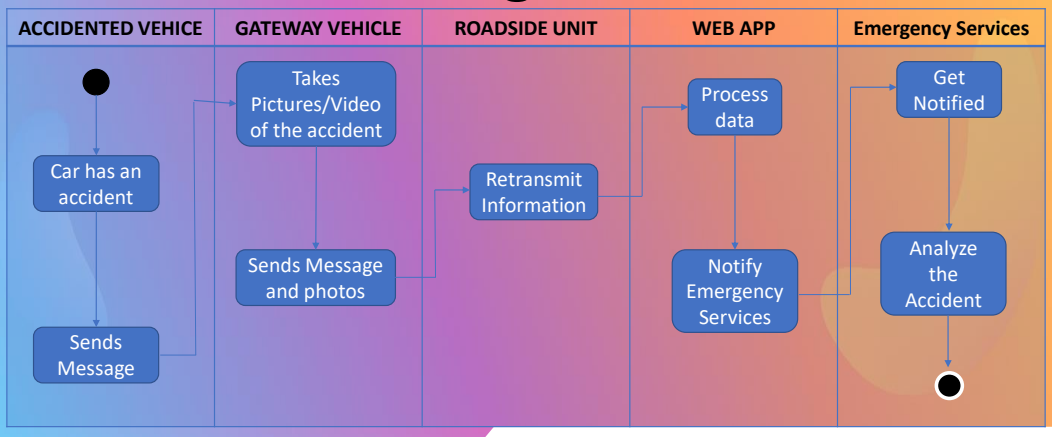
Message Flow



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