Immersive Insights: Virtual Tour Analytics System for Understanding Visitor Behavior

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Abstract. Virtual tours are gaining increasing importance especially in the last year, when emerged the need to make develop new products and strategies due to the COVID-19 pandemic, in which people where obliged to stay at home or, however, with strong limitations. To increase visibility and attraction of the users towards many kinds of services, virtual tours are used in different contexts: mainly tourism, but also universities and schools, real estate agencies and commercial activities. Then, virtual tours are communication tools that allow the visitor to navigate in an immersive and interactive way inside a website thanks to the integration of multimedia contents, so to live a real experience. Therefore, it has become mandatory the definition of a standard method for the creation of virtual tours and also a tool for evaluating their effectiveness related to the context in which they operate. In this context, this paper aims at proposing a standard data layer as a baseline to develop serialized virtual tours. Moreover, it presents an analytic tool able to evaluate the performance of a specific virtual tour. The case study taken into exam is the Open Days in a University located in the Marche region, in the center of in Italy. However, the approach can be extended in several context and can be generalised.

Keywords: Virtual tour · Standardization · Analytic · Virtual reality · Editor

1 Introduction

The spread of digital technologies implies that they are increasingly perceived as the most effective means to communicate ideas, concepts, aspirations, news, and research results. The perception of information technology as a privileged

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means of transmitting information is related to the immediateness with which it allows to reach a large audience, the reproducibility, the apparent simplicity of implementation and the infinite availability of products such as videos, images, up to three-dimensional models. Information technology effectively removes this distance through the possibility of reproducing and recreating objects distant in time and space, even those that no longer exist.

The use of Virtual Reality (VR), the last frontier of new media that allows raising communication to an experiential level, has led to the birth of virtual tours [4], an evolution of the static image, which makes the user protagonist of the scene and navigation within it. Virtual tours [11] are communication tools consisting of images or videos that can be intuitively navigated and allow the user to make an immersive and interactive visit thanks to the integration of multimedia content such as audio, video, images, texts, etc., for recreating the real experience [1,17]. In this way, virtual tours, together with the use of high-definition 360° images or videos, are able to recreate a greatly realistic response to visual stimuli, appearing a highly informative and simultaneously engaging tool for the visitor. Virtual tours can be used in different areas. In particular, as well as in tourism [15], they are frequently used by universities and schools, real estate agencies and commercial activities of various kinds, in order to increase visibility and attract new users to the services offered. Compared to a simple web page containing texts, images or videos, the advantages associated with the use of virtual tours come from the ability to better emphasize the particularities of a place and capture the attention of the visitor, who will be completely involved in the experience and will have time to explore further. The increased visibility will produce an immediate image return and an increase in the number of visitors and customers [18]. Thus, there will be the possibility of transforming virtual visits into real visits [12]. Moreover, due to the huge spread of the coronavirus pandemic and the continuous directive of "stay at home" the movements of people have been restricted and many places are not accessible [20]. So, the introduction of virtual tours can produce similar feelings to a real experience since it stimulates the human senses such as images and sounds to trick the brain which is responding to virtual stimuli [8].

One of the main characteristics that a virtual tour must have is the accessibility to different places, through different devices and heterogeneous communication tools. For these reasons, one of the best solutions for their implementation turns out to be a web application for which the use of a web browser is required without the use of additional components.

In general, and regardless of ambit, the elements that must necessarily be included in a virtual tour are: i) informative and descriptive contents of the environments and activities that can be carried out; ii) multimedia content, such as photo and video galleries; iii) a map with the route of the tour; iv) menu with the steps of the tour for the quick selection of the environments; v) a virtual guide properly integrated into the environment; vi) a 360-degree video to introduce the dynamism of the environments or provide useful instructions.

Nowadays, there are two main bottlenecks that researchers and practitioners are facing: the first one is related to the lack of existing tools to speed up the

creation of Virtual Tours. Indeed, despite the acquisition phase is more straightforward than in the past, the editing tools are complex, very time consuming and not licence free [14]; a brief examination of the existing tools will be given in the following section. The second one is the lack of well-established methods to monitor the performances of users' usage. In other words, Virtual Tours are not designed with a user-centered approach, but still relies on the developer choices. Instead, it would be useful to share analytic able to provide developers with a data-driven design. To evaluate the performance of a virtual tour, five are the areas can be investigated [13]:

- Storytelling: the tour must tell a true and identifiable story about the location, with the aim of creating an emotional relation with users.
- Engagement: the tour must combine the right content in the right positions in order to keep users engaged.
- User-experience: the tour must be user-friendly, intuitive and easy to explore.
- Accessibility: a user should access to the tour anytime and everywhere. The access must be available in all device and for all people to the same extent.
- Analytics: the tour should offer not only a personal and dedicated experience to the visitor, but also acquire data on the behavior of the visitor (visit time, visited areas, completion time of tasks, number of clicks, etc.).

The works of the literature neglects all these areas, but evaluate the performance of a virtual tour by limiting the investigation only to a limited number of areas, mainly depending on the context. In fact, some areas are of interest independently by the field of application, while others are strictly related to the context.

Given the above, this work has the twofold aim of, on one hand, i) proposing a standard data layer which could become the baseline for a serialized development of virtual tours. The data schema has been developed in *.json* format to manage a huge amount of spherical images (more than 300) and all the elements for the users' interaction. Thanks to this data layer, the development of the tour is easier and agile. On the other ii) developing an analytics tool to monitor the performances of the virtual tour. The analytics have been set up in Google Analytics, considering the previously mentioned data layer so that developers and managers can understand the real potential of the tool in term of usability and usefulness of the virtual tour.

The remainder of the paper is organized as follows: Sect. 2 describes the state of art for virtual tour evaluation. Section 3 is focused on the description of the workflow and in particular the details of phases that compose the overall system. Some insights about the potential given by the analytic tool set up for this virtual tour are discussed in Sect. 4. Finally, the Sect. 5 closes the paper, presenting also future developments.

2 Related Works

According to [7], is currently limited the number of researches that measure the effectiveness of virtual tours, by evaluating the measure to which they can replace

site visits and the real benefit of users. Therefore, the role of virtual tours as a provisional tool associated to a crisis, such as the one we are undergoing [20], and as promotional tools [9] and also the improvement of quality based on user experience [3], requires further research works.

However, in this section, we present works that propose evaluation tools of virtual tours in different contexts. Concerning the cultural heritage context, the work of [5] aims to propose a study that creates an online platform (Cultural Tourism Digital Guiding Platform, CTDGP) and also evaluates the performance of the user-experience. They based their model on an unified theory of acceptance model of [19], to highlight the relations among the elements that influence the use of the platform. After the virtual tour, a web-based questionnaire to collect data concerning the user perception and usability was administrated. Moreover, the validity of the questionnaire was examined by two experts in the sector. Then, several metrics are used to quantitatively validate the platform.

Another work that evaluates the efficiency of a virtual tour in terms of the user-experience is presented by [2]. The virtual tour is hosted in a University website. The aim of the study is to evaluate the needs and expectations of visitors, mostly students. The participants of the test were 6 students with different technological skills. They must complete seven tasks, and the indicators taken into consideration were how many tasks was completed and the time of completion. In particular, the research wants to estimate how the virtual tour provides the requirements of the students, how this last engage with the virtual tour, and finally to recognise any problems that users meet by clicking link during the virtual tour.

Another research that involves students is proposed by [6]. The authors have studied the perception of the students (two males and four female) that have tested a virtual tour application in an educational context. The study consisted of usability analysis, a user-experience evaluation, and two questionnaires (using a five-point scale) to verify if there were changes in the attitude of students, before and after the experience. The questionnaire concerned engagement, accessibility and user-experience areas. As in [2], the participants had to complete the assigned tasks and a parameter of evaluation was the time of completion.

The evaluation of a 360° virtual tour application in a University website is made in the study proposed by [16]. The tour was constructed through a collection of 3600 images of offices and structures, and shows the location and directions to go to the building. After the tour, a questionnaire, quantified using five-point scale values, was administered to 100 participants, to assess the effectiveness, efficiency, and satisfaction of users. A quantitative evaluation was made: an equation is used to calculate both effectiveness and efficiency, and another for satisfaction. The usability is the mean value in percentage terms of the three previous parameters.

A complex framework of a virtual tour evaluation is proposed in the study of [10]. The case study is a virtual tour of Italian museums. The authors combine two multi-criteria decision making theories: the analytic hierarchy process (AHP) implemented to estimate the weights of the heuristics and the fuzzy technique for order of preference by similarity to ideal solution (TOPSIS) to evaluate the

virtual tours of museums. Unlike previous approaches, the evaluators of virtual tour in museums considered are four experienced researchers in VR, pattern recognition, software engineering and in cultural heritage conservation. During the evaluation of the virtual tour of different museums, they assigned a score (using a five-point linguistic scale) transformed then into fuzzy numbers.

3 Materials and Methods

3.1 Methodology of Data Acquisition

Prior to describe the core contributions of the paper, namely the data layer and the analytics tool, it is worth mentioning the data acquisition phase. Nowadays, to achieve the best resolution and image quality for 360° images, the most widespread practice is that of collecting single pictures with a spherical head and stitching the images in post-processing. This process, albeit allowing to achieve the best result, is very time consuming and might not result affordable in cases, like the one here presented, where the rapidity of acquisition is a must. The images used for the virtual tour have been acquired with the Insta360 Pro 2 camera (see Fig. 1). It is a six-eye panoramic camera, whose wide-angle fish-eye lens is parallel to one turn of the camera itself. The Insta360 Pro 2 has an accurate stitching parameter that can be used in most shooting situations, which can vary due to the differences between specific shooting situations. Moreover, the stitching effect calibration on the camera or on the control app can be used.

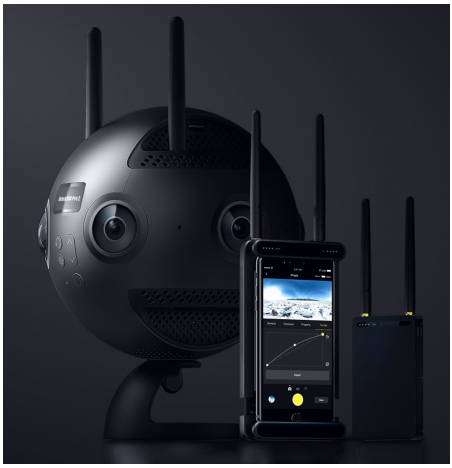


Fig. 1. Frontal view of Insta360 Pro 2 camera.

It offers different camera connection modes which can be divided into three types: Farsight, Wired Connection and Wi-Fi Connection. The connection can occur through a computer, an Ipad or a smartphone, and thus have remote control of the camera. Among these modes, the wired connection has been achieved

via a network cable or a local area network (LAN). Connecting via Farsight has a more stable signal and farther communication distance.

Fig. 2. Image of the entrance of faculty of Engineering.

Fig. 3. Image of break room of Engineering Faculty.

Summarizing, the special functions of this camera are:

1. FlowState stabilization: the Pro 2's hardware has 9-axis gyroscopes and implements a super FlowState stabilization to counteract moving scenes.
2. Photography with Auto Exposure Bracketing (AEB), which allows to choose to take 3, 5, 7, 9 photos at equal intervals for high dynamic range photos for post production synthesis.
3. All photo modes can be photographed in Raw + Jpg formats (generic single shot, AEB shot, groups of 10 burst photos, delayed timelapse photography). The images are stored in dng and jpg formats.

Fig. 4. Image of auditorium of Engineering Faculty.

4. HDR video: Some video modes allow to shoot high dynamic range HDR effect videos and are suitable for shooting scenes with a large illumination.
5. Multi-channel shooting, higher frequency, wider color gradation and better quality: Pro 2 has 7 cards stored inside, which include 6 TF (MicroSD) cards plus one SD card. When storing in the SD card of the real-time stitching with low bitrate proxy video, it can store the original high bitrate chip in 6 TF (MicroSD) cards up to 120 MBps, with more detail in the image quality. Pro 2 uses YUVJ420P, a color gamut that displays brighter and darker colors.
6. Dual antenna, more distant and stable signals: It has an external antenna to ensure smooth control preview from 0 to 20 m. The antenna and the GPS module have been added to the same camera, so as to avoid the clutter of external accessories and signal interference when shooting for Street View.
7. Onboard Farsight system support: the latest graphics transmission system introduced by Insta360, which can achieve smooth handling of long distances. The communication distance can be up to 300 m in open ground-to-ground environments without shelter.

3.2 Editing Tool for Virtual Tour

To the best of our knowledge, since there is not in literature a standard procedure to produce virtual tours, our idea is to create a standard data structure for this purpose. Nowadays, in fact, we can divide the tools for Virtual Tour Creation into two categories. Commercial software, like the more famous Pano2VR[1], that allow the user to manage the digital contents; the intuitive interfaces is at the expenses of costs, since an expert operator is needed and the number of panoramic images that can be managed is limited. Free of licenes web-tools like Marzipano[2], on the counterpart, have very limited and basic functions

[1] https://ggnome.com/pano2vr/.
[2] https://www.marzipano.net.

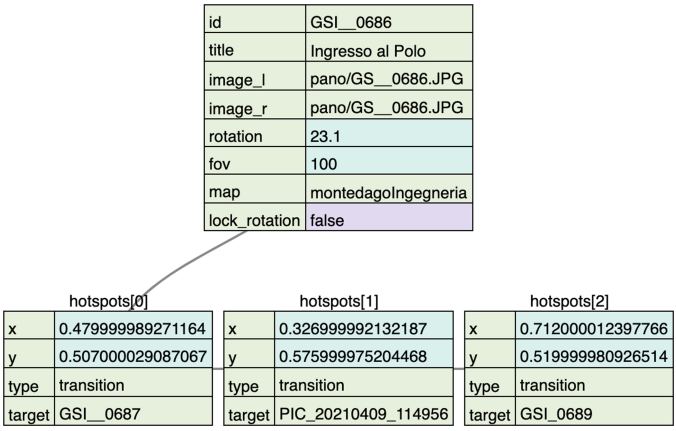


Fig. 5. JSON scheme of entrance of Engineering Faculty.

Data structures in Figs. 5, 6 and 7 are some examples of JSON diagrams of three different scenes belonging to the virtual tour. These diagrams have the same structure. That is, each scene is univocally identified by an ID code. Within each scene there is a number of hotspots, that represent interactable points linked to a list of contents available for users. Through the hotspot it is possible:

- to move towards another scene;
- to show contents in the form of: text, image, audio, and video.

The hotspots can be useful to track the path of visitors with the aim to obtain a quantitative evaluation of the most visited and attractive locations.

Moreover, the virtual tour has one or more maps. The map aims to provide a spatial positioning of different locations and a fast navigation. Then, the map is formed by an image with different locations, each of them associated with a scene. The tour is shown on a normal screen and the interaction occurs through a mouse or touch.

Some example of images belonging to the virtual tour of the Polytechnic University of Marche are presented in the Fig. 2, 3 and 4.

4 Data Analytics of the Virtual Tour

In this section, it is our aim to provide some insights about the potential given by the analytic tool set up for this virtual tour. Of course, the statistics here shown are limited to a specific monitoring period (1^{st} of May to 01^{st} of August). It is worth to note that the tour was not yet advertised at the time of the submission of this manuscript, even if the virtual tour is available in the University web-site [3].

[3] https://www.orienta.univpm.it/virtual-tour/.

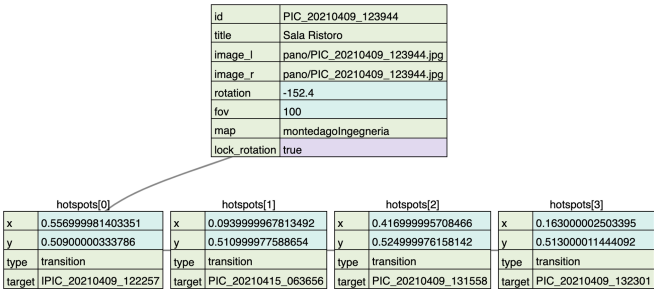


Fig. 6. JSON scheme of break room of Engineering Faculty.

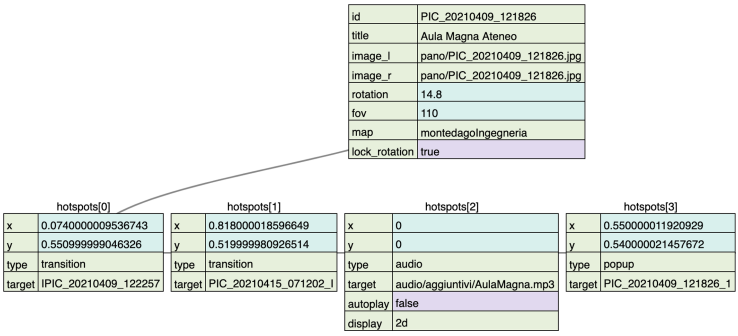


Fig. 7. JSON scheme of auditorium of Engineering Faculty.

Figure 8 shows that in total 1070 users access to the tour of which 1066 had never accessed the tour before that time. 1339 are the sessions started for a total of 1720 accesses to all pages. The averages are 1.25 sessions per user and 1.28 pages per session. The average duration of a session is 3 min and 1 s.

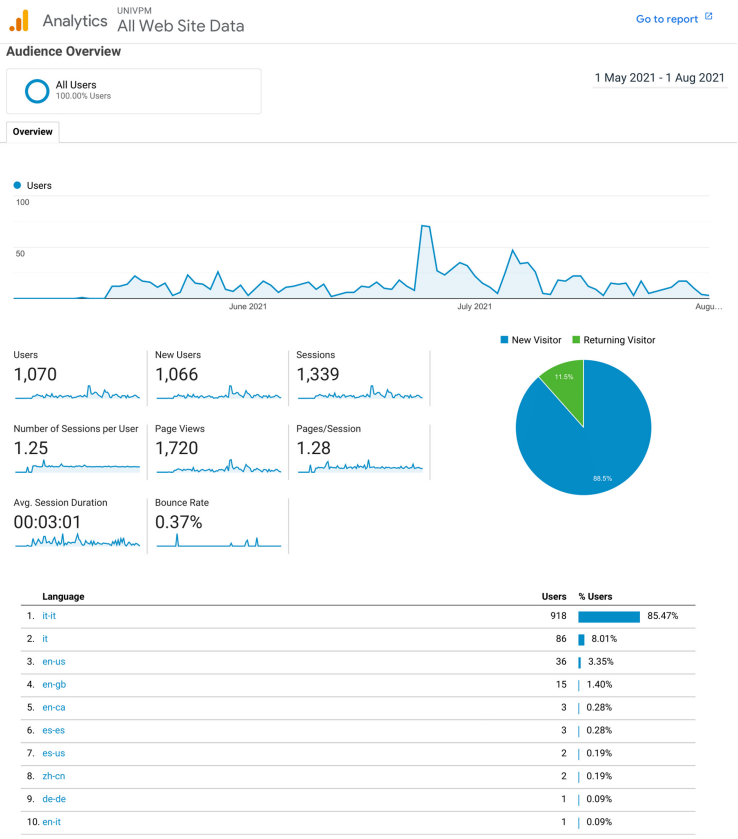
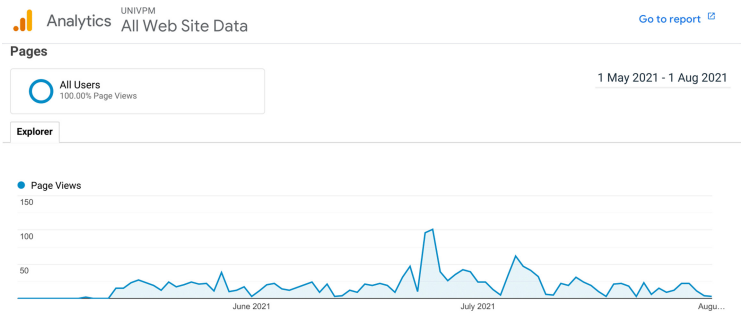


Fig. 8. Data Audience Overview in period from 2021/05/01 to 2021/08/01

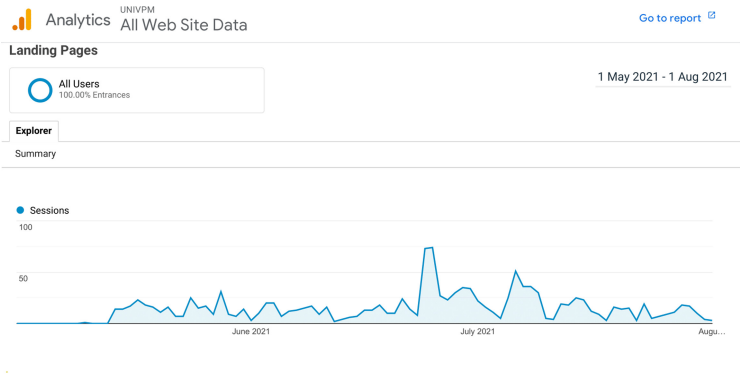
Figure 9 shows a list of the visited pages in the considered period. In total, the different pages were opened 1720 times, but actually, for each session they were visited 1357 times.



Page	Page Views	Unique Page Views	Avg. Time on Page	Entrances	Bounce Rate	% Exit	Page Value
	1,720 % of Total: 100.00% (1,720)	1,357 % of Total: 100.00% (1,357)	00:09:54 Avg for View: 00:09:54 (0.00%)	1,320 % of Total: 100.00% (1,320)	0.37% Avg for View: 0.37% (0.00%)	76.74% Avg for View: 76.74% (0.00%)	€0.00 % of Total: 0.00% (€0.00)
1. /virtual-tour/	1,245 (72.38%)	992 (73.10%)	00:11:23	982 (74.39%)	0.50%	78.55%	€0.00 (0.00%)
2. /virtual-tour/?start=PIC_20210420_083736	95 (5.52%)	75 (5.53%)	00:06:51	65 (4.92%)	0.00%	70.53%	€0.00 (0.00%)
3. /virtual-tour/?start=GSS_689	73 (4.24%)	58 (4.27%)	00:13:16	55 (4.17%)	0.00%	79.45%	€0.00 (0.00%)
4. /virtual-tour/?start=GSI_0689	61 (3.55%)	53 (3.91%)	00:09:43	49 (3.71%)	0.00%	78.69%	€0.00 (0.00%)
5. /virtual-tour/?start=PIC_20210408_151234	56 (3.26%)	52 (3.83%)	00:15:17	50 (3.79%)	0.00%	91.07%	€0.00 (0.00%)
6. /virtual-tour/?disable_tracking=true&appview=true	48 (2.79%)	13 (0.96%)	00:01:56	11 (0.83%)	0.00%	25.00%	€0.00 (0.00%)
7. /virtual-tour/?appview=1	38 (2.21%)	26 (1.92%)	00:02:34	26 (1.97%)	0.00%	68.42%	€0.00 (0.00%)
8. /virtual-tour/?start=720	36 (2.09%)	32 (2.36%)	00:07:21	29 (2.20%)	0.00%	77.78%	€0.00 (0.00%)
9. /virtual-tour/?disable_tracking=1&appview=1	20 (1.16%)	13 (0.96%)	00:08:44	13 (0.98%)	0.00%	65.00%	€0.00 (0.00%)
10. /	2 (0.12%)	1 (0.07%)	00:00:44	1 (0.08%)	0.00%	50.00%	€0.00 (0.00%)
11. /virtual-tour/?fbclid=IwAR0GaBXsF8ysjQigc_NzUCBJIGAJ4fNU1WUrqZTsAwZ-VIZERHY184WFI80	2 (0.12%)	1 (0.07%)	00:00:54	1 (0.08%)	0.00%	50.00%	€0.00 (0.00%)
12. /virtual-tour/?fbclid=IwAR0ypUFwI8xOsn0mZqawanPw25kRK40vQUMTa7a7hryWUQ8X8h4XOqK-WtM	2 (0.12%)	1 (0.07%)	00:00:53	1 (0.08%)	0.00%	50.00%	€0.00 (0.00%)
13. /virtual-tour/?fbclid=IwAR2B4g18KLgRy9O0dl5HMreBLKUFf7_FI14qoppxqWdJ_4fIWFd9EqzIBs0	2 (0.12%)	1 (0.07%)	00:03:36	1 (0.08%)	0.00%	50.00%	€0.00 (0.00%)
14. /virtual-tour/?fbclid=IwAR3HMikSkKjpA_Fm8QtptGcmQqMb0KwDgeX-llyEGVZS7AWOFZeusPvcVF0	2 (0.12%)	1 (0.07%)	00:00:41	1 (0.08%)	0.00%	50.00%	€0.00 (0.00%)
15. /virtual-tour/?fbclid=IwAR04elw2fkHfAm5xKNMQ_CtGApsnEtM7_je0MK0Lca4evZBXb31XMy-SVFI	1 (0.06%)	1 (0.07%)	00:00:00	1 (0.08%)	0.00%	100.00%	€0.00 (0.00%)
16. /virtual-tour/?fbclid=IwAR0bsJZJyUhSxHNIBHd6s-fNjek5nA60neiFXCugctQ7ZCmZDxhfltcMbYw	1 (0.06%)	1 (0.07%)	00:00:00	1 (0.08%)	0.00%	100.00%	€0.00 (0.00%)
17. /virtual-tour/?fbclid=IwAR0FjhnhXOQTSWpO969aMavZDXECME5tTJfo6jziiyrElnN37mcAVC5ZtqY	1 (0.06%)	1 (0.07%)	00:00:00	1 (0.08%)	0.00%	100.00%	€0.00 (0.00%)
18. /virtual-tour/?fbclid=IwAR0fkgS29A_OHCibGxb3wqv3Fatc5pORVI3LesrdQJm5rQuV4Dq0x1-I1Is	1 (0.06%)	1 (0.07%)	00:00:00	1 (0.08%)	0.00%	100.00%	€0.00 (0.00%)
19. /virtual-tour/?fbclid=IwAR0Gau8HQA13n3FREOfNmlePK0Mx5pSFPH827_xErwzbWSTShJZPHMeVcyc	1 (0.06%)	1 (0.07%)	00:00:00	1 (0.08%)	0.00%	100.00%	€0.00 (0.00%)

Fig. 9. Data pages. List of visited pages.

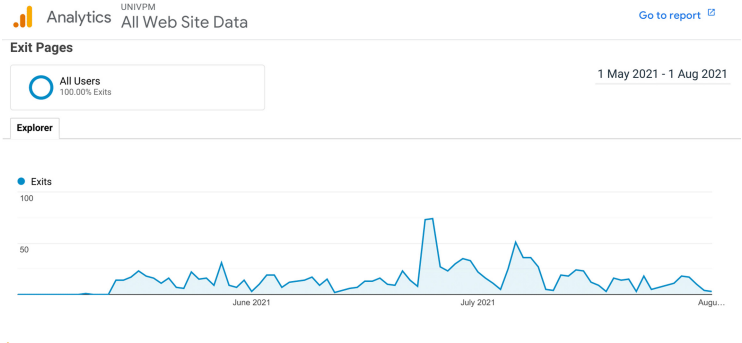
Figure 10 presents a list of pages with which the session began started; while Fig. 11 in detail considers the list of the exit pages from the session.



Landing Page	Acquisition			Behaviour			Conversions		
	Sessions	% New Sessions	New Users	Bounce Rate	Pages/Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,339 % of Total: 100.00% (1,339)	79.69% Avg for View: 79.61% (0.09%)	1,067 % of Total: 100.09% (1,066)	0.37% Avg for View: 0.37% (0.00%)	1.28 Avg for View: 1.28 (0.00%)	00:03:01 Avg for View: 00:03:01 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	€0.00 % of Total: 0.00% (€0.00)
1. /virtual-tour/	982 (73.34%)	78.41%	770 (72.16%)	0.51%	1.29	00:03:13	0.00%	0 (0.00%)	€0.00 (0.00%)
2. /virtual-tour/?start=PIC_20210420_083736	65 (4.85%)	89.23%	58 (5.44%)	0.00%	1.28	00:02:13	0.00%	0 (0.00%)	€0.00 (0.00%)
3. /virtual-tour/?start=GSS_689	55 (4.11%)	87.27%	48 (4.50%)	0.00%	1.27	00:03:37	0.00%	0 (0.00%)	€0.00 (0.00%)
4. /virtual-tour/?start=PIC_20210408_151234	50 (3.73%)	88.00%	44 (4.12%)	0.00%	1.08	00:01:30	0.00%	0 (0.00%)	€0.00 (0.00%)
5. /virtual-tour/?start=GSI_0689	49 (3.66%)	81.63%	40 (3.75%)	0.00%	1.24	00:02:35	0.00%	0 (0.00%)	€0.00 (0.00%)
6. /virtual-tour/?start=720	29 (2.17%)	86.21%	25 (2.34%)	0.00%	1.24	00:01:09	0.00%	0 (0.00%)	€0.00 (0.00%)
7. /virtual-tour/?appview=1	26 (1.94%)	88.46%	23 (2.16%)	0.00%	1.46	00:01:11	0.00%	0 (0.00%)	€0.00 (0.00%)
8. (not set)	19 (1.42%)	5.26%	1 (0.09%)	0.00%	0.00	00:02:10	0.00%	0 (0.00%)	€0.00 (0.00%)
9. /virtual-tour/?disable_tracking=1&appview=1	13 (0.97%)	100.00%	13 (1.22%)	0.00%	1.54	00:04:42	0.00%	0 (0.00%)	€0.00 (0.00%)
10. /virtual-tour/?disable_tracking=true&appview=true	11 (0.82%)	45.45%	5 (0.47%)	0.00%	4.00	00:06:11	0.00%	0 (0.00%)	€0.00 (0.00%)
11. /	1 (0.07%)	100.00%	1 (0.09%)	0.00%	2.00	00:00:44	0.00%	0 (0.00%)	€0.00 (0.00%)
12. /virtual-tour/?fbclid=IwAR04eIw2fkHfAm5xKNMQ_CtGApsnEtM7_je0MK0Lca4evZBXb31XMy-SVFI	1 (0.07%)	100.00%	1 (0.09%)	0.00%	1.00	00:00:03	0.00%	0 (0.00%)	€0.00 (0.00%)
13. /virtual-tour/?fbclid=IwAR0bsJZJyUhSxHNIBHd6s-fNjek5nA60neiFXCugctQ7ZCmZDxhfItcMbYw	1 (0.07%)	100.00%	1 (0.09%)	0.00%	1.00	00:00:32	0.00%	0 (0.00%)	€0.00 (0.00%)
14. /virtual-tour/?fbclid=IwAR0FjhnhXOQTSWpO969aMavZDXECME5tTJfo6jziiyrElnN37mcAVC5ZtqY	1 (0.07%)	100.00%	1 (0.09%)	0.00%	1.00	00:00:34	0.00%	0 (0.00%)	€0.00 (0.00%)
15. /virtual-tour/?fbclid=IwAR0fkgS29A_OHCibGxb3wqv3Fatc5pORVI3LesrdQJm5rQuV4Dq0x1-I1Is	1 (0.07%)	100.00%	1 (0.09%)	0.00%	1.00	00:03:01	0.00%	0 (0.00%)	€0.00 (0.00%)
16. /virtual-tour/?fbclid=IwAR0GaBXsF8ysjQigc_NzUCBJIGAJ4fNU1WUrqZTsAwZ-VIZERHY184WFI80	1 (0.07%)	100.00%	1 (0.09%)	0.00%	2.00	00:00:55	0.00%	0 (0.00%)	€0.00 (0.00%)
17. /virtual-tour/?fbclid=IwAR0Gau8HQA13n3FREOfNmIePK0Mx5pSFPH827_xErwzbWSTShJZPHMeVcyc	1 (0.07%)	100.00%	1 (0.09%)	0.00%	1.00	00:00:19	0.00%	0 (0.00%)	€0.00 (0.00%)

Fig. 10. Data landing pages.

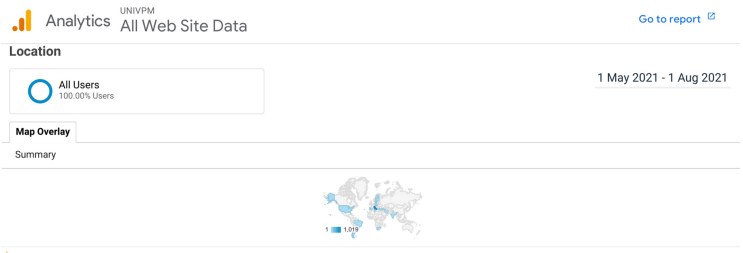
Figures 12 and 13 respectively present the list of nation and the list of city from which the tour was accessed.



Page	Exits	Page Views	% Exit
	1,320 % of Total: 100.00% (1,320)	1,720 % of Total: 100.00% (1,720)	76.74% Avg for View: 76.74% (0.00%)
1. /virtual-tour/	978 (74.09%)	1,245 (72.38%)	78.55%
2. /virtual-tour/?start=PIC_20210420_083736	67 (5.08%)	95 (5.52%)	70.53%
3. /virtual-tour/?start=GSS_689	58 (4.39%)	73 (4.24%)	79.45%
4. /virtual-tour/?start=PIC_20210408_151234	51 (3.86%)	56 (3.26%)	91.07%
5. /virtual-tour/?start=GSI_0689	48 (3.64%)	61 (3.55%)	78.69%
6. /virtual-tour/?start=720	28 (2.12%)	36 (2.09%)	77.78%
7. /virtual-tour/?appview=1	26 (1.97%)	38 (2.21%)	68.42%
8. /virtual-tour/?disable_tracking=1&appview=1	13 (0.98%)	20 (1.16%)	65.00%
9. /virtual-tour/?disable_tracking=true&appview=true	12 (0.91%)	48 (2.79%)	25.00%
10. /	1 (0.08%)	2 (0.12%)	50.00%
11. /virtual-tour/?fbclid=IwAR04elw2fkHfAm5xKNMQ_CtGApsnEtM7_je0MK0Lca4evZBXb31XMy-SVFI	1 (0.08%)	1 (0.06%)	100.00%
12. /virtual-tour/?fbclid=IwAR0bsJZJyUhSxHNIBHd6s-fNjek5nA60neiFXCugctQ7ZCmZDxhfItcMbYw	1 (0.08%)	1 (0.06%)	100.00%
13. /virtual-tour/?fbclid=IwAR0FjhnhXOQTSWpO969aMavZDXECME5tTJfo6jziiyrElnN37mcAVC5ZtqY	1 (0.08%)	1 (0.06%)	100.00%
14. /virtual-tour/?fbclid=IwAR0fkgS29A_OHCibGxb3wqv3Fatc5pORVl3LesrdQJm5rQuV4Dq0x1-I1Is	1 (0.08%)	1 (0.06%)	100.00%
15. /virtual-tour/?fbclid=IwAR0GaBXsF8ysjQigc_NzUCBJIGAJ4fNU1WUrqZTsAwZ-VIZERHY184WFl80	1 (0.08%)	2 (0.12%)	50.00%
16. /virtual-tour/?fbclid=IwAR0Gau8HQA13n3FREOfNmlePK0Mx5pSFPH827_xErwzbWSTShJZPHMeVcyc	1 (0.08%)	1 (0.06%)	100.00%
17. /virtual-tour/?fbclid=IwAR0kD3-tvc3W3YqelhDy007Ti5IsdJuMKQG670EipFnoRnAG0QfNaAjSrBc	1 (0.08%)	1 (0.06%)	100.00%
18. /virtual-tour/?fbclid=IwAR0M4OdkBhY0SNT2vV2WvQcz7neSEYr5aJC1I7eqjoycGSzJI6fzcMtsfbk	1 (0.08%)	1 (0.06%)	100.00%
19. /virtual-tour/?fbclid=IwAR0N_ic1QySkmVRNv7O8W15QTxjf0Dx4gZBhFpMD8-hBgKFtdvg7kzfB3tc	1 (0.08%)	1 (0.06%)	100.00%
20. /virtual-tour/?fbclid=IwAR0Sx7UiTAhijHgf-CSFVORf75JPvM8gCSum7zzzdfbeu477IA8RL9cAssI	1 (0.08%)	1 (0.06%)	100.00%

Fig. 11. Data exit pages.

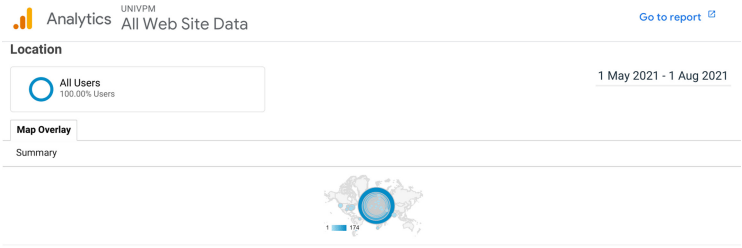
A list of devices from which the tour was accessed is presented in Fig. 14. There are smartphone, tablet and computer.



Country		Acquisition			Behaviour			Conversions		
		Users	New Users	Sessions	Bounce Rate	Pages/Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
		1,070 % of Total: 100.00% (1,070)	1,067 % of Total: 100.09% (1,066)	1,339 % of Total: 100.00% (1,339)	0.37% Avg for View: 0.37% (0.00%)	1.28 Avg for View: 1.28 (0.00%)	00:03:01 Avg for View: 00:03:01 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	€0.00 % of Total: 0.00% (€0.00)
1.	Italy	1,019 (95.14%)	1,016 (95.22%)	1,282 (95.74%)	0.31%	1.29	00:03:06	0.00%	0 (0.00%)	€0.00 (0.00%)
2.	United States	25 (2.33%)	25 (2.34%)	25 (1.87%)	0.00%	1.20	00:00:17	0.00%	0 (0.00%)	€0.00 (0.00%)
3.	Argentina	4 (0.37%)	4 (0.37%)	8 (0.60%)	0.00%	1.00	00:04:46	0.00%	0 (0.00%)	€0.00 (0.00%)
4.	Albania	3 (0.28%)	3 (0.28%)	4 (0.30%)	0.00%	1.25	00:00:53	0.00%	0 (0.00%)	€0.00 (0.00%)
5.	India	3 (0.28%)	3 (0.28%)	3 (0.22%)	0.00%	3.00	00:03:53	0.00%	0 (0.00%)	€0.00 (0.00%)
6.	Poland	2 (0.19%)	2 (0.19%)	2 (0.15%)	0.00%	1.00	00:00:00	0.00%	0 (0.00%)	€0.00 (0.00%)
7.	Turkey	2 (0.19%)	2 (0.19%)	2 (0.15%)	0.00%	1.00	00:00:24	0.00%	0 (0.00%)	€0.00 (0.00%)
8.	Brazil	1 (0.09%)	1 (0.09%)	1 (0.07%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	€0.00 (0.00%)
9.	Chile	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:02:56	0.00%	0 (0.00%)	€0.00 (0.00%)
10.	Germany	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:01:13	0.00%	0 (0.00%)	€0.00 (0.00%)
11.	Spain	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	2.00	00:01:19	0.00%	0 (0.00%)	€0.00 (0.00%)
12.	Finland	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:00	0.00%	0 (0.00%)	€0.00 (0.00%)
13.	Israel	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:03:16	0.00%	0 (0.00%)	€0.00 (0.00%)
14.	Iran	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:00	0.00%	0 (0.00%)	€0.00 (0.00%)
15.	North Macedonia	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	2.00	00:01:19	0.00%	0 (0.00%)	€0.00 (0.00%)
16.	Portugal	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	2.00	00:00:34	0.00%	0 (0.00%)	€0.00 (0.00%)
17.	Sweden	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:01	0.00%	0 (0.00%)	€0.00 (0.00%)
18.	Slovakia	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:05:27	0.00%	0 (0.00%)	€0.00 (0.00%)
19.	Tunisia	1 (0.09%)	0 (0.00%)	1 (0.07%)	0.00%	1.00	00:00:01	0.00%	0 (0.00%)	€0.00 (0.00%)
20.	South Africa	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:28	0.00%	0 (0.00%)	€0.00 (0.00%)

Fig. 12. Data nation location.

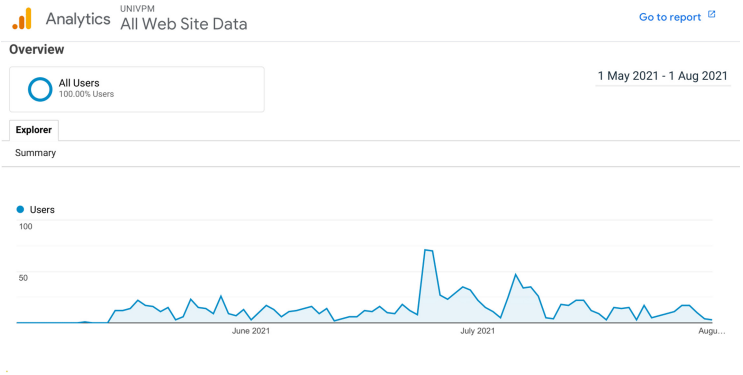
Interesting is the information concerning the way with which users have accessed the tour. Figure 15 indicates that the access occurred mainly through a direct link, and minimally reference on the web, search engine. A more detailed description on the way and sources of access to the tour is highlighted in Fig. 16.



City	Acquisition			Behaviour			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages/Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,070 % of Total: 100.00% (1,070)	1,067 % of Total: 100.09% (1,066)	1,339 % of Total: 100.00% (1,339)	0.37% Avg for View: 0.37% (0.00%)	1.28 Avg for View: 1.28 (0.00%)	00:03:01 Avg for View: 00:03:01 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	€0.00 % of Total: 0.00% (€0.00)
1. Ancona	174 (15.04%)	167 (15.65%)	225 (16.80%)	0.00%	1.31	00:03:53	0.00%	0 (0.00%)	€0.00 (0.00%)
2. (not set)	142 (12.27%)	135 (12.65%)	148 (11.05%)	0.00%	1.28	00:01:41	0.00%	0 (0.00%)	€0.00 (0.00%)
3. Rome	99 (8.56%)	90 (8.43%)	107 (7.99%)	0.93%	1.21	00:01:57	0.00%	0 (0.00%)	€0.00 (0.00%)
4. Pesaro	70 (6.05%)	63 (5.90%)	93 (6.95%)	0.00%	1.18	00:04:54	0.00%	0 (0.00%)	€0.00 (0.00%)
5. Milan	60 (5.19%)	52 (4.87%)	68 (5.08%)	0.00%	1.16	00:01:43	0.00%	0 (0.00%)	€0.00 (0.00%)
6. Senigallia	54 (4.67%)	52 (4.87%)	65 (4.85%)	1.54%	1.37	00:02:41	0.00%	0 (0.00%)	€0.00 (0.00%)
7. Fano	42 (3.63%)	36 (3.37%)	50 (3.73%)	2.00%	1.14	00:03:54	0.00%	0 (0.00%)	€0.00 (0.00%)
8. Civitanova Marche	37 (3.20%)	34 (3.19%)	53 (3.96%)	0.00%	1.38	00:02:41	0.00%	0 (0.00%)	€0.00 (0.00%)
9. Iesi	34 (2.94%)	30 (2.81%)	36 (2.69%)	0.00%	1.11	00:02:16	0.00%	0 (0.00%)	€0.00 (0.00%)
10. San Benedetto del Tronto	28 (2.42%)	25 (2.34%)	30 (2.24%)	0.00%	1.53	00:05:23	0.00%	0 (0.00%)	€0.00 (0.00%)
11. Florence	26 (2.25%)	23 (2.16%)	29 (2.17%)	0.00%	1.10	00:01:41	0.00%	0 (0.00%)	€0.00 (0.00%)
12. Montesilvano	21 (1.82%)	20 (1.87%)	29 (2.17%)	0.00%	1.55	00:03:21	0.00%	0 (0.00%)	€0.00 (0.00%)
13. Pescara	19 (1.64%)	17 (1.59%)	20 (1.49%)	0.00%	1.55	00:01:49	0.00%	0 (0.00%)	€0.00 (0.00%)
14. Macerata	18 (1.56%)	17 (1.59%)	20 (1.49%)	0.00%	1.30	00:07:09	0.00%	0 (0.00%)	€0.00 (0.00%)
15. Osimo	16 (1.38%)	15 (1.41%)	20 (1.49%)	0.00%	1.55	00:03:39	0.00%	0 (0.00%)	€0.00 (0.00%)
16. Perugia	14 (1.21%)	13 (1.22%)	17 (1.27%)	0.00%	1.41	00:03:10	0.00%	0 (0.00%)	€0.00 (0.00%)
17. Ascoli Piceno	13 (1.12%)	13 (1.22%)	13 (0.97%)	0.00%	1.15	00:03:54	0.00%	0 (0.00%)	€0.00 (0.00%)
18. Fermo	11 (0.95%)	11 (1.03%)	12 (0.90%)	0.00%	1.25	00:02:51	0.00%	0 (0.00%)	€0.00 (0.00%)
19. Bari	10 (0.86%)	9 (0.84%)	10 (0.75%)	10.00%	1.00	00:00:20	0.00%	0 (0.00%)	€0.00 (0.00%)
20. Chieti	10 (0.86%)	10 (0.94%)	12 (0.90%)	0.00%	1.00	00:02:39	0.00%	0 (0.00%)	€0.00 (0.00%)
21. Terni	10 (0.86%)	8 (0.75%)	12 (0.90%)	0.00%	1.00	00:00:32	0.00%	0 (0.00%)	€0.00 (0.00%)
22. Falconara Marittima	9 (0.78%)	7 (0.66%)	11 (0.82%)	0.00%	1.09	00:02:01	0.00%	0 (0.00%)	€0.00 (0.00%)

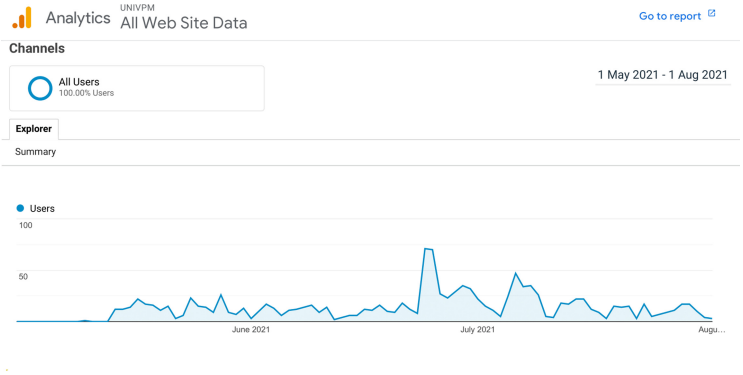
Fig. 13. Data city location.

Figure 17 shows the events generated by clicking on buttons during the tour. In particular, there were a total of 14828 interactions (user-button). Figure 18 shows a detail of the action generated by the event: 3880 times the “ing” button was clicked, while only 10 times the “MODE” button was clicked. Figure 19 shows a detail of the label associated to the event. Figure 20 represents the flow of the events departing from the page of access the tour.



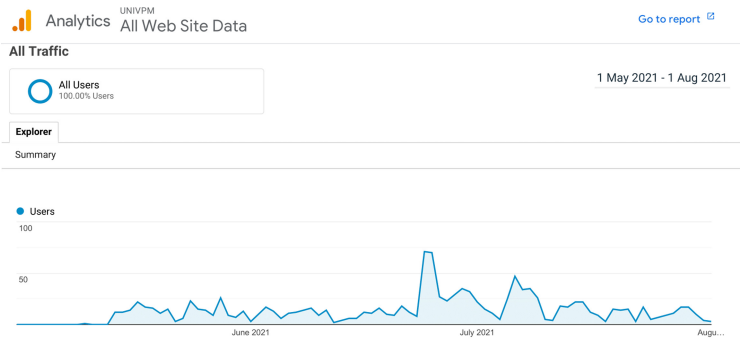
Device Category	Acquisition			Behaviour			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages/Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,070 % of Total: 100.00% (1,070)	1,067 % of Total: 100.09% (1,066)	1,339 % of Total: 100.00% (1,339)	0.37% Avg for View: 0.37% (0.00%)	1.28 Avg for View: 1.28 (0.00%)	00:03:01 Avg for View: 00:03:01 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	€0.00 % of Total: 0.00% (€0.00)
1. mobile	618 (57.76%)	615 (57.64%)	757 (56.53%)	0.66%	1.32	00:01:59	0.00%	0 (0.00%)	€0.00 (0.00%)
2. desktop	440 (41.12%)	440 (41.24%)	570 (42.57%)	0.00%	1.24	00:04:26	0.00%	0 (0.00%)	€0.00 (0.00%)
3. tablet	12 (1.12%)	12 (1.12%)	12 (0.90%)	0.00%	1.33	00:01:32	0.00%	0 (0.00%)	€0.00 (0.00%)

Fig. 14. Mobility. List of devices (mobile, tablet, desktop) used to access the tour.



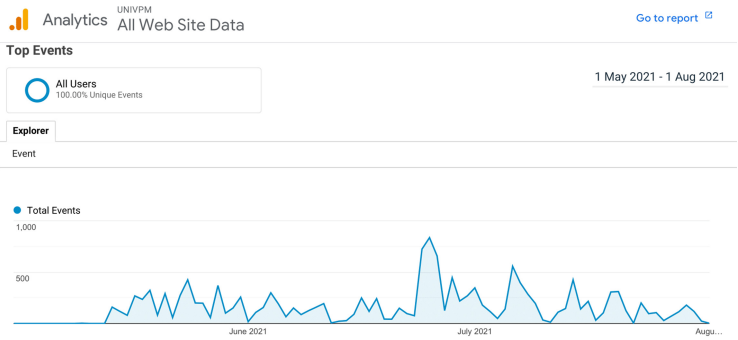
Default Channel Grouping	Acquisition			Behaviour			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages/Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,070 % of Total: 100.00% (1,070)	1,067 % of Total: 100.09% (1,066)	1,339 % of Total: 100.00% (1,339)	0.37% Avg for View: 0.37% (0.00%)	1.28 Avg for View: 1.28 (0.00%)	00:03:01 Avg for View: 00:03:01 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	€0.00 % of Total: 0.00% (€0.00)
1. Direct	922 (85.93%)	923 (86.50%)	1,161 (86.71%)	0.34%	1.28	00:03:08	0.00%	0 (0.00%)	€0.00 (0.00%)
2. Social	81 (7.55%)	81 (7.59%)	84 (6.27%)	1.19%	1.31	00:02:01	0.00%	0 (0.00%)	€0.00 (0.00%)
3. Referral	45 (4.19%)	40 (3.75%)	53 (3.96%)	0.00%	1.21	00:01:52	0.00%	0 (0.00%)	€0.00 (0.00%)
4. Organic Search	25 (2.33%)	23 (2.16%)	41 (3.06%)	0.00%	1.49	00:03:19	0.00%	0 (0.00%)	€0.00 (0.00%)

Fig. 15. Access Mode.



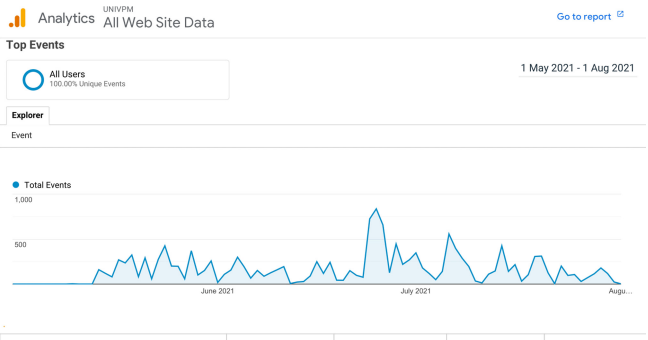
Source/Medium	Acquisition			Behaviour			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages/Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,070 % of Total: 100.00% (1,070)	1,067 % of Total: 100.09% (1,066)	1,339 % of Total: 100.00% (1,339)	0.37% Avg for View: 0.37% (0.00%)	1.28 Avg for View: 1.28 (0.00%)	00:03:01 Avg for View: 00:03:01 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	€0.00 % of Total: 0.00% (€0.00)
1. (direct) / (none)	922 (85.93%)	923 (86.50%)	1,161 (86.71%)	0.34%	1.28	00:03:08	0.00%	0 (0.00%)	€0.00 (0.00%)
2. m.facebook.com / referral	70 (6.52%)	70 (6.56%)	72 (5.38%)	1.39%	1.33	00:01:06	0.00%	0 (0.00%)	€0.00 (0.00%)
3. google / organic	23 (2.14%)	21 (1.97%)	39 (2.91%)	0.00%	1.41	00:03:19	0.00%	0 (0.00%)	€0.00 (0.00%)
4. linktr.ee / referral	22 (2.05%)	20 (1.87%)	22 (1.64%)	0.00%	1.14	00:01:40	0.00%	0 (0.00%)	€0.00 (0.00%)
5. univpm.it / referral	19 (1.77%)	17 (1.59%)	26 (1.94%)	0.00%	1.35	00:02:22	0.00%	0 (0.00%)	€0.00 (0.00%)
6. facebook.com / referral	5 (0.47%)	5 (0.47%)	5 (0.37%)	0.00%	1.20	00:00:45	0.00%	0 (0.00%)	€0.00 (0.00%)
7. l.facebook.com / referral	4 (0.37%)	4 (0.37%)	4 (0.30%)	0.00%	1.25	00:20:20	0.00%	0 (0.00%)	€0.00 (0.00%)
8. bing / organic	2 (0.19%)	2 (0.19%)	2 (0.15%)	0.00%	3.00	00:03:02	0.00%	0 (0.00%)	€0.00 (0.00%)
9. l.workplace.com / referral	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:00	0.00%	0 (0.00%)	€0.00 (0.00%)
10. lm.facebook.com / referral	1 (0.09%)	1 (0.09%)	2 (0.15%)	0.00%	1.00	00:01:36	0.00%	0 (0.00%)	€0.00 (0.00%)
11. mail.google.com / referral	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:00	0.00%	0 (0.00%)	€0.00 (0.00%)
12. ubisive.it / referral	1 (0.09%)	0 (0.00%)	2 (0.15%)	0.00%	0.50	00:00:29	0.00%	0 (0.00%)	€0.00 (0.00%)
13. universitaly.it / referral	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:00:03	0.00%	0 (0.00%)	€0.00 (0.00%)
14. youtube.com / referral	1 (0.09%)	1 (0.09%)	1 (0.07%)	0.00%	1.00	00:01:40	0.00%	0 (0.00%)	€0.00 (0.00%)

Fig. 16. Access source.



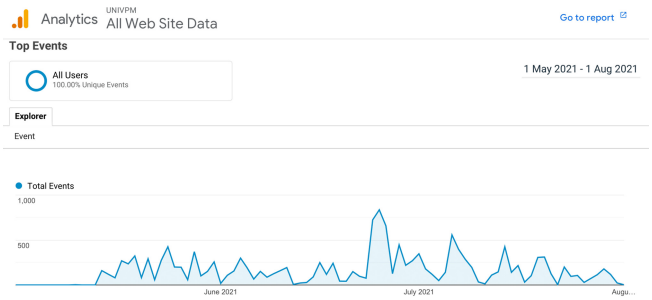
Event Category	Total Events	Unique Events	Event Value	Avg. Value
	14,828 % of Total: 100.00% (14,828)	11,312 % of Total: 100.00% (11,312)	0 % of Total: 0.00% (0)	0.00 Avg for View: 0.00 (0.00%)
1. ing	3,880 (26.17%)	2,894 (25.58%)	0 (0.00%)	0.00
2. med	2,776 (18.72%)	2,228 (19.70%)	0 (0.00%)	0.00
3. sci	2,327 (15.69%)	1,727 (15.27%)	0 (0.00%)	0.00
4. agr	1,913 (12.90%)	1,442 (12.75%)	0 (0.00%)	0.00
5. eco	1,495 (10.08%)	1,231 (10.88%)	0 (0.00%)	0.00
6. uni	1,448 (9.77%)	1,085 (9.59%)	0 (0.00%)	0.00
7. MENU	791 (5.33%)	535 (4.73%)	0 (0.00%)	0.00
8. cus	188 (1.27%)	165 (1.46%)	0 (0.00%)	0.00
9. MODE	10 (0.07%)	5 (0.04%)	0 (0.00%)	0.00

Fig. 17. Top event category.



Event Action	Total Events	Unique Events	Event Value	Avg. Value
	14,828 % of Total: 100.00% (14,828)	11,312 % of Total: 100.00% (11,312)	0 % of Total: 0.00% (0)	0.00 Avg for View: 0.00 (0.00%)
1. loadScene	11,555 (77.93%)	8,630 (76.29%)	0 (0.00%)	0.00
2. openPopup	1,744 (11.76%)	1,563 (13.82%)	0 (0.00%)	0.00
3. toggleGroup	791 (5.33%)	535 (4.73%)	0 (0.00%)	0.00
4. playAudio	728 (4.91%)	579 (5.12%)	0 (0.00%)	0.00
5. enableVR	6 (0.04%)	3 (0.03%)	0 (0.00%)	0.00
6. disableVR	4 (0.03%)	2 (0.02%)	0 (0.00%)	0.00

Fig. 18. Top event action.



Event Label	Total Events	Unique Events	Event Value	Avg. Value
	14,828 % of Total: 100.00% (14,828)	11,312 % of Total: 100.00% (11,312)	0 % of Total: 0.00% (0)	0.00 Avg for View: 0.00 (0.00%)
1. inizio	1,448 (9.77%)	1,085 (9.59%)	0 (0.00%)	0.00
2. GSI_0689	354 (2.39%)	279 (2.47%)	0 (0.00%)	0.00
3. PIC_20210415_063656	353 (2.38%)	184 (1.63%)	0 (0.00%)	0.00
4. GSI__0687	342 (2.31%)	189 (1.67%)	0 (0.00%)	0.00
5. GSI__0686	285 (1.92%)	218 (1.93%)	0 (0.00%)	0.00
6. GSS_689	225 (1.52%)	177 (1.56%)	0 (0.00%)	0.00
7. ing	203 (1.37%)	160 (1.41%)	0 (0.00%)	0.00
8. PIC_20210409_123944	197 (1.33%)	134 (1.18%)	0 (0.00%)	0.00
9. PIC_20210420_083736	190 (1.28%)	153 (1.35%)	0 (0.00%)	0.00
10. 720	177 (1.19%)	128 (1.13%)	0 (0.00%)	0.00
11. 671	162 (1.09%)	132 (1.17%)	0 (0.00%)	0.00
12. med	158 (1.07%)	114 (1.01%)	0 (0.00%)	0.00
13. PIC_20210408_151234	158 (1.07%)	127 (1.12%)	0 (0.00%)	0.00
14. GSS_706	136 (0.92%)	89 (0.79%)	0 (0.00%)	0.00
15. sci	122 (0.82%)	86 (0.76%)	0 (0.00%)	0.00
16. 674	117 (0.79%)	101 (0.89%)	0 (0.00%)	0.00
17. 675	114 (0.77%)	94 (0.83%)	0 (0.00%)	0.00
18. 677	110 (0.74%)	85 (0.75%)	0 (0.00%)	0.00
19. cus	107 (0.72%)	42 (0.37%)	0 (0.00%)	0.00

Fig. 19. Top event label.

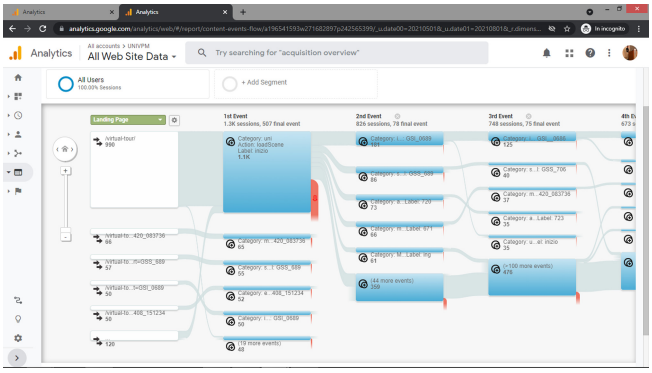


Fig. 20. Events flow detail.

5 Conclusions

The global spread of the COVID-19 pandemic has noticeably hastened the testing forward-looking technologies. In this work, it is presented an analytics system for virtual tour data analysis. These important statistics provide a decision-making tool useful for both the manager and the developers. In fact, the standardization of virtual tour creation provides useful statistics that are important for the definition of KPIs. Leveraging the degree of immersion provided by virtual tours, we were able to study how these rising technologies can contribute to understanding and evaluating user behaviour. We also evaluated and defined immersive insights, with a real case study which is an Italian University during the open days.

Thanks to these useful insight manager and events creators can define the virtual journey of a user. Future works involves the applications of the proposed tools to other case studies. Further investigations will be devoted to the to the integration with users' trajectories for a complete behaviour understanding. In addition, we seek to extend the tool measuring the impact of VR adoption.

References

1. Aguilera, J., Alonso, F., Gomez, J.B.: Generating three-dimensional virtual tours from two-dimensional images, 22 April 2014, uS Patent 8,705,892
2. Alenazi, M., Demir, F.: Understanding virtual reality tours: a user experience study with the princess Norah University. Int. J. Current Res. Life Sci. **8**(10), 3248–3253 (2019)
3. Andri, C., Alkawaz, M.H., Waheed, S.R.: Examining effectiveness and user experiences in 3d mobile based augmented reality for msu virtual tour. In: 2019 IEEE International Conference on Automatic Control and Intelligent Systems (I2CACIS), pp. 161–167. IEEE (2019)
4. Barbieri, L., Bruno, F., Muzzupappa, M.: Virtual museum system evaluation through user studies. J. Cult. Herit. **26**, 101–108 (2017)
5. Chiao, H.M., Chen, Y.L., Huang, W.H.: Examining the usability of an online virtual tour-guiding platform for cultural tourism education. J. Hospitality Leisure Sport Tourism Educ. **23**, 29–38 (2018)
6. Dirin, A.: User experience of mobile virtual reality: experiment on changes in students' attitudes. Turkish Online J. Educ. Technol. -TOJET **19**(3), 80–93 (2020)
7. El-Said, O., Aziz, H.: Virtual tours a means to an end: An analysis of virtual tours' role in tourism recovery post covid-19. Journal of Travel Research, p. 0047287521997567 (2021)
8. Hsu, W.Y.: Brain-computer interface connected to telemedicine and telecommunication in virtual reality applications. Telematics Inform. **34**(4), 224–238 (2017)
9. JS, R., Reddy, T.N., Ghouse, S.M., Reddy, K.S.: A study on effectiveness of google virtual tour on business promotions. In: National Conference on Marketing and Sustainable Development, vol. 13, p. 14 (2017)
10. Kabassi, K., Amelio, A., Komianos, V., Oikonomou, K.: Evaluating museum virtual tours: the case study of Italy. Information **10**(11), 351 (2019)
11. Mohammad, A.O.N.A.W., Ismail, H.: Development and evaluation of an interactive 360 virtual tour for tourist destinations (2009)

12. Ortiz, J.L.: A case study in the roi of online virtual tours (2003)
13. Pagano, A., Palombini, A., Bozzelli, G., Nino, M.D., Cerato, I., Ricciardi, S.: Arkaevision vr game: user experience research between real and virtual paestum. Appl. Sci. **10**(9), 3182 (2020)
14. Pierdicca, R., Frontoni, E., Zingaretti, P., Mancini, A., Loncarski, J., Paolanti, M.: Design, large-scale usage testing, and important metrics for augmented reality gaming applications. ACM Trans. Multimed. Comput. Commun. Appl. **15**(2) (2019). https://doi.org/10.1145/3311748
15. Pierdicca, R., Paolanti, M., Frontoni, E.: etourism: Ict and its role for tourism management. J. Hospitality Tourism Technol. (2019)
16. SETIAWAN, Y., ERLANSHARI, A., Mochammad, Y., Purwandari, E.P., et al.: Usability testing to measure real perception generation level in introduction of bengkulu university building based on virtual tour with 360° object modelling. In: Sriwijaya International Conference on Information Technology and Its Applications (SICONIAN 2019), pp. 645–648. Atlantis Press (2020)
17. Spielmann, N., Mantonakis, A.: In virtuo: how user-driven interactivity in virtual tours leads to attitude change. J. Bus. Res. **88**, 255–264 (2018)
18. Stewart, S., Warburton, F., Smith, J.D.: Cambridge international AS and A level travel and tourism coursebook. Cambridge University Press (2016)
19. Venkatesh, V., Thong, J.Y., Xu, X.: Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS quarterly, pp. 157–178 (2012)
20. Yang, T., Lai, I.K.W., Fan, Z.B., Mo, Q.M.: The impact of a 360° virtual tour on the reduction of psychological stress caused by covid-19. Technol. Soc. **64**, 101514 (2021)