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Future Public Parks: Integrating Facilities for Locative Augmented Reality Games

Fadzidah Abdullah[1,*], Mohd Faredzuan Mohd Noor[1], Mohd Raziff Abd Razak[2]

[1] Department of Architecture, Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Jalan Gombak, 53100, Kuala Lumpur, Malaysia
[2] Communication Technology Section, Universiti Kuala Lumpur British Malaysian Institute, Jalan Sungai Pusu, Gombak, 53100, Kuala Lumpur, Malaysia

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ABSTRACT

Contemporary youth culture has caused public parks to be used as locations for them to play Locative Augmented Reality Games (LARG). Nevertheless, the existing public parks were not designed for LARG, which requires wide space for youth to have rigorous physical activities and movement. Therefore, there is a need to integrate facilities for players of LARG in the development of future public parks. This research aims to evaluate the characteristics and components of public parks often chosen by youngsters to play locative augmented reality games and to recommend additional facilities to be integrated into future public parks for all-inclusiveness. This research uses Vlog and On-site observation to evaluate components of public parks. It also employs an open-ended questionnaire survey for collecting primary data on needed additional facilities for future public parks. For reason of Movement Control Order (MCO) during the Covid19 pandemic, the research could evaluate only three (3) public parks that are located in Kuala Lumpur, Malaysia. The finding shows that public parks need design improvement to integrate spaces and facilities for Locative Augmented Reality games players (LARG). The research implies that the function of public parks evolves based on demands from visitors. This research indicates that public parks should be designed to cater for digital recreational activities, triggered by contemporary youth culture and relevant to the digital future.

1. Introduction

The Recent ICT advancement has triggered the enthusiasm for metaverse: "a simulated digital environment that uses Augmented reality (AR), virtual reality (VR), and blockchain, along with concepts from social media, to create spaces for rich user interaction mimicking the real world" [17]. The world is witnessing the changes from the physical to the digital environment as everything is becoming digitalized as the Fourth Industrial Revolution (IR 4.0) continues to evolve. Physical work

* *Corresponding author.*
E-mail address: fadzidah@iium.edu.my

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has become digital, and machines have replaced humans in carrying out tasks. Everything now uses the digital mode, including the communication and interaction between people.

Similarly, public parks have started to be sprightly vibrant in the recreation field with youths who play locative augmented reality games (LARG). As one of the current advancements that come with the digital world, LARG is very popular among youngsters and is a recreational activity for them to have healthy wellbeing. As stated by Ha *et al.,* [5], the young generation nowadays actually is most focus on own health and comfort. In fact, LARG encourages gamers to play outdoors and enables exploration of public parks among digital youths. A recent study has proven that outdoor air quality is usually better than indoor air quality, hence it is encouraged for youngsters to have recreational activities outdoor [13].

The use of parks and public spaces have increased since LARG was first released. According to Kooragayala and Srini [8], Pokémon GO encourages virtual place-making as players find new purpose in their everyday commutes. LARG players explore new areas in their neighbourhoods and cities in hopes of finding rare Pokémon and perhaps establishing relationships between acquaintances they would never have otherwise.

Unfortunately, the existing public parks were not designed for LARG. Playing LARG requires ample space for youth to have rigorous physical activities that somehow might appear to be a disturbance for other visitors to public parks. Therefore, there is a need to integrate facilities for players of LARG in the development of current and future public parks. This research aims to evaluate the characteristics and components of public parks often chosen by youngsters to play LARG and to recommend additional facilities to be integrated into the future development of public parks, for all-inclusiveness.

2. Literature Review

2.1 Functions of Public Parks

Traditionally, public parks are used for recreational activities like jogging, picnicking, exercising, playing with children, and relaxing. Recreational activities at public parks provide peace of mind (Kaplan [7]) and reduce mental stress (Ulrich [14]). Frequent usage of public parks could produce people with good health (Godbey and Mowen [2]), eventually assisting in improving the quality of human life and supporting community development. Visitors of public parks have specific preferences and expectations, depending on their ages, purposes of visit and the park's environment (Hartabela *et al.,* [3]).

2.2 Augmented Reality

Augmented reality is a technology of interactive experiences in a real-world environment. The physical objects or elements in the real world are enhanced by computer-generated perceptual information across multiple sensory modalities. According to Wu *et al.,* [16], the augmented reality system has three fundamental features: the combination of natural and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects. These features are the essential functions that define how augmented reality works.

In addition, Paladini [10] explained three different types of augmented reality triggers: marker, marker-less, and location. A marker-based augmented reality has a trigger switch for a virtual object to be superimposed with the real-life environment. The marker could be anything with unique visual points, and a virtual object could be visualized on the screen of a mobile phone when pointed to the marker. Second, a marker-less augmented reality is a type of augmented reality that allows the user

to choose where to place the virtual object. The virtual object would then be visualized with a superimposed natural environment. Third, location-based or locative Augmented Reality is a type of augmented reality connected to the specific coordinates and location on the map of our physical world. A global Positioning System (GPS) is used to navigate the virtual object, and the device must accurately figure out the location of the virtual object for the digitally augmented reality content to appear exactly in the right place.

2.3 Locative Augmented Reality Games (LARG)

In the gaming platform, digital games started from virtual reality and then evolved to augmented reality, where computer games use the actual physical surroundings as a part of the game architecture. Augmented reality game overlays the physical and virtual environments and embed the produced superimposed environment with visual and audio contents in real-time [12]. Most augmented reality games use geo-location as one of the features embedded in the game system. Hence, the term "locative" derives from the embedded Global Positioning System (GPS) in augmented reality games.

As locative augmented reality enhances the perception of the game, its' feature produces an unorthodox way of playing a computer game, where players need to move around to play the game actively. LARG also encourages players to explore outdoor spaces, venturing into the outside environment rather than just being situated in indoor spaces. "Pokémon Go." is an example of a widely used location-based augmented reality game, but ARQuake was the first AR game introduced in the market in 2000.

LARG, also called a location-based AR game, uses actual location with specific coordinates and geographical elements as the digital game environment. Location-based games can be defined as activities that evolve according to the players' location [1]. LARG includes coordinates and geographical elements, uses real-world weather information, and integrates them with the digital world of augmented reality games. LARG uses players’ physical and geographical location through a GPS sensor module as an input for generating the game level or access to location-specific information, including maps, weather, or location-based services [6].

2.4 Public Parks for LARG

Most LARG players choose public spaces as their playground. In Kuala Lumpur, Malaysia, the common public parks that are usually used by LARG are spaces that are accessible and open to all. Examples of the parks usually used as the place for LARG are KLCC Park, Uptown Damansara, and a residential park in Wangsa Siaga residences. Although the public parks are not designed for LARG, players prefer such places because they have the chance to meet with friends who share the same enthusiasm.

The first invented LARG, Ingress Prime, has created a virtual spatial database for the game based on the actual physical environment worldwide. This database also becomes the digital geographical reference for other LARG, such as Pokémon Go and Harry Potter: Wizards Unite. These games require a high density of virtual game places, and virtual spatial maps allow players to venture into LARG. The Ingress Intel Map is a digital map for navigation of portals location for players, and it shows the number of virtual places accessible for players to venture. Players, however, usually concentrate in public open spaces for ease of play-acting. Figure 1 shows an image of KLCC Park, Dataran Merdeka and Perdana Botanical Garden, in Ingress Intel Map, where the concentrated areas of game portal locations are shown in coloured dots based on players' themes.

LARG players usually choose public parks with Points of Interest (POI) and Wayspot. POI is a term in LARG that refers to an interesting, specific, and significant location on earth. POI is an element of the locative augmented reality that affects the game's virtual world. LARG players choose physical elements like sculpture, pavilion, and structure as POI.

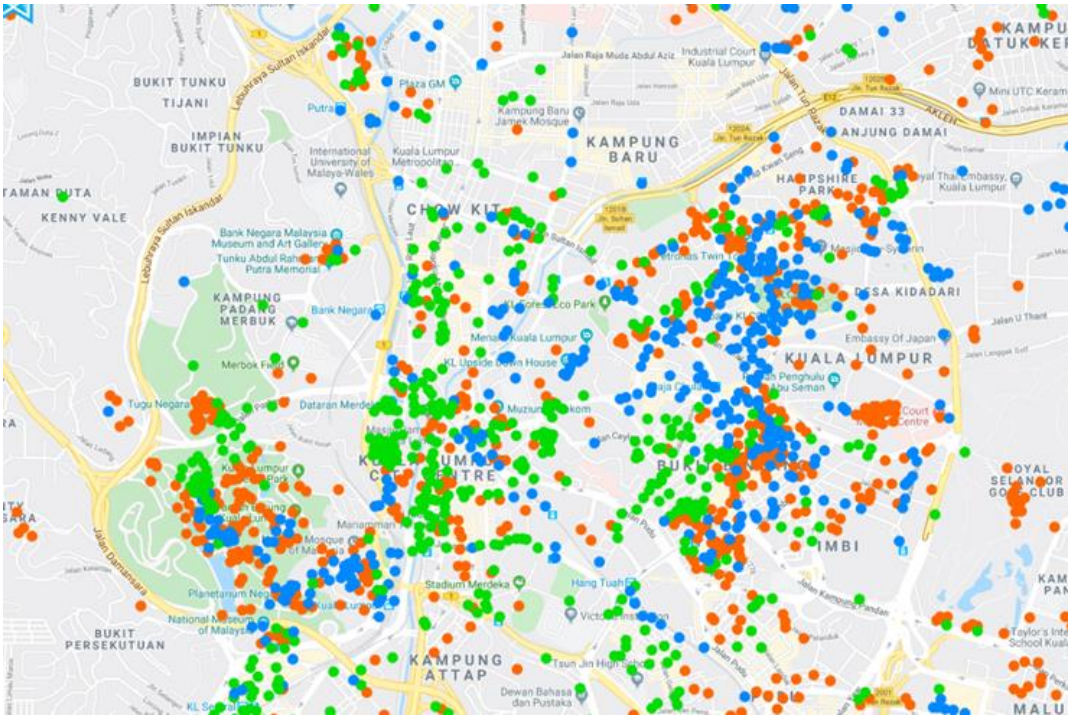

Fig. 1. Concentrated Area of LARG portals at KLCC Park, Dataran Merdeka and Perdana Botanical Garden, where the coloured dots indicate players' themes (Source: Intel Ingress [4])

POI in the physical world can be transformed into a Wayspot in the virtual world. A Wayspot is a specified virtual location in LARG, used predominantly in AR games, such as Ingress Prime, Pokémon Go, and Harry Potter: Wizards Unite. High-quality Wayspots are significant locations for players to gather in groups. A particular website named Niantic Wayfarer reviews Wayspot's eligibility and quality of Wayspots [9]. Table 1 shows examples of places or objects that could be virtually transformed into Wayspots.

All Wayspots that exist in the augmented reality world reflect the real-life world properties and location. Although the virtual location does not physically affect the physical location, the behaviour and social activities of the players with the intervention of space and public engagement affect the real-life environment. LARG technology can indirectly increase social interactions in public parks as places for community gatherings. Thus, it is safe to say that LARG is taking part in creating place-making in the real world and redefining the public spaces [8].

Table 1
Wayspot Characteristics (adapted from Niantic Wayfarer)

Wayspots	Characteristic	
Location with story/history or educational value	✓	Interesting story behind the location or object
	✓	Signboards with educational information
	✓	Historical significance (apart from just being old)
Piece of Art or Unique Architecture	✓	Interesting story behind the location or object
	✓	Signboards with educational information
	✓	Historical significance (apart from just being old)

Piece of Art or Unique Architecture	✓ Statues, Paintings, Mosaics, Light Installation ✓ A venue that showcases fine art (e.g., performance art theatre and museum) ✓ Buildings designed by renowned architects or structures famous specifically for their architecture
Hidden Gem or Hyper-local Spot	✓ Popular local spot for community ✓ Popular local spot for gatherings ✓ Tourist spots that showcase local flavour and culture ✓ More off-the-beaten-path tourist attractions ✓ Adventurous tourist attractions (e.g., observatories, signs or markers atop mountain peaks)

Nevertheless, utilizing public parks by LARG players has somewhat become an intervention to the original function of the public parks. Some visitors perceive that the sudden emergence of the LARG players at certain times creates a disturbance when the players seem to conquer the public parks. Wagner *et al.,* [15] reported that LARG evokes numerous issues in the public space, where countless news reports show driving, biking, or walking accidents related to people playing Pokémon GO. The spatial intervention of LARG players in the public space affects not only the frequent visitors of the public parks but also the players of LARG. Players often feel uncomfortable, nervous, and uninvited when playing in public [11].

LARG requires ample space for the rigorous movement that somehow might appear to be a disturbance for other visitors of public parks. Therefore, there is a need to integrate locative augmented reality game facilities to develop future public parks. For all-inclusiveness, public parks must be designed with additional facilities to cater for the need of LARG players.

3. Methodology

This research assesses the potential of having integrated facilities for LARG that could be implemented in future public parks. This research aims to evaluate the characteristics and components of public parks often chosen by youngsters to play LARG and to recommend additional facilities to be integrated into the future development of public parks. This research employs observation and an open-ended questionnaire survey. The data would then be analysed using the descriptive analysis method.

3.1 Observation

For observation, researchers originally planned to observe at least five (5) public parks. However, due to the strict Malaysian Movement Control Order (MCO) during the Covid 19 Pandemic (between March 2019 to June 2020), the units of study for this research were narrowed down to one (1) public park in Kuala Lumpur. The selected public park was the Kuala Lumpur Convention Centre (KLCC), where the density of the LARG players who visited the places is high. KLCC was chosen because of its distinct, attractive, and feasible outdoor environment.

Due to MCO, observation had to be carried out using two (2) different methods: Vlog pre-observation and the actual on-site observation. Vlog is derived from a combination of the words 'video' and 'blog' (Baker). A vlog is a video that documents an individual life. Vlogs of LARG players offer reliable secondary data before the researcher can conduct an on-site observation at KLCC Park.

The on-site observation was one of the essential methods of this study that could assist the researcher in collecting primary data for this research. The on-site observation was carried out on 25th July 2020, right after the park was open to the public again. During the time, movement between

city districts was still not allowed, and Covid'19's standard operational procedures (SOP) must be carefully observed for safety and precaution measures. The observation began by observing the behaviours of the players and the public by checking the park layout to identify the most concentrated flock areas used by players. Photographs and video recordings were also used to aid in the data collection.

3.2 Open-Ended Questionnaire Survey

The open-ended questionnaire survey was distributed to visitors of KLCC parks. The questionnaire had a brief description of the research to ensure that the respondents understood the survey's aim. Section A of the questionnaire focused on the demographic of the respondents, both LARG players and non-players.

4. Analysis of Research

4.1 Analysis of Observation

The observations at the park revealed the emergence of a crowd of people, indirectly conquering the space used by the public. The existing facilities designed at the public park have become inadequate. Figure 2 and Figure 3 show groups of players flocked at certain places at KLCC park.

Fig. 2. A Small Group of Players Gathered along the Jogging Path of KLCC (Source: Vlog MirulMirul)

Fig. 3. A Huge Crowd between the Entrance of Suria KLCC and KLCC Park (Source: Vlog MirulMirul)

Meanwhile, Table 2 shows the observation analysis and evaluation of the components of a public park that invites the players to play in the specific space with the comparison between Vlog pre-observation and the actual on-site observation.

Table 2
Components/characteristic of Public Space Observed in Vlogs and On-Site

Components	Pre-observation (Vlog)	On-site Observation
Resting Area or Shelter	Fully occupied by players	Fully occupied by players
Seating Area	Fully occupied by players	Fully occupied by players
Shaded Area	Crowded by players	Crowded by players in a smaller number
Pedestrian Pathways	Players use the jogging path	Players use the jogging path
Open Area or Space	Crowded and affecting the circulation of public	Less crowded due to fewer people

4.2 Analysis of Questionnaire Survey

Section A focused on the demographic of the respondents, both LARG players and non-players. Section A asked five (5) questions to know the respondents' backgrounds. The information gathered is on:

i. gender
ii. age
iii. race or nationality
iv. occupation
v. status of respondents, either LARG player or non-player

A total of 210 respondents (n = 210) participated in the questionnaire survey. Based on the collected data, 77.8% of the respondents are male, and 22.2% are female. The age range of the respondents is categorized into five (5) groups: 20 years old and below, 21 to 30 years old, 31 to 40 years old, 41 to 50 years old, and 51 years old and above. Most of the respondents fall among those whose age ranges are between 21 years old to 40 years old (84%). Most of the respondents are Malaysians, with 64.3% of them being of the Malay race, 28.5% being Chinese, and 2.9% being Indian. The rest of the respondents, 4.3%, are from other races and nationalities such as Indonesian, Filipino and Arab.

Furthermore, the survey results show that most respondents work in the private sector, which is 49.8%, followed by 33.3% of students, 11.6% are self-employed respondents, and 5.3% are those who work in government sectors. For question no. 5, the respondents were also asked to participate in the survey as players or non-players. The result shows that 86.5% are LARG players and the rest are non-players.

Section B enquired about visitors' insights on LARG. For this paper, the discussion is concentred only on a question regarding visitors' suggestions of how to solve and improve the environment of public space used for LARG. Since the question is open-ended, respondents gave their opinion in verbatim form. The answer texts were then thematically analysed to generate themes based on the frequency of similar answers. Table 3 shows the 20 components of public space for LARG, as proposed by respondents.

Table 3
Components of public space for LARG

No.	Proposed Components	Frequency-of-mention	Remarks
1	Safety and Security	41	Safe Pedestrian/Security Camera
2	Resting Area or Shelter	28	Gazebo/Rest Hut
3	Seating Area	28	Benches/Chair
4	Accessibility to the Public Park	21	Nearby Location/Public Transport
5	Designated Area or Boundaries	19	Less crowd/Avoid disturbance of other people
6	Spacious Space	18	Wider Walking Area
7	Charging Station	17	-
8	Shade Area	15	Due to Malaysia's Climate
9	Access to Food and Beverage	15	Vendors/Water Refill Dispenser/Vending Machine
10	Signage/Label/Landmark	14	Accurate Physical Signage Showing Digital Map
11	Free and Stable Public Wi-Fi	9	-
12	Stable Internet & GPS reception	8	-
13	Parking Facilities	7	-
14	Adequate Gathering Space	5	Interaction of Players

15	Rule and Regulations with Guidelines	5	Official authorisation to use the space for the games
16	Good Landscape	2	Improve Physical Environment
17	Physical Integration	2	Cultural/Historical Integration
18	Good Ventilation	1	-
19	Air Conditioning Space	1	-
20	Kids Area	1	For kids' safety and security

To exhibit the significance of the proposed components for LARG, the answer is diagrammed in chart form. Figure 4 shows LARG's proposed components of public space based on the frequency ranking. Nevertheless, this research analysis section will discuss only the first ten proposed components.

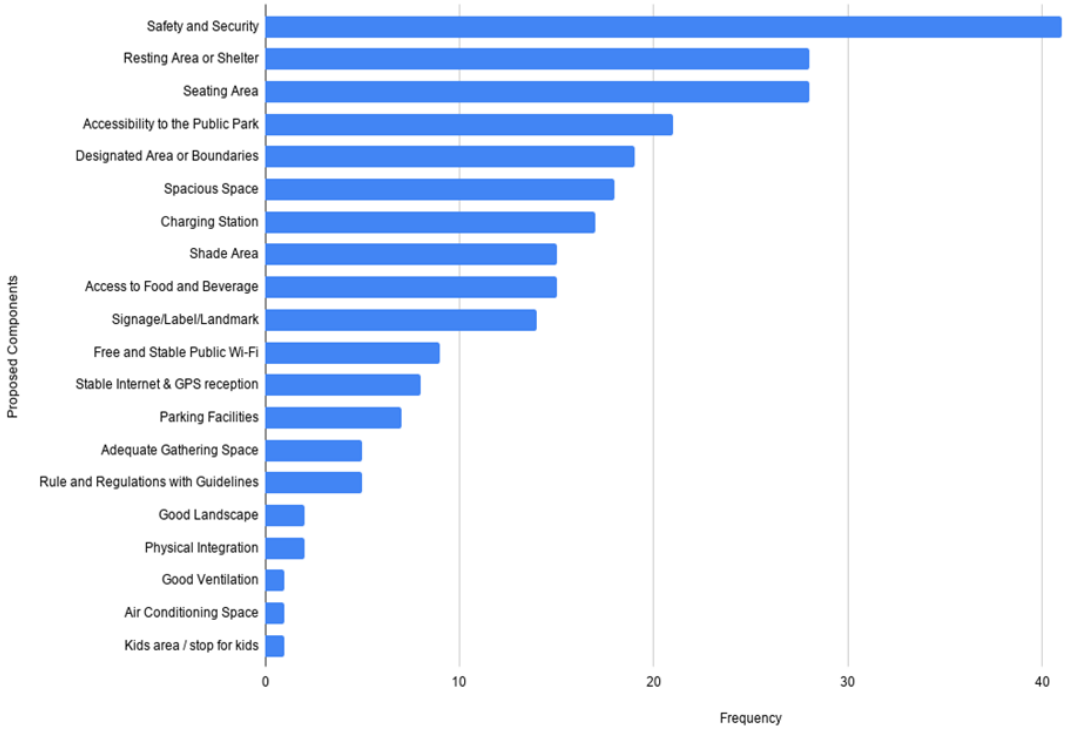

Fig. 4. Proposed components of public space for LARG, based on frequency ranking

4.3 Safety and Security

The respondents suggested that public parks should provide better safety and security for visitors since players and non-players use the same physical space simultaneously. The public parks used for LARG should be designed with a safe pedestrian walkway and separated vehicular access. The designers of public parks need to examine public parks' users' movement and behaviour, for both LARG players and non-players, to create a well-organised space without intervening in both groups' passages.

4.4 Resting Area or Shelter

Providing resting areas to shelter LARG players during the game activities is among the essential components proposed by the respondents. This component was mentioned 28 times in the open-ended survey. Players require a resting stop such as a gazebo or rest hut while playing the game to take a rest and break while playing the game, especially because playing LARG involves active physical

movement. Public parks for LARG should be equipped with adequate numbers and sizes of resting areas to maximize the AR gaming experience for players.

4.5 Seating Area

The respondents recommended that public parks provide seating areas for LARG players, also mentioned 28 times in the open-ended survey. LARG requires players to do physical activities such as walking and running from one place to another as part of the game missions. These physical activities require an intermediate space, such as a seating area, to allow players to break from continuous physical movements. A seating area is becoming one of the determinants of space for LARG because it affects the communal activity of the players, such as for group gatherings.

4.6 Accessibility to the Public Space

As mentioned, 21 times, the accessibility from players' houses to public parks is one of the essential components that the respondents propose. In addition, providing public transport to public parks could attract players to visit and play LARG. The players are inclined to choose the nearest parks from their houses. Therefore, future public parks should be designed to accommodate players' accessibility to the space.

4.7 Designated Area or Boundaries

Respondents suggested that public parks should have designated areas, with boundaries, for LARG players. The existing public parks are shared among multi-groups of users: LARG players, non-players, joggers, and others. Therefore, a designated area or boundaries that separate the game zone from other users' areas should be designed to make a particular space for LARG. This endeavour could ensure the comfort of public park visitors, and for LARG players, the separation could maximize their gaming experience.

4.8 Analysis of Observation

Respondents perceived that a spacious area is necessary for LARG players in public parks, especially for gathering large groups. Players often gather in groups to play together to achieve a LARG group gaming mission. Future public parks should have ample space for a large gathering of player groups. Respondents also hope the authority provides wide pathways for ease of movement.

4.9 Charging Station

Mentioned 17 times, respondents suggested that public parks should be provided with mobile phone charging stations. LARG players must have a charging facility to ensure their mobile devices are not running out of power while playing AR games. Respondents prefer not to bring or use a power bank as it would affect players' mobility. The charging station could be in a shaded area or a gazebo for players to charge their mobile devices before continuing the game activities.

4.10 Shaded Area

Having shaded areas at public parks is one of the recommendations given by respondents, with 15 times mentioned. Physical activities, such as walking and running to complete the digitally augmented mission require players to play in an outdoor area. The shortage of shaded areas at public parks exposes players to uncomfortable weather, such as scorching hot sunny sun and rainy days. These weather conditions could limit players' gaming experiences. Provision of covered pedestrian walkways and shaded open areas at public parks could ensure LARG players' comfort and wellbeing.

4.11 Access to Food and Beverages

Respondents perceived that public parks should have food and beverages retail shops/kiosks. Most respondents prefer to play in an area with direct access to retail and restaurants so that it would be easy for them to have a meal or shop while playing the game. Providing food and beverage retail is one of the determinants of the space for LARG.

4.12 Signage, Label and Landmark

The respondents suggested that public parks designed for LARG should have proper and relevant signage, label, and landmarks. The public is often curious about why some youngsters move aberrantly in public spaces. Thus, the situation may create an uncomfortable atmosphere. Therefore, installing signages or labels to inform other visitors of LARG players' presence, LARG events, and the LARG realm's digital map may reduce the battle of curiosity. These physical indicators could provide information to the public so they can see what is happening in the augmented digital layer without playing the game. The physical signage can also help the public and players from bumping into each other, as the direction and information provided can prevent both groups' movements from clashing.

5. Conclusions

This research has evaluated the characteristics and components of public parks often chosen by youngsters to play locative augmented reality games and recommendation for public parks improvement has been concurrently discussed in analysis section. The recommended additional facilities are to be integrated into the future public parks for all-inclusiveness, and they are derived from the survey conducted at the Kuala Lumpur Convention Centre Public Park. Although this small-scale research could not generalize an idea, the findings are deemed essential for city authorities' consideration in developing future public parks.

Even though this article only discusses the first ten respondents' suggestions, the other ten recommendations listed in Table 3 are equally important for designing future public parks that integrate the needs of LARG players. All components mentioned by respondents should be taken care of so that all visitors of public parks can comfortably use the facilities and LARG players could get the best experience playing LARG.

This research is significant because it creates an opportunity to give a new definition of public parks, as the nature of LARG is to encourage the exploration of public and local places. The conventional public parks, spaces, and squares could be transformed into a new urban digital playground, where spatial elements are integrated with game architecture. The spatial intervention generated by LARG players at public parks has allowed the community to increase social engagement and interaction among visitors. This research could also function as a guideline to city planning authorities to develop future public parks to accommodate the needs of all walks of life.

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