Redefinition of Heritage Public Spaces Using PPGIS: The Case of Religious Complex in Old Cairo

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Abstract: Plenty of challenges all over the world are affecting the urban development of spaces in the cities, especially those of heritage sites; these urban spaces provide various ambiances that appeal to the senses. Although surrounded open spaces in heritage sites are full of rich, deep knowledge that plays an active role in the community perceptions, it has been recently neglected. A contribution is paid to the combination of digital technologies to help in preserving those spaces. Its integrated use could exponentially increase the effectiveness of conservation strategies of ancient buildings. GIS technology became a usual documentation tool for heritage managers, conservators, restorers, architects, archaeologists, painters, and all other categories of experts involved in cultural heritage activities. Consequently, the GIS has faced strong criticism as it is a tool for documentation without engaging in the public environment and the users' needs; as a result, GIS cannot help in any enhancing process as it does not have any idea about the needs of the users. This paper analyses public uses efficiency in heritage public spaces in Cairene context using public participation geographic information system (PPGIS) methodology, as it gives attention to the term "user" to include the "public" incorporating the concept of "public participation" commonly used in planning. An online survey was set up, based on Google Maps, where respondents were asked to place and rate twenty-five items on an interactive map done by ARCGIS 10.4. These items were based on the criteria of placemaking to make those spaces full of creative ambiance to be more attractive and useful to the communities. Finally, 200 valid surveys have been collected and mapped 1500 opinions have been mapped. The Results of this research show that PPGIS is an effective tool in measuring the efficiency of those heritage public spaces, which may be valuable for future planning.

Key words: public spaces, heritage sites, cultural heritage PPGIS, preserving, digital heritage

1. Introduction

Within the previous years, the rapid and massive process of developing countries took place. This massive process is called urbanization. This phenomenon is not a new or modern one, but it became clearer due to the rapid change. These changes challenge a lot of issues to achieve resiliency, inclusiveness, sustainability and enhancement of the quality of urban life [1]. Quality of urban spaces can be enhanced in different ways. This research will focus on heritage public spaces. Before the pandemic, those spaces were neglected in a lot of countries especially in Careine context. These heritage public spaces contain a significant part of the cultural heritage [2]. Cultural heritage is important for its generation and future generations in order to know their original form or that which has been kept so far [3]. The historic urban landscape has been preserved in the historic centre of the European centre and it was a very successful model. Old towns with surrounding landscapes are being restored and it is attempted to incorporate them into the contemporary urban functions, by recognizing their importance [2]. The main key for protecting the historical sites or areas is to know all the relevant information. This information should be collected and mapped in a database to be easily accessed by each of the researcher, the architect, and the urbanist while enhancing the processes.

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Traditional research methods are not able to successfully meet the need of collecting, elaborating, and analysing mass data. As a result and in order to have more accurate georeferenced information from non-expert users and a reference procedure, public participation geographic information system (PPGIS) is used to engage the public participation visitor with those heritage public spaces [4]. Public participation geographic information system (PPGIS) naturally enables a wide range of events to be placed into coordinates and mapped using the ArcGIS [5]. In this paper, we analyse public use of heritage public spaces using public participation geographic information system (PPGIS). The main aim of the paper is to determine how and where users use the most spaces and know their opinions on them. In our study we choose "The Case of Religious complex" in old Cairo. The public space in this heritage complex is unique and rare as it is home to three monotheistic religions [6].

2. Digitalization of Cultural Heritage

The meanings of the past are conceptualized as "heritage attached to the present", or as "socially established awareness, including material, as well as intangible, political, and cultural backgrounds". It has been defined that *digitalization* of cultural heritage is a comprehensive procedure of cultural heritage management in a digital setting [7]. It also been used in the long-term preservation, presentation, and provision of accessibility to the contents [7].

During the 21st century, preservation technologies were used while preserving or enhancing any heritage space to make its cultural heritage more efficient and effective [8]. Culture heritage is local culture and identity of urban spaces with a lot of meaning. The built environment and the culture are relatively close together [9]. While studying the relation between design of the built environment and the culture, there was a reflection of this relation on the public spaces [10]. The cultural heritage is an integration of several

aspects such as human, social and physical activities beyond the urban elements [11].

Recently, a lot of researches have been calling for enchaining the connection of heritage and planning to management with the daily life of the communities [12]. In line with recent research, historic urban cores can be enhanced by applying new policies, regulations, and criteria for preservation [12], especially after the 2020 pandemic, where open spaces gained a lot of attention. An open space can be considered an oasis of greenery and heritage in a concrete desert [13]. Although surrounded open space in heritage sites is full of rich, deep knowledge and plays an active role in the community, it has been neglected. Due to the rapid change and development in the urban context, a lot of this heritage public space lost environmental quality, natural resource production economic opportunity, and a sense of place [13]. Therefore, the following section of the literature review will introduce the digital heritage idea then focus on the public participation geographic information system (PPGIS) methodology that will help in enhancing those heritage public spaces to become more attractive to the users.

2.1 Digital Heritage Definitions and Domains

According to the UNESCO, digital heritage is referred to as any "born digital" as it contains unqiue resources of human knowledge "created digitally or converted into digital-form from existing analogue resources" [14]. A lot of researchers defined "Digital heritage" as the integration between culture of users with Technology, and of digital knowledge with research [15]. Nevertheless, the definition of the "digital heritage" is still a huge one with no clear methods and objectives. "Digital heritage" is considered a process more than merely a tool to present or communicate with end-users [16].

Under the UNESCO Charter, the main sources of intangible cultural heritage, such as e-form (electronic copies, etc.) for conventional cultural storage (e.g., electronic archives, archives, exposures, databases, etc.)

and electronic format, may ultimately become an object of cultural heritage but may become artefacts of a new cultural heritage (computer programmes, webs, technologies, digital works of art etc.) [8]. Using computers, technology helps in creating these digital resources which help to obtain a huge database to be shared over time and across spaces. This is confirmation of a digital heritage. It is a legacy in many countries with many different features and many common risks [14].

Due to timely changes or versatile implementations of current standards, many countries have created digital preservation rules. This law helped form effective cooperation for better use of the data [17]. Consequently, there was a development of the social, economic, and touristic aspects of any heritage space. GIS is particularly a useful tool for saving the cultural heritage to preserve in the right direction and not lose cultural heritage meaning. In addition, both researchers need to work together to overcome challenges like antiquated copyright systems, rapidly developing new technologies and the huge diversity of digital content [17]. Generally, GIS is multi-disciplinary data which can help in evaluating and preserving sites with historic or cultural value (as it provides data for the researcher to do a lot of studies). It combines database with geometrical and spatial referencing [2]. GIS has been around for years all over the world in large amounts by keeping cultural heritage digitality but never "fixed" in a physical form [17]. In the 1990s, a strong criticism towards the GIS was evolved as it did not have impact on the physical life of the users [18]. "While digital technologies offer a means of giving unlimited access to culture today, access tomorrow is far from guaranteed" [17]. Finally, a lot of researchers and urbanists realized that GIS is more than just a tool for storing the data and displaying it. GIS was used for spatial analysis and mapping based on survey and public participation geographic information system (PPGIS) methodology [5]. As shown in Fig. 1, In the late 1990s, tourism researchers developed the GIS tool
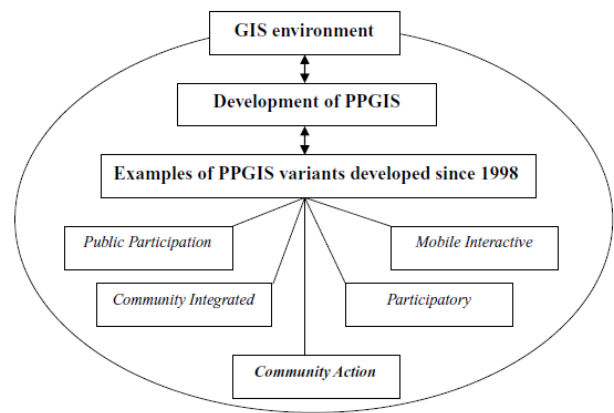

Fig. 1 Relationship between GIS, PPGIS and variants of PPGIS [19].

and became interested in public participation geographic information system (PPGIS) methodology as a tool to enhance citizen participation in tourism planning and development [19].

The following sections will focus on the public participation geographic information system (PPGIS) and how it will help in improving usability of heritage public spaces.

2.2 Toward Successful Heritage Public Spaces Using (PPGIS) In 1996, public participation geographic information system (PPGIS) attracted the attention of a lot of researchers as it engaged the public in applications of GIS in improving the transparency process [20]. Public participation geographic information system (PPGIS) has been recognized in many processes of decision making such as in urban planning, pollution assessment, and natural resource management [21], in addition to the public users such as stakeholders and interested citizens who can help produce decisions that could better serve people's needs [21].

Nowadays, the Public Participation Geographic Information System (PPGIS) has gained significant interest as a tool that can enable societies to create a framework for future planning [22]. The Public Participation Geographic Information System (PPGIS) is a methodology that aims to include more comprehensive ways of engaging local communities and individuals in a method called participatory

mapping [1]. A lot of studies were done by a lot of researchers especially Kevin Lynch. In three separate cities Kevin Lynch examines the interpretation of consumers by drawing up maps that display major characteristics of their towns and the effects of those features of their maps of how people arrange space knowledge on their buildings [23]. As shown in Fig. 2, public participation geographic information system (PPGIS) can offer five stages for visualizing, situating, and integrating numerous stakeholders' perspectives, which can offer proposals for better heritage public spaces [21].

Recently, public participation geographic information system (PPGIS) has played an important role in different disciplines such as urban planning, community development, landscape ecology and those of natural resources [24]. Public participation geographic information system (PPGIS) approach contributes to the combination of various qualitative and quantitative research tools [25]. In various projects using public participation geographic information system (PPGIS), it was found that research is supported by different stages of a collaborative planning process which enhances the quality of the entered data to GIS [26]. This planning process has been done based on a number of participants in this process. The participatory mapping has been expanded by a lot of techniques in GIS which helps GIS to create activity maps for the spaces; this is useful for the spatial context and complexity, articulation of spaces through analysing both interactivity and interconnection [27]. The spatial context can be analysed in GIS through a lot of different queries: for example, the stakeholder, activities in space, circulations, geographic accessibility, mobility, place identity and attractive points in the spaces. The approach of public participation geographic information system (PPGIS) approach has a strong component in the heritage public spaces as it helps collect data from the community interacting with the spaces. This strong component
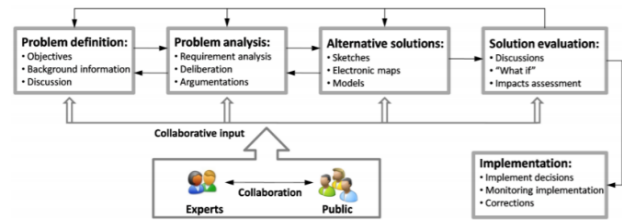

Fig. 2   Five stages for visualizing, situating, and integrating numerous stakeholders' perspectives [21].

enables and gives chances to the community to evolve in the enhancing process of the space knowing their interests and needs [25]. Nowadays, a lot of attention and emphasis is put toward the social and environmental sustainability especially after the 2020 pandemic, hence, the public participation geographic information system (PPGIS) approach should move beyond the conventional representations of where people live to describe more effectively the dynamics of how people live [1], nonetheless enhance the quality of life of communities.

3. (PPGIS) Evaluation Criteria Based on Placemaking

First, in this paper researchers selected and proposed the criteria to be evaluated. Second, it helps in the designed, configuration of the survey and PPGIS interface; and third, the researcher can evaluate efficiency of those heritage public spaces.

Placemaking with creative ambiance principles will be the base of this study in alliance with the fact that the philosophy of placemaking is based on the fact that every human has the right to access a liveable and attractive place. Successful places will greatly impact on their perception and social quality of life [28]. Placemaking was introduced as a new concept for a better belonging and sense of place in the book of Edward Relph "Place and Placelessness": directly experienced phenomena of the lived-world and hence is full of meanings, with real objects and with ongoing activities [29]. This new concept was to translate physical and non-physical aspects integrated with ambiance taxonomy as shown in Fig. 4. This is called creative ambiance [6].
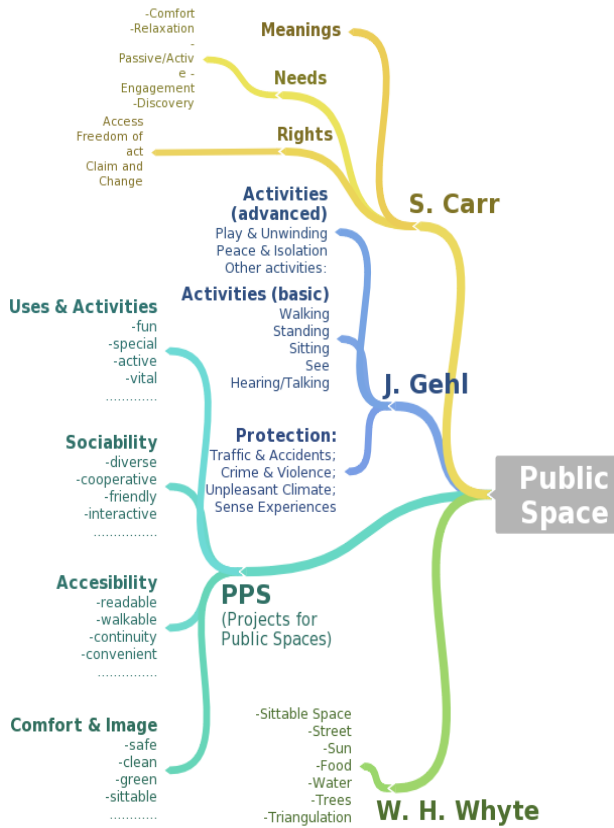
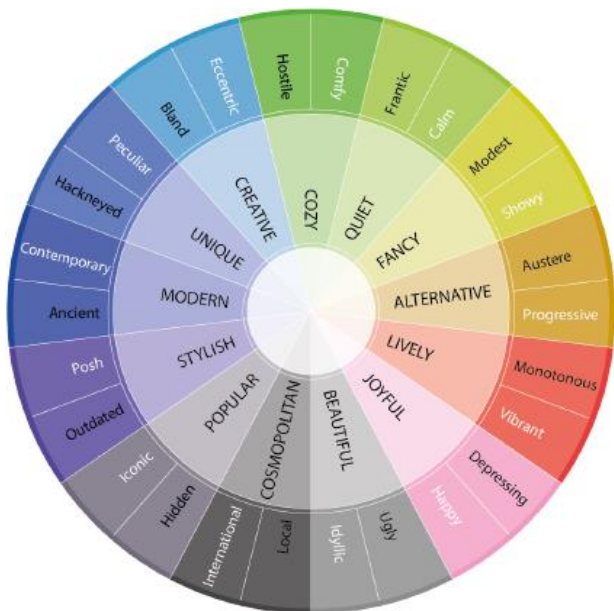**Fig. 3   A successful basic public space criteria [31].**

Fig. 4   Ambiance taxonomy wheel.

Public participation geographic information system (PPGIS) gives attention to the term "user" to include the "public" incorporating the concept of "public participation" commonly used in planning [30]. Public

participation geographic information system (PPGIS) method involves local communities creating information to be fed into a spatial mapping database and later used in decision making on spatial issues affecting those communities [30]. To provide useful, proper, and timely information that civil and governmental organizations can use, there are three types of data for urban planning: physical data, socioeconomic data from surveys, and physical data related to built environments [30]. So, the approach of public participation geographic information system (PPGIS) helps in achieving the concept of placemaking with creative ambiance as they both work on studying and analysing the physical and non-physical aspects of the users' environments.

4. Materials and Methods

To achieve the aim of the research, a four-step procedure was taken. First, the authors formulated and selected the items to evaluate based on placemaking criteria, for example, the activities of users and attractive nodes in heritage public spaces. The chosen case study was selected upon differences between them in three independent variables; built environment, social activities, and cultural heritage. The case study is full of rich and deep cultural heritage. It also raises various socio-economic dynamics and historical backgrounds. Second, the authors build a new design and construct the PPGIS interface. Third, the authors start to distribute the PPGIS survey using Google maps; and finally, a performed statistical, spatial analysis and qualitative interpretation done.

4.1 Items Selected

The researcher evaluated this heritage public spaces by considering the seven items of Project for Public Spaces (PPS). Project for Public Spaces (PPS) makes a development in the basic criteria diagram that are divided into four sections: Access & Linkage, Comfort & Image, Uses & Activities, and Sociability [31]. This new diagram contains many key attributes and new

measurements for placemaking, which can be applied to any public spaces, as shown in Fig. 5 [31].
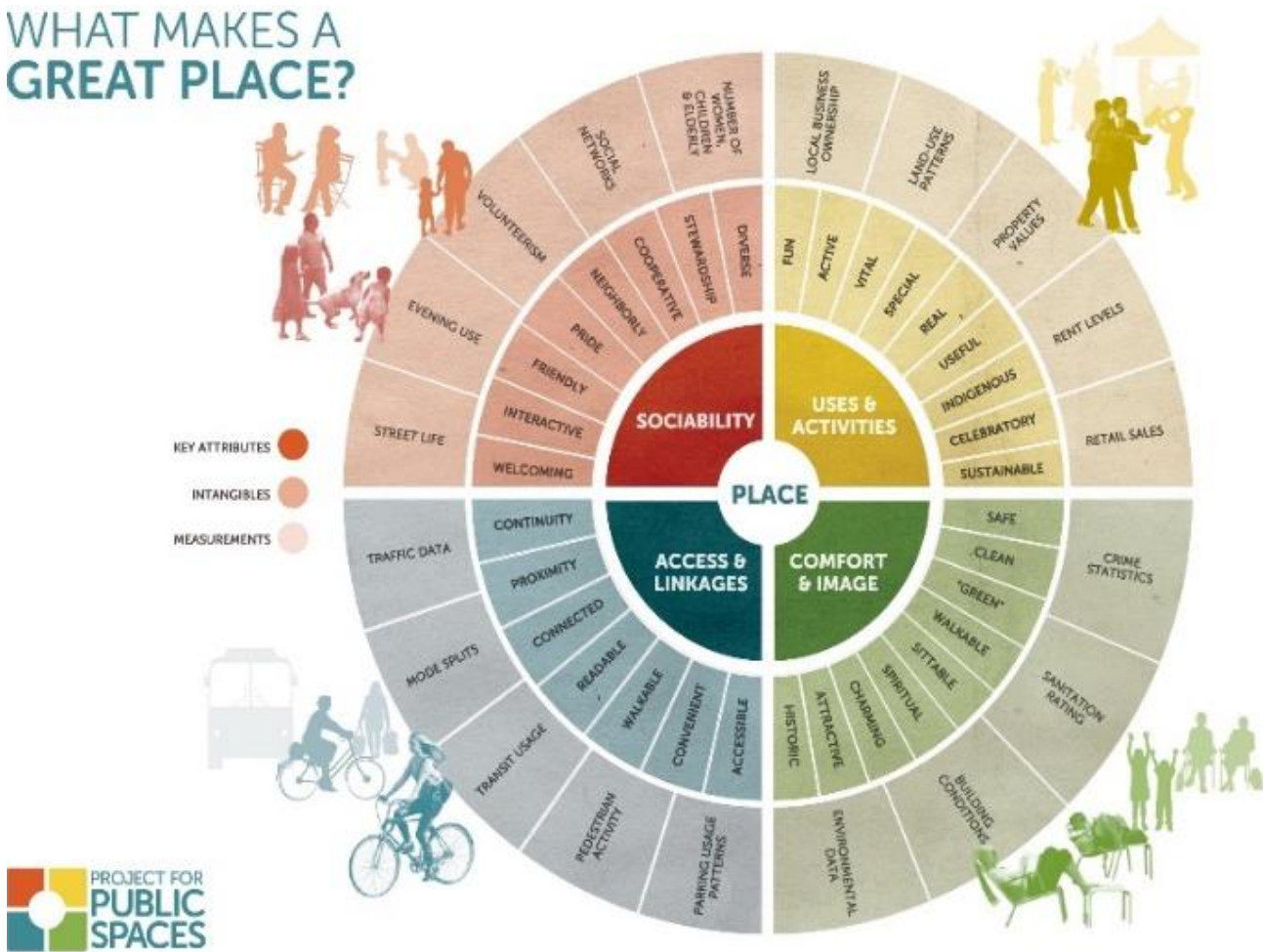

Fig. 5 Shows placemaking criteria required to create successful spaces [31].

4.2 PPGIS Survey Interface

PPGIS was designed as a spatial online survey in Google maps. The survey's base map was taken from Google Maps and imported to GIS. In the survey we start to evaluate items by rating items in the place and locate them on the base map on GIS.

The survey is divided into four sections with a total of twenty-five questions. The first section is composed of five questions about Access & Linkage. The second section asked participants about Comfort & Image on a spatial basis by using interactivity. This section contains ten questions. The third section is on Uses & Activities; they were asked to place and rate items about this heritage public space location on the map

(Fig. 6). To evaluate this section, we chose a score rate. The scores were set in five categories: "very satisfied", "quite satisfied", "satisfied", "quite dissatisfied", and "very dissatisfied". The fourth section asked participants ten questions on the Sociability in these heritage public spaces. Before answering this section, the author demanded they read background information and a briefing on instruction how to answer survey. This section gives the participants multiple answers to choose from. Respondents' opinions were about their social interaction in these heritage public spaces and their community attachment and engagement in the enhancing process. The responses were in the form of Likert scale (the five Likert scale varies from 1 to 5, as 1 = strongly disagree,

to 5 = strongly agree) as shown in Fig. 5.

4.3 Data Analysis

The results of a spatial online survey in Google maps were analysed statistically and spatially to achieve the qualitative approach. These results help to interpret 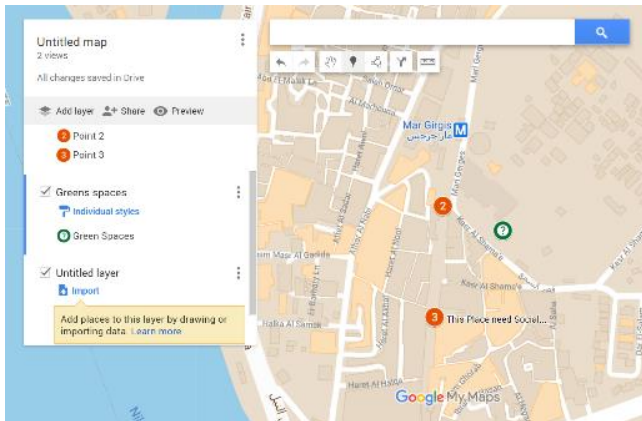the problem of the studied area. Excel 2013 was used to collect statistical data to import actual data on ArcGIS 10.4. GIS was used for spatial analysis and mapping which helped correlating locations and it was more accurate than Google Maps. This base map will help in the improving and enhancing of the studied area based on deep survey.

Fig. 6   Screenshot of the online survey.
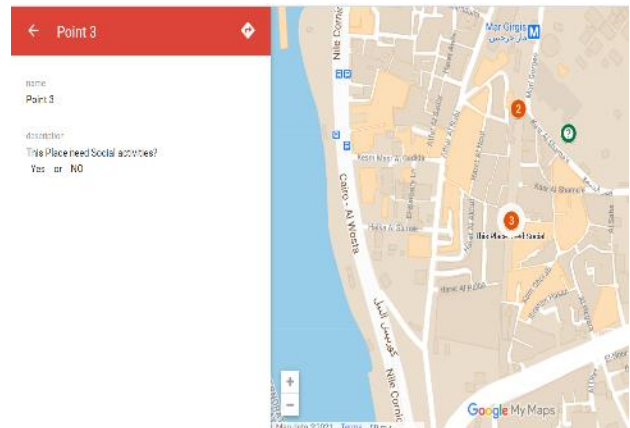
5. Studied Area

This study was conducted in one of the largest religious complexes in Egypt, old Cairo. It has a lot of unique churches as well as the Jewish temple and Amr Ibn el Aas mosque. The public space in this heritage complex is unique and rare as it is home to three monotheistic religions [6]. The area attracts over 1000 and more visitors daily for various purposes, who enjoy the unique historical architecture scenery, religious sprite, visiting museums, shopping in the traditional Souq and tourism.

This studied area has a special interest which can help in promoting it; it is the surrounding public spaces as it is full of social and cultural value. Those spaces have been neglected without any numerous managements and improvement to attract more visitors.

6. Results

The results were based on online survey, quantitative and spatial analysis. The online survey was done over a six-month period in the studied area. The researcher
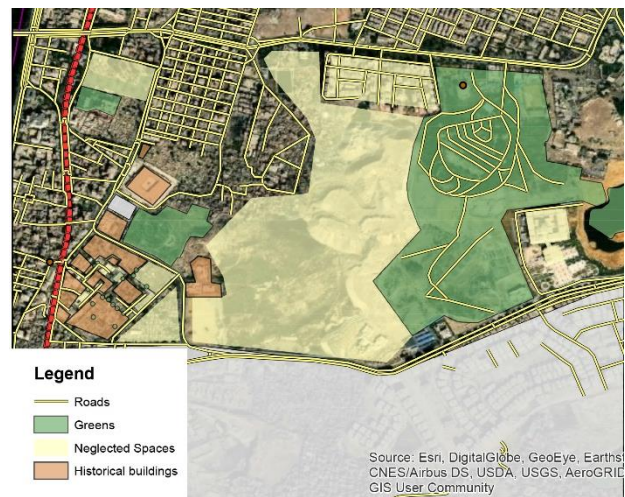

Fig. 7   Illustrated by the authors. Shows case study location using ArcGIS 10.4.

collected 200 valid surveys and mapped 1500 georeferenced opinions.

To get georeferenced maps for the studied area we converted survey and spatial analysis into integrated vector feature classes. This map will show identified locations, access points, attractive area, needed services, needed social activities and green space whether it is neglected or used by users as shown in Fig. 8.

Fig. 8 Identified locations, access points, attractive area, needed services, needed social activities and green space whether it is neglected or used by users.

Fig. 10 shows the people's opinion about their social interaction in these heritage public spaces and their community attachment and engage in the enhancing process. Respondents answers are in the form of Likert scale (the five Likert scale varies from 1 to 5, as 1 = strongly disagree, to 5 = strongly agree) as shown in Fig. 10.
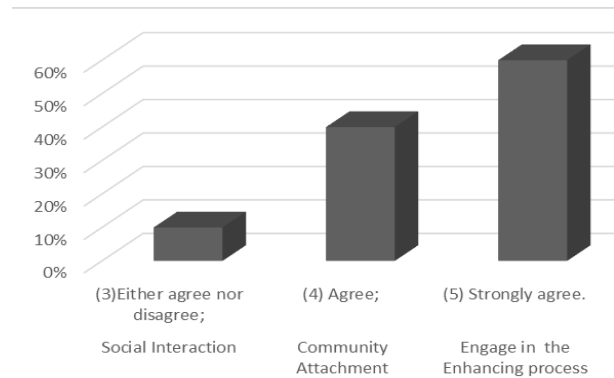

Fig. 9 Shows the percentage of needs, path, and network analysis.

Fig. 10 Shows the percentage of people's opinion about their social interaction in these heritage public spaces and their community attachment and engage in the enhancing process.

After observing and analysing all the collected data in the case study, this heritage site is unique and in a landmark location. The surrounding spaces are huge enough to help the preservationist to add creative atmosphere and ambiance by adding events, exhibitions area, and social activities with the same spirit of the building. It is worth saying that the surrounding buildings have unique architecture, so the attached space should help to reflect and define it for the users. This reflection will be done if the attached space supports the buildings by engaging activities for achieving the main aim of the research for better social quality of life. PPGIS framework was proposed, which gives guidelines to the problem. These guidelines will help to overcome the social problem users face nowadays in the attached space in heritage sites. The results of this evaluation have a significant impact and opportunity to make this heritage site with its attached spaces more attractive and full of more activities [28] Nevertheless, the setting suffers a lot of negative issues based on the proposed criteria. Such activity needs and unsafe places leave a negative impression in their minds as shown in Figs. 9 and 10. 75% of the respondents mention that they need more commercial, social, recreational, and cultural activities. They suggest that those heritage public spaces undergo a critical development to improve the sense of belonging and pride of the place. This improvement will
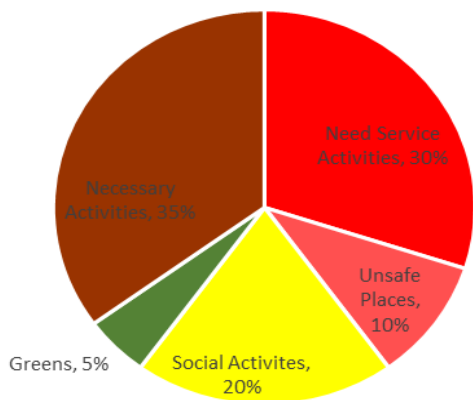
significantly impact the user's social behaviours and perception in utilising the heritage spaces. Moreover, 70% of the respondents linked their feeling of attachment and sense of place to the process of improving this heritage public space. If these places are available for the public with useful attraction, new social bonds and cohesion will exist between the community categories. This bond is one of the essential placemaking credibility outcomes. The respondents need varied activities with a new spirit full of hospitality and attraction of social network. All respondents expressed their desire to participate in this process by criticizing, developing, and voting on the proposals.

7. Conclusion

In this paper, the researcher proposed placemaking with creative ambiance criteria. The aim of this research is to evaluate the social and spatial experience of local populations, using public participation geographic information system (PPGIS) methodology, to explore the relationship between events, their understanding of the built environment and culture. To achieve the research aim, a proposed quantitative and spatial analysis was proposed by examining the activities of users and attractive nodes in heritage public spaces. The studied area was selected based on differences within three independent variables; built environment, social activities, and cultural heritage. In this research, the authors follow a framework for evaluating participation methods. To achieve their aim, they employed participatory mapping and Geographic Information Systems. This research uses participatory mapping and GIS methodologies to increase our understandings of how users perceive and interact in a range of activities in heritage public spaces. This collaborative participatory approach will capture the diversity of interactions of people. In comparison, it is more "available" and attractive for people unable to translate their experiences into scales. PPGIS methodology revealed that 75% of the respondents

mention that they need more commercial, social, recreational, and cultural activities. They suggest that those heritage public spaces undergo a critical development to improve the sense of belonging and pride of the place. This improvement will significantly impact the user's social behaviours and perception in using the heritage spaces. Moreover, 70% of the respondents linked their feelings of attachment and sense of place to the process of improving this heritage public space. It was concluded that (PPGIS) methodology is a more effective participation method to validate the idea and test any criteria. This analysis found PPGIS to be effective and interesting in public heritage spaces. We truly believe in the fact that the management strategies, environmental growth projects and consensus-based decision-making will benefit from this approach tremendously. Further research will focus on public use, attitudes and behaviour of the users. Another important research will concentrate on the proposal or a trial of development in 3D visualization those spaces based on PPGIS methodology that can deliver interesting and attractive places for users.

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