Description of the Challenge

The challenge posed by the Directorate General for Innovation and Road Management of the Department of Infrastructures and Territorial Development is entitled: ***"How can we offer users of the road network in Bizkaia useful transportation information based on the data collected by sensor networks installed on roads, which can be used to improve transportation management and therefore have an economical and environmental impact in the Historical Territory of Bizkaia?"***

This challenge addresses the needs described below:

Background

The road network of the Historical Territory of Bizkaia, [1], is made up of a total of 1,273.1 km, with an overall traffic volume of 4,757.2 million vehicles. The Network of Preferential Interest or High Capacity network accounts for 19.2% (245.1 km) of this but has 58.8% of the overall traffic volume, followed by the Basic Network that accounts for 16.4% (209 km) with a traffic volume of 26%. Most of this transportation is centred around Bilbao and its metropolitan area, where the A-8, AP-8 and AP-68 are included, as Bizkaia forms part of the Atlantic corridor and the Cantabrian corridor of the trans-European transport network.

The road network in Bizkaia has been maturing and developing over the last few decades, with projects aimed at increasing the capacity of the existing road network. For example, increasing the number of lanes on several sections of the A-8 or the widening of the entrance to Bilbao via Enekuri. This has mainly been due to projects aimed at developing the network, with iconic projects such as the Txorierri corridor, the Artxanda tunnels, the Southern Metropolitan Bypass in phase 1A and currently with phase 1B, the Ballonti corridor, etc.

Real-time transportation information allows users to organise their journeys by public or private transport, both in terms of selecting a time slot and the route chosen for the journey. This allows better use of existing infrastructure. This type of information has proven to be effective in improving the efficiency of the road network, which has a direct impact on the environment and the economy.

Beneficial effects include the following:

- Improved effective capacity of the road network
- It allows the user to organise a route
- Improved transport system
- Reduction of greenhouse gas emissions
- Reduced hours lost by users in normal traffic and incident-related traffic

Several sensor networks or mobility data collection systems are currently available.

A network of traffic detectors consisting of a total of 106 remote stations with a traffic detector in each lane of the motorway section and at each of the entrances and exits at their location. This network covers virtually all links of the high-capacity network and some intermediate sections between links. These sensors provide information on:

- Vehicle classification
- Vehicle density by vehicle class
- Average vehicle speed per class
- Congestion alerts

LV bollard network consisting of 62 LV bollards with 3 LV sensors, installed on the main links of the high capacity network. A bollard provides information on traffic in both directions. This sensor network is providing the following information:

- Travel times between any pair of bollards
- Hours lost in standard or non-standard traffic congestion
- Behavioural patterns between two bollards (travel times)
- Automatic incident detection alerts with real-time travel time information.
- Origin - Destination Matrices

Network of 125 TV cameras forming a CCTV network, covering the main links of the high capacity network and some sections between links.

These three sensor networks send their information to the Bizkaia Mobility Management Centre (known as MKZ) where it is visualised, stored or recorded and processed.

The data collected from the traffic detector network is stored in an Oracle database, version 11g, which is currently being migrated to a MariaDB database. This information is processed and the traffic service levels of the network sections are calculated. A section is defined between two adjacent traffic detector zones.

The information from the LV bollards is available on an information server that features a set of web services, each of which has a REST API for querying the information. The query provides a JSON file with the requested information.

The images from the TV camera network are recorded on a Geutebrück digital recorder.

Transport information is currently offered to the user through the Bizkaimove information server [2], which displays:

- The traffic situation, showing the service level calculated with the traffic detectors.
- Incidents (incidents, works and winter maintenance) entered manually by MKZ operators.

- A static image of the available cameras, which is updated every 4-5 minutes. The cameras have been grouped by corridor to give the user a quick overview of the status of a large section of the network.
- Winter road conditions (mountain pass conditions)

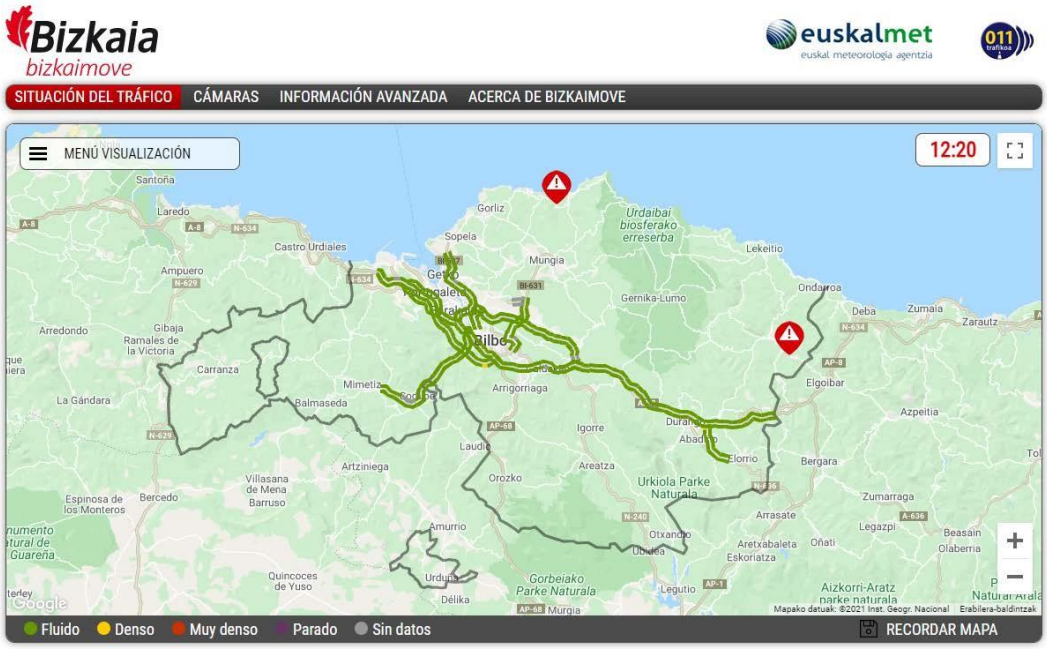

Image 1: Bizkaimove main map

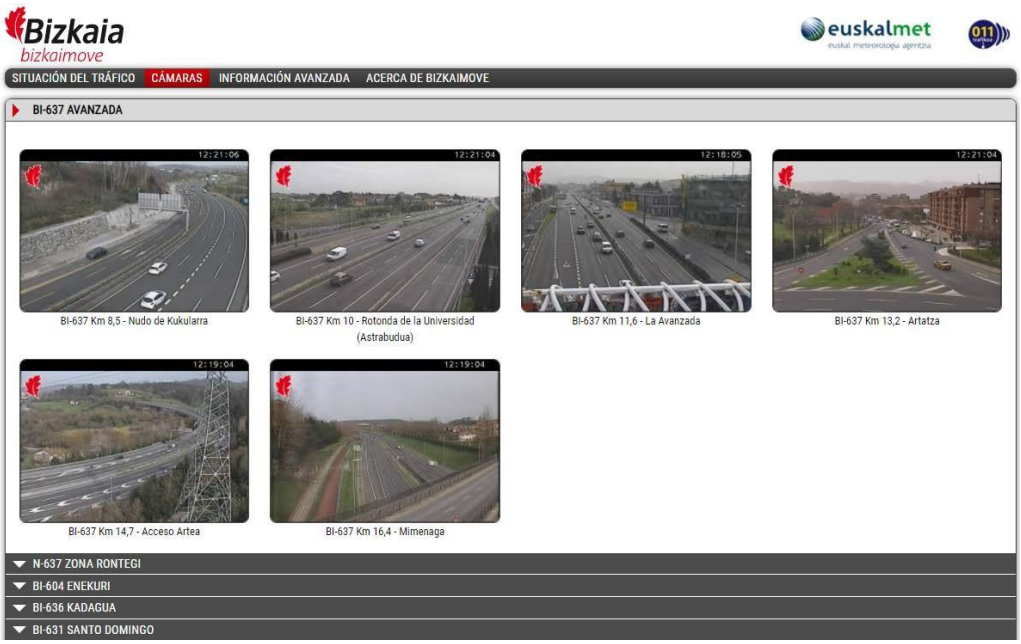

Image 2: TV camera display by corridor

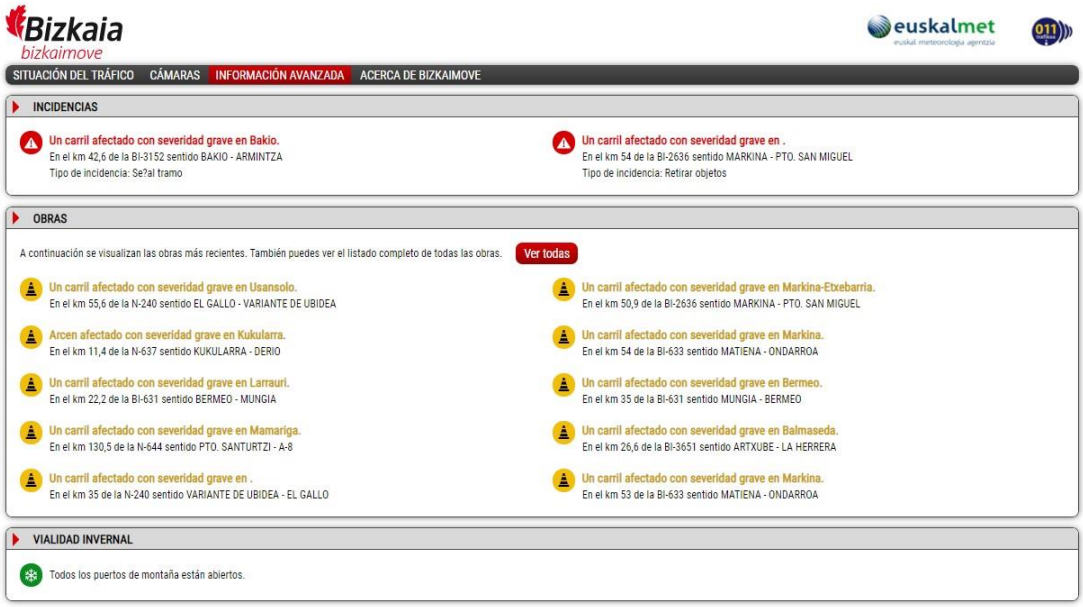

Image 3: Information on incidents, works and winter maintenance

A mobile application is also available for iOS and Android that can display the same type of information under similar conditions to those offered on Bizkaimove, but they are two different applications.

The mobile application information is obtained from the same database from which the web server information is extracted. However, sometimes the information displayed in both information systems is inaccurate and may lead to confusion if the user checks both sources.

Needs

Given the current situation, there are several challenges to address. The first of these is to standardise the information displayed to the user in such a way as to ensure that at all times the information a user receives does not depend on the medium through which it is accessed.

Another challenge would be to propose how users can receive real-time images from the cameras and not just a static image that is updated every 4-5 minutes. These images provide real-time information on the state of the network and allow the user to have a true picture of the state of the roads.

It would be ideal if the user could easily view a set of cameras that would provide a view of the traffic and road conditions on the route they plan to take. This is very important for day-to-day travel, so that the user has information that allows them to adjust the departure time on their journeys and also in special situations such as in winter road conditions, where the user can see the state of the road.

Another challenge is to merge the different types of information obtained from the network of traffic detectors, Bluetooth bollards and TV cameras to provide relevant transport information to private vehicle users, public transport users, freight transport services, emergency services, etc.

An additional challenge would be to incorporate other external information such as traffic data provided by companies, e.g. TomTom or other external information relevant to the user.

Objectives

The aim is to have a single information portal that users of the transport system in Bizkaia use to stay informed, offering in real time the most accurate image possible of the state of the road network in Bizkaia. The information provided to the user should be the following as a bare minimum:

- Route creation, providing travel times between the origin and destination of the routes
- Traffic alerts on selected routes
- Proposal of an alternative route to the user's route when an incident occurs
- Real-time video from TV cameras along journeys or routes
- Network service levels with sensors

This information will bring the following benefits to Bizkaia's road network:

- Reduction of usual congestion and congestion due to an accident
- Reduction of accidents in regular traffic congestion
- Improvements in planning

The indicators of success for this challenge will be the following parameters:

- Reduction of hours lost by network users
- Reduction of travel time
- Reduction of the consequences of accidents or usual traffic congestion
- Reduction of greenhouse gas emissions

The proposed solution should be capable of integrating new transport parameter sensor systems, integrating the information into the information server and incorporating it in the dedicated user information portal.

The scope must be specified in a pilot version for controlled users that allows at least a web version and a mobile application version that has the required features as a bare minimum and must incorporate the features included in the bidder's proposal. These applications may include communication platforms suggested and deemed useful by the evaluation team.

As a guideline, the following table includes the functional needs required, classified as a requirement or weighted according to their level of importance, with 3 being the lowest level and 9 the highest:

Variable	Functional need	Weight
The solution creates routes	It is easy to generate the routes	Requirement
	The tool facilitates the location on the map with place names and municipalities	9
	In terms of the route, the traffic situation and incidents affecting the route are shown with colours	6
	The most relevant camera images are included on the route	Requirement
The solution reports travel times	It reports the travel time of a route at all times	Requirement
	It reports travel times on major roads	6
	It shows the increase over the standard travel time	6
The solution generates traffic alerts	The map shows any alerts clearly	Requirement
	In addition to travel time alerts, it displays other significant incidents and sources of information	3
	The alerts will also be displayed in Control Centres	6
The solution provides images of the road	It shows images of the incident area associated with an alert	6
	The cameras will provide information so the user can clearly identify the road and direction	9
	It will offer the ability to save queries for certain cameras	3
The solution offers an alternative route	The tool will offer an alternative route with the shortest possible time	Requirement
	The tool offers more than one alternative route	6
	Among the alternatives, the tool provides routes from outside Bizkaia	3
The solution offers the ability to view a map of the state of the roads in Bizkaia	It offers the ability to select regions	3
	It offers the ability to select more information for important locations (hospitals, universities, etc.)	3
The solution has a simple, lightweight architecture	The mobile version and the app take up little space and consume little data	6
	It is easy to incorporate new data sources	6
	The tool allows interaction with the user	6

Features other than those included in this table that may improve the performance of the solution proposed to address the challenge will be considered.

References

[1] DF Bizkaia, "Evolución del tráfico en las carreteras de Bizkaia, 2019", p. 75, 2019.

[2] D. F. de Bizkaia (Bizkaia Provincial Council), "Portal de Información Bizkaimove" (Bizkaimove Information Portal). [Online]. Available at: https://www.bizkaimove.com/bm/inicio.html. [Accessed: 19-Feb-2021].