

# Augmented Reality as a tool for Urban Design

*Case study Quaiserbagh Cultural heritage complex, Lucknow*

<sup>1</sup>Dr Indrani Chakraborty <sup>2</sup>Dr Subhrajit Banerjee

<sup>1</sup>Faculty of Architecture and Planning, Integral University, Lucknow, Uttarpradesh, India

<sup>2</sup>Faculty of Architecture and Planning, AKTU, Lucknow, Uttarpradesh, India

**Abstract:** Augmented reality is a technological breakthrough that stimulate reality perception. Augmented reality is a new technology that merges the virtual and real worlds and offers support for the urban design process. Technologies are important tool to design smart heritage zones by making concrete contribution to trigger dynamic process of place based development. Several digital interfaces had been developed over the years that utilize virtual and the augmented reality technologies for visualizing the heritage zones digitally in an interactive manner through the use of several different input devices. An integration of those technologies provides a novel multi modal mixed reality interface that facilitates the implementation of more interesting digital heritage exhibition.

This paper presents the actual simulation possibilities and challenges of augmented reality in the field of experiencing cultural heritage. It also describes a study of pedestrian navigation in a cultural heritage neighborhood in Lucknow India by proposing customized path with the aim of promoting cultural tourism and explains the benefits of using augmented reality in tourism and place making.

**Index Terms:** augmented reality, pedestrian navigation, mixed reality interface, digital heritage exhibition, place making

## I. INTRODUCTION

Recently AR is being widely used in the field of education, entertainment, Virtual heritage, Simulation and games. Specifically in virtual heritage AR is used to enhance the overall experience of the visitor of a cultural heritage site. Furthermore with the interactive realistic and complex AR System it can enhance, motivate and stimulate students understanding of certain events, especially for the traditional notion of instructional learning that has proven inappropriate or Difficult(Noh. Z, M.S.&Pan. Z 2009). The augmented reality in cultural heritage is been elaborated as regards to the acquisition, management and dissemination. It helps to reduce time and overall cost related to the acquisition, modeling and management due to the non modeling of the present scenario. Second it can improve the understanding of cultural heritage, as it has the power to generate hybrid environments (real and virtual), mixing together past (non existing part, virtually modeled) and present (real part, not modeled) scenarios. Finally, AR improves user impression over virtual reality systems as the user can move around, see the objects and their present size and explore them in a more natural way thus allowing applications in real time on site (Portales, C., Lerma J.L., Perez C, 2009)

## II. Concept and Approach

3D data has always been a critical component to record the object and the site permanently. As a digital form of these historical sites they could be passed down to future generations. In the past most of the 3D modelling of historical sites are done by using the non real 3D modelling approaches or procedural modelling approaches (Remondino,F., El Hakim, S. 2006). This method needs to capture data by using active sensors, range based methodsactively interfered with the reconstructed object, either mechanically or radio metrically using rangefinders, in order to acquire the depth map, eg structured light, laser range finder and other active sensing techniques. To wrap every aspect of the object, it is generally required to make multiple scans from different locations, which appropriate to object size, shape and occlusions.

The digitization of cultural heritage is the process of digitizing the movable or unmovable cultural heritage using contemporary remote sensing and virtual technologies to achieve 2d or 3D digital archiving. The result can be used for many purposes such as historical documentation, digital protection, cross-comparisons, Monitoring shape and colours, simulation of aging and deterioration, virtual reality/computer graphics application, 3d repositories and catalogues, web based geographic systems, computer aided restoration, multimedia museum exhibitions, visualization and so on(Remondino,F 2011). The importance of quality dimension within AR research has been supported by Jung et al., 2005. In addition Olsson et al, 2012 revealed that AR applications should provide practical benefits that cannot be delivered through other forms of media. The above reviewed studies identified a number of external variables that are applicable to the AR acceptance context including enjoyment (Haugstvedt & Krogsite, 2012; Shin, 2007); personal innovativeness (Zarmpou et al., 2012) perceived benefits (Olsson et al., 2012); as well as information quality (Jung et al. 2015; Olsson et al., 2012). The identification of different research context is particularly important in order to account for different technological characteristics. This was supported by Ayeh et al. (2013), who identified the importance of using context specific external variables within TAM research in order to ensure the applicability within given contexts. Researchers had supported the idea of importance of enjoyment as an external variable within the AR acceptance context Haugstvedt & Krogsite, 2012, Leue et al 2014). The implementation of enjoyment as an external variable particularly increased with the emergence of online networks (Lee et al 2012; Lin and Lu 2011). Within the mobile service acceptance context, personal innovativeness (Zarmpou et al, 2012, as well as the perceived benefits (Iopez Nicolas et al, 2008) were confirmed to influence the

behavioral intention to use. In addition, personal innovativeness, originally from the diffusion of Innovation theory (Rogers, 1962), has increasingly gained importance within TAM research (Gao et al., 2012; Yi et al., 2006).

### 1. *Space layout for customized pedestrian navigation*

Augmented reality technologies are becoming increasingly popular, not only among the scientific community but also for the general public. Augmented reality is the up gradation of virtual reality (Azuma, 1997). Compared with virtual reality augmented reality enhances the real world instead of replacing it.

The user can view the real world enhanced with additional 3D graphics superimposed to his/her field of view. The possibility of combining real and virtual objects will allow a huge amount of applications. This enhancement is achieved by virtual object added to the environment or by non-geometric information about existing elements. Ideally, the user perceives that real and virtual objects co-exist in the same place. These augmented systems combine the virtual and real, are interactive in real time and can handle 3D objects. In terms of experiencing culture and heritage, the Quiserbagh heritage walk starts from begum Hazrat Mahal Park, from there to the two mausoleums of Mushirzadi and Saudat Ali khan. The walk continues through Parikhana and butler park. To the further the walk is to Safed baradari, proposed Meena bazar. There is also proposal for Amir-Uddaula library and Roshan-Ud-daula kothi. The heritage walk finally ends at Quiserbagh chauraha. The whole heritage complex is a part of Quiserbagh palace complex which is now only a remnant.

### 2. *Storey telling*

Lucknow was shooting site for many of those classical Bollywood movies. It is the glimpse of the total palace complex that could be seen today. As for once Quiserbagh palace was once the most beautiful palaces anywhere, with well laid landscaped gardens, gilded domes and minarets that added to the overall beauty of this huge palace complex. The palace complex was in fact the most planned grandeur works by Wajid Ali Shah. Currently the extension of the city into digital space has changed the organization and use of physical spaces. This transformation of the city has given way to integration of the infrastructure in context to user and the system than a stand alone entities. The urban space associated with informational spaces (Castells, 1989; Stock, 2011), becomes a place where digital technologies with coded algorithms bring out the complex cultural apparatus of a city of a city through the dense and overlapping layers of representation (Kitchin and Dodge, 2011)

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2. A connection to sensitive information on the web
3. Accessibility to all users

(1) sensitivity, made possible with special sensors; (2) a connection to sensitive information on the web; (3) accessibility to all users; (4) UC, which allows access to the system through a mobile device at any time and place; (5) a connection with social networks; (6) the ability to share any object that is not exclusively made up of data and (7) the visibility of the system not only through the mobile device but also in the physical environment (Vianello, 2013). Despite a great variety of examples boundaries between using these kinds of technologies and tourist experiences haven't been specified by researchers (Flavian et al., 2019). The social presence affects the entertainment, education, aesthetics and experience (Jung et al, 2016). The of digital technology in heritage tourism not only enable to manage or preserve cultural heritage but also improve the tourist experience through visualisation which in turn enhances interest in history (Bec et al, 2019).

### 3. *Panoramic documentation*

In virtual heritage AR is used to enhance the overall experience of the visitor of a cultural heritage site. Furthermore with the interactive, realistic and complex AR system it can enhance, motivate and stimulate students understanding of certain events, especially for the traditional notion of infrastructural learning that has proven inappropriate or difficult (Noh Z et al 2009)

Several characteristics of AR can produce benefits in the world of heritage, mainly as regards acquisition, modeling and management due to the non modeling of the present scenario. Second, it can improve the understanding of the cultural heritage, as it has the power to generate hybrid environments (real and virtual), mixing together past (non existing part, virtually modeled) and present (real time) scenarios. Third AR involves user immersion over VR systems, as the user can move around see the objects in their present size and explore them in a more natural way, thus allowing applications in real time, on site (Portales C et al 20110.)

## III Site survey

Lucknow, the capital of Uttar Pradesh was historically known as the Awadh region. Today, it is the administrative headquarters of Lucknow District and Lucknow Division. Fondly known as the 'City of Nawabs' or the 'City of Tehzeeb', it has always been a city filled with varied cultures. Its beautiful sprawling gardens, polite mannerisms, fine-cuisine, music, and poetry (*Shayari*), had found patronage in the Shia Nawabs of the city who loved Persian. The city has been given various other names too, such as The Constantinople of India, Shiraz-i-Hind and the Golden City of the East. Today, it is known as one of the most important cities of the country which is now emerging in various sectors like retailing, manufacturing and commercial. Lucknow city has to offer a unique feature to its travelers, which is a perfect combination of its rich traditions and the modern growth of new-mannerisms. The same is its USP. After Kanpur, it is the second-largest city of Uttar Pradesh.

Lucknow, which is considered to be The Golden City of The East, has still kept its old-world charm intact, which is an appealing feature for the tourists. It is no exaggeration to call the capital of Uttar Pradesh

There were three principal parts of the complexes. Firstly, the public areas where the king met his official and subjects and where large melas and functions like coronation took place. These areas were open to the public and subjects of the king. These courts also had religious buildings like the Friday mosque and temples.

The second important part of the palace complex was the residential quarters of the king along with his offices, library, the treasury, hammams, private mosque, etc. and finally, there were the residential quarters of the queens. Since each Muslim ruler had a large number of queens, the zenana formed a bulky part of the whole palace complex. This was located in the innermost part of the complex and was strictly guarded by female attendants and eunuchs. Only the king and selected guests were allowed to enter these spaces. Qaiserbagh fulfills all the necessary aspects of planning and hierarchy with a distinct characterizes.

In appearance, the palace complex was a series of courtyards, both large and small, usually enclosed by walls of different heights. Within these walled enclosures, large independent structures were integrated either within the courtyards or along the walled enclosures to form an integral whole. No-one building assumed undue prominence over another. Another with the help of link ways and passageways making it difficult to ascertain where one structure started joined one building and another ended. Qaiserbagh had such large buildings like Kaiser Pasand, Chaulakhi, Lanka, and the tombs, all enclosed by walled structures. The ChaulakhiKothi was made by Wajid Ali Shah's barber Azim-ullah Khan. While making the palace complex, the Nawab confiscated the building and made it a part of his palace. During the First War of Independence was supposedly the residence of Begum Hazrat Mahal. What remains today is part of the main Qaiserbagh quadrangle known as the 'Parikhana' where the queens of the King lived. The quadrangle was an enclosed garden with the Safed Baradari in the Centre, a small mosque, many small marble pavilions and kiosks, and a large tent-like structure called Lanka. Lanka was demolished and in its place stands the Amir- ud-daula library. It was an elevated platform supported by eight pillars with water flowing through it. Wajid Ali Shah used it during the monsoons. Some people believe that it was not one building but collectively the Qaiserbagh palace complex was called Lanka due to its impregnable position.

The palace complexes of the Nawabs like Qaiserbagh were similar to those of the Mughals and other Indian rulers. They were a city within a city. Each palace accommodated the residential quarters of the king, his queens, the court officials, the Diwan-e-am and the Diwan-e-khas, mosques, baradaris, enclosed gardens for entertainment, kitchens, servant quarters, the treasury, hammams, stables, markets, etc. Baradaris have been a regular feature being used in simply articulating a garden space for housing libraries and holding coronations. The kings also held court in these structures.

Street segment were characterized through detailed field surveys in terms of the pedestrian quality attributes that are shown to affect navigation in urban environments through their impacts on pedestrians perceptions. These include accessibility sidewalk width and maintenance; street sign, safety, aesthetics- enclosure along the sidewalk and street trees, soft architectural parameters such as five senses are considered in the field surveys.

Public art can develop a positive identity for an area; it can create landmarks, provide a meaning full way to engage with local communities and help to create local distinctiveness and a sense of place. Public art does not only encompass sculptural or monumental features, but can also include elements integrated into the design of building, structure and landscaping, artworks defining routes and interchanges across the site or artistic design enhancing functional elements of a scheme such as seating and signage.

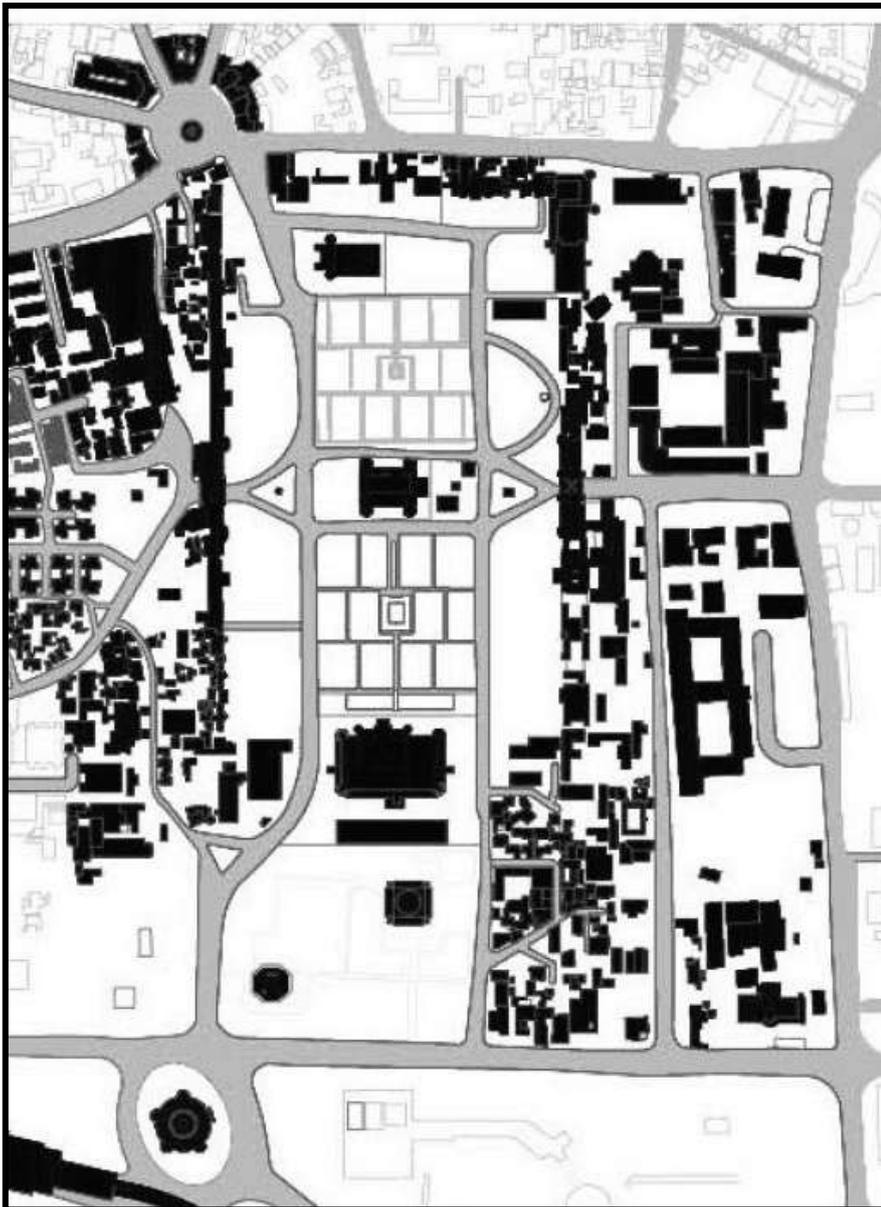


Fig 1 Site plan of Qaiserbagh complex



Fig 2 Existing condition of the site

#### IV PROPOSAL- DEVELOPMENT OF DIGITIZED MODEL

Photogrammetry is a very important image-- based technique. The technique employs high-- speed imaging and remote sensing in order to detect, measure and record complex 2D and 3D objects. Photogrammetry is considered the best technique for the processing of image data, being able to deliver at any scale of application accurate, metric and detailed 3D information with estimates of precision and reliability of the unknown parameters from the measured image correspondences (tie points) (Remondino, F., 2011). The image data can be acquired from ground level or at different altitude and with different sensors. The main benefit of photogrammetric technique is the possibility to simultaneously provide both geometry and surface texture for depicted objects.

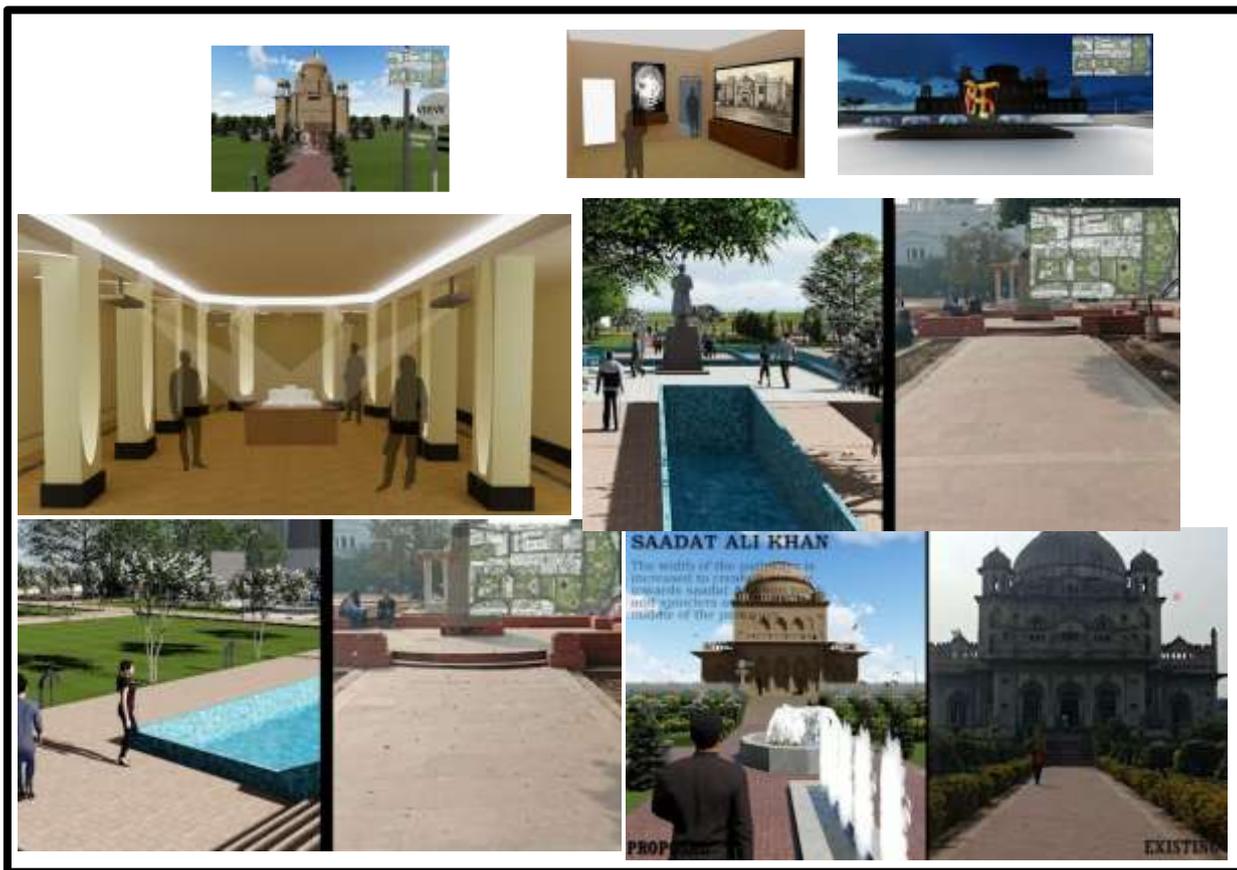


Fig 3 Surreal experience by incorporating augmented reality

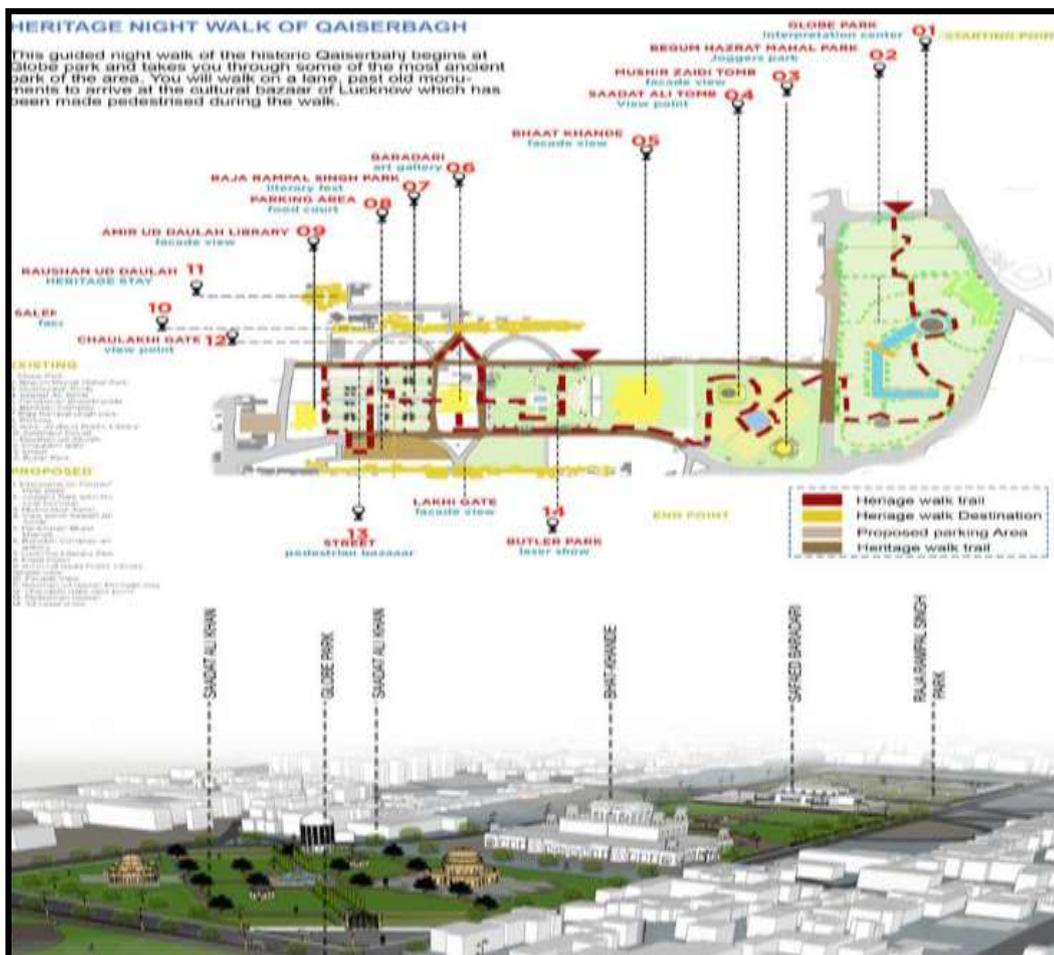


Fig 4 Site map of the proposed Qaiserbagh complex

## V Discussion and experiment results

As technologies evolve the tourism industries tend to adopt and incorporate the same in the system to improve user experience. The large quantities of hotel reviews which results in big data source are a great example (Moro et al 2019). Likewise, both VR and AR has enabled new tourism applications. AR witnessing an exponential increase in applications due to blessings of mobile devices and wearable technologies.

In the effort to improve tourist's experience tourism managers incorporated smart devices into their strategies by developing mobile AR applications. These applications in tourism not only incorporated these devices into only museums and cultural sites but also points of interest are geotagged by National tourist office or sometimes influencing users to travel while looking for gaming experience.

According to some researchers' VR is the computer-generated medium that gives people the feeling that they are being transported from a physical world to a world of imagination. VR technologies provide environments where consumers can interact with simulation of the real world. These involves the use of various technologies to create environments where people can experience and interact with event simulations or build fictional scenarios.

This provides an interesting review of VR uses within tourism and raises relevant questions and challenges regarding the use of VR technology to enhance and substitute tourism experiences.

The experiences with emerging technologies are taking place in tourism context. Some examples include specially developed AR wearable technologies such as smart glasses, which is rather an uncharted domain requiring additional attention in the future. Another interesting and innovative research project is a proposed AR framework devoted to developing enhanced AR system for exploring five human senses

### 1. Begum Hazrat Mahal Park

Begum Hazrat mahal park is situated in front of Saadat Ali Khan Maqbara and at Parivartan Chowk. For the proposal, we redeveloped the Begum Hazrat Mahal Park focusing on the principle of design like Axis, Balance, Rhythm, Unity, and Repetition which can be observed in Qaiserbagh complex very precisely like water channels flower gardening, fountains. There is one gathering point that is surrounding by trees and there are foundations at the center of it. We introduced tensile structure shading in food count to make this park more environments friendly. The water channel enriches the pathways and landscaping.

### 2. Saadat Ali Khan Park

Tomb of Saadat Ali Khan & Khurshid Zadi, "Set amidst a lush green landscaped garden, these present a serene view of a bustling city". The imposing twin tomb of Nawab Saadat Ali Khan and his wife Khurshid Zadi, stand near the historical Begum Hazrat Mahal Park

Street vendors mean individual merchants who offer products for sale in stands, booths or other non-permanent structures usually located on the sidewalk and designed to attract passing pedestrians. It means any person who, from a motor vehicle, trailer or cycle as defined and licensed under the motor vehicles act, sells or offers for sale goods, merchandise or services or who advertise or take orders for goods or services. Loading and Unloading Zones are a region designed for rapid loading and unloading of materials.

## V CONCLUSION

The following general conclusion was stated in the context of landmark-based navigation systems: "People feel comfortable if they recognize reference features early, before arrival at a decision point. They feel confirmed that they are on track, and they do not need to break movement at the decision point, but can interpret the next way finding instruction in advance." The claim that the ordering of connectivity, measured by direction changes, plays an important role in determining the distribution of movement is consistent with research findings in spatial cognition which suggest that direction changes, as an aspect of configuration, are related with the cognitive effort required to navigate through an area

A multimedia approach to the diffusion, communication, and exploitation of Cultural Heritage (CH) is a well-established trend worldwide. Several studies demonstrate that the use of new and combined media enhances how culture is experienced. Pedestrians are required to stay on sidewalks and crossings. The walk has to be started (at a constant speed of 5m/s) along the designated navigation path in a first-person view. The instructions are to be communicated as and when required by pushing the joystick.

The local correlates of the street environment used in empirical studies range from the dimensions and design of sidewalks to the frontages of retail or the prevailing levels of environmental comfort that may encourage pedestrian movement. Pedestrian safety, of course, is also shown to be a major factor in determining physical activity levels. Safe and pleasant conditions encourage walking, presence of street crossings, attractive landscaping, tree covers, and signalization as well as aesthetic or safety features, such as cleanliness, interesting sights, and architecture are used to encourage walking in adults and children.

Several researchers in the field of spatial cognition assert that navigating humans rely on three forms of spatial knowledge: landmark, route and survey knowledge. Exploring an unfamiliar environment, pedestrians first notice outstanding objects or structures at fixed locations. These unique objects or places are easy to recognize and can be kept in memory without difficulty. The importance of landmarks for pedestrian navigation and wayfinding instructions has been demonstrated in empirical studies range from the dimensions and design of sidewalks to the frontages of retail or the prevailing levels of environmental comfort that may encourage pedestrian movement.

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