

Using a digital participatory approach to facilitate inclusivity in Jordanian heritage sites: Stakeholders' requirements and a proposed system

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Abstract: The combination of social engagement engines and immersive technologies, such as virtual reality (VR), augmented reality (AR), and digital twins holds great potential for the development of tourism industry during the designing and planning stages. When introduced to experts, this innovative approach allows us to advance creative solutions while keeping the community engaged and enhancing the decision-making process. Virtual designing and planning processes can significantly transform the workflows of professionals and promote inclusive practices in all Jordanian archaeological and heritage sites, particularly those involved in the "Accessible Tourism" project. This article presents an exploratory quantitative study conducted through a comprehensive literature review and participatory interviews. The study involved 23 participants from the "Accessible Tourism" project. It focused on identifying professionals' barriers affecting the application of inclusivity in historical sites. Additionally, the study defined challenges and requirements to determine digitally inclusive applications. The study results highlighted the challenges faced by stakeholders and experts in developing inclusivity in built heritage sites in Jordan, such as interdepartmental communication, historic preservation constraints, and comprehension of accessibility codes. It also addressed the difficulties in engaging users with disabilities or marginalized communities in developing inclusive facilities. Based on these findings, a unique framework for remotely analysing target users within an immersive environment is proposed. This framework has been developed in collaboration with key stakeholders and set the stage for further research and collaboration. Future research should emphasize the importance of inclusive practices and user involvement in designing accessible and enriching tourism experiences at Jordan's heritage sites.

Keywords: participatory approach, inclusive design, immersive technology, community engagement, built heritage sites

INTRODUCTION

Built heritage refers to architecturally and historically significant structures, monuments, and buildings, it is a non-renewable and irreplaceable resource, but it is also susceptible to alteration (Tan, Ti, 2020; Azmi, Ali, Ahmad, 2020). In Jordan, over 20,000 documented archaeological sites are dispersed (Al Adarbeh, Haron, 2018), on the other hand, 13.2% of the population has severe disabilities, and out of those, 74% suffer from permanent ones (Thompson, 2018). Introducing inclusivity in built heritage can promote various positive outcomes, including social cohesion and cultural understanding and appreciation, equal opportunities, empowerment and representation, and economic benefits (Lewis, Arthurs, Berker, Bishop, Louis, Slack, Stenning, Thomas, Thomas, 2018), which means that architects and planners need to design places that take into consideration the life cycle of people with disabilities, senior tourists, those with temporary constraints, and people who are traveling with children (Darcy, McKercher, Schweinsberg, 2020; Shahzad, Elgammal, 2022).

Recently, the Jordanian Ministry of Tourism and Antiquities has established the "Accessible Tourism" project to comply with

legislation and encourage community and visitor inclusion. Nevertheless, inclusion in tourist design demands more than only responding to the demands of people with disabilities. This requires a grasp of their way of life, the dynamics of their social environment, as well as their behaviour in a variety of different circumstances. According to Zallio and Clarkson (2021), "Inclusive design" is a method that "defines accessibility" and "seeks to design broadly a product or environment so that as many people as possible are able to use it." Inclusive design approaches in cultural and historical sites prioritize authenticity, integrity, identifiability, readability, and sustainability. The objective is to maximize preservation with minimal intervention, incorporating diversity and social justice considerations.

Digital technologies have opened up opportunities for a more inclusive approach to cultural heritage, incorporating diverse perspectives and voices. Institutions must adapt quickly and transform their practices, using digital technology for recording, understanding and communication. Research on digital technology in the cultural-historical sector should focus on encouraging discussion (Jameson, 2022), engaging stakeholders (Spadaro, Pirlone, Bruno, Saba, Poggio, Bruzzone, 2023), and involving the community in heritage dialogues (Hasan, Chowdhury, Wakil,

2022). The transition from site visitors to heritage users is crucial, and heritage professionals must adapt to this transformation. A study of Jordanian stakeholders and professionals involved in the “Accessible Tourism” project is necessary to understand challenges and concerns in architectural design, planning, and implementing inclusive design principles in built heritage sites.

RECENT DEVELOPMENTS AND PRACTICES IN THE FIELD OF DIGITALLY MEDIATED CULTURAL HERITAGE PROJECTS

Digital technologies have significantly impacted the integration of cultural heritage sites, revolutionizing the way we experience and interact with the past. These technologies, such as 3D photogrammetry and immersive techniques, are applied across various disciplines, including architectural and urban environments, archaeological and cultural heritage sites, building and site monitoring, mapping, and model making (Di Stefano, Chiappini, Gorreja, Balestra, Pierdicca, 2021; Cheng, Ch'ng, 2022). 3D photogrammetry is widely used in digital mapping (Hatzopoulos, Stefanakis, Georgopoulos, Tapinaki, Pantelis, Liritzis, 2017), heritage display (Montusiewicz, Barszcz, Korga, 2022), building ontology preservation (Cheng, Ch'ng, 2022), repair (Shabani, Skamantzari, Tapinaki, Georgopoulos, Plevris, Kioumars, 2022), structure precision measurement (Barrile, Bernardo, Bilotta, 2022), archiving (Poloprutský, Frommeltová, Münzberger, Sedlická, 2022), digital basic database construction (Zhang, Zhi, Xu, Han, 2022), industrial reverse engineering (Laroche, 2022), virtual reality (Bevilacqua, Russo, Giordano, Spallone, 2022), and other fields.

However, preservation, design development, and built heritage interventions are complex and cross-disciplinary processes (Besana, 2019). Collaborative methodologies leveraging 3D photogrammetry technology have demonstrated enhanced adaptability, enabling their application across a diverse spectrum of architectural heritage. The integration of 3D photogrammetry, 3S technology (Zhang, Zhi, Xu, Han, 2022), 3D virtual reality (Bevilacqua, Russo, Giordano, Spallone, 2022), 3D printing (Yu, 2020), and big data analytics (Wallace, Pouloupolos, Antoniou, López-Nores, 2023) has enabled flexible attainment of multiple goals, including digital preservation, interactive display functionalities, virtual restoration, and reconstruction methods, safeguarding authenticity and integrity, promoting suitability, optimizing sustainable heritage environments and facilitation of community involvement.

Digital technologies have also opened up new possibilities for community engagement in the heritage sector, improving opportunities for dissemination and access while establishing frameworks that facilitate grassroots involvement (Mattone, Frullo, 2022; Khan, Huda, 2023). Cultural institutions have adopted participatory design approaches to improve audience engagement and foster conversations with visitors. For example, cultural institutions have used participatory design methods to create interactive experiences for exhibition spaces (Smith, Iversen, 2014) and digitally augmented visitor experiences (Ciolfi, Avram, Maye, Dulake, Marshall, van Dijk, McDermott, 2016). These innovations provide cultural gatekeepers the power to decide what, where, and how to disseminate their own cultural content (Styliaras, Koukopoulos, Lazarinis, 2011). Technology solutions, such as Linked Data (Webster, Nguyen, Beel, Mellish, Wallace, Pan, 2015), crowdsourcing support systems (Bonacchi, Bevan, Keinan-Schoonbaert, Pett, Wexler, 2019), exergaming (Grammatikopoulou, Laraba, Sahbenderoglu, Dimitropoulos, Douka, Grammalidis, 2019), wikis (Giglietto, 2017), and virtual reality (Calil, Fauville, Queiroz, Leo, Newton Mann, Wise-West, Salvatore, Bailenson, 2021), have become increasingly used in community-led cultural heritage initiatives.

The roles of designers and developers in digital technologies are undergoing a transformation, with human-computer interaction now encompassing a broader range of cultural contexts. The emergence of “toolkits” has changed the responsibilities of technical specialists, enabling them to manage and lead digital projects. However, further work is needed to support cultural engagement with specific communities, such as people with disabilities and older individuals. Issues related to community engagement and participation, particularly for individuals with disabilities, include inadequate assessment of users' needs and expectations, incorrect assumptions about participants' digital literacy, and potential community divisions. The empirical study presented in this paper serves as a valuable contribution to filling this research gap by capturing the views and experiences of key stakeholders.

METHODOLOGY

Participatory qualitative interviews were used to create the presented research. This method transforms the traditional passive questions and answers into interactive, productive sessions. Many scholars, including Schuler, Namioka (1993); Spinuzzi (2005); Simonsen, Robertson (2013), have provided in-depth definitions of the term “participatory design” and its application in the academic community. According to Spinuzzi, participatory design aims to achieve several key objectives. These include involving stakeholders in the innovation process, considering their feedback while developing design ideas, and fostering collaborative efforts to create novel design solutions. The utilization of participatory design has played a crucial role in deepening our understanding of the existing approach to design and development, particularly in enhancing accessibility in historical sites. Moreover, the active involvement of professionals in the design process has a positive impact not only on the design and development stage itself but also on the overall implementation of the workflow.

The research conducted involved all members who participated in the “Accessible Tourism” national project, which comprised 23 members. The participants were interviewed at their workplaces in Amman, Jordan, using a semi-structured interview format. The data were synthesized, coded, and analysed using NVivo software. After interviewing around half of the participants, the analytic codes reached saturation for the research. The final section elaborated on and expanded upon previously covered themes, provided fresh insights into the issues, and shed light on the bigger picture of the situation.

Participants and procedure

The 23 participants in the national project “Accessible Tourism” were mostly relevant stakeholders and leading experts. The first group of stakeholders included legal affairs actors, technical and development architects and planners, heritage site staff, and project managers. These individuals provided valuable insights into the design and planning approach, preservation regulations, and implementations, as well as valuable input on challenges encountered during pre-implementation. The second group comprised leading experts on accessibility and inclusive design from private or public sector, as shown in Tab. 1.

The semi-structured interviews were conducted in two sessions, each lasting approximately 45 minutes. In the first session, the interviews focused on understanding user design and planning barriers, challenges, and requirements. The second session of the interviews centred on understanding participants' views on using digital technologies in the design and development process. The primary objective was to identify significant nodes and themes from the collected data and validate and integrate the

interview outcome to present an initial system design solution. The data facilitated the recognition of shared everyday obstacles faced by all participants in the “Accessible Tourism” national project and identified participants' positive perspectives, views, and concerns about using digital technologies in the design and development process.

Tab. 1. A summary table of all the participants. (Source: Authors, 2023)

Participants	Role	Segment of expertise
P01	Accessibility consultant	Accessibility auditing, Inclusivity research/Regulations development
P02	Accessibility consultant	Accessibility auditing, Inclusivity research/Regulations development
P03	Architect	Architectural Design / Digital Documentation and Visualization
P04	Planner	Design and Planning
P05	Project Manager	Design practice /Project design management
P06	Legal Affairs Actor	Legal affairs and expropriation
P07	Architect	Architectural Design / Digital Documentation and Visualization
P08	Architect	Architectural Design / Digital Documentation and Visualization
P09	Legal Affairs Actor	Legal affairs and expropriation
P10	Project Manager	Engineering and Conservation of Antiquities
P11	Legal Affairs Actor	Legal affairs and expropriation
P12	Accessibility consultant	Accessibility auditing, Inclusivity research/Regulations development
P13	Accessibility consultant	Accessibility auditing, Inclusivity research/Regulations development
P14	Architect	Architectural Design / Digital Documentation and Visualization
P15	Planner	Design and Planning
P16	Accessibility consultant	Accessibility auditing, Inclusivity research/Regulations development
P17	Heritage Site Staff	Cultural Resource Management
P18	Heritage Site Staff	Cultural Resource Management
P19	Project Manager	Design practice, /Project design management
P20	Heritage Site Staff	Cultural Resource Management
P21	Planner	Design and Planning
P22	Project Manager	Design practice, /Project design management
P23	Heritage Site Staff	Cultural Resource Management

FINDINGS AND DISCUSSION

SESSION 1: UNDERSTANDING USER DESIGN AND PLANNING BARRIERS, CHALLENGES, AND REQUIREMENTS

In the initial phase, participants explained the difficulties and challenges faced while designing, planning, and implementing inclusive and accessible tourism. The data was used to identify common daily challenges and role-specific ones.

Common challenges

Facilitating accessibility and inclusivity in cultural and historical sites posed various common challenges among participants. Data analysis revealed several challenges in adapting effective interdepartmental communication, balancing historical preservation limitations with the need for accessibility modifications, as well as securing funding for such projects. In addition, all

participants considered engaging with users, particularly those with disabilities or from marginalized communities, a challenge that can be difficult due to factors like mobility limitations or limited resources. Obtaining diverse perspectives and conducting comprehensive user research, along with involving end-users from the early stages of the project, is important. Professionals need to devote time and resources to user engagement, use accessible communication methods, and adopt a user-centred approach to achieve true accessibility and inclusivity at historic sites.

Role-specific challenges

1) Legal affairs actors

Legal affairs actors P06, P09, and P11 in heritage site accessibility design faced challenges in navigating complex legal frameworks, adhering to local, national, and international laws, codes, and guidelines, and staying updated with new requirements.

2) Architects

As regards facilitating accessibility projects, architects emphasized that they always need to find creative and sensitive architectural solutions to seamlessly integrate them without detracting from the site's historical value, pre-existing structures, and layouts. As emphasized by Participant P07, *“It is important to acknowledge that not every site lends itself to uniform architectural design solutions or interventions.”* Moreover, Participants P03, P08, and P14 highlighted that *“We encounter different physical limitations in each site, such as narrow doorways, uneven terrain, or fragile materials.”* Consequently, architects need to possess a comprehensive understanding of architectural history, technical expertise and thorough assessment of the structural conditions and spatial constraints specific to each site. Simultaneously, they must carefully address the needs of all users, including individuals with disabilities or limited mobility, ensuring that the chosen design solution is appropriate and efficient.

3) Planners

Urban planners possess knowledge and expertise in the strategic allocation and arrangement of spaces, site's layout, infrastructure, mixed-use development, public spaces and gathering areas, integration of public transport, and pedestrian-friendly infrastructure. Participants P04 and P15 stated that *“Managing these competing demands can be challenging and may require effective negotiation and compromise.”* Therefore, this requires prioritization, trade-off analysis, and finding creative solutions that address these objectives simultaneously. In addition, participants P04, P15, and P21 stated that *“Incorporating inclusive features in archaeological and heritage buildings is a complex task due to the limited physical space and structural limitations”* and *“every time we need to assess the structural integrity of buildings and ensure that the modifications we make comply with safety regulations while preserving the historical fabric of the structure.”* Therefore, innovative solutions allowing for timesaving are needed to facilitate more streamlined workflows, enabling professionals to allocate their resources more effectively and focus on developing appropriate solutions that strike a balance between safety, historic preservation, and inclusive design.

4) Heritage site staff

Heritage staff daily manage historical sites, coordinate visitor services, ensure safety, manage budgets, and work with contrac-

tors. In terms of providing accessibility, participants P17, P18, P20, and P23 face challenges in integrating accessibility features while ensuring that the overall visitor experience remains authentic and immersive. Therefore, heritage site staff requires training and education to effectively understand and address the needs of diverse visitors, including individuals with disabilities. As participants P17, P18, and P23 stated, *"Honestly, we need to acquire the necessary knowledge and skills related to accessibility and inclusive practices."* Other participant responses explicated the requirement for a guiding tool to facilitate a more comprehensive design process and augment comprehension of the user's journey, abilities, and desires. Sites management teams stated that *"having an assistance tool that can be used as a monitoring tool is useful in collecting data on how people move through a site and interact with its features"* (P20 and P23). This tool can help to identify potential barriers to accessibility and inclusion, as well as understand visitors' needs and desires.

5) Project managers

A project manager plays a vital role in leading, coordinating, and overseeing the implementation of accessibility in Jordanian heritage sites. P05 stated that one of the main challenges faced is *"There are still no specific guidelines regarding implementing accessibility to Jordanian heritage sites"* and added *"Each heritage site has unique architectural components and its own preservation regulations."* This lack of comprehensive guidelines challenges individuals and organizations involved in enhancing accessibility in these sites, as they must navigate the process without standardized protocols or frameworks to follow. Furthermore, participants P10, P19, and P22 highlighted another challenge regarding *"monitoring the progress of implementing accessibility interventions and solutions"*, where the challenges are connected with ensuring that the implemented solutions meet the required standards. For this reason, a pre-implementation stage is necessary that includes evaluating proposed solutions with other stakeholders, including the local community and people with disabilities.

6) Accessibility consultants

Inclusive design advisors faced challenges due to differing perspectives and stakeholder engagement. P01, P02, P13, and P16 pointed out that *"Inclusive design requires input from various stakeholders; however, lack of knowledge of stakeholders as to accessibility regulations and guidelines is a major challenge faced during the development process,"* *"We waste much time on explaining accessibility guidelines to the employees, especially during their official meetings"* (P02 and P13). This results in inefficient and less productive work.

SESSION 2: PARTICIPANTS' VIEWS AND DISCUSSION ON USING DIGITAL TECHNOLOGIES IN THE DESIGN AND DEVELOPMENT PROCESS

During the discussion on digital strategies and immersive technologies' application in inclusive design, participants expressed various perspectives and concerns. Technical architects highlighted the benefits of digital tools, such as 3D modelling and virtual reality, for enhanced visualization of accessibility modifications. Improved remote communication and collaboration were recognized by participants, including technical architects, planners, heritage staff members, and project managers, who could easily share files, track progress, and engage in virtual meetings. Accessible digital platforms with project management

features were suggested by accessibility consultants for effective stakeholder collaboration. Digital technologies were also seen as cost and time-efficient, allowing for early issue identification and virtual design testing.

However, concerns were raised by legal affairs actors about balancing accessibility with the preservation of historical integrity, addressing it by establishing comprehensive online archives. Technological barriers and the digital divide that some employees face were also acknowledged, where not all participants may have equal access to or proficiency with digital technologies, thus emphasizing the need for investment in digital infrastructure, workshops, training, and support to ensure inclusivity. Developing mobile applications and optimized websites for easy access to heritage site information was also proposed. Clear guidelines and protocols were recommended to address challenges and ensure that digital interventions align with historical standards.

PROPOSAL FOR INITIAL DESIGN SOLUTION

The subsequent section introduced an initial system design diagram developed based on existing guidelines, design methods, user feedback, and in-depth discussions. A new workflow was conceptualized, incorporating cutting-edge, user-friendly immersive technologies to address accessibility issues and sustainable interventions in the design and planning process. As depicted in Fig. 1, this workflow involves capturing historical sites through 360-degree photographs or digitizing them into 3D models, making them accessible to a larger audience. It also includes identifying accessibility issues indoors and outdoors, such as pathways, entrances, handrails, signage, seating, and lavatory facilities. Specific instruments will be developed for each mission.

Advanced camera techniques and consumer devices such as iPhone 12 and iPad Pro 2020 enable the capture of 360-degree photographs and the creation of virtual tours. Applications such as "Matterport," "SiteScape," and "Polycam" offer user-friendly scanning and photogrammetry capabilities. The collected data is processed to generate a three-dimensional representation of the site. Once the historical site assets are created, they will be uploaded to an interactive online platform or imported into a virtual reality (VR) application. This allows users to engage in an immersive experience within a digital replica of the site, fostering inclusivity and drawing inspiration from the concept of a Digital Twin (Liu, Fang, Dong, Xu, 2021; Shabani, Skamantzari, Tapinaki, Georgopoulos, Plevris, Kioumarsis, 2022).

The primary phase of this workflow is identifying users' issues and needs, involving online communication and social engagement strategies. Crowdsourcing platforms, online surveys, and interactive platforms supported by 3D virtual models gather information about inclusivity needs and provide an interactive means for the public to experience the site's properties, as shown in Fig. 2. Stakeholders collect feedback, analyse, and develop initial solutions, considering factors such as budget, time allocation, regulations, and historical preservation (Fig. 3). The final phase is improving the final design, where stakeholders present initial ideas to users for input before implementing the design. The goal is to optimize buildings and sites for maximum value and usability, considering accessibility, inclusivity, and user preferences. Continuous engagement with users refines and enhances the final solutions, leading to an improved overall design outcome.

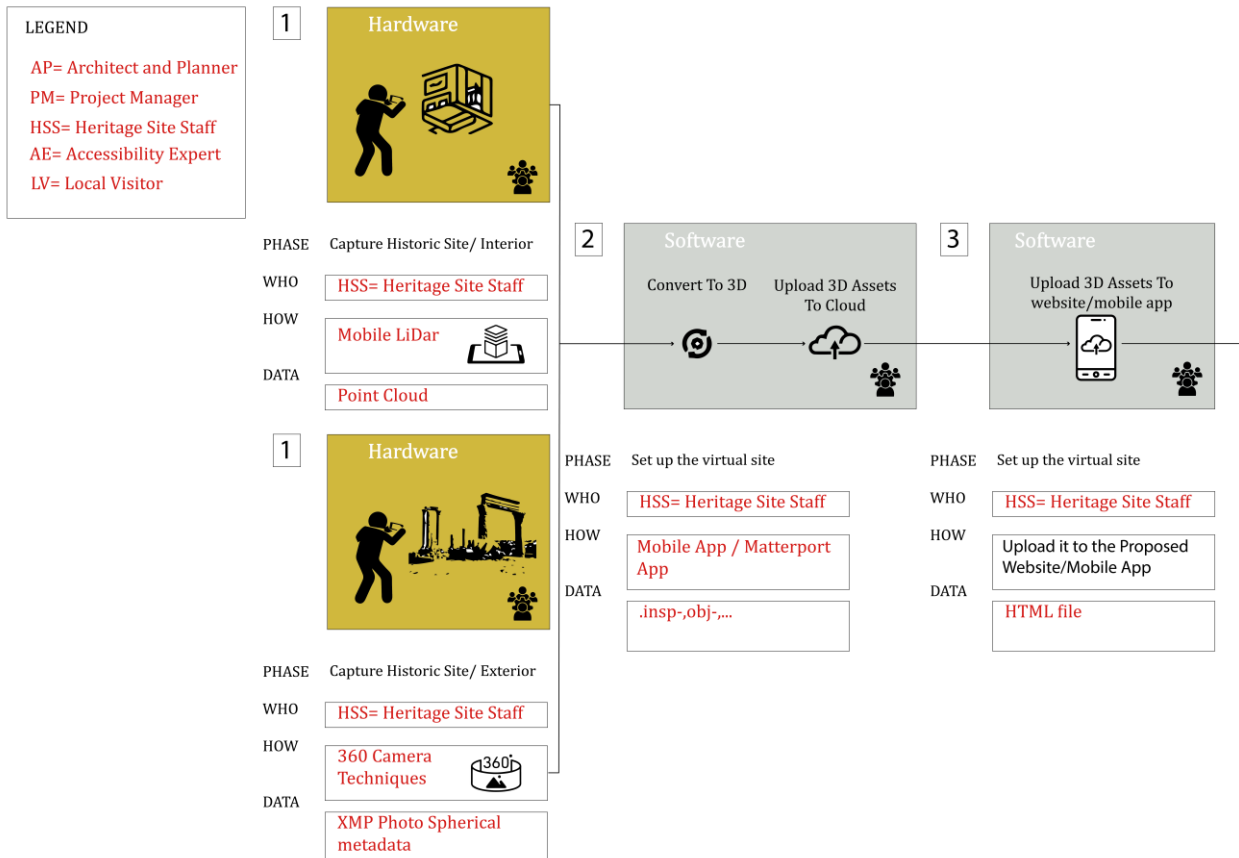


Fig. 1. Capture phase. Legend: A/P = Architect and Planner, PM = Project Manager, HSS = Heritage Site Staff, AE = Accessibility Expert and LV = Local Visitor. (Source: Authors, 2023)

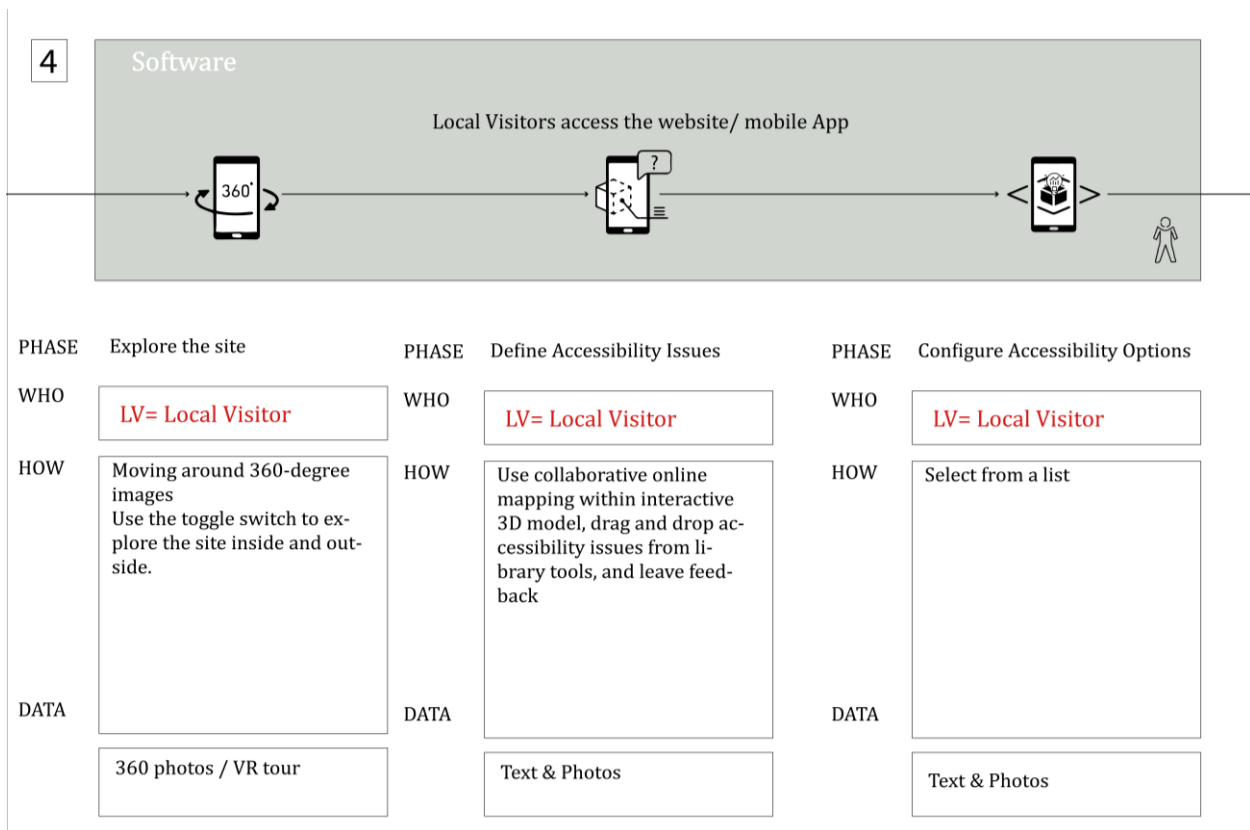


Fig. 2. “Explore the Site” and “Identify Users’ Issues and Needs” phases. (Source: Authors, 2023)

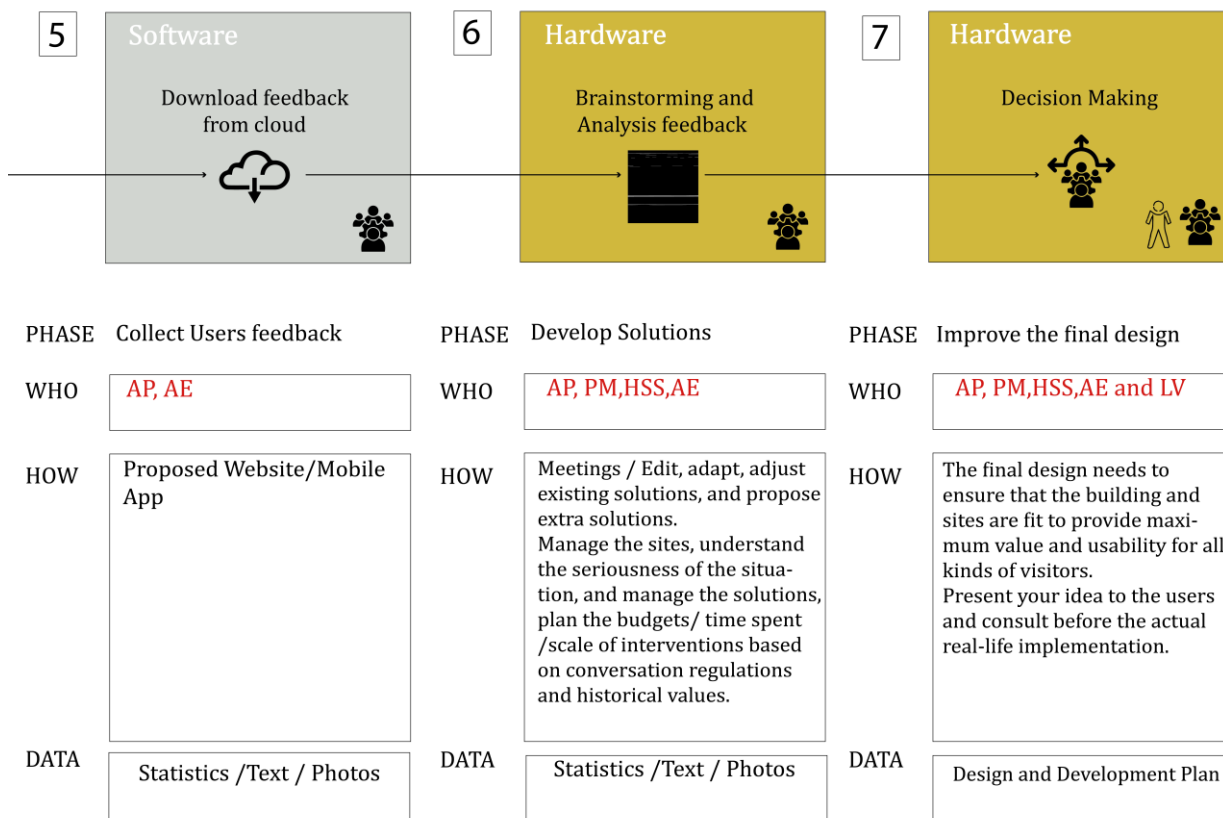


Fig. 3. “Collect User Feedback”, “Develop Solutions”, and “Improve the Final Design” phases. (Source: Authors, 2023)

CONCLUSION

By conducting a qualitative analysis of interview data gathered from the national project on “Accessible Tourism,” this study has successfully identified the primary daily challenges encountered by technical architects, planners, project managers, heritage site staff members, and legal affairs actors during the design, development, and implementation phases. Furthermore, the study has determined the potential advantages associated with the adoption of digital technologies in the design and planning process. Drawing upon the feedback and comments provided by the participants, this article presents a proposed workflow that integrates 3D capturing technology with interactive crowdsourcing platforms. This workflow includes a sub-platform functioning as a 3D viewer throughout the design and planning stages, with a particular emphasis on engaging the local community during the pre-implementation phase. Additionally, the study has collected and discussed the user requirements necessary for developing a first-generation prototype.

This study is a component of a broader PhD research project that aims to investigate the factors, challenges, and potentialities associated with implementing inclusive design principles in historically significant built environments. In the subsequent stages of the project, site surveys and user experience observations will be used to supplement the existing data and conduct a deeper investigation into the characterization of the targeted audiences, taking into account users’ diversity from physical, psychological, and social points of view, especially users with disabilities. These studies will complete an understanding of the complex problems associated with promoting accessibility in

cultural heritage sites. Following that, the research will expand to encompass the evaluation of existing commercial hardware and software tools. The primary objectives of this extension will be to determine the most suitable application for integration within the initial phase of the workflow and to capture the digital representation of the sites.

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