MERIDIAN Deliverable D33 – "D4.09 - Traffic counting and classification environment with multi-technology sensors support and A.I. engine"

Document Information

Author

Name	Organisation
Matteo Gironi	A4 Mobility

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Abstract

Autostrada BS-VR-VI-PD SpA participated in the Meridian project leading the development and the implementation of a new, evolved, traffic counting and classification system. This specific subproject involves the physical installation of dedicated hardware sensors along the managed road infrastructure and the development of a sophisticate software environment.

The works along the road have seen the installation of a major quantity of multi-lane, transversal radar sensors. Considering every couple of consecutive tolling station or interconnection, it has been installed at least one transversal radar. In addition to them, a frontal radar sensor has been tested as experimentation, concluding that in motorway application a transversal sensor seems to be more efficient. In addition to the radars, combined cameras which houses both thermal and visual sensors, have been installed in order to provide video combined streaming to the Artificial Intelligence Engine.

Autostrada BS-VR_VI-PD SpA also owns a "Weight in Motion" plant, made near Garda Lake during a previous project, which can produce precise traffic data. For this reason,

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it has been integrated in the counting and classification environment within the Meridian Project.

The central software environment has been developed using cutting edge technologies, such as kafka datalake ingestion engines, data optimization and cloud processing. The data visualization layer is available on the company Power BI instance. A couple of separate Artificial Intelligence engines perform the real time processing of the video streaming produced by the cameras, in order to provide advanced vehicle classification.

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Author	Matteo Gironi
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Working Group	Matteo Gironi (A4 Mobility Srl) Andrea Braggio (Autostrada BS-VR-VI-PD Spa)

Project description.

Autostrada BS-VR-VI-PD SpA participated to Meridian leading a project focused to the traffic counting and classification. The project goals are the improvement of the classification capabilities and the simplification of maintenance along the A4 Brescia-Padova section (>150km) and A31 (>80km).

The baseline of data is collected using transversal multi-lane radar sensors. Autostrada BS-VR-VI-PD installed a base of 34 radar sensors, which are used for the monitoring of every single segment, located between a couple of consecutive tolling stations or road interconnections.

An Artificial Intelligence module, composed of two physical specialized and GPU-based machines, process the streaming of the traffic produced by four dedicated cameras in order to extract advanced traffic classification data. Specialized cameras houses both a thermal and a visual sensor and have been positioned in strategic traffic locations along the highway.

Additional traffic data comes from a Weight In Motion (WIM) station that has been developed before the initiative, and has been integrated into the system within the Meridian project.

All the sensors are permanently connected to the private communications network owned by Autostrada BS-VR-VI-PD Spa.

Technical infrastructure.

The logical chart of the system is represented in the figure below:

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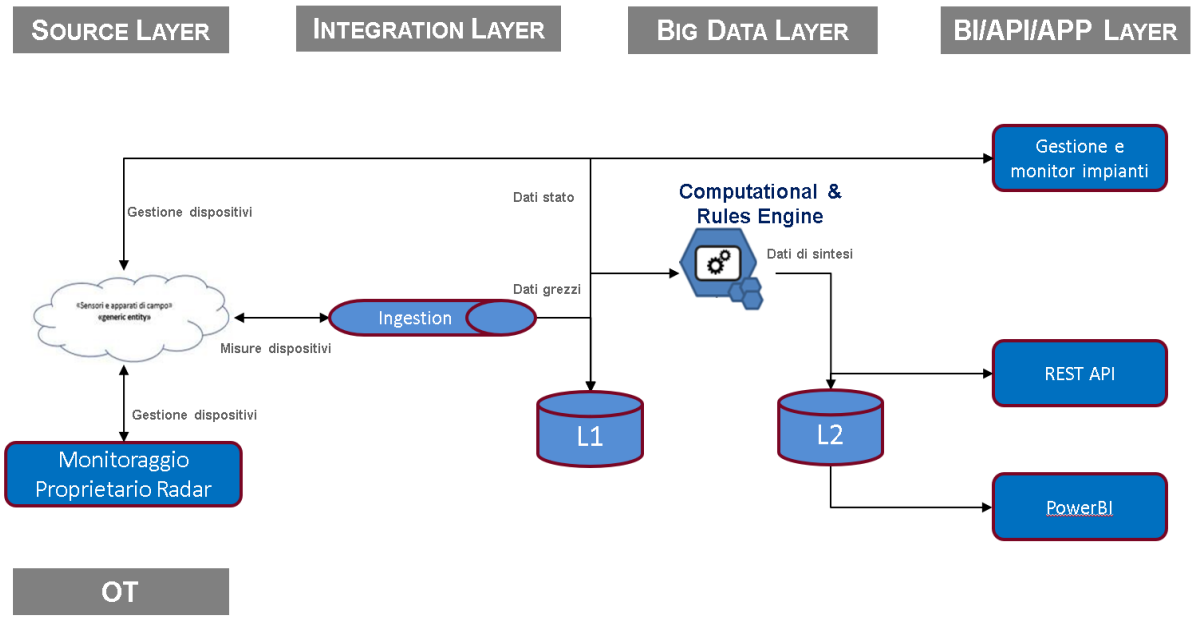

Fig. 1

Hardware installed.

Transversal radars have been installed along the highway in various scenario:

- existent towers (Fig. 2), originally made for tvcc and for this reason equipped with data connection and power supply.
- existent VMS (Fig. 3).
- existent weather stations.
- New pole, installed especially for the purpose, where new IP data connection have been set up (Fig. 4).

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Fig. 2

Fig. 3

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Fig. 4

Cameras have been installed generally above VMS, at the centre of the road.

Software developed.

The central software has been designed in order to collect a great amount of data, coming from different sources and different timings.

Thinking for example about the radars, every radar produces a record for every vehicle it reveals. Considering the quantity of vehicles and the quantity of sensors, it produces a great number of records per day that can overpass 3 billion. Every record contains the timestamp plus information about the speed of a vehicle, the length, the class, the spacing between the previous. All these records are received centrally and processed for aggregation using different logics (Fig. 5).

The ingestion component of the software is located inside the company datacentre, on a specialized virtual machine. Once data have been received, the aggregation and the processing are performed on a cloud environment.

The cloud application also produces a monitoring interface (Fig. 6), used for the configuration, for the monitoring and for the maintenance of the sensors (Fig. 7, Fig. 8).

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All the sensors are registered on the list contained in the appliance (Fig. 9).

Data visualization is made via Power BI (Fig. 10, Fig. 11, Fig. 12).

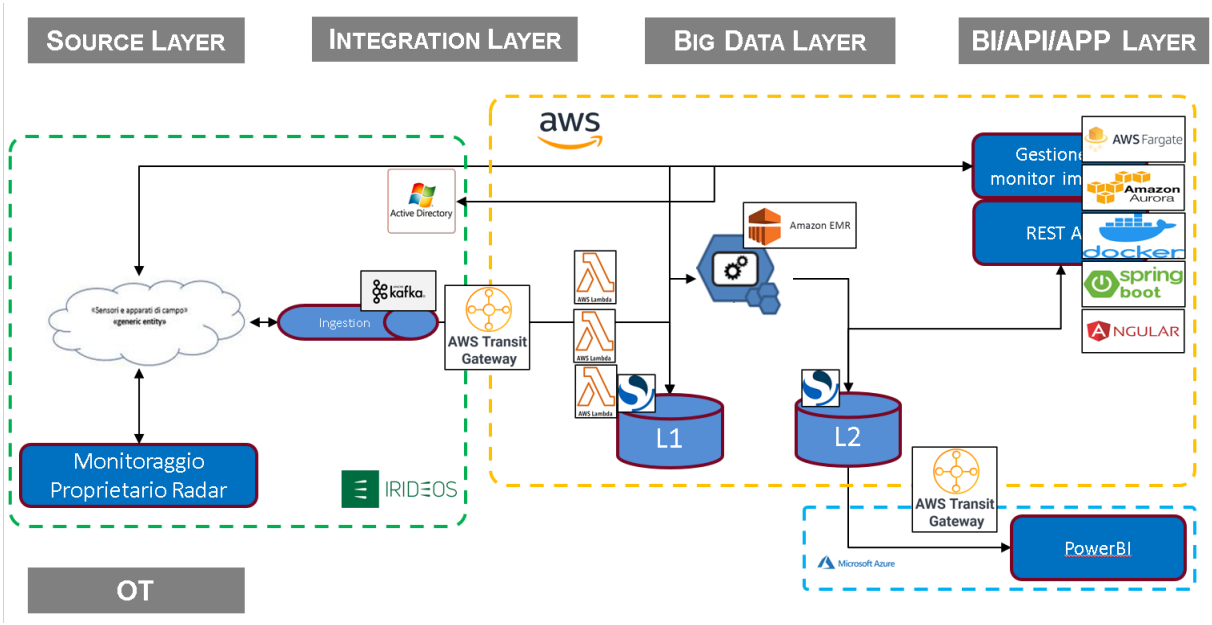

Fig. 5

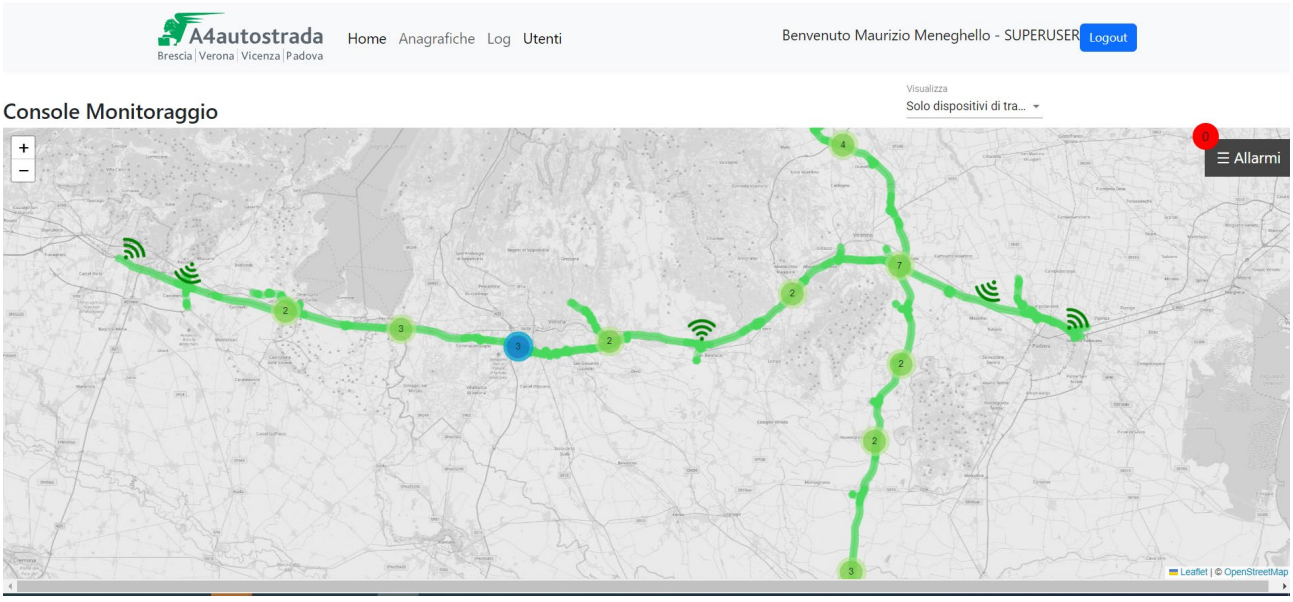

Fig. 6

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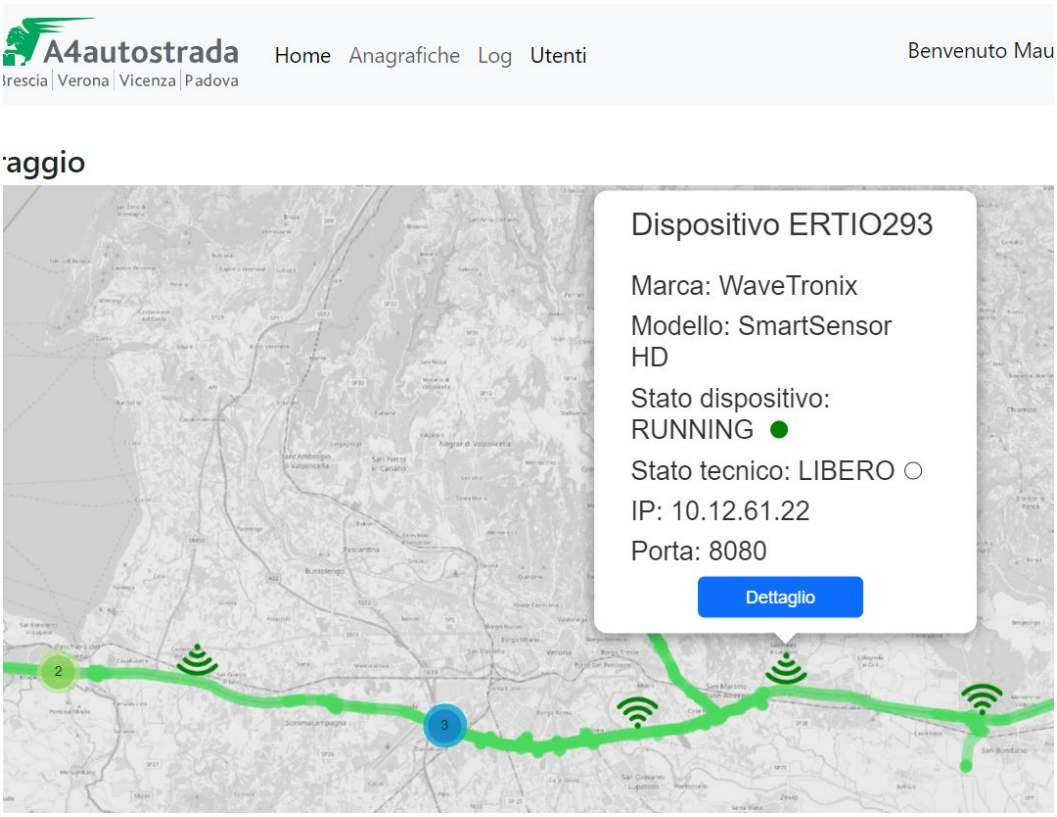

Fig. 7

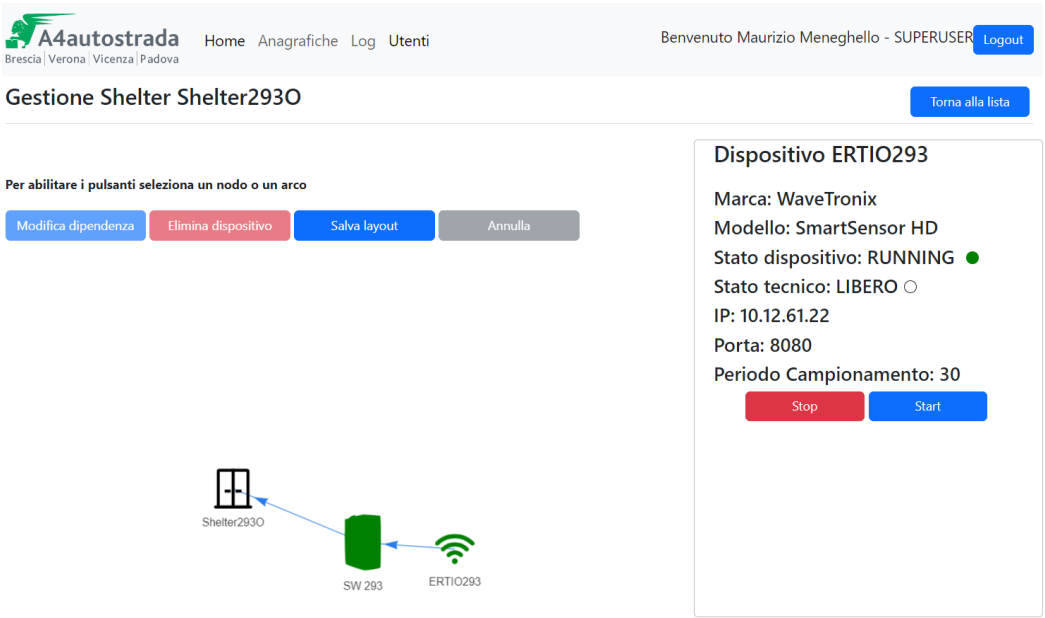

Fig. 8

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A4autostrada Home Anagrafiche Log Utenti

Benvenuto Maurizio Meneghello - SUPERUSER Logout

Anagrafica Dispositivi

Aggiungi nuovo Dispositivo

Mostra 10 elementi

Cerca: ERT

Nome Postazione	Progressivo Km	Marca	Modello	Modifica Dispositivo	Gestione Shelter	Gestione Allarmi
ERTIE219	219	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE240	240	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE245	245	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE255	10	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE286	286	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE303	303	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE335	335	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE336	336	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIE362	362	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci
ERTIN002	2	WaveTronix	SmartSensor HD	Modifica	Gestisci	Gestisci

Fig. 9

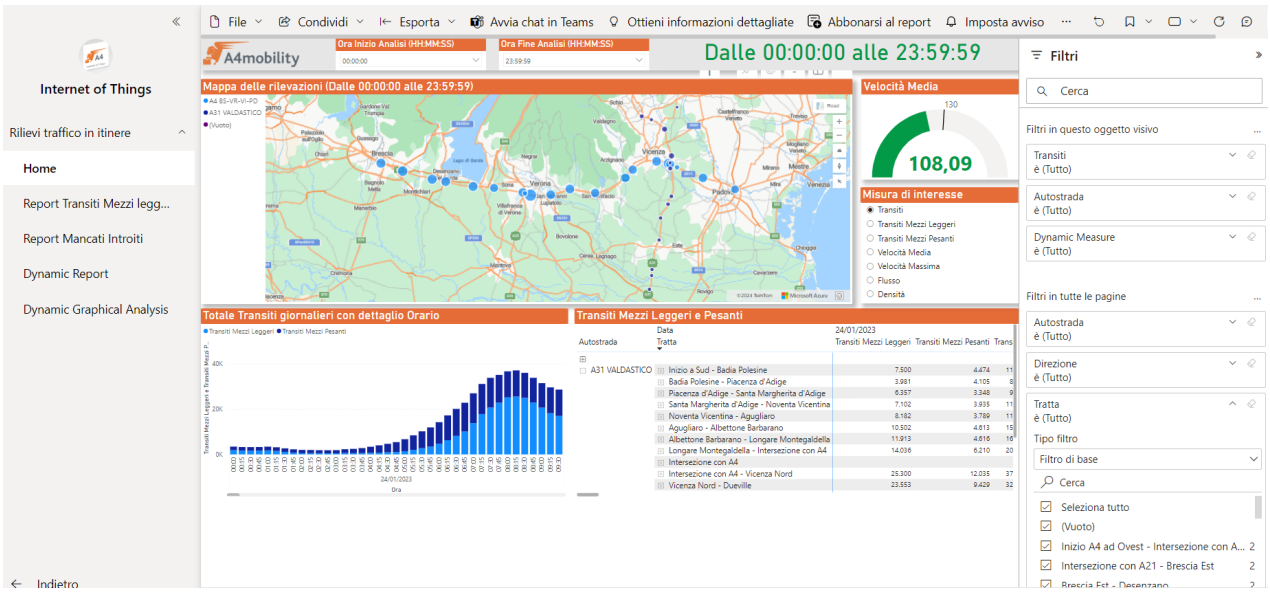

Fig. 10

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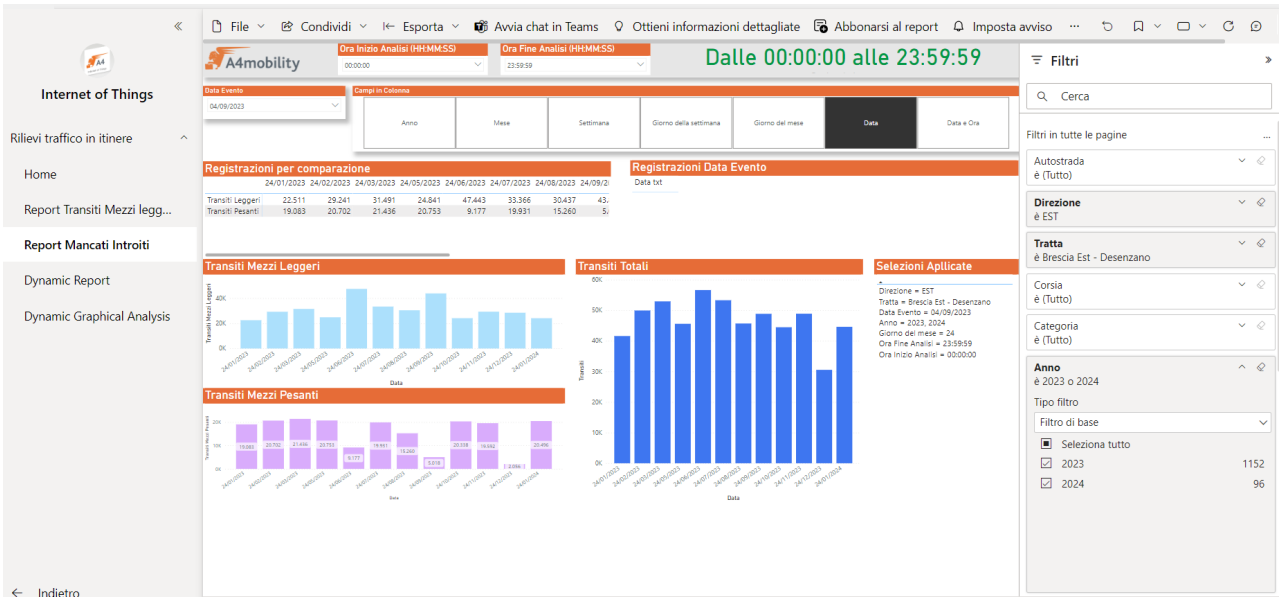

Fig. 11

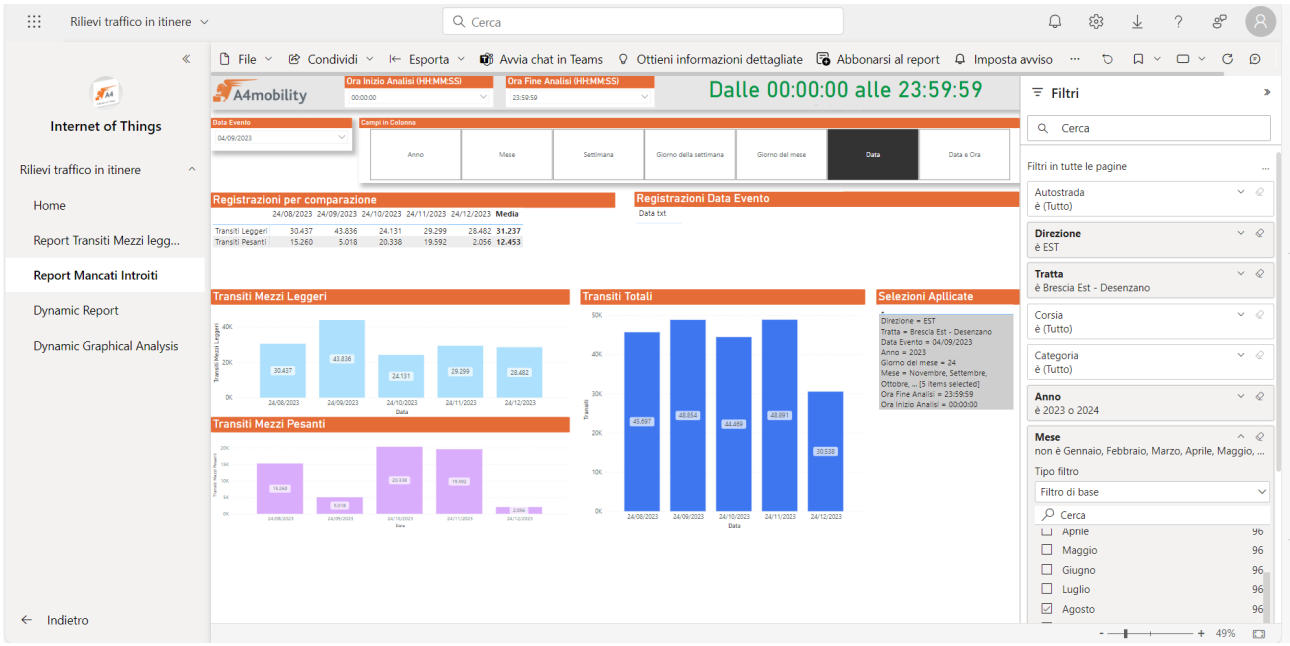

Fig. 12

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