TEMA
Technologies
Engineering
Materials
Architecture

Journal Director: R. Gulli

e-ISSN 2421-4574
DOI: 10.30682/tema0801

Vol. 8, No. 1 (2022)

Issue edited by Editor in Chief: R. Gulli

Cover illustration: Tokyo International Forum by Rafael Viñoly, interior view.

Editorial Assistants: C. Mazzoli, D. Prati

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e-ISSN 2421-4574
ISBN online 979-12-5477-084-9
DOI: 10.30682/tema0801

Vol. 8, No. 1 (2022)
Year 2022 (Issues per year: 2)

Scientific Society Partner:
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c/o DA - Dipartimento di Architettura, Università degli Studi di Bologna
Viale del Risorgimento, 2
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TEMA: Technologies Engineering Materials Architecture
Vol. 8, No. 1 (2022)
e-ISSN 2421-4574

CONSTRUCTION AND BUILDING PERFORMANCE

BUILDING AND DESIGN TECHNOLOGIES

ACCESSIBILITY AND VALORISATION OF HISTORICAL UNIVERSITIES THROUGH DIGITAL INCLUSIVE SOLUTIONS: THE CASE STUDY OF THE UNIVERSITY OF PAVIA (ITALY)

Valentina Giacometti, Alessandro Greco, Carola Ricci, Silvia Favalli, Andrea Campotaro

DOI: 10.30682/tema0801a

TEMA Technologies Engineering Materials Architecture

e-ISSN 2421-4574

Vol. 8, No. 1 - (2022)

Abstract

The University of Pavia, established in 1361, is well known for its historical and cultural importance, also reflected in the value of its architectural heritage. It includes several ancient structures, most of which are located in the city centre. The *Palazzo Centrale* is the main building: its architectural complexity is due to its big dimensions and composite configuration, the result of an expansion process over several centuries. Moreover, it is one of the rare examples of "passing architecture" allowing people to cross the building from the *cardo* of the Roman grid of Pavia, Corso Strada Nuova, towards the eastern part of the city centre.
For these reasons, *Palazzo Centrale* presents several difficulties of accessibility and orientation for students, visiting academics and cultural tourists, but most of all for people with blindness or low vision.
To tackle this problem, the research team is developing a pilot project in collaboration with a specialised NGO for the installation of vocal aids helping the orientation through selected paths. The project is aimed at providing a smartphone APP able to intercept the signals emitted by small e-beacons and receive voice information enabling users to move easily and independently through a selected accessible path. The vocal aids will use the architectural elements to characterise and describe the space, underlining not only the obstacles to be avoided but also the points of interest for historical, architectural, and academic reasons.
Once tested, this solution could be widespread also in other University buildings, creating more accessible, inclusive, and thus sustainable environments for students and tourists in compliance with international standards.

Keywords

Valorisation, Inclusion, Technology, Safety, Heritage.

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1. INTRODUCTION

1.1. ACCESSIBILITY AS A KEY ISSUE FOR THE VALORISATION OF CULTURAL HERITAGE

Although disability has always been part of the history of humankind [1], in the last 25 years, the understanding of this concept gradually has changed. Disability is no longer considered a medical condition of the individual but rather a result of the interaction between personal abilities and environmental barriers.

This change of perspective, facilitated and supported by the UN *Convention on the Rights of Persons with*

Disabilities (2006) [2], also entailed a different approach toward the accessibility and usability of the cultural heritage. In Italy, the *Code of Cultural Heritage* (2008) highlights how its valorisation can be fully achieved only by guaranteeing "the best conditions for public use and enjoyment of the heritage, even by people with disabilities, in order to promote the development of culture". This issue is obviously multifaceted since the requests for the protection and valorisation of a historic building must be declined to ensure an inclusive public use, capable of satisfying the experience of everybody, even users with special needs. As mentioned by the architect Amedeo Bellini, "the mere contemplation of it does not belong to architecture" [3]: we must increasingly strive towards the complete safety, comfort, and autonomy of use.

Guaranteeing the accessibility of the built heritage is complex, also considering that it is made up of unique and non-replicated elements to be respected, conserved and valorised with specific and proper solutions. However, it is a huge opportunity to improve the environmental, social, and cultural quality of cities and countries, as it is also referred to in the *2030 Agenda for Sustainable Development*, which reminds the importance of inclusiveness in several targets [4].

1.2. THE PARTICIPATORY AND MULTIDISCIPLINARY APPROACH

A participatory and multidisciplinary approach is needed to achieve this purpose. This approach is the key to identifying proper tools, aids, and innovative solutions to overcome the various barriers (physical, sensorial, cognitive, and cultural) and ensure an inclusive use of the space. Only the dialogue between designers, clients and users can achieve this goal in respect of the historical and cultural values of the building.

The involvement of professionals from sectors and disciplines different from the architectural design (such as experts in IT and digital technologies, new construction systems and innovative materials, craftsmen, and companies with specific expertise) represents the only possibility to find the appropriate solution to the specific context, according to an approach oriented to "creating" and "doing" [5].

1.3. THE SUPPORT OF THE DIGITAL TECHNOLOGIES

Nowadays, it is particularly appropriate to focus on new technologies that allow minimising the intervention on the heritage. They can offer reversible and easily implementable or replaceable aids, flexible and adaptable to the different needs of users.

Information and communication technologies (ICTs) have rapidly acquired a primary role worldwide in individual and community life. For persons with disabilities, they represent an unprecedented opportunity to participate actively and be fully included in society. In this vein, the number of digital services and tools (i.e., speech or voice recognition technology, video captioning services, targeted mobile APPs, etc.) dedicated to users with disabilities is increasing. At the same time, however, ICTs can represent a major risk of leaving people with disabilities further behind, where digital tools are not accessible and usable by all users [6].

In this connection, from the *Convention on the Rights of Persons with Disabilities* (2006), it is possible to infer an international obligation to take all appropriate measures to ensure people with disabilities equally perceive, understand, navigate, and interact with websites and tools, namely to guarantee web accessibility and digital equality. Overall, the CRPD qualifies web accessibility as a necessary precondition for equality and freedom of expression and opinion, also affirming its importance as a tool for participation and social inclusion [7, 8].

Moreover, people with disabilities and their representative organisations should be actively involved in developing new digital technologies. Although States are the primary duty-bearer called to protect the human rights of all individuals, civil society is required to participate actively as well, in a sort of 'multi-stakeholder alliance' to implement the human rights standards set within the CRPD [9].

1.4. ACCESSIBILITY AND VALORISATION OF HISTORICAL UNIVERSITIES: A MATTER OF HUMAN RIGHTS

Access to the physical environment, transportation, information and communication, and other facilities and

services is indispensable to guarantee that people with disabilities have equal opportunities for participation in society [10]. In this connection, the UN *Convention on the Rights of Persons with Disabilities* [2], which represents a milestone for the protection of the rights of people with disabilities globally [11], formulates the right to accessibility (Article 9) for the first time as a human right. Accessibility, which permeates the entire Convention, is considered as "a precondition for persons with disabilities to live independently and participate fully and equally in society" (Article 9), as well as "a means to achieve *de facto* equality for all persons with disabilities" (General Comment No. 6).

Accessibility is also closely interconnected to the right to inclusive education, which cannot be guaranteed without an accessible built environment, including schools, universities, and all other education places, and without accessible public transport, services, information, and communications technologies. As the UN *Committee on the Rights of Persons with Disabilities* clarifies, "[t]he whole environment in which students with disabilities learn must be designed in such a way as to foster inclusion. Inclusive education is also a powerful tool for promoting accessibility and universal design" (General Comment No. 4).

Moreover, in the UN *2030 Agenda for Sustainable Development*, the purpose "to ensure that all the human beings can fulfil their potential in dignity and equality and in a healthy environment" is affirmed and developed in all its 17 goals and 169 targets. The *Agenda 2030* underlines that States have to "respect, protect and promote human rights and fundamental freedoms for all, without distinction of any kind". There are explicit references to "persons with disabilities" in several targets, and all human activities have to be accessible and carried out by all people in all parts of society. On these particular issues, the Agenda guides to ensure the inclusive and equitable quality of education, promote lifelong learning opportunities for all (Goal 4) and make cities and human settlements inclusive, safe, resilient, and sustainable (Goal 11). In this line, States parties must ensure persons with disabilities have access to education in both public and private academic institutions on an equal basis with others, thus providing inclusive, accessible, and sustainable university buildings.

Furthermore, Universities can be possibly referred to as the world cultural heritage (tangible and intangible), recognised and protected under the 1972 UNESCO *Convention Concerning the Protection of the World Cultural and Natural Heritage* and the 2003 UNESCO *Convention on the Safeguarding of the Intangible Cultural Heritage*, to be shared by all members of the society, including people with disabilities.

1.5. THE UNIVERSITY OF PAVIA

The University of Pavia was formally established in 1361, when Galeazzo II Visconti (imperial vicar) asked Carlo IV (Bohemian king and Emperor of the Holy Roman Emperor) to found the *Studium Generale*, which had the same rights and dignity as the Universities in Bologna, Paris, Orleans, Montpellier, and Oxford.

For 660 years, the University of Pavia has strongly characterised the history and evolution of the city. Its present impact can be fully understood even only considering two aspects:

1. the structure assets that sums 52 buildings for about 225,000 square meters;
2. the residential system of 17 university colleges (10 public, 4 recognised and accredited by MUR as Colleges of Merit and 3 private) hosts more than 2,500 students out of a total of 23,000. This makes Pavia a *university city-campus* with buildings and utilities spread in the city.

It is possible to identify three different *campuses* in Pavia (Fig. 1):

1. the downtown Campus, with the Human Science and Economic Departments and the most important administrative offices;
2. the "University Institutes", with the Departments of Chemical and Physical Sciences and the Medical Institutes;
3. the "Cravino Campus", with Engineering, Math, and Earth Sciences.

Nowadays, the University of Pavia is facing new challenges: on one side, the purpose of growing its national and international appeal by making new spaces and services available with restoration projects; on the other side, improving the functional and energetic effi-

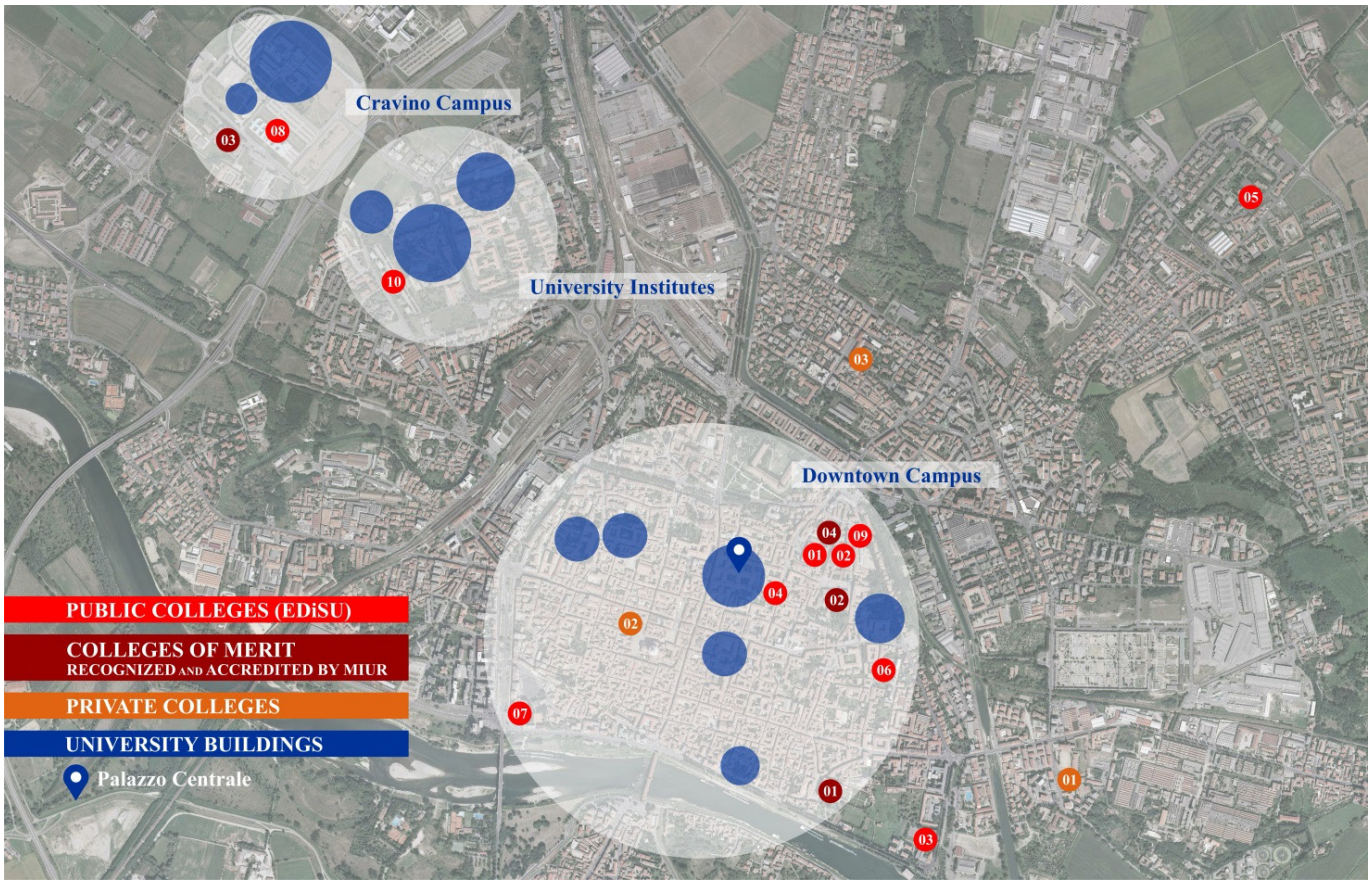

Fig. 1. *Buildings and Colleges of the University of Pavia.*

ciency, the accessibility, the usability, and the safety of the existing buildings.

Considering the accessibility of the buildings and the inclusiveness of the students with disabilities, the University of Pavia has been developing different actions since 1999, when the SAISD (Services and Activities for the Integration of Students with Disabilities) was established.

Since 2006 several works have been developed by the Department of Civil Engineering and Architecture (DICAr), especially on the historical university buildings of downtown, which are fundamental also for tourism. Both didactic activities (courses insights, design workshops, ideas competitions) and research actions have been carried on with the aim to develop objective assessment methods and innovative solutions to improve the accessibility and quality of the building [12].

In this background, the *Palazzo Centrale* of the University is the heart (Fig. 2). It is an extremely complex building with a vast surface (16,000 sqm) that houses the Departments of Political and Social Sciences, Law, some sections of the Department of Humanities, a Historical Library, the Rectorate Offices, and some historical halls with high architectural, decorative, and cultural value (including halls dedicated to Foscolo, Scarpa and Volta).

1.6. THE ACCESSIBILITY OF PALAZZO CENTRALE: STATE OF THE ART

A huge dimension characterises the *Palazzo Centrale* of the University of Pavia (two main floors, 8,000 square meters of covered surface each) and a complex morphology (12 entrances, 9 of which only pedestrian, and 11 porched courtyards). These features inevitably affect the ease of use of its spaces (Fig. 3).

Helping people with disabilities to use the building easily and safely is a priority also due to its institutional importance and the number of services provided, and the people who visit it (it is estimated more than 7,000

Fig. 2. *The courtyard of Alessandro Volta (left) and the coffered ceiling of the Aula Magna (right). Two of the main iconic places of Palazzo Centrale, the main building of the University of Pavia.*

people every day). It is also one of the main tourist destinations of the city, thanks to its history and architectural value. Furthermore, it is a "crossing building" that many people merely pass through to move from Corso Strada Nuova (the cardo of the original Roman grid) to Piazza Leonardo da Vinci.

The state of the art of accessibility of *Palazzo Centrale* is challenging to evaluate, and there are many obstacles for people with disabilities (both motor and visual), also because the building is the result of the addition of different blocks during several centuries, realised when there was no attention to users with disabilities. As it happens in several historical buildings, the main difficulties are caused by:

- the presence of differences in height (with steps) between several parts of the building;
- the huge dimension, the complexity of the structure and morphology and the alienating similarity of some spaces (the collonaded courtyards, connected to each other, can always seem the same to a careless eye);
- the presence of only one elevator (far from the main entrance) connecting the public colonnades of the ground floor with the ones at the first level, where some historical Halls are located;
- the lack of a rational, widespread, and multisensorial signage system to help the orientation.

In this context, *Palazzo Centrale* has become one of the main objectives of the research activities carried on by the Department of Civil Engineering and Architecture (DICAr). Between 2009 and 2013, they developed and realised tactile maps to improve accessibility for people with blindness or low vision (Fig. 4). The work started thanks to the "Pavia participated City" project carried out by the Municipality of Pavia with the collaboration of the SAISD, and it continued with the "P.A.V.I.A." Project (*Partecipare, Abitare, Valorizzare, Ideare, Ascoltare la città* – Participate, Live, Valorise, Design, Listen to the city) funded by ANCI.

The results of these projects are:

- two global tactile maps, one for the ground floor and one for the first floor, which illustrate the arcades and the halls of the different levels;
- six specific tactile maps for the main historical spaces (Aula Scarpa, Aula Volta, Aula Foscolo, Aula Magna,

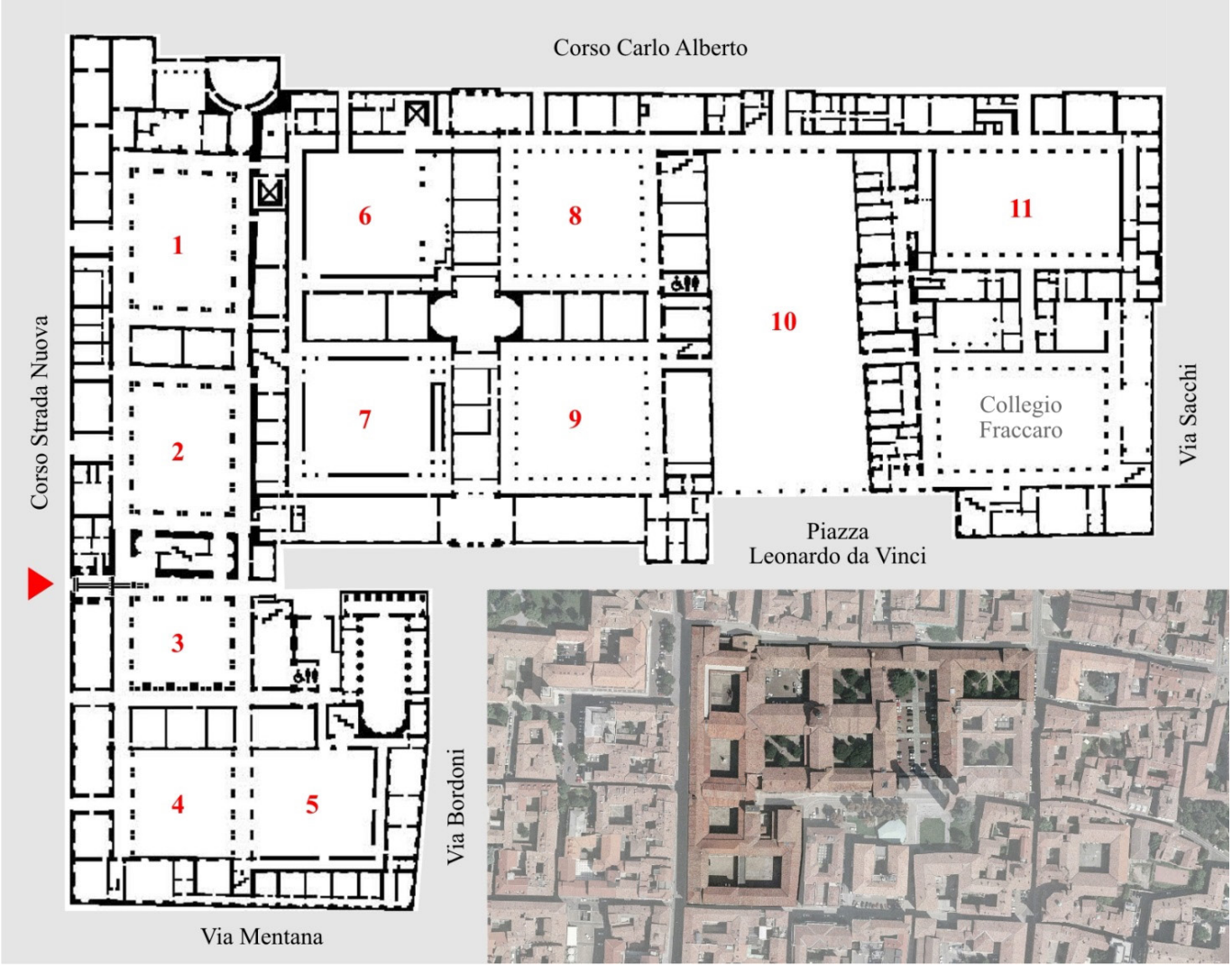

Fig. 3. *Plan of the ground floor (with the 11 courtyards numbered in red) and air view of Palazzo Centrale of the University of Pavia in the urban context.*

University History Museum and Rectorate) and one for the public toilets on the ground floor.

All the maps are made of aluminium, and the chosen colours guarantee proper chromatic contrasts to help the fruition of people with low vision: the background is black for the general maps and brown for the ones of the historical spaces, while walls and information are white, both in relief and in Braille. The maps are fixed on stainless steel inclined planes to allow easy use for all. They are produced by an Italian company, thanks to the specific skills of its founder, a blind young man, who undertook a constructive and participatory process with the research team of the University, aimed at finding the best tricks for the maps' contents. All the choices about dimensions, materials, colours, and positions were also agreed with the Superintendence.

This paper explains new research – started in 2019 – aimed at improving the inclusiveness of *Palazzo Centrale* with information and communication technologies (ICTs). This project integrates the tactile maps to develop an orientation system for people with blindness or visual impairment based on Bluetooth signals emitted by small e-beacons installed in the courtyards of the building. They transmit vocal information to the visitors through an APP for the smartphone.

The *Palazzo Centrale* is chosen as a pilot project because of its importance and complexity, but the future target is to export this method to other case-studies and contexts.

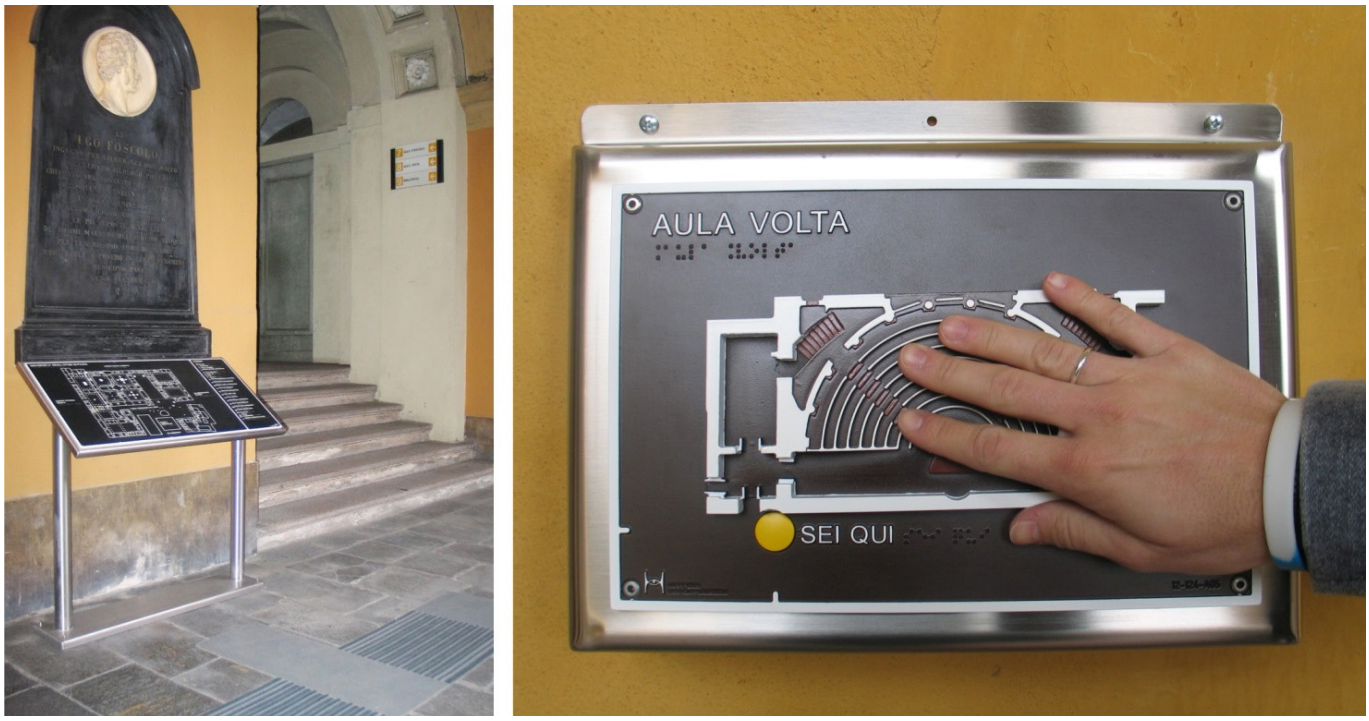

Fig. 4. *The tactile map of the ground floor of Palazzo Centrale at the main entrance (left). The tactile map of Aula Volta, one of the historical rooms of the building (right).*

2. METHODS

2.1. THE METHOD APPLIED

The research methods used and developed by the Department of Civil Engineering and Architecture of the University of Pavia during 15 years of studies and works on the accessibility of urban spaces and historic buildings (including the tactile maps described before) matched the more recent experiences carried out by the Department of Political and Social Sciences. The common approach lets the team define the strategy to adopt in the presented project (Fig. 5).

The method applied to the project here presented is declined as follows:

- *multidisciplinary approach* – after a detailed analysis and synthesis of state of the art, the multidisciplinary team (engineers, architects, jurists, and experts in ICTs) work together to develop the solution, always respecting the cultural and architectural value of the historic building;
- *participatory process and dialogue* – the teamwork with an association promoting the inclusion of people with disabilities, from the beginning to the end of the process. Every step is tested and verified together;
- the aim and the *solutions' features* are discussed and shared together – flexible and reversible technological devices are proposed, integrated into the previous interventions (tactile maps).

Also, considering that the available budget could not cover all the extent of *Palazzo Centrale*, the team had to split the project into two different phases. The first phase consists of the following steps:

1. recognition of the most used entrance of the building (Corso Strada Nuova 65);
2. identification of the most frequented paths;
3. acknowledgement of the key spots (halls, sculptures, commemorative plaques, etc.);
4. selection of only three main paths to be improved with ICTs;
5. localisation hypothesis of the e-beacons along these paths (at the best places respecting the technology issues, the heritage respect and conservation);
6. functional test to verify the signal transmission and reception between the e-beacons and the APP developed by ASPHI onlus;
7. usage test, involving associations and people with blindness and low vision;
8. definitive installation of the e-beacons.

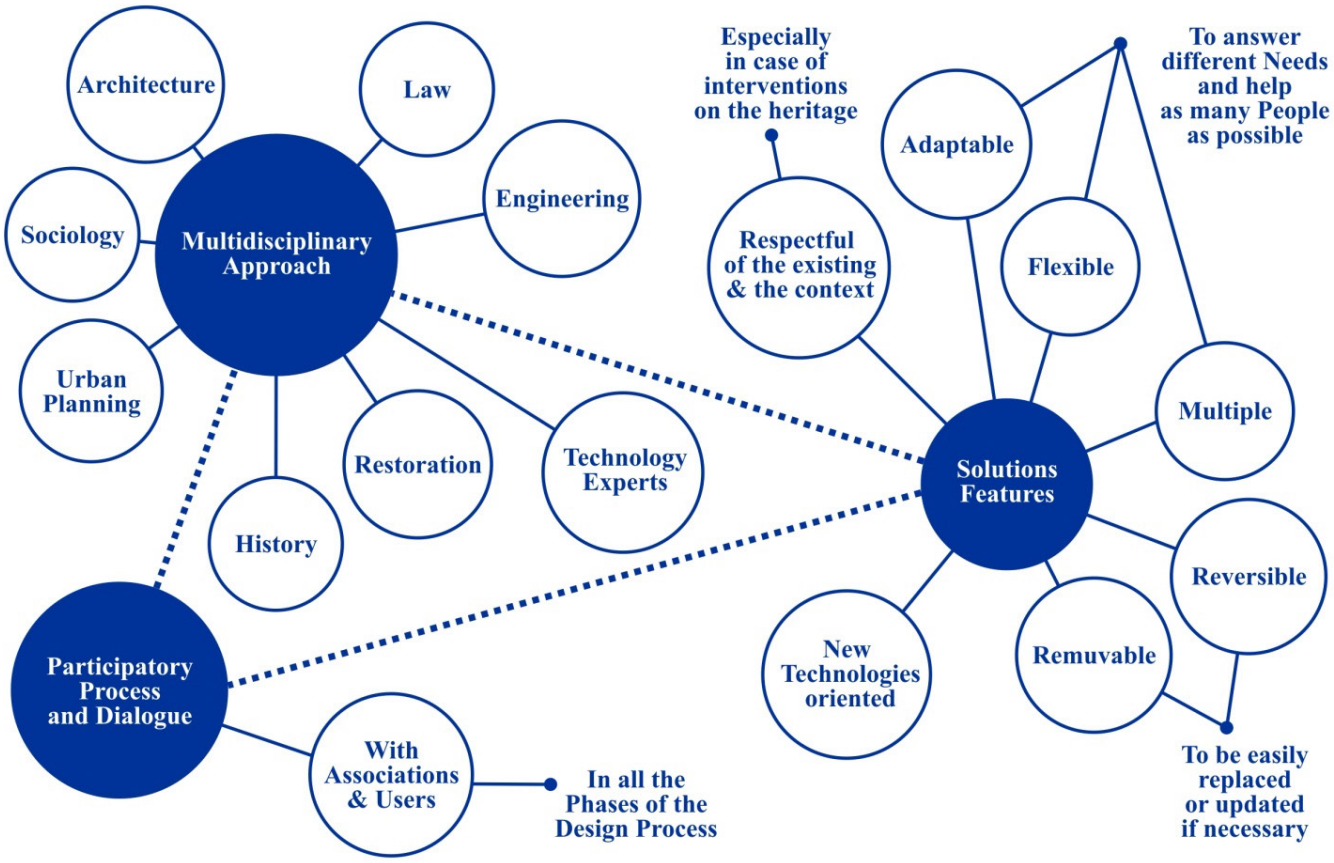

Fig. 5. *The concept of the method develops to improve the accessibility and inclusiveness of the building.*

This first phase confirmed the great potential of this technology applied to improve the accessibility of historical buildings. It was useful to approve the research method and obtain the first feedback from the users with disabilities. It will be the starting point to continue the project in the rest of the building, applying the same steps (second phase).

2.2. THE PILOT PROJECT OF THE UNIVERSITY OF PAVIA IN COLLABORATION WITH ASPHI ONLUS

This approach has been adopted to develop the digital tool «SI@» (Smart Inclusion at the University of Pavia) under the research project "Building an Inclusive Digital Society for Vulnerable Persons: The Role of Social Media Tools in a Disability Human Rights Perspective" (hereafter, BIDS Project), financed by the University of Pavia under the call *Blue Sky Research Project* 2017. This pilot project is the result of a cooperation between the University of Pavia and the consultant Fondazione ASPHI onlus, the developer of the APP. The latter is an Italian NGO promoting the inclusion of people with disabilities in society using digital technologies since 1979. Its mission is to implement the use of technology to improve the quality of life for people with disabilities, ranging from sensory and motor disabilities to mental and physical disabilities to the loss of autonomy and ability determined by ageing. It is also a certifying entity (*valutatore di accessibilità*) recognised by the Agency for Digital Italy (AgID).

The digital tool SI@ implements an APP working in iOS, which, thanks to a set of e-beacons, is a class of Bluetooth low energy devices that broadcast their identifier to nearby portable electronic devices. It enables people with blindness or low vision to move independently in the building. It leverages upon very light instrumentation based on e-beacons positioned along routes, which is ideal for addressing sites subjected to severe architectonical/artistic restrictions. This tool con-

cretely puts into operation an innovative, sustainable, and economical digital technology within the historical courtyards of the *Palazzo Centrale* to target the effective demands of people with disabilities. The APP works on iOS, as this is the operative system commonly used among people with blindness or low vision due to its accessibility features [13].

3. RESULTS

3.1. MAIN PATHS AND PHASES OF INSTALLATION

The implementation of the pilot project in the *Palazzo Centrale* of the University of Pavia led to the definition of three paths that help reach some of the key spots of the building, starting from the main entrance, located in Corso Strada Nuova, the original cardo of the Roman structure of the city centre of Pavia (Fig. 6).

The paths start at the main entrance (Corso Strada Nuova 65) and bring to three different areas, coming across several places of interest:

- *path 1*, from the main entrance to the Department of Political and Social Sciences: crossing two courtyards (Cortile A. Volta, Cortile dei Caduti), the user reaches the Museum for the University History and the Aula Scarpa (also seat for graduation sessions), then, crossing the Cortile Carraio, the path brings to the classrooms of the Department of Political and Social Sciences and its offices, study rooms and library on the upper floor;
- *path 2*, from the main entrance to the Aula Magna: walking along the Cortile delle Statue, the user reaches the Aula Magna, which hosts the most important events of the University;
- *path 3*, from the main entrance to the Rectorate Offices: taking the Honor Staircase located near the entrance, the user reaches the upper floor, having, therefore, access to the University Library, the Aula Volta, and the Rectorate Offices.

Considering the dimensions of the e-beacons (84x84x24 mm), their range (100 m without obstacles) and the needs highlighted by the surveys conducted between September and December 2020, the installation of 46 devices has been defined along the three paths.

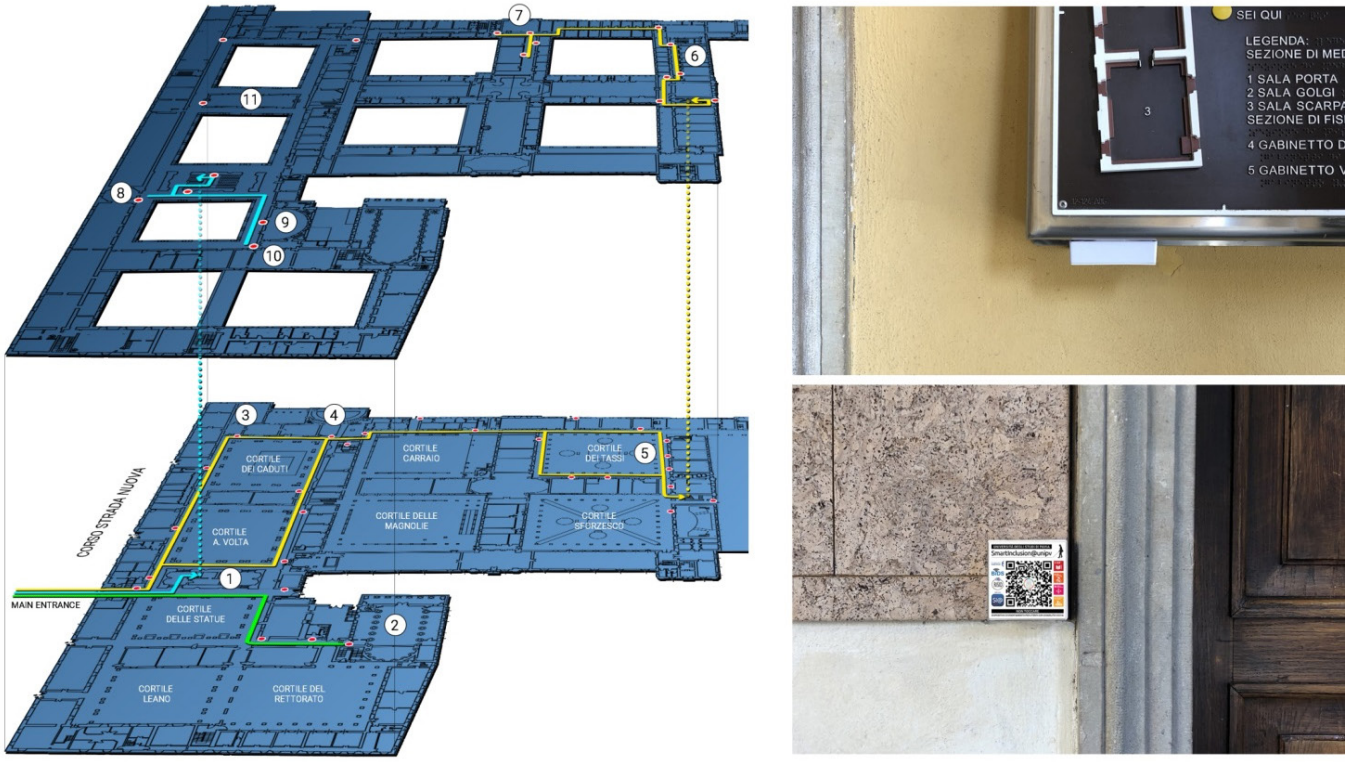

Fig. 6. *The paths identified by the e-beacons through the ground floor and the first floor of Palazzo Centrale (left): path 1 in yellow, path 2 in green and path 3 in light blue Examples of application (right): e-beacon hidden under the tactile map of the Museum (up) and e-beacon clearly visible on one of the removable cork boards, integrated with information, logos and QR code (down).*

In trying to preserve the historical and architectural value of *Palazzo Centrale*, which is protected by Article 10 of the Italian Legislative Decree 42/2004, it has been necessary to identify non-invasive posting methods that did not damage the surfaces or penalise its aesthetic. No constructing intervention was necessary, in full respect of the material consistency of the building, as requested by the Superintendence. In addition, instead of screws or dowels, the e-beacons are fixed by double-sided adhesive, allowing their easy removal without leaving marks. Furthermore, it was decided to install them on existing supports, such as notice boards, signs and the tactile maps mentioned above, not on the historical walls.

The installation phase took place in mid-December 2020, and it also involved the technicians from ASPHI onlus and the engineers from the Technical and Safety Area of the University of Pavia. After that, the ASPHI technicians assessed whether the identified paths were covered by a good quality Bluetooth signal emitted by the devices.

The test phase was carried on in January and February 2021 and involved the contribution of some users with visual impairment in order to establish the type of indications provided by the e-beacons through the mobile APP SI@ and how the user would interface with the technology to receive the information necessary to orient himself.

The implemented APP will be able not only to transmit the directions to reach a place ("turn left", "go straight", etc.) but also to report the presence of dangers and obstacles along the way and to provide precise descriptions of the surrounding space. As well as a navigator, it will also be possible to query the APP to receive historical-artistic information on the building. In this regard, this last type of information will be accessible not only through the mobile APP but also thanks to the QR code stuck on the visible e-beacons. In fact, where it was not possible to hide the devices, it was chosen to make them a recognisable information tool for everyone through the design of a specific graphic with logos and QR codes.

3.2. TECHNOLOGY DETAILS

The APP SI@ purports to support people with blindness or low vision to move independently throughout the courtyards of the *Palazzo Centrale* of the University of Pavia. It has been designed to provide on-time indications acting in reinforcement, not in substitution, of any individual's mobility aid (i.e., white cane, guide dog or sighted guide) and other mobility and travelling personal skills already in use.

SI@ uses a voice information system technology delivering indications on the pathway to follow in order to reach the selected destination, from "x" (starting point) to "y" (arrival point). Pieces of information are organised for selectable routes connecting points of interest (POIs) identified across the campus. A customisable multimodal approach characterises user interaction. Along with the indicated route, users are made aware of:

- architectural elements (steps, gratings, walls, etc.) as spatial references;
- obstacles to avoid;
- available points of interest (halls, libraries, reception services, information services, restrooms, etc.).

SI@ can also be modulated to meet different needs, selecting the best pathway based on identified priorities (i.e. shortness, accessibility for wheelchairs, etc.), and the APP automatically elaborates the most efficient pathway showing it on a map (on a smartphone or tablet) and delivering indications through the voice information system.

The digital tool functions using the signals emitted by Bluetooth low energy devices (e-beacons), which are positioned in 46 selected points of interest within the courtyards of the University. It does not collect any user-identifying or private information.

SI@ has been projected to tackle the structural/architectonical constraints of the ancient building and preserve its great value. It has been designed to function without Internet access or GPS signal to overcome the poor or absent connectivity characterising several areas of *Palazzo Centrale*. In addition, the technology used is non-invasive, cheap, and reversible, as e-beacons are small-sized and easily removable.

Moreover, to preserve the historical walls, e-beacons installed have been limited in number and positioned on existing supports (notice boards, signs, and tactile maps). The backlashes of such limitations (poor Bluetooth signal, less vocal messages available for users) have been

overcome by modulating the content of vocal messages and their timing of the release. These elements have been chosen on the basis of the empirical tests performed in January and February 2021 by one expert and two volunteers with blindness from Fondazione ASPHI onlus, along with the researchers and the technicians of the University of Pavia.

At present, the implementation of the APP SI@ is in due course as further tests are still ongoing to verify the usability of the digital tool. Researchers from the Department of Political and Social Sciences are carrying on user-centred surveys and brainstorming studies involving all the students (with and without disabilities) passing by *Palazzo Centrale*. The purpose is to collect users' feedback and preferences on its further implementation.

4. CONCLUSIONS

4.1. WHAT WE HAVE LEARNED

The BIDS project demonstrates how the key to guaranteeing the safe and easy fruition of the architectural heritage is a multidisciplinary and participatory approach, actively involving people with disabilities and associations supporting and representing them [14].

The researchers and the technicians of the University of Pavia worked together with ASPHI onlus intending to find the best paths to be implemented by this technology and the proper locations to install the e-beacons preserving the historical structures of the building (walls, decorations, headstones, plaques, statues, etc.) [15]. The main effort of the research team was to find the right balance between the issues of accessibility, conservation and valorisation of the historical university building *Palazzo Centrale* [16, 17].

The BIDS project underlines how the applications of new digital technologies can represent a new opportunity for research about the intervention on the historical and cultural heritage, also considering the restart in the presence of academic and tourism activities after the restrictions imposed by the COVID-19 pandemic emergency [18].

This work led to the definition of three guided paths that link the most significant parts of *Palazzo Centrale*, helping the fruition not only for people with blindness or low vision but for all. In addition, it was possible to develop and test the participatory and multidisciplinary approaches [9].

These tangible and methodological results can be considered an excellent starting point to continue to outline new applications of this technology, which is non-invasive, cheap, and reversible [19]. These features make its application to historical heritage possible, guaranteeing the respect and conservation of the architectural values [20, 21]. In addition, this technology is easy to be used by everybody, ensuring its quick spread of use.

4.2. FUTURE SCENARIOS

Considering that this technology respects the existing, is completely reversible and easily adaptable to new needs, only by modifying the contents of the vocal messages or the position and the number of the e-beacons new research, several developments and innovative uses can be identified.

Starting from 2019, the digital tool SI@ has been developed as a pilot project under the first phase of implementation with basic functionalities within the BIDS Project. It will be further developed with the project "RISID – Realising the Right to Social Inclusion for persons with Disabilities through new tools of smart communication and sharing knowledge: from international to local effectiveness" (hereafter, RISID Project), financed by Fondazione Cariplo.

New pathways will be developed by adding 60 e-beacons to cover other points of interest in *Palazzo Centrale*. In addition, new functionalities will be implemented on the basis of the preferences collected through surveys and brainstorming studies. The ambition is to provide multiple services and tackle the need of different users passing by the University's courtyards. The digital tool could be developed to meet the needs of students (information on the location and timetable of classes, exams, libraries, and other services), visiting researchers (information on the location of venues of conferences), tourists (artistic and historical information of the courtyards), and the whole community (information improving the safety or communicating notices). A version of SI@ compatible

with Android will be released to ensure the mobile APP's widespread to all potential users.

Moreover, SI@ will be used to share scientific knowledge effectively, thus communicating in a simple and captivating way – through a mobile APP – the research activities carried out at the University. The mutual exchange of ideas and synergies between society and the scientific community will also be ensured by implementing surveys and questionnaires via the APP. This tool will remain freely available as it will be acquired as an asset to connecting the scientific community with society through a mobile APP, giving free accessibility to physical and digital new spaces.

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