S.LI.DES

Smart strategies for sustainable tourism in LIvely cultural DEStinations

2014 - 2020 Interreg V-A
Italy - Croatia CBC Programme
Priority Axis: Environment and cultural heritage
Specific objective: 3.1 - Make natural and cultural heritage a leverage for sustainable and more balanced territorial development

Deliverable D.4.3.2

Destination dashboard - final considerations

Work Package:	**4 – Pilot actions**
Activity:	**3 – From the pilot actions to the destination dashboard testing**
Responsible Partner:	**PP9 – Development Agency of the City of Dubrovnik – Dura**
Partners involved:	**LP – Ca' Foscari University of Venice (IT)** **PP1 – CISET (IT)** **PP2 – Ecipa (IT)** **PP3 – SIPRO Ferrara (IT)** **PP4 – City of Bari (IT)** **PP5 – City of Venice (IT)** **PP6 – CAST – University of Bologna (IT)** **PP7 – Institute for Tourism** **PP8 – Craft College – Institution for adult education Subsidiary Rijeka** **PP9 – Development Agency of the City of Dubrovnik – Dura** **PP10 – Šibenik Tourist board**

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1. Introduction

The scope of Deliverable 4.3.2. Destination dashboard - final considerations is to provide a final evaluation of the effectiveness of the dashboard prototype and related datahub according to the results of the pilot actions and to give suggestions for further improvement. Deliverable 4.3.2. Destination dashboard - final considerations has been based on the results of Activity 4.2 Pilot actions: design and implementation. Additional valuable information has been collected via in-depth interviews with five partner cities (PP3 Sipro, PP4 Bari, PP5 Venice, PP9 DURA, PP10 Šibenik) that implemented pilot actions and tested the destination dashboard and related datahub.

As stated in the Application Form, Activity 4.2 "Pilot actions: design and implementation „develops the cross-border methodology to plan actions to test and evaluate the effectiveness of the Smart Destination Ecosystem. The methodology was implemented by each involved destination (Venice, Dubrovnik, Šibenik, Bari, Ferrara) to support specific territorial initiatives to generate added value in the sustainable promotion of tangible and intangible cultural assets, with a focus on crafts, as well as reduction of visitors' time and spatial concentration. The areas of intervention initially identified by cities were:

1) New thematic itineraries/improvement of existing ones,

2) Mobile applications to promote craft activities and stimulate contents' co-creation by visitors,

3) Concept of a "destination food & craft hub" to stimulate the re-opening of traditional craft shops in the city center, exploiting the appeal of contemporary design stores and typical restaurants/ food shops to attract visitors.

During the development of the project, the topic of the pilot actions was revised according to the cities' priorities. Four of them focused on the organization of repeated or occasional events to promote local identity and intangible heritage (Bari, Ferrara, Dubrovnik and Sibenik), while the last one (Venice) maintained the initial idea to promote new itineraries to discover hidden parts of the city.

Following the results of Activity 4.2., activity 4.3 "From the pilot actions to the destination dashboard testing" aims at assessing the effectiveness of the destination dashboard in providing:

1) Useful inputs to properly plan the pilot actions and then promote cultural heritage as leverage of balanced territorial development and reduce seasonality,

2) Real-time information on the pilot actions' outcomes in order to promptly modify/adapt them.

The purpose of deliverable 4.3.2. is to help identify potential difficulties in using the Datahub and the Dashboard as well as potential problems in the population of the Datahub and the design of the Dashboard. However, it has to be said that the pilot action, by its very nature, can help to test only a part of the potential of the Dashboard prototype,

which can support other initiatives and actions. It represents a first test and the final considerations derived from its use can also support the definition of the S.LI.DES. strategy and design of the Transferability framework.

2. Methodology

The Deliverable 4.3.2. is developed based on secondary and primary research. Secondary research is focused on the analysis of the reports (Annex 1, Annex 2, Annex 3, and Annex 4) prepared by PP9 DURA, as leader of WP4, to monitor the design, development and implementation of the pilot actions (action 4.2.). Primary research consists of an in-depth interview conducted by PP7 Institute for Tourism with partner cities who performed the pilot actions, namely PP3 Sipro Ferrara, PP4 Bari, PP5 Venice, PP9 DURA, and PP10 Šibenik.

3. Analysis of reports

The secondary research provides a transversal reading of four annexes delivered by each partner city within activity 4.2. “Pilot actions: design and implementation with the emphasis on the destination dashboard testing”.

The reports analyzed are:

- Annex 1 – Pilot action form;
- Annex 2 – Pilot action in-depth description form;
- Annex 3 – Pilot action monitoring form;
- Annex 4 – Pilot action final report form.

3.1. Annex 1 – Pilot action form

Annex 1 includes general information about the pilot action, such as a draft of the pilot action general title, a short description, its main objectives, and the list of tangible and intangible heritage to be promoted through the pilot action. For the purpose of this report, the focus of the analysis is on the benefits from the information displayed in the destination dashboard and the contribution it makes to the Smart Destination Ecosystem's effectiveness. The main idea is to start from the typology of the pilot action because each typology can imply different data needs as well as different information collected during the implementation of the action.

- Ferrara

PP3 Sipro Ferrara developed several initiatives to enhance the excellence of the urban area and its province. About thirty operators were involved in the organization of two educational tours for journalists, bloggers, local authorities and tourism operators / associations. Four "Lessons of the Territory" dedicated to tour operators were also developed, aimed to know and understand the territory in order to better promote it to tourists. The data provided by the dashboard on tourist flows and mobility helped to create a marketing campaign to attract new visitors through the testing of a new temporary Showroom located in the city center of Ferrara.

- Bari

The city of Bari organized “Turisti per Bari”, four evenings of events dedicated to the discovery and valorization of the historical center of Bari and the Murat district through a series of activities, events and exhibitions linked to the history of the territory. The pilot action involved about sixty selected exhibitors, among the food and wine sector (bakeries, delicatessens, street food, restaurateurs) and artistic craftsmanship (shops, ateliers, art masters, shops, design stores). The operators organized demonstrations, practical workshops and tastings of their products. The mobility of visitors was facilitated by the presence of qualified tourist guides and cultural animators, who accompanied the participants to discover the beauties of Bari Vecchia and Borgo Murattiano, animated for the occasion by musicians and street artists. The Dashboard helped the selection of the artisans to be involved and in the monitoring of visitor mobility.

- Venice

Thanks to the data and maps provided by the Dashboard, PP5 Venice developed “The Routes of Venetian craftsmanship and creativity”, ten thematic itineraries to enhance the history and uniqueness of Venetian excellence. The itineraries are intended to stimulate the visit of lesser-known places and routes in the city, along which it is possible to find excellences of traditional Venetian craftsmanship, such as artistic glass, lace, fabrics, mosaics, but also modern and creative products, as well as local food and gastronomy.

- Dubrovnik

An art and crafts fair was the pilot action developed by PP9 DURA to reduce overcrowding in the historic center and enhance the local cultural heritage and traditions. The Fair was organized in the complex of Lazareti, outside the city walls, an area often insufficiently valorized and visited. Aside the exhibition of traditional products and handicrafts, four thematic workshops were organized and traditional folk dances, as well as acapella singing, were performed during the event. The initiative was also promoted through the homepage of the free city Wi-Fi, in order to inform participants about the various scheduled events. The use of Wi-Fi also made it possible to monitor their movements and enrich the dashboard and the database connected to it with real-time information.

- Šibenik

PP10 Šibenik, between the months of July and August, organized a weekly "Heritage day" to promote local cultural heritage and crafts and facilitate the mobility of visitors in less frequented areas of the historic center. A rich program of events involved residents and tourists, combining workshops, movie projections and arts and crafts fair. Sensors along the streets helped the monitoring of visitors' movements and the presence of overcrowded areas. Comparison of tourist flows registered by cameras with the database of tourist overnight stays (from eVisitor[1]) could provide them with better insight on the number of daily visitors.

To summarize, three partner cities have focused on the organization of repeated or occasional events (PP4 Bari, PP9 DURA, and PP10 Šibenik). One partner city focused on a mix of initiatives (PP3 Sipro Ferrara) and one partner city on the organization of the thematic itineraries (PP5 Venice). As better highlighted in the next section, this analysis shows that even though some partner cities planned similar pilot actions (e.g., PP4 Bari, PP9 DURA, and PP10 Šibenik), the use of the indicators and maps included in the destination dashboard differed, also depending on the perception of what kind of data are useful from their point of view.

3.2. Annex 2 – Pilot action in-depth description form

The form includes more extensive information about the pilot action, such as a list of target groups to be reached and the stakeholders to be involved. The expected implementation steps, as well as specific objectives based on the main pilot action objective and their impact on tourist mobility, cultural heritage promotion, and craft activities, are described in detail by project partners. Moreover, the degree of innovation as well as the contribution of the pilot action to the effectiveness of the Smart Destination Ecosystem must be explained. In particular, Annex 2 shows how the pilot action plans to test the Smart Destination Ecosystem (how to use indicators in the dashboard for pilot action development; e.g. data from sensors/cameras). The goal is to use the destination dashboard in purpose to develop the pilot action - it is not necessary to consult every category in the destination dashboard, but more than one category is acceptable.

In addition to the aforementioned information, Annex 2 provides a list of destination dashboard indicators that partner cities were most likely to refer to, as they were more closely associated with the implementation of the pilot action. Table 1 provides a summary of destination dashboard data used for each of the partner cities.

[1] https://www.evisitor.hr/eVisitor/hr-HR/Account/Login?ReturnUrl=%2FeVisitor%2Fhr-HR

As mentioned earlier, even though some cities planned similar pilot actions, they used different indicators from the destination dashboard. For example, PP9 DURA and PP10 Šibenik organized fairs. PP9 DURA used data on monthly tourist arrivals and overnight stays to decide when to organize a pilot action and also to compare with pedestrian mobility data. PP10 Šibenik did not use tourist arrivals and overnight stays from the destination dashboard because, like all tourist boards in Croatia, they have access to the eVisitor system that provides data on a daily basis, which have not been included in the prototype of the destination datahub, because of the lack of comparable data for other partner cities. PP9 DURA, a development agency for the city of Dubrovnik, does not have access to the eVisitor system. Furthermore, PP10 Šibenik organized free entrance to the museums for visitors who participated in the "Šibenik hat" workshop. For this reason, they used data on museum attendance in order to measure the effectiveness of this pilot action activity.

PP4 Bari used information regarding tourist arrivals and overnight stays, the dynamic map of craft activities and of pedestrian mobility, as well as TripAdvisor data. As for PP5 Venice, the city uses the same information, apart from craft activities. As a public entity, the Municipality decided to make a public announcement to recruit the tourist guides who were willing to develop the itineraries and the craftsmen available to be included in the routes. Anyway, the dynamic map present in the destination dashboard was used as a reference to understand where the craft activities were located and to give some hints to tourist guides.

PP3 Sipro Ferrara is the only partner city that decided to use indicators from the City at Glance dimension (direct employment in tourism, tourism market vs. hotel accommodation development, tourism specialization of local entrepreneurship) because they wanted to analyze the evolution of tourism employment and tourism supply. PP3 Sipro Ferrara was not interested in a dynamic map of the craft activities.

None of the partner cities decided to test the Environment dimension. As stated at the beginning, the pilot action, by its very nature, can help to test only a part of the potential of the destination dashboard prototype, which can support other initiatives and actions. Regarding the environment, at the moment, partner cities only have an estimate of the impact that tourism has on waste production on an annual basis, but not publicly available or regularly updated data that take into account also energy or water consumption. At the moment, they cannot perform a very valuable analysis with the data they have at their disposal (i.e., annual data, last update in 2016). In addition, the environmental effects are noticeable only over a longer period and, in this context, it is very difficult to assess the environmental impact of a single event (pilot action).

Instead, all partner cities have used pedestrian mobility data (see section 4).

Dimension	Šibenik	Dubrovnik	Venice	Ferrara	Bari

City at Glance	-	-	-	- Direct employment in tourism - Tourism market vs. hotel accommodation development - Tourism specialization of local entrepreneurship	-
Tourism	-	- How many tourists in my city - Who are my international clients	- How many tourists in my city - Trends in international tourism - Trends in domestic tourism	- How many tourists in my city - Trends in international tourism - Trends in domestic tourism - Seasonality of international tourism - Seasonality of domestic tourism	- How many tourists in my city - Trends in international tourism - Trends in domestic tourism
Culture & Crafts	- Museum attendance	-	- The territorial distribution of craft activities: the dynamic map		- The territorial distribution of craft activities: the dynamic map
Environment	-	-	-	-	-
Accessibility & Mobility	- Pedestrian mobility	- Pedestrian mobility	- Pedestrian mobility	- Pedestrian mobility	- Pedestrian mobility
City Popularity & Attractiveness			- TripAdvisor data	- Popularity of the city "brand" in the world - Popularity of the city "brand" in the home country	

				- Ranking of top attractions for visitors	

Table 1. The indicators used by each partner city, by destination dashboard section

3.3. Annex 3 – Pilot action monitoring form

The document deals with the implementation of the pilot action. During the implementation, partner cities carried out a monitoring activity in order to assess the initial results and take remedial action if necessary.

Even though some partner cities had problems meeting deadlines and/or engaging particular stakeholders, all pilot action activities were eventually implemented without serious deviation from what was planned.

3.4. Annex 4 – Pilot action final report form

Annex 4 gives an overview of the pilot action's implementation, including the activities carried out during the implementation process, the pilot action's actual contribution to heritage promotion, potential problems, deviations, and delays previously identified, their causes and solutions, and finally, a description of the pilot action's main achievements, the stakeholders' involvement in the implementation process, and the target. In addition, Annex 4 contains a comprehensive evaluation of the dashboard testing process, as well as recommendations to improve the dashboard in order to support tourism policies in the future.

Table 2 provides a summary of the recommendations for destination dashboard improvement as they emerge from the texts. PP3 Sipro Ferrara stated that the destination dashboard could be further improved but did not provide specific recommendation. PP4 Bari suggested that destination dashboard could be further improved by adapting its contents to the specific needs/context of each city (fewer contents but more strategic). Furthermore, they would like to have a possibility to export dynamic map in JPG or PNG format, as well as to be able to display more craft activities at the same time. PP9 Dubrovnik suggested displaying more details of a particular data in a dashboard. PP10 Šibenik suggested that data should be available in a more user-friendly format. Also, they proposed more training sessions considering dashboard usage. Recommendations were further discussed with each of the partner cities during the in-depth interviews (see section 5).

PP3 Sipro Ferrara	• No concrete recommendation.
PP4 Bari	• To be an effective tool for supporting tourism policies, this instrument could be further improved by adapting its contents to the specific needs/context of each city (fewer contents but more strategic). This would make the dashboard sustainable after the project end date, since would let each city to update it with data already at disposal/easy to find.
PP5 Venice	• It would be useful to be able to view the maps in full screen and to be able to easily export them to good quality JPG or PNG files where all the data can be well displayed, as well as being able to view even more types of activities in the same map. • Furthermore, given the effort required to populate the platform with data, perhaps it would be appropriate to reduce the amount of data categories and focus on those that are most important to develop the future administration's tourism strategies.
PP9 DURA	• Future improvements should be based on enabling the display of more details of a particular data.
PP10 Šibenik	• Data should be in more user friendly format (excel – numeric) to be able to compare, draw conclusions, etc.

Table 2. Recommendations for the improvement of the destination dashboard

4. S.LI.DES. mobility experiments

Within the testing of the Dashboard, all partner cities also check the pedestrian mobility data included in the Accessibility and Mobility section. They were interested in monitoring tourist flows per day and hour, event-related, etc. Monitoring tourist flows can help them better plan resources, working hours, event distribution. For this purpose, PP6 CAST collected and analyzed the data for each of the partner cities (see Annex 1 – S.LI.DES. Experimental activity report).

- Ferrara experimental activity

The data collection can help performed using six Wi-Fi scanners that record the presence of a mobile device in the chosen area when the Wi-Fi connection is turned on and assign an anonymous ID mac address to each device. Other information provided by the sensor systems is related to the duration of the stops in the different locations and the mobility network: i.e., the frequency of switching between the different locations.

- Bari experimental activity

PP4 Bari decided to use the video cameras installed between the station and the historical center (via Sparano, which connects the train station to the historical center) by upgrading these cameras to people flow sensors. The system uses artificial intelligence-based video analytics to measure the pedestrian flows in the monitored area.

- Venice experimental activity

The S.LI.DES. project developed a system of data acquisition for the presence of city users in San Marco square. The system uses installed video cameras connected with a server, where real-time analysis is performed by an algorithm based on a deep learning neural network.

- Dubrovnik experimental activity

The experimental activity in Dubrovnik has been implemented by using a system to detect the presence of a mobile phone connected to the Wi-Fi access points present in the city. This system can be integrated with the video camera system at the entrances of the historical center and allows to obtain information on a larger area both on the tourist presences at different points of interest (to each connected device it is assigned an anonymous ID) and in the mobility network (i.e., the presence of the same device at different points at different times).

- Šibenik experimental activity

PP10 Šibenik has installed four video cameras. The experimental campaign has been performed using video-camera analysis to detect the tourist flows. The videos are collected on a dedicated server, and they are analyzed in real-time with software developed by the PP6 CAST.

5. In-depth interview with partner cities

Starting from the results of the secondary research, PP7 Institute for Tourism carried out interviews with partner cities to gather additional information about the Dashboard testing. In particular, the main goal was to understand the

reasons why some data have been used or not used, the difficulties encountered, the features they would like to add or modify and what is their perspective about the future use of the Dashboard. Interview with partner city PP10 Šibenik was held in person, on August 27th, 2021, in Šibenik. Communication with PP5 Venice was realized via e-mail correspondence (from March 9th- March 11th, 2022). Interviews with other partner cities were held via Google Meet as follows:

- PP9 DURA on December 14th, 2021, from 11.00 - 12.00,
- PP3 Sipro Ferrara on December 21st, 2021, from 11.00 - 11.45,
- PP4 Bari on December 21st, 2021, from 12.00 - 12.45.

At the beginning of the meeting, partner cities were briefly introduced with the aim and the scope of the interview. Each interview started with partner cities' short description of pilot actions and their main objectives. The interview consisted of seven main questions that were modified/expanded depending on the respondent's answers.

1. Are you satisfied with the realization of the pilot action?

   Each city was generally satisfied with the realization of their pilot actions, taking into account the COVID-19 pandemic, pandemic measures, and the lack of tourists in their cities. They all received great feedback from local craftsmen as well as from visitors. Some craftsmen never had the opportunity to present their work close to the city center. In Dubrovnik for example, some visitors never saw the interior of Lazareti, which is the oldest quarantine in the world, so they were pleasantly surprised. Lazareti was built as one of the preventive health measures to protect the population of Dubrovnik during the times of the Dubrovnik Republic. One visitor stated: „I live my whole life in Dubrovnik, but never had a chance to experience inside of Lazareti complex". PP5 Venice intends to continue carrying out initiatives to enhance Venetian craftsmanship and creativity. The S.LI.DES. pilot action provided them an opportunity of opening a communication channel with artisans that can be used in the future for all initiatives that go in this direction. All partner cities believe that they have fulfilled their pilot action objectives.

2. What would you change/ improve and why?

   Parter cities stated that in the pre-pandemic time, the implementation of the pilot action would be even more successful. During 2021, people were avoiding crowded places and indoor activities. In PP10 Šibenik, they decided to move some activities outdoors (Šibenik hat workshop) and it was the right thing to do because they had more visitors. But, on the other hand, they had to cancel one pilot action activity (*a capella* singing concert) because of the COVID-19 restrictions. PP4 Bari would like to attract more foreign visitors since their pilot actions were visited mostly by locals (around 90% of visitors were local residents). PP5 Venice would like to extend the range of action of future initiatives to enhance the City's craftsmanship. They concluded that the public tender would have to be reopened in the future, leaving more flexibility to the City also to include some companies of recognized historical

and artistic value and to involve them even if they will not participate in the tender. Only PP3 Sipro Ferrara stated that implementation of their pilot actions was not impacted with COVID-19 measures.

3. How did you use the destination dashboard?

   Partner cities used the destination dashboard for planning the pilot action and for data analysis after the implementation of the pilot actions. Given the nature of the pilot action chosen, in the planning phase all partner cities used the dynamic map on craft activities (because it allowed them to easily locate craft activities in their city and identify, for example, the best areas to build the itineraries). They were also interested in the TripAdvisor data. Furthermore, PP9 DURA used data on tourism arrivals and nights in order to plan the pilot action date.
   Partner cities wanted to use the destination dashboard to analyze mobility data after the implementation of the pilot action. The data were provided directly by CAST because the prototype does not allow an automatic download. Partner cities received analysis of mobility data from PP6 CAST both with the approximation for the places that were not covered with sensors or cameras. They found those approximations very useful.

4. Is there any feature that would you like to add/change on the dashboard?

   The features mentioned refer, for example, to the type, the format the timing and the display of data. Partner cities expressed their opinion above all on the volume, timing and representation of data. For example, partner cities would like to have a complete list of local craftsmen available on a destination dashboard. They would also like that the list is presented in another, more user-friendly way. Partner cities would like to filter local craftsmen more easily (by location, for example). PP4 Bari and PP5 Venice would like to adapt destination dashboard contents to the specific needs of each city. They suggested to focus on indicators that can be regularly updated. PP10 Šibenik would like to use mobility data in order to obtain a new indicator - approximation of daily visitors. This would be a very useful indicator because the city of Šibenik has many daily visitors and currently they can't approximate/measure them. Some partner cities commented that the destination dashboard is good for visualizing data, but it is not suitable for producing their own analyzes.

5. Did you have any difficulties with the destination dashboard, technical or else?

   The difficulties mentioned do not refer to the Dashboard directly, but mainly with the sensors used to collect mobility data. Partner cities had some difficulties due to the location of the devices (sensors and cameras) installed for recording the tourist flows and due to the use of city infrastructure (electricity, internet, etc.) PP3 Sipro Ferrara sensors were not working at all during the pilot action implementation while in PP10 Šibenik cameras lost signal for a few weeks. Regarding the Dashboard, PP10 Šibenik expressed the interest in more destination dashboard training sessions because they would like to learn more about all the available features. This would be also very

helpful for the workshops when they will have to demonstrate the destination dashboard and its functionalities to their stakeholders.

6. Who will use the destination dashboard in the future?

   PP3 Sipro Ferrara will continue to use the destination dashboard in the future. They are also interested to continue to update destination dashboard data. PP4 Bari is also interested to continue to use the destination dashboard but would like to focus on data that can be regularly updated. PP4 Bari considers useful only data on a daily, possibly monthly basis. PP10 Šibenik didn't used TripAdvisor data for the pilot action but thinks they can be very useful for future actions. They did not have the opportunity to test them during the pilot action, but they will use them in the future organization of the events. PP9 DURA believes that the destination dashboard should be used the most by local authorities since they are local decision-makers. PP9 DURA suggested that the destination dashboard could be interesting for destination data providers since they can keep some destination data up to date, for example, tourist board. PP5 Venice stated that the destination dashboard could be a very useful tool for the tourism office to produce analyses and reports for policy and decisions makers. The main problem they see in the future use of the dashboard is that there is not a back office to let tourism personnel easily upload new data, but there is the need for an IT technician.

7. What are your general impressions after destination dashboard testing?

   Partner cities, in general, concluded that the destination dashboard is potentially very useful tool for the tourism office to produce analyses and reports for policy and decisions makers. They think that the destination dashboard will not be in use after the project ends if there will be no possibility to update destination data and if users will not possess enough technical knowledge to do it. Furthermore, it will be very challenging to oblige data providers to continue to deliver new data.

6. Recommendations for further dashboard improvement

The destination dashboard is a very well-structured tool that can help local decision-makers in tourism management. According to what we know so far, the S.LI.DES. project is the first attempt to create an integrated knowledge system that employs data analytics to provide a holistic view of the city and its performance from various viewpoints, not just tourism.

But, creating value from data is a complex process. A general challenge, in both countries and all five destinations, is the spread of data culture and then the general awareness of the importance to have updated data regularly available,

in order to support decision-making processes. Partner cities manage to collect a valuable set of data, but they invested much time and energy. They had to identify data sources, extract data, and prepare them for analytics.

Data availability directly relates to the territorial level of analysis. As Italian and Croatian National Institutes of Statistics have acknowledged, there is still a lot of work to be done to improve data collecting at the municipal level. However, data sharing is also required. Not only is there no open data, but several departments within the same municipality maintain a policy of "watertight compartments" or use distinct data gathering and storage techniques, preventing information from being shared. When it comes to the usage of private data, i.e., acquired by physical organizations (such as transportation providers) or online platforms, the question is how to manage the connection with them, given that the data relate to the city and its performance.

Given the difficulties encountered during the development of the S.LI.DES. prototype system, it is worthwhile to learn and spread some lessons from this experience, which will support future development of the destination datahub and dashboard, as well as the planning of other projects in the field and, more broadly, the evolution of data culture at the city level. This is also significant in the context of the S.LI.DES. project, which entails sharing the destination datahub and dashboard framework with other EU cities.

All of the mentioned issues, from a global sustainability perspective, highlight the need for cities, as well as stakeholders directly and indirectly involved in local development and data management, to prioritize data collection, elaboration, and sharing in order to monitor tourism evolution within the urban context and contribute to social, economic, and environmental development balance through informed and evidence-based strategies and actions.

Attachments

The document contains attached Annex 1 – S.LI.DES. Experimental activity report.

S.LI.DES.
Experimental activity report

In this report PP6 CAST described the experimental activities that have been implemented in the cities during the S.LI.DES. project. The focus is to illustrate the data quality recorded by the detection systems and the analysis performed in the dashboard. The sections refer to the experimental activities in the different cities.

Ferrara experimental activity

The data collection is performed by means of 6 WiFi scanners that record the presence of a mobile device in the chosen area when the connection WiFi is switched on and associate an anonymous ID to each device macaddress. The location of the sensors in the Ferrara historical centre has been discussed with the Minicipais shown in the Fig. 1. The WiFi scanners consider only a sample of the population in an area whose dimension depends on the antenna sensitivity, they do not distinguish the flows in different direction but since the ID associated to the device is unique that are able to detect the same device in different location and to reconstruct the mobility demand. The sensor location has been chosen to consider the problem of detecting the mobility flows from the station and the parking areas near the historical centre and the presence the main POI of the Ferrara centre. The data are collected in the datahub and make available to the models.

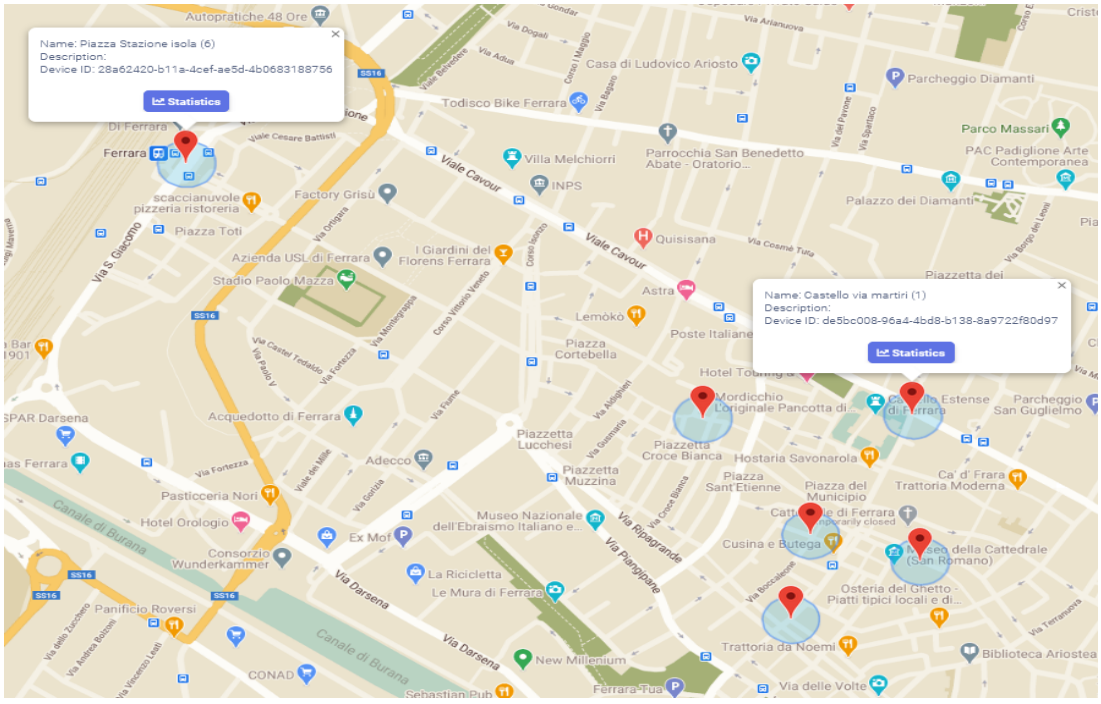


Fig. 1: the markers show the location of the wifi scanner installed in the Ferrara historical centre to perform the experimental campaign.

In Fig. 2 we plot an example of the presences detected each 15 minutes by the Piazza Castello sensors and Station sensors during three different days (27/3, 24/4 and 8/5/2021).
We also apply an averaging procedure to smooth the sensor fluctuations in the data acquisition. The data collected in the dashboard are analysed to highlight some signals that can be related to events or seasonal changes for the visitors flows. The analysis is based on the comparison of the recorded data during the period of interest and the average expected presences according to the data recorded in the previous or successive weeks considering the same day of the week. The Fig. 3 shows an example of the data recorded by the Station: the red curve refers to the presences recorded from 7/1/2021 and 10/01/2021, whereas the blue curve refers to the average presences in the 2 successive weeks at a time scale of 15 minutes. The figure highlights clearly the circadian rhythms of the use of the station area and difference among the days of the week. A fluctuation analysis points out the peculiarities of the presences during the selected day with respect to the expected average so that it would be possible to analyse the changes due to the realization of the pilot actions of the project comparing the measures collected during different periods. One of the results of the experimental campaign is to characterize the average use of the considered area during the different periods of the year to distinguish the presences of the visitors from the presence of residence and commuters and to study the changes in concomitance with particular tourist events or after the realization of new tourist initiative. The penetration of the mobile device sampling recorded by the sensors with respect to the total population present in the area will be estimate during the experimental campaigns (a rough estimate is ~1/3 of the total population). In the Fig. 4 we show an example of presences analysis performed using the sensors systems during 31/7/2020 when an event (a concerto) was organized in the historical centre of Ferrara in the evening.

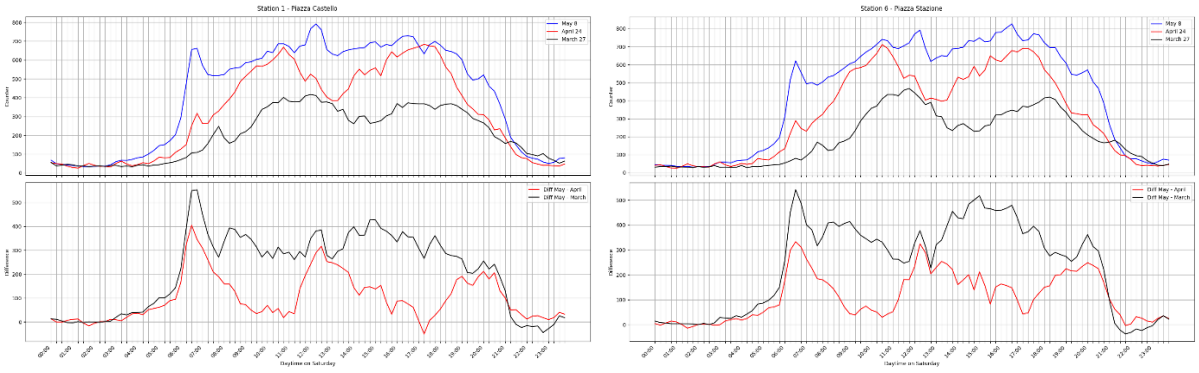


Fig. 2: detected presences by the Piazza Castello sensors (left) and Station sensor (right) during three different days.

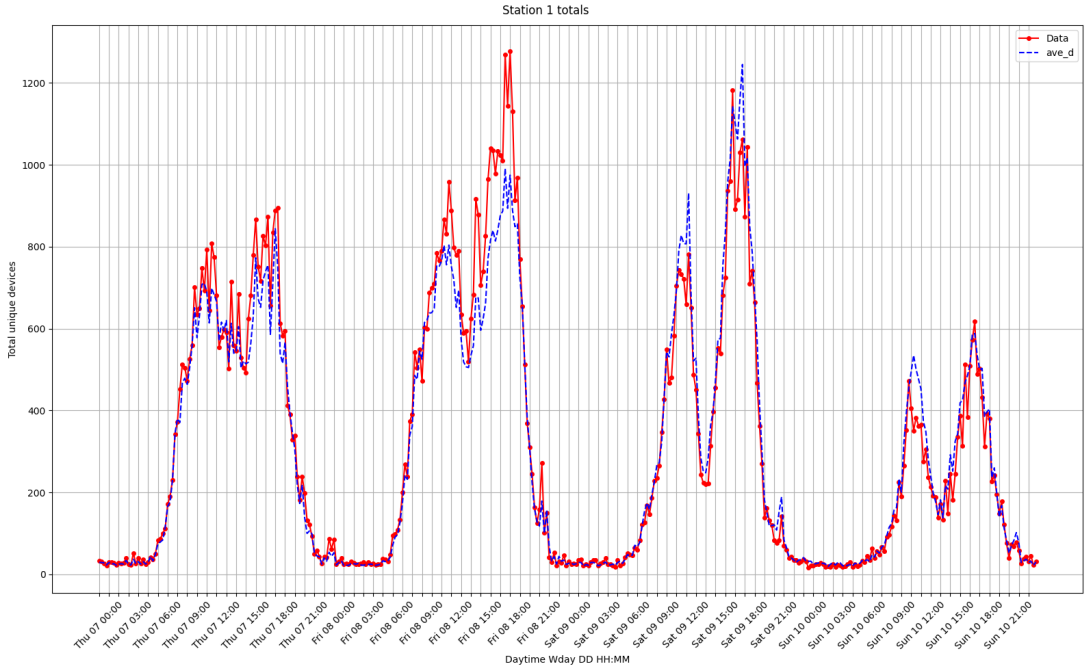


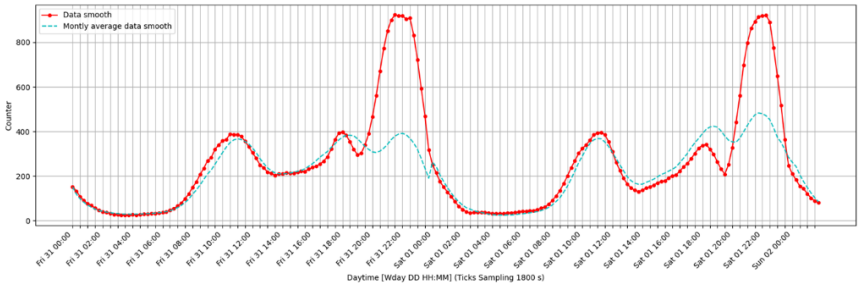
Fig. 3: example of presences recorded by the Station wifi sensor each 15 minutes. The red curve shows the presences detected from 07/01/2021 to 10/01/2021 whereas the blue curve is the average presences during the two successive weeks.

We remark as the system was able to detect an increase of presences in the Piazza Trento e Trieste and Castello area during the evening 31/07/2020 (the measured presences are more than 800 with a sample penetration of 30-40%) whereas we have a weaker signal in the other sensors. However an increase of presences is also observed during Saturday 01/08/2020 by all the sensors, that could be related to summer activities in the centre.

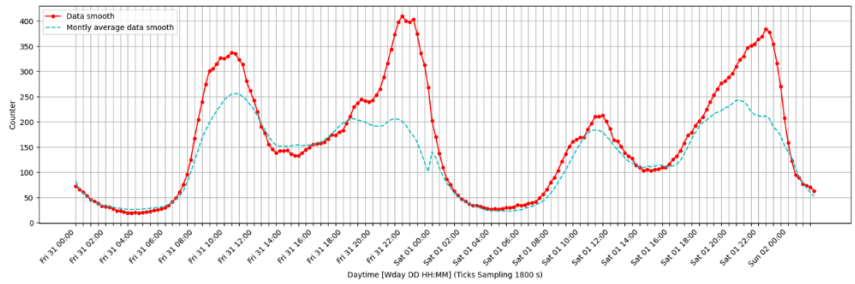
Other information provided by the sensor systems are related to the duration of the stops in the different location and the mobility network: i.e. the frequency of the displacement among the different locations. Indeed the possibility of detecting the macaddress allows to associated an ID to the device, so that, if the same device is detected into different positions at different time there exists mobility path. In Fig. 5 we show the average stop durations of the presences detected by the Castello sensors: we see as the stop duration tends to increase in the evening, but the number of presences follows the cycadean rhythms. In Fig. 6 we plot the reconstructed mobility network during 31/07/2021 according to the displacements of anonymous ID in the area: we remark as the in the afternoon there was a mobility from the station to different destination in the centre whereas in the night the mobility highlights outgoing flows from the centre.

a)

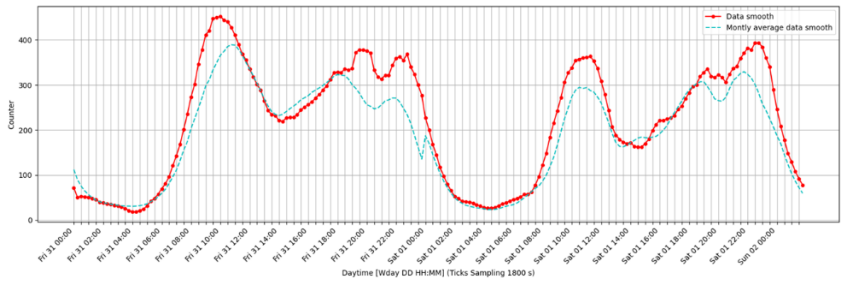
b)



c)



d)



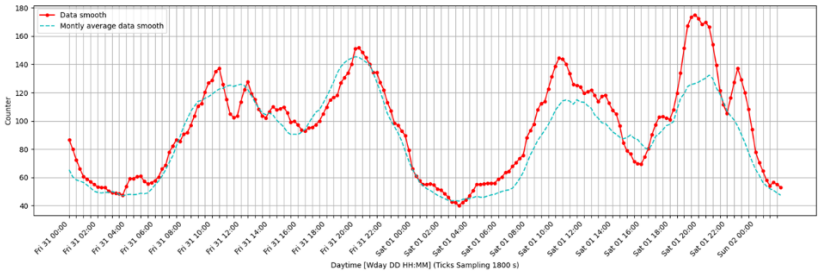


Fig. 4: detected presences during 31/07 and 01/08/2020 by the wifi sensors in Ferrara historical centre (red dots) compared with the average presence in the month: a)Piazza, b)Castello, c)Podestà, d)Carlton sensor. We have a clear increase of presences in the evening

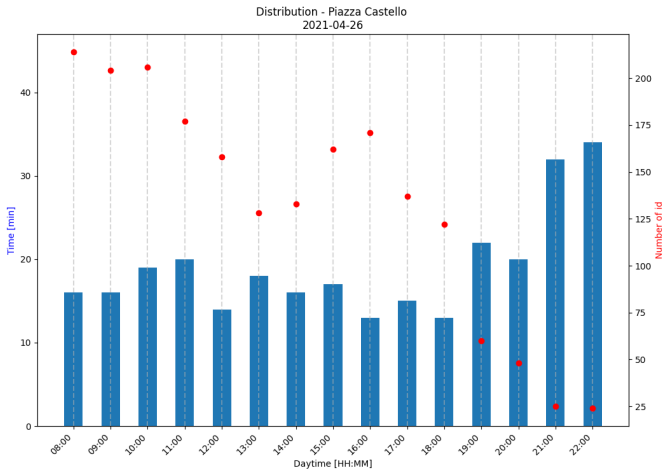


Fig. 5: Stop duration of the detected presences by the Castello sensors during 26/07/21. The histogram gives the duration (min.) wheres the dots are the total counts (right axis).

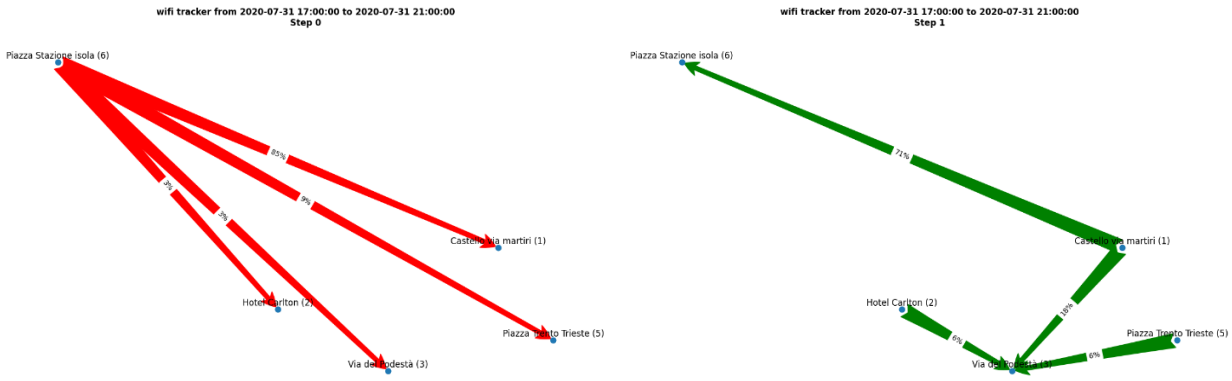


Fig. 6: mobility network reconstructed by the sensor data during 31/7/2020 from 17:00 to 21:00 (left) and during the night (right)

Bari experimental activity

The city of Bari has decided to take advantage from the installed video cameras between the station and the historical centre (via Sparano that connects the train Station to the Historical Centre) by upgrading these cameras to people flow sensors. The location of the video cameras available for upgrading to people counting sensors is shown in Fig. 1 The system is completed by a server that collects the videos and performs a real time data analysis. The measures will be

collected at the SLIDES dashboard and made available for further analysis and for the model simulations. The system uses video analysis based on artificial intelligence to measures the pedestrian flows on the monitored area. In Fig. 1 we show the location of the installed video cameras.

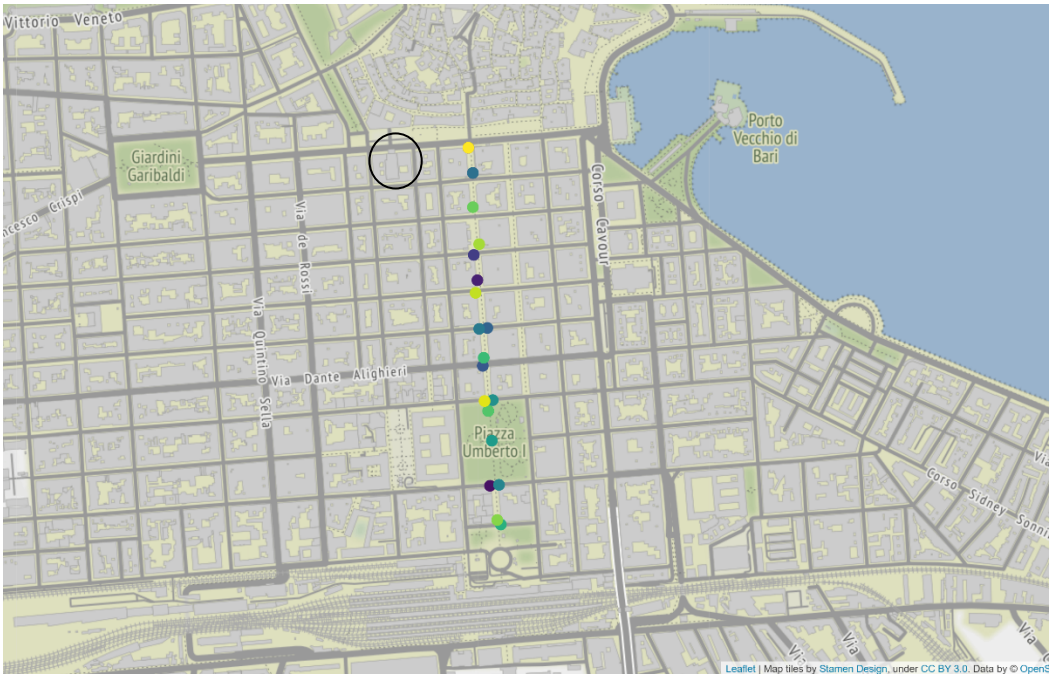


Figure 1: Locations of the video cameras installed in Bari. The cameras are able to detect all the pedestrian flows that enter or exit along via Sparano connecting the Station and the Historical Centre. The circle highlights the video cameras used for the analysis of the presences during events in the Old Town.

The data collected are the presences in the monitored areas and the pedestrian flows that crosses virtual barriers into different directions each 15 minutes. In Fig. 2 we show an example of data acquisition during the month of November 2021 for the presences and the flows along via Sparano.

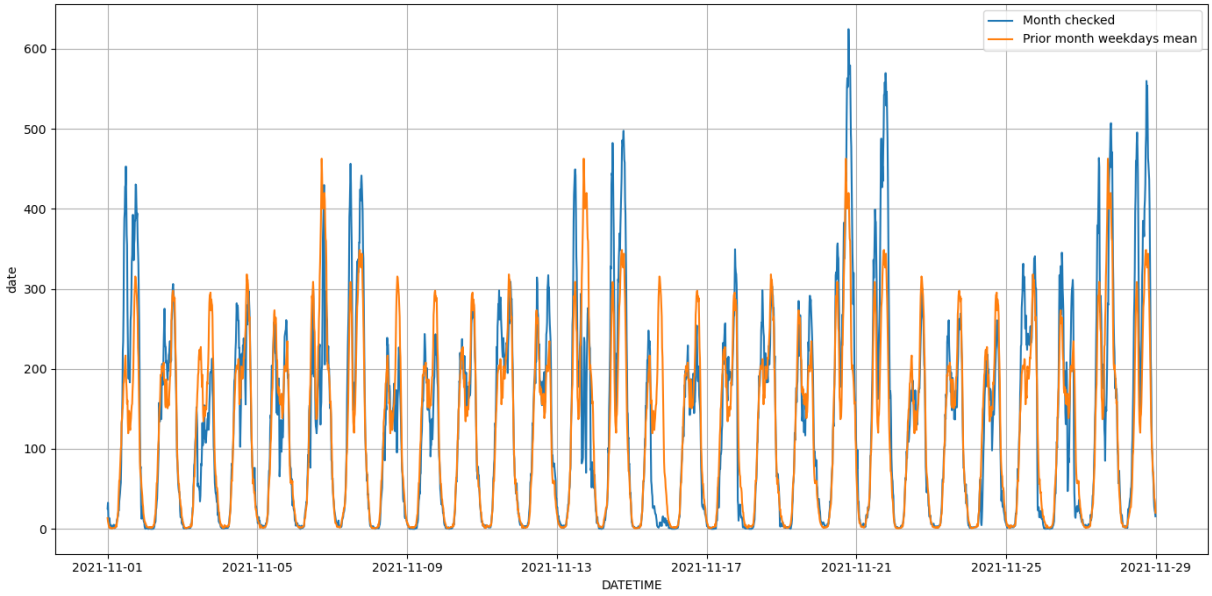


Fig.2.1: total presences each 15 minutes detected during November 2021 (blue line) and October 2021 (brown line). We remark the increase of the presences during the weekends.

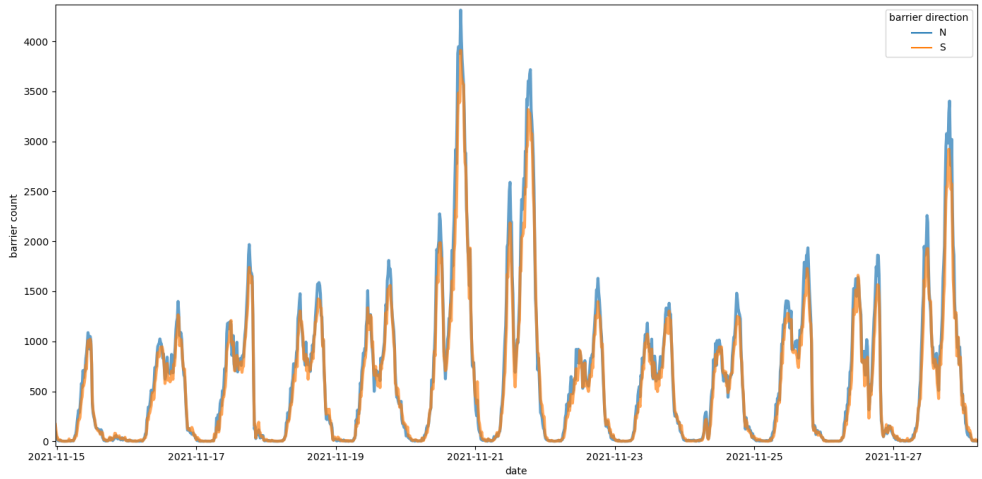


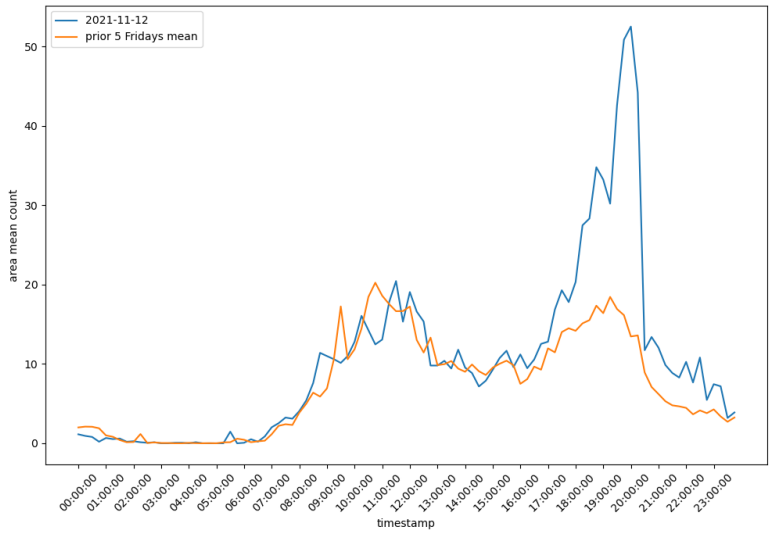
Fig. 2.2: detected flows along via Sparano in the North and Sud directions during the two weeks of November 2021. We remark the symmetricity of the flows and the circadian rhythms.

We observe as the data highlight the circadian rhythms and the increase of the presences during the weekend. The flows can be related to the attractivity of the Historical Centre and the mobility generated by the train station. The methodology proposed to correlate the recorded data with specific events organized in the Old Town compares the recorded presences during the considered period and to estimate the percental changes with respect the expected

average presences computed in the larger period. This analysis is implemented in the dashboard. As an example, we show the analysis performed to study the presences during two events organized in the afternoon of 12-13 November and 19-20 November 2021.

To detect the presences correlated to the events of interest we have compared the presences each 15 minutes with the average presences measured the same day during previous 5 weeks.

This analysis has been focused on the video cameras installed at the entrance of the Old Town (highlighted by a circle in Fig. 1) since the considered events took placed there. In particular, we focus on the presences during the afternoons of Friday and Saturday 12-13 November and 19-20 November that could be correlated with the events of interest. The results are reported in the Fig. 3 where we show a comparison with the average presences in the same day of the previous five weekends.



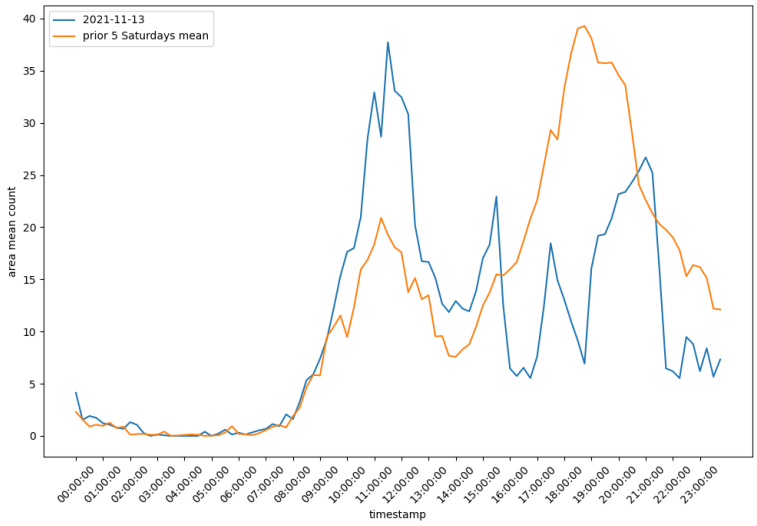


Fig. 3.1: detected presences (blue line) each 15 minutes during 12 November (top) and 13 November (bottom) by the video cameras at the entrance of the Old Town compared with average presences (brown line) detected in the five previous Friday and Saturday. During 13 September afternoon the signal is degraded probably due to weather conditions.

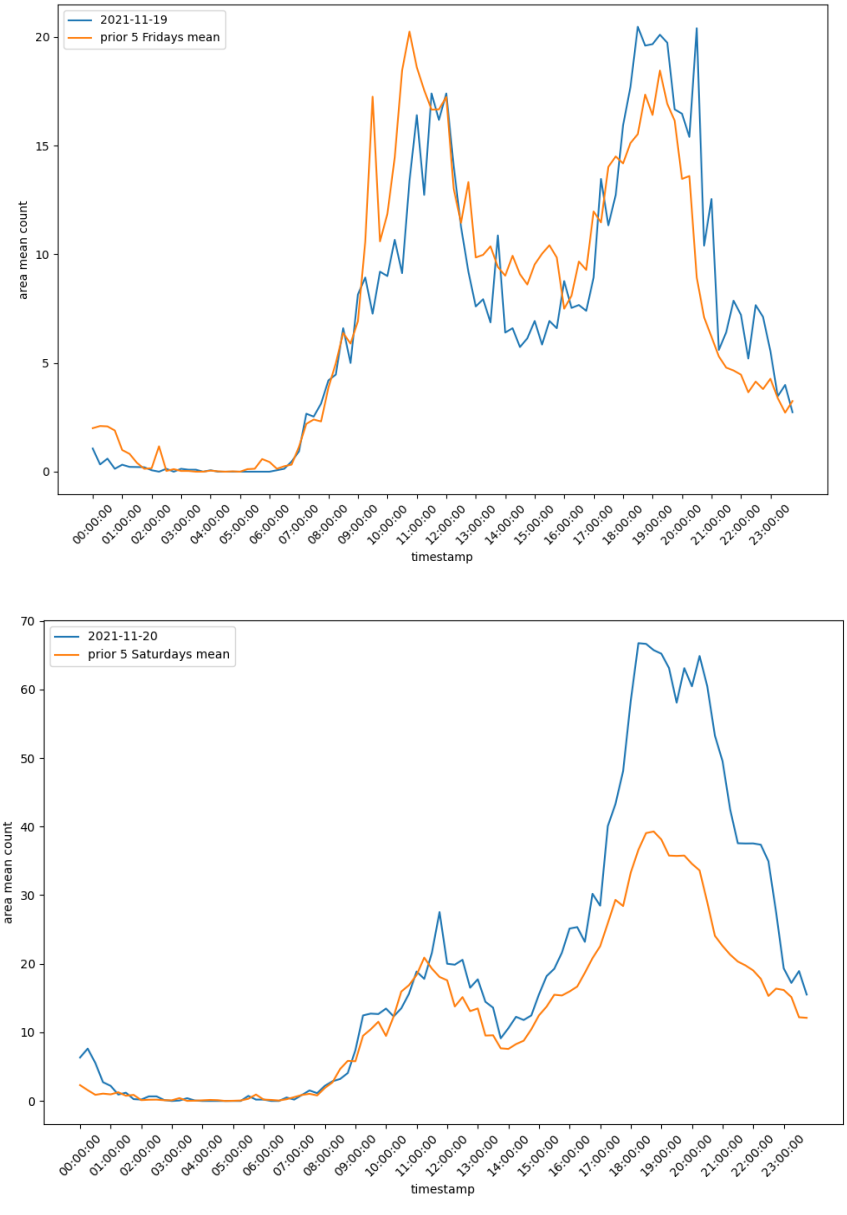


Fig. 3.2: detected presences (blue line) each 15 minutes during 19 Sep (top) and 20 September (bottom) by the video cameras at the entrance of the Old Town compared with average presences (brown line) detected in the five previous Friday and Saturday.

The system shows a clear increase of the presences during 12 November afternoon (almost double the expected presences), whereas no conclusion is possible on Saturday 13 due to the lack of measures (this effect could depend on bad weather conditions). Conversely a small increase of presences is observed during the afternoon of 19 November whereas a remarkable increment is detected during 20 November. To understand if this increment could be related to the activity in the Old Town and not to a generic increment of presences in via Sparano (as suggested by Fig. 1) we have considered all the presences detected by the video camera system during Saturday 20 (see Fig. 4).

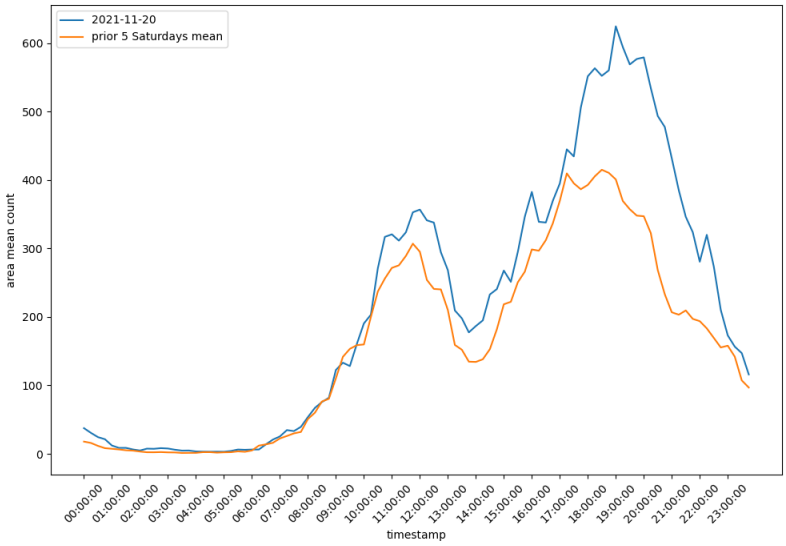


Fig. 4: detected total presences (blue line) each 15 minutes during 20 September by the video cameras along via Sparano compared with average presences detected (brown line) in the previous Saturdays.

We see that a relevant increase is detected by all the camera, however the peak in Fig. 3.2 is in advance with respect the peak in the Fig. 4. Indeed, in the Fig. 3.2 the peak starts at 6:00 o'clock pm whereas the peak in Fig, 4 is at 7:00 o'clock. Then we can conclude that the initial peak of presences (approximately 65 presences each 15 minutes) near the Old Town during Saturday 20 is related to an activity in the Old Town (i.e. to the event of interest).

Venice experimental activity

The SLIDES project has realized a system of data acquisition for the prensences in San Marco square using installed video cameras connected with a server where a real time analysis is performed by algorithm based on a deep learning neural network. This system can be be integrated with the system of people and flow counter sensors that collect real time for the Smart Control Room project of Venice Municipality. These data are available for the Visitors' Mobility Models developed in the SLIDES project thanks to an agreement with the Venice Municipality. The location of the video cameras is shown in Fig. 1. The video analysis will be performed by the same algorithms developed by the CAST-UNIBO partner based on a deep learning neural network. In Fig. 2 we show an examples of frames where we have drawn the bounding box where the neural network performs the people counting and the performance of people detection by the algorithm. As a matter of fact, the efficiency of people counting depends both on the luminosity and crowding conditions of the area, however in normal condition (light hours and not too high people density) the counting has an error ~10% on the ground truth. The video analysis results are illustrated in Fig. 2 by the red dots associated to each individual present in the picture. In the Fig. 3 we plot a comparison between the ground truth and the results of the people counting algorithm for two of the video cameras.

Fig. 1: the yellow dots show the positions of the video camera system installed in the San Marco square to detect the presences.

Fig. 2: examples of frames from the video cameras installed in San Marco square: the red box are the selected areas of the square to optimize the algorithms efficiency and to infer the presences in the whole square throught a scaling of the density. The blue spots denote all the individuals (ground truth) whereas the red dots are the individuals detected by the the neural network.

The video analysis is performed in real time so that there is no necessity to store the video and one can customize the time interval for the people count. Due to the individual movements the data show fast fluctuations in the presences (see Fig. 4 for an example) and it is convenient to apply a moving average algorithm to highlight the evolution of the presences (see Fig. 4 right). As an application in Fig. 5 we show the detected presences in San Marco square during the 2022 New Year's night.

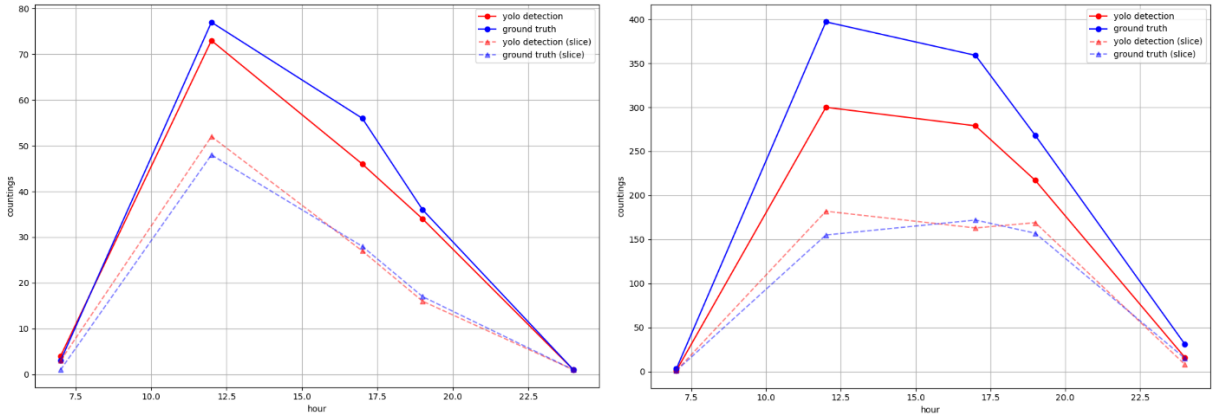


Fig.3: two example of the efficiency of the people counting in different crowding conditions. The blues lines are the ground truth and the red lines the video analysis results. The dotted lines refers to the people counting restricted to the red boxes shown in Fig. 2.

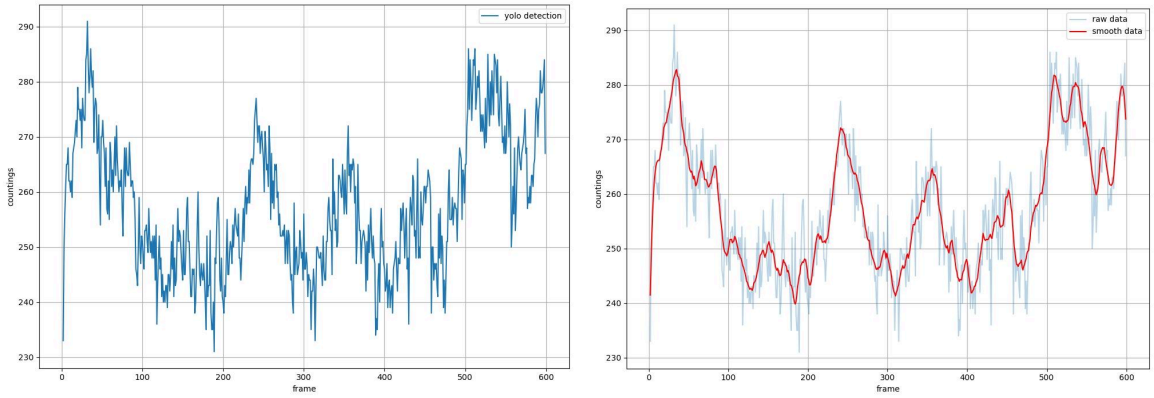


Fig. 4 Left picture: flutuation in the people counting in the successive video frame. Right picture: application the average (continuous lines) to detect the presences time evolution.

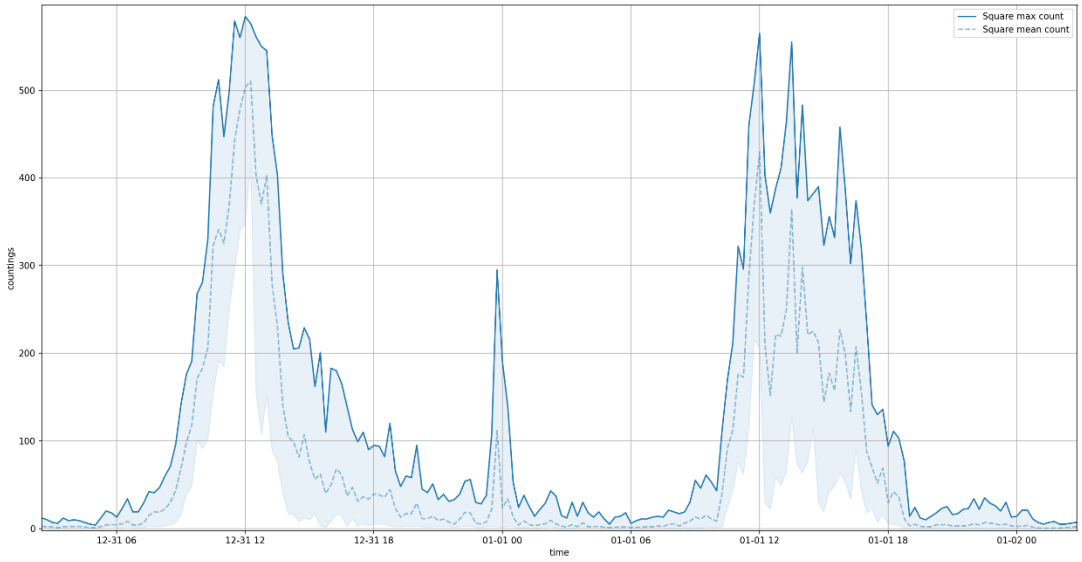


Fig. 5: detected presences in San Marco square during the 2022 New Year's night. The continuous line refers to the maximal counts whereas the dotted lines to the average presences.

Šibenik experimental activity

The experimental campaign in Sibenik has been performed using video-camera analysis to detect the tourist flows. The map in Fig. 1 shows the location of the video-camera positions at entry points for the tourist flows in Sibenik. The location of the four cameras has been decided in collaboration with the tourist agency of Sibenik. The videos are collected on a dedicated server, and they are analysed in real time by a software developed by the CAST-Unibo unit of the SLIDES project. The algorithms are able to recognize an individual walking in the monitored area with an efficiency greater than 90% (depending on the crowding conditions). In this way we are able to count how many individuals are present in each area monitored by the camera, to tracking their trajectories and to count how many individuals are crossing some virtual barriers in a given time interval. In Fig. 2 we show two frames of the monitored areas where we have drawn the virtual barriers to compute the pedestrian flows. The data are collected in the datahub to be visualized and to be integrated in the visitor mobility models. In Fig. 3 we show an example of daily presences during the month of July 2021 using the video cameras *Piazza* (near St Jakov Cathedral) and *Porto* cameras during the whole month of July (blue curves), where we see the increasing tendency due to the summer season. The graph counts all the presences detected by the video cameras so that it is a proxy measure of the tourist activity in the city, but certainly one overestimates the individual presences since the system cannot recognize if the same individual crosses the area several time or remain in the area for a long time. This effect probably reduces in the port area. The oscillation in the presence data near 22 July is a consequence of data loss dur to communication problems among the video cameras

and the server. In Fig. 4 we show the pedestrian flows each 15 minutes detected by the video camera Centro 1 during the month of August 2021 where we see the typical circadian rhythms and a maximal activity in the middle of August.

As an example of data analysis, we consider the change in the expected tourist flows in Sibenik during July 8-9, 2021, using the presence data.

Figure 1: Locations of the video cameras installed in Sibenik. The camera at the port monitors the incoming and outgoing visitor flows, whereas the other cameras are located at the points of interest in the Historical Centre.

Figure 2: examples of frames provided by the video cameras. The left frame is recorded by the video camera near Poljana (*Centro 1*) and the right frame is recorded by the video camera near St Jakov Cathedral (*Piazza*). The red lines are the virtual barriers to estimate the visitor flows

The aim of the analysis to highlight the increase of presences related to the event of interest. The proposed methodology compares the recorded presences in the different areas during the whole month of July to detect the percental increases during the monitored period. In the Fig. 3 we show the sum daily presences detected the whole month of July 2021 that reflects the tourist activity in the city: we remark that the total presences may contains repeated counts if individuals cross the area many times or remain in the area.
The two selected cameras (Piazza and Porto) have recorded an increasing number of presences during July 2021 due to the summer activities and the easing of social restrictions due to the Covid-19 pandemic.

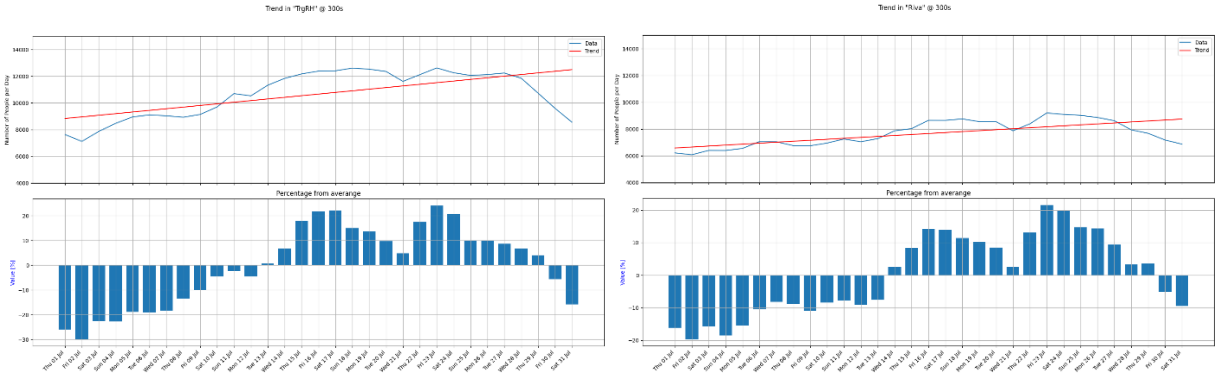


Fig. 3: daily presences detected by the Piazza (left) and Porto (right) cameras during the whole month of July (blue curves). The red line shows the increasing tendency, and the lower histograms give the percentage difference between the data and the interpolated values (red line).

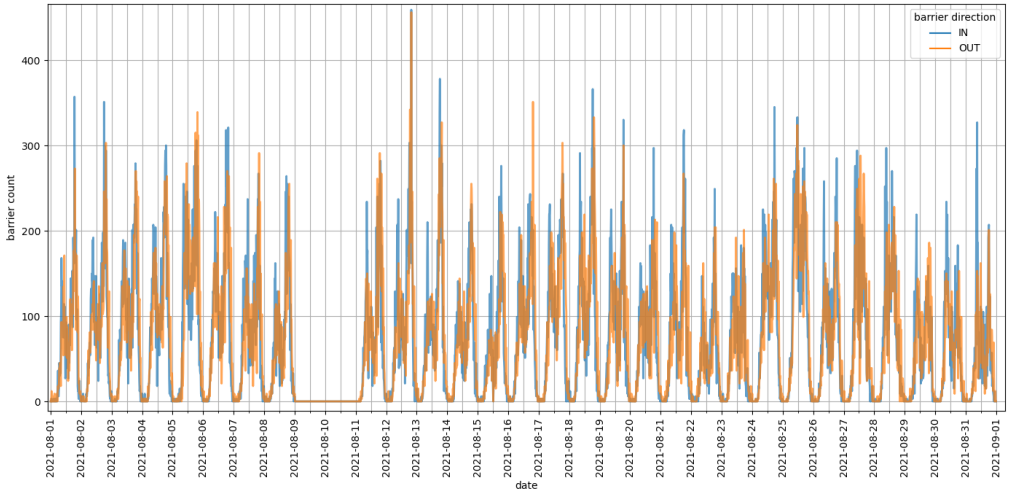


Fig. 4: example of visitor flows recorded by the camera Centro 1each 15 minutes during the month of August 2021 (the two colours refer to different directions). The circadian rhythms area clearly visible. On 10 august we had a loss of data due to communication problems.

To detect the presences correlated of an event of interest we focus the analysis on the afternoon of 8 and 9 July at small time scale, since the comparison of daily presences would be affected by the increasing tendency of July. In Figures 5 we plot the evolution of the presences measured each 5 minutes by the all the video cameras during 8 and 9 July compared with the average presence measured on Thursday and Friday during the whole month.

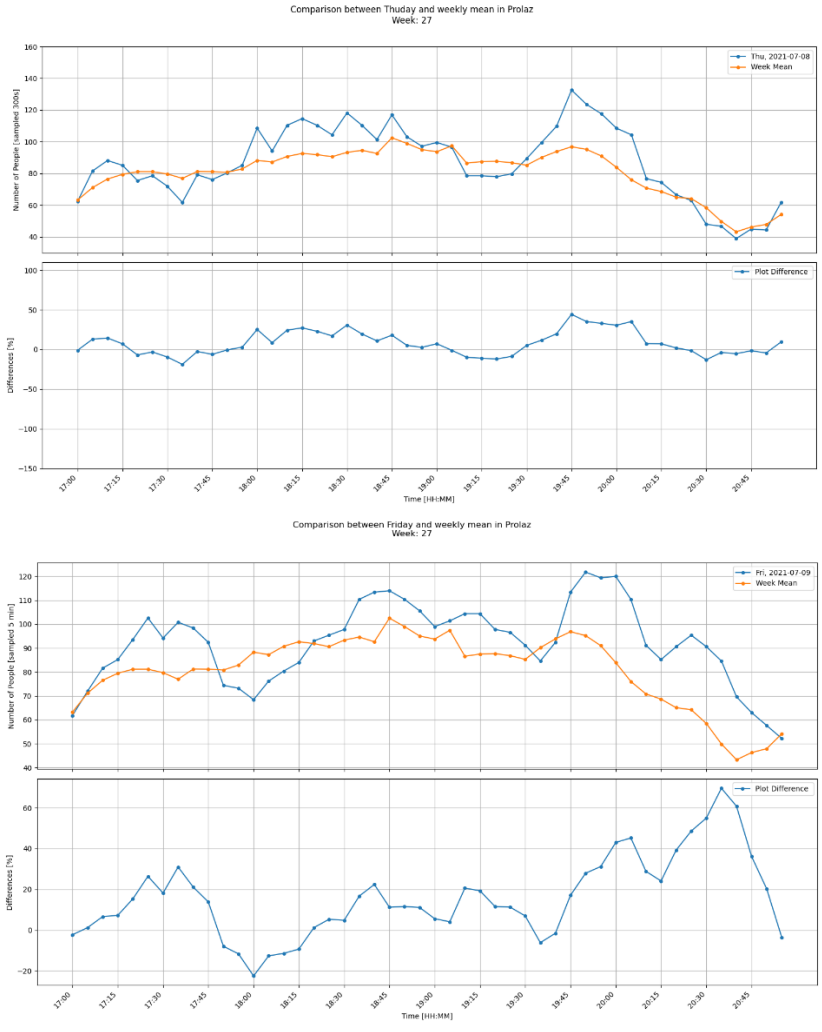


Fig. 5.1: detected presences (blue line) in the afternoon each 5 minutes during 8 July (top) and 9 July (bottom) by the video camera *Centro 1* compared with average presences of July in the same day of the week. An increase of the presences is clearly visible around 8 o'clock pm in both cases.

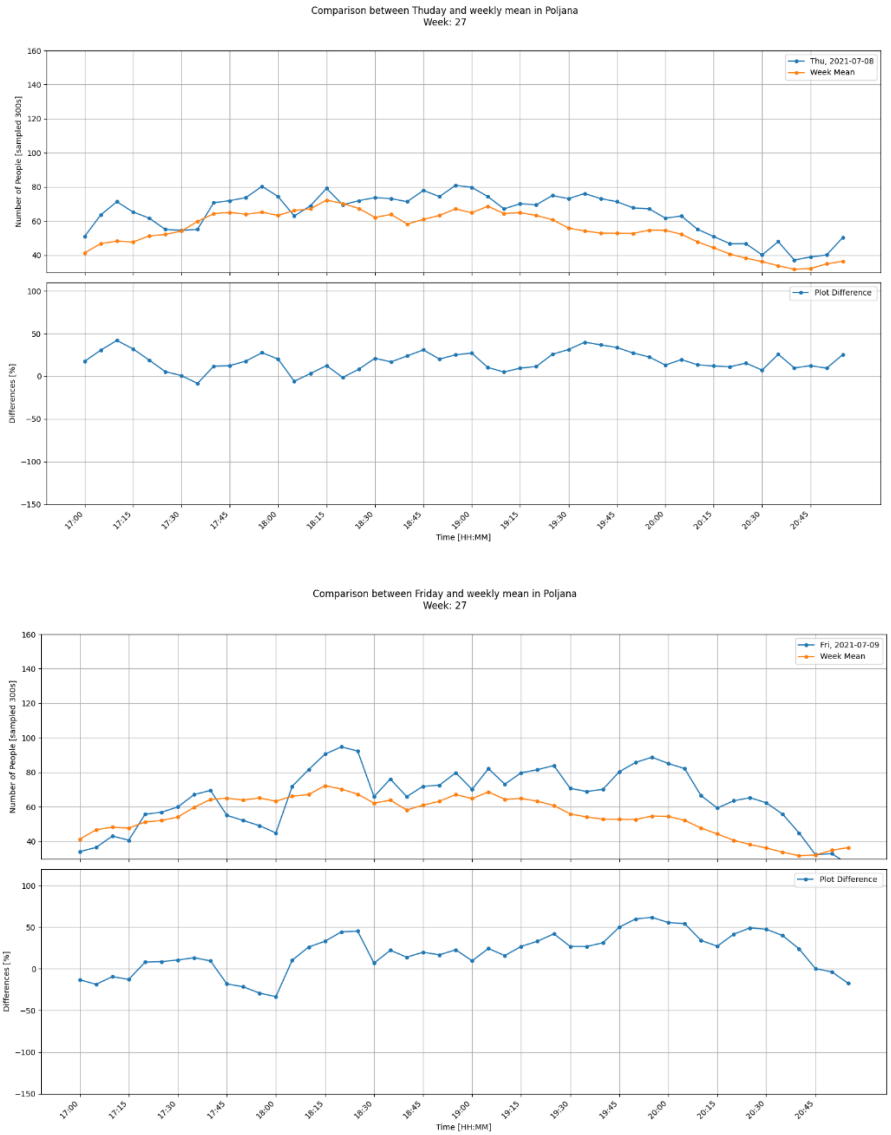


Fig. 5.2: detected presences (blue line) in the afternoon each 5 minutes during 8 July (top) and 9 July (bottom) by the video camera *Centro 2* compared with average presences of July in the same day of the week. An increase of the presences is visible around 8:00 o'clock pm in both cases but less evident than in the other cases.

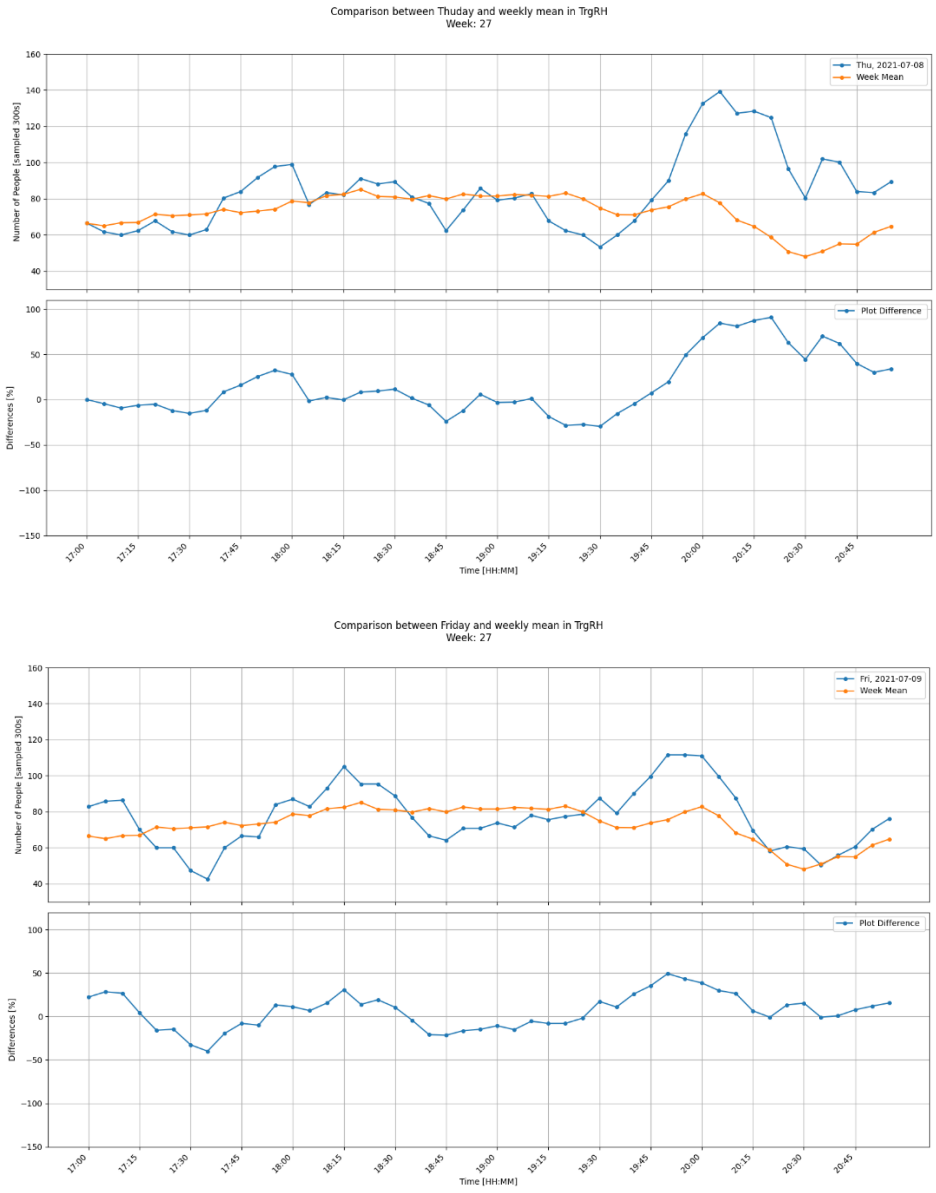


Fig. 5.3: detected presences (blue line) in the afternoon each 5 minutes during 8 July (top) and 9 July (bottom) by the video camera *Piazza* compared with average presences of July in the same day of the week. An increase of the presences is clearly visible around 8:00 o'clock pm especially on 8 July.

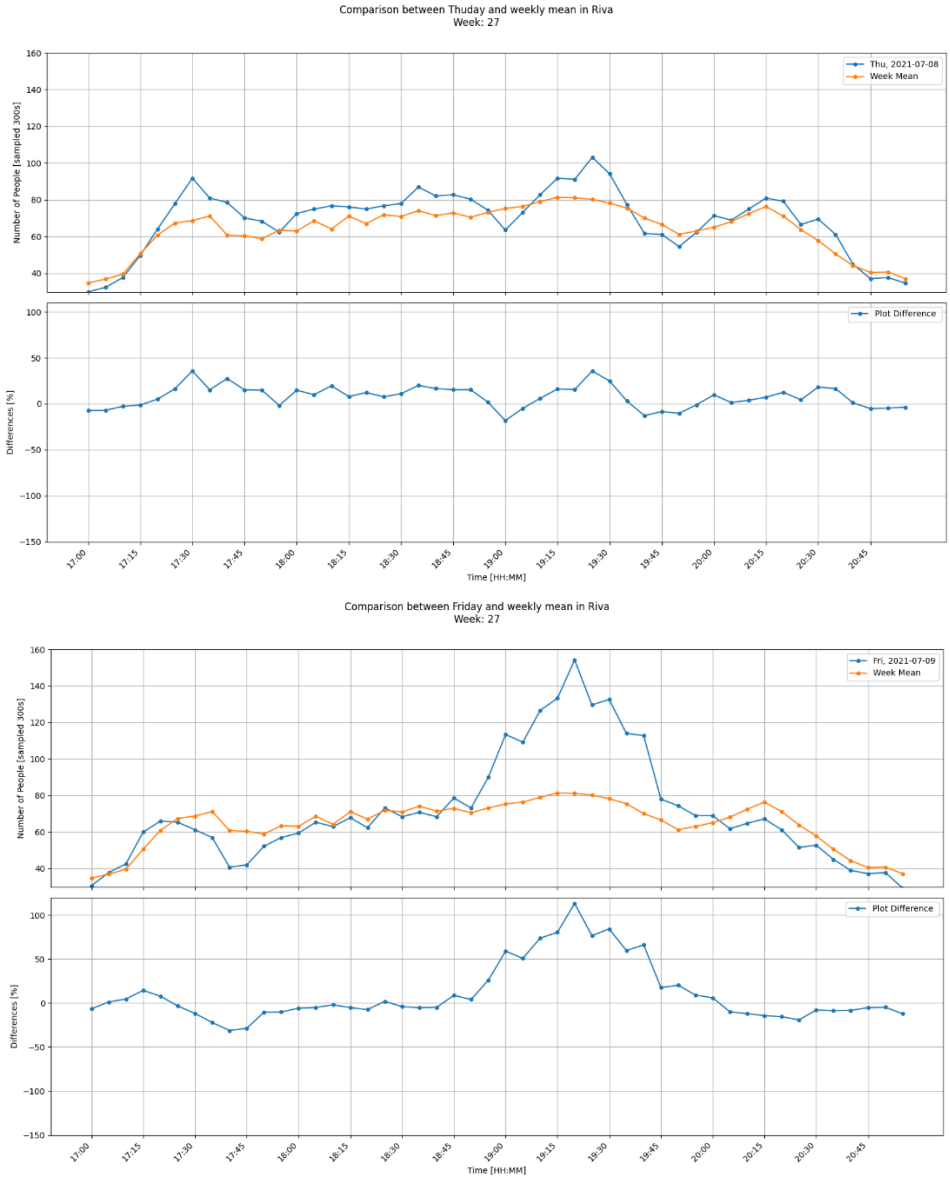


Fig. 5.4: detected presences (blue line) in the afternoon each 5 minutes during 8 July (top) and 9 July (bottom) by the video camera *Porto* compared with average presences of July in the same day of the week. An increase of the presences is clearly visible at 9 July but in advance with respect the previous case.

The study of the presences of the *Centro 1* and *Piazza* cameras highlight a clear increment around 8:00 o'clock pm for both days: 50% more than the expected values that corresponds to ~50 counts each 5 minutes. It is likely that

these signals are correlated with the event of interest. The camera *Porto* also shows a similar increase but in advance so that the detected presence can be interpreted as an incoming flow towards the centre.

Dubrovnik experimental activity

The experimental activity in Dubrovnik has been implemented by using a system to detect the presence of a mobile phone connected to the wifi access points present in the city. This system can be integrated with the video camera system at the entrances of the historical centre and allows to get information on a larger area both on the tourist presences at different points of interest (to each connected device it is associated an anonymous id) and on the mobility network (i.e. the presence of the same device at different points at different times). The distribution of the monitored wife access point is shown in Fig. 1. As it is shown by the figure, due the presence of multiple access points in some location we have performed a clustering procedure for the data analysis.

Fig. 1: the red circles show the location of the wifi access points able to detect the presence of mobile device wifi connected in the Dubrovnik historical centre to perform the experimental campaign.

In Fig. 2 we give an example of the total unique presences recorded by the sensors during some days of January 2021: the data are actually recorded in the SLIDES datahub and the comparison between the presences during winter and the presences in summer would allow to measure the visitors flow in the area.

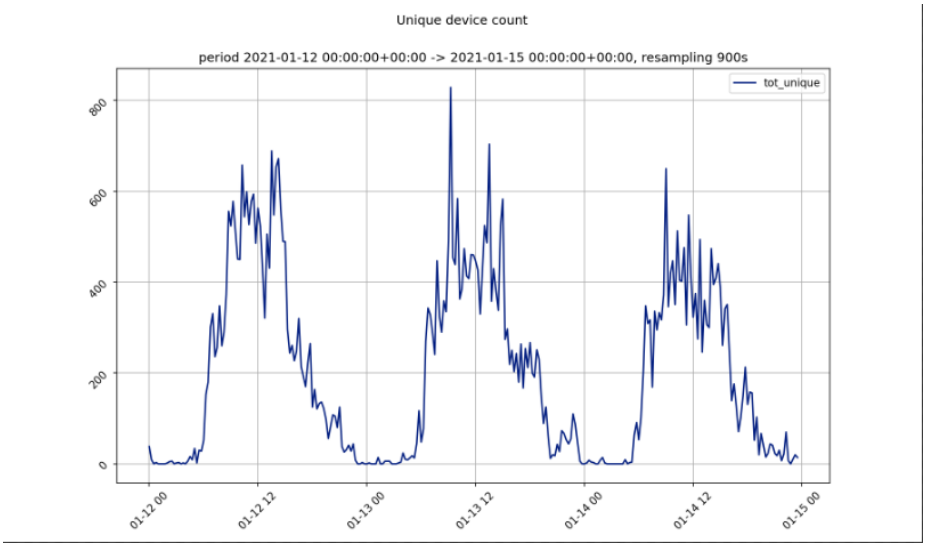


Fig. 2: total unique presences recorded by the wifi access points in Dubrovnik during three days of January 2021. The data are consistent with the flow recorded by the video cameras installed at the entrances of the historical centre.

As an example of data analysis is to estimate the change in the expected tourist flows in Dubrovnik during the September 25, 2021, using the presence data collected by the system of wifi antenna (sensors) distributed in the Historical Centre. We have selected the sensors located in different points of interest that have correctly worked during September 2021. The event takes place on 25 September 2021 in the area of Lazareti (Fig. 3).

Figure 3: Locations of the selected wifi sensors in the Historical Centre of Dubrovnik to detect the visitor presences The circle highlights the Lazzaretto area where the event takes place.

The proposed methodology compares the recorded presences in the different areas during the whole month of September to detect the percental increases during the event. It is difficult to get an absolute estimate due to local character of the measures that considers a sample of mobile phone (identified by an anonymous id) connected to the wifi network in a small area near the wifi-antennas (i.e. the sensors): the average radius is of order ten-twenty meters around each antenna. Moreover, one has to consider the decreasing of the tourist presences in September due to the end of Summer activities (in both cases we observe a decreasing trend of the daily average presences up ~15%). This effect is illustrated in the Fig. 4.1 and 4.2 where we show the daily presences measure by the sensors during September 2021 for the two areas in the Old Town with a tendency line that shows the decreasing rate. The bottom figures give the percental changes with respect to the 1st September. 2021 (Wednesday) chosen as pivot and the presences tend to decrease during the weekend. This analysis has been performed on the two monitored areas in the Historical Centre.

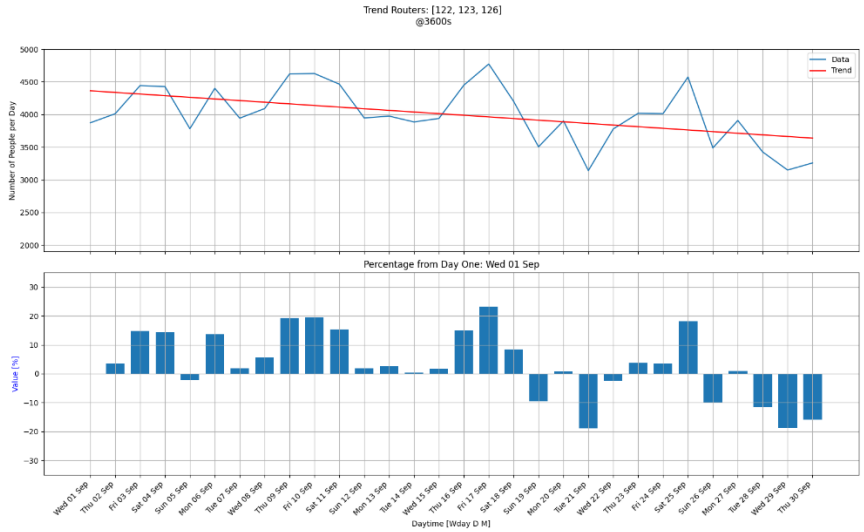


Fig. 4.1 Top: detected presences near the port during the month of September 2021; the straight line shows a decreasing tendency. Bottom: percental changes of the measure presences in the same area with respect to the 1st September. 2021 (Wednesday).

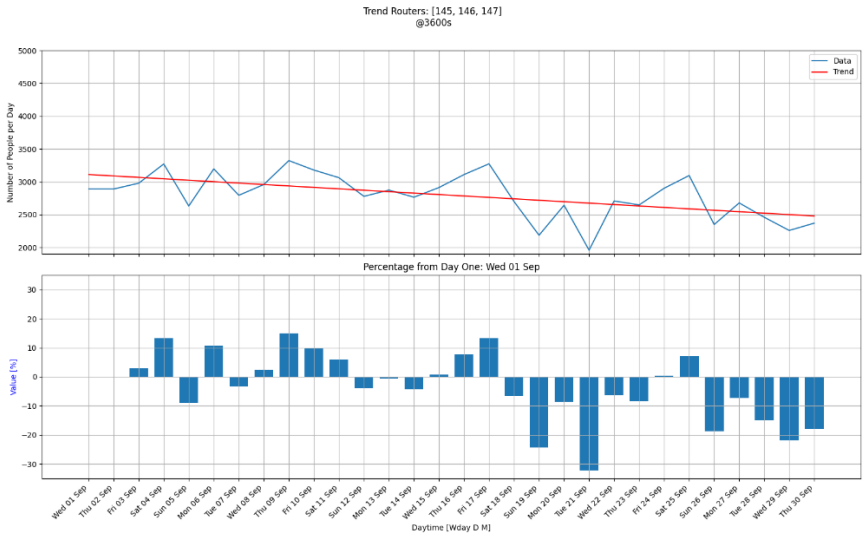


Fig. 4.2 Top: detected presences in the north part of the Historical Centre during the month of September 2021; the straight line shows a decreasing tendency. Bottom: percental changes of the measure presences in the same area with respect to the 1st September. 2021 (Wednesday).

Observing the daily differences (with respect the 1 September), we see that during the weekends the presences usually reduce but on Saturday 25 where we have a reversal trend with respect the previous days. This difference cannot be explained by an increase of presences during the weekend (as one can see by comparing the previous weekends). This effect is present in both the monitored areas, but in the first area is greater and it could be correlated to the event of interest. The number of recorded daily presences near the port is 4500 and it should be comparable with the tourist presences in Dubrovnik at the beginning of September.

In order to detect the presence correlated to the event of interest, we have studied in more detailed the presences during the week from 23/9 to 29/9 2021. In the Fig. 5 we report the hourly presences recoded by the sensor 131 near Lazateri where the event takes place compared with the same average day of all the 4 weeks in September.

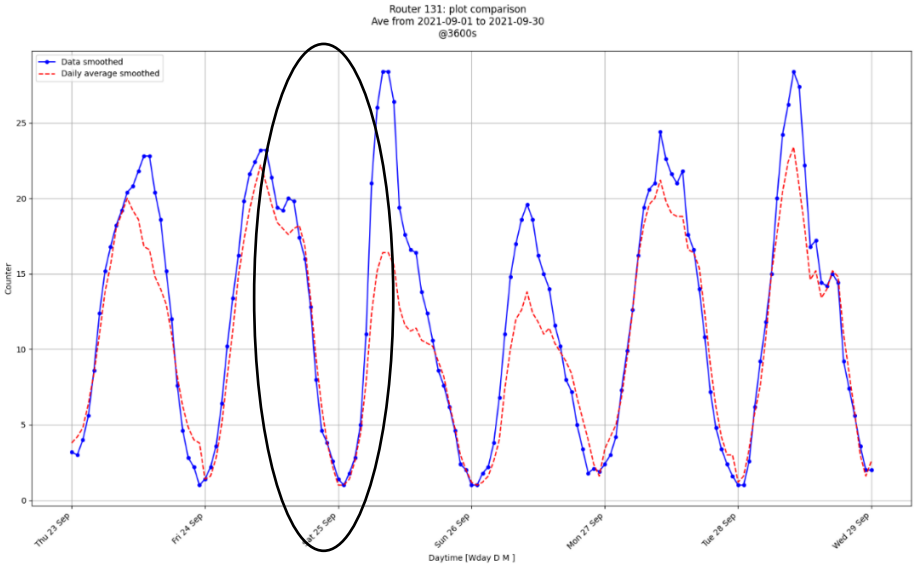


Fig. 5: hourly presences detected by the sensor 131 (Lazareti) from 23 to 29 September (blu line) compared with the average daily presence (in the same day of the week) recorded during the whole month; the ellipse highlights Saturday 25 September.

We clearly see a signal during Saturday 25 September that denotes a remarkable increase of the presences. Then we have performed the same analysis for the other areas to consider the presences in the whole Historical Centre. In the Fig. 6.1 and 6.2 we report the hourly presences for the two areas in the Historical Centre recorded during the same week.

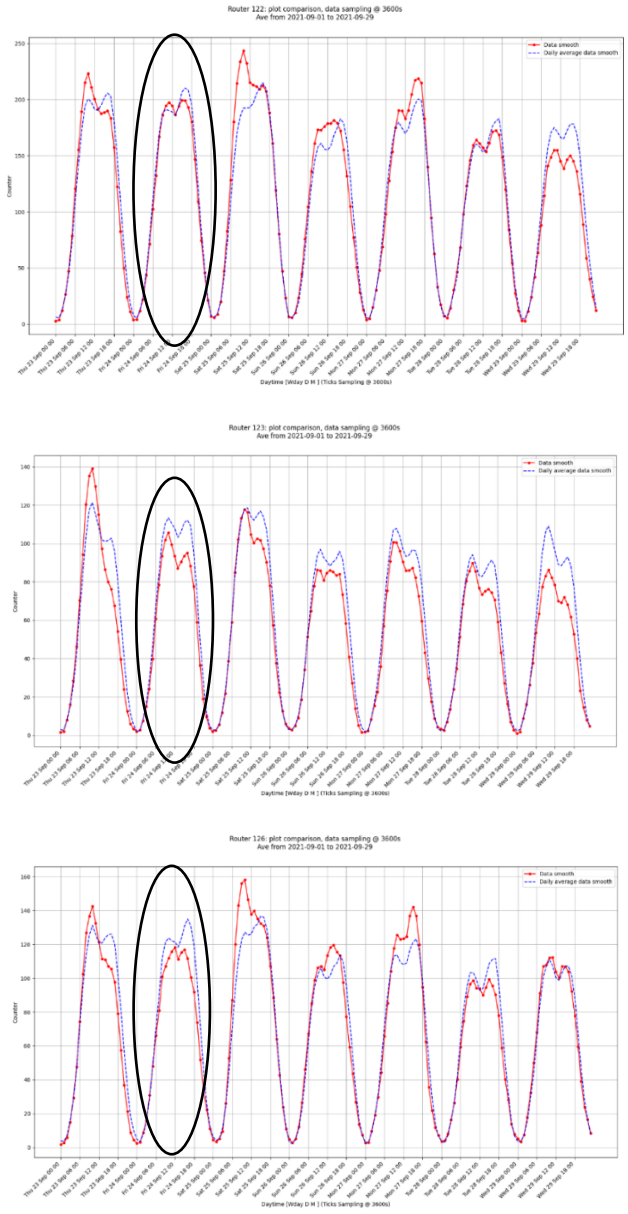
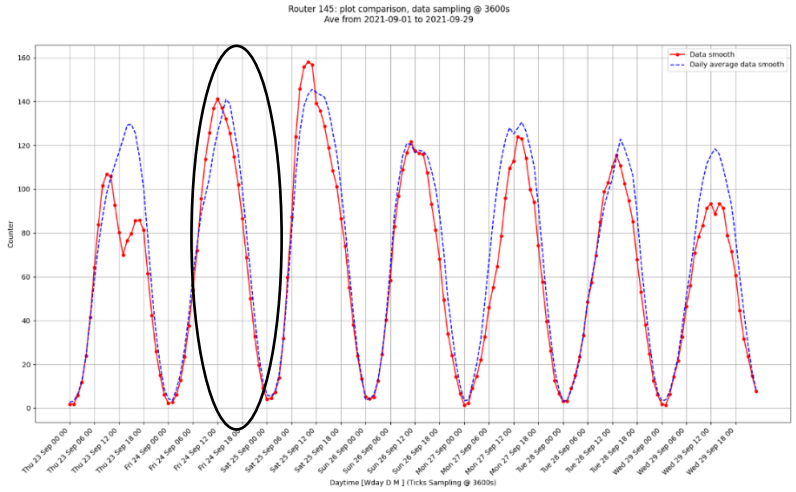
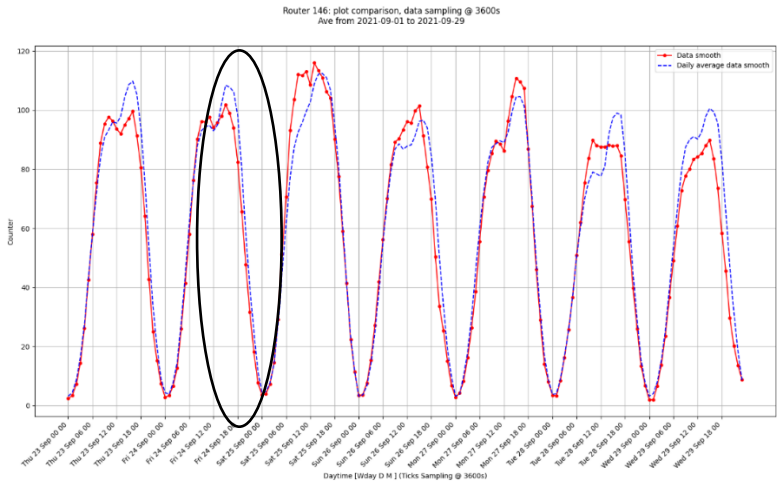


Fig. 6.1: hourly presences detected by the sensors 122 (top),123(center) and 126 (bottom) in the port area from 23 to 29 September (blue line) compared with the average daily presence (in the same day of the week) recorded during the whole month; the ellipses highlight Saturday 25 September.

The sensors 122 and 126 show an increase of presences in the morning of Saturday 25 September consistently with Fig. 5. Conversely, this signal is not detected by the sensor 123 that is slightly displaced (cfr. Fig. 2). A possible explanation is that the sensors 122 and 126 detect the flows north-south in the direction to Lazareti. The increase is quantified by an increment of 20% in the morning with respect to the expected value. In Fig. 6.2 we plot the results for the north area in the Historical Centre.

We observe that during the morning on September 25 there is a signal of an increased number of presences similar as in the previous cases. This signal is probably correlated with the presences in the area near the port: i.e. some visitors in Dubrovnik during the morning have visited both areas.





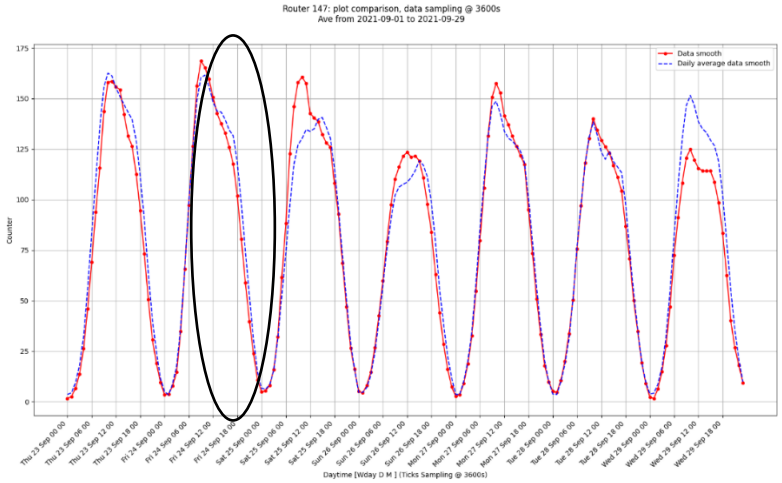


Fig. 6.2: hourly presences detected by the sensors 145(top), 146(centre) and 147 (bottom) in the port area from 23 to 29 September (blue line) compared with the average daily presence (in the same day of the week) recorded during the whole month; the ellipses highlight Saturday 25 September.

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