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A Proposed Model for Measuring the Performance of Urban Child's Activity Spaces

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ABSTRACT
The child is one of the most important topics in many studies, and the childhood stage is one of the most important periods in a person's life, as it is the stage during which his personality and abilities develop. And, because the home is not only what the child requires to discover the world around him, the external environment is regarded as one of the most important factors that can aid the child in deep and enjoyable growth and discovery. It has been observed that the spaces of the child's urban activities suffer from lack of care and deficiencies in several elements, including safety, as well as their inability to meet the needs of the child.
As a result, the inductive method is used in order to study the urban spaces associated with the child's activities and their relevance to his needs. The research then uses the deductive method, analyzing some global and regional experiences to come up with a model for measuring the performance of these spaces, identifying flaws, and converting them into smart urban spaces, with the results being applied to a local model.

Keywords: *smart urban spaces, child's needs in urban spaces, elements of child activity urban spaces.*

1. Introduction

Because the child is the foundation of the family and society, he requires undivided attention and care. Childhood is the most crucial period in a person's life because it shapes his personality and develops his abilities through play, exploration, and learning. To grow up healthy, a child needs a suitable place to play freely and safely. Because the child needs to interact with the environment, home is not the only place for learning and exploration. As a result, the urban spaces for the child's activities are regarded as one of the most important elements that allow him to freely play and learn. However, it is plagued by neglect, weakness, and a lack of many elements that provide safety and support the child's development. As a result, the research is interested in studying its elements and confirming that they meet the needs of the child by creating a model to measure the performance of those spaces with the potential of converting them into smart spaces to maximize benefit.

2. Aim and Research Significance

The significance of the research stems from studying the elements of the urban child's activity spaces and emphasizing the interrelationship between them and the child's needs, as well as developing a model to measure the performance of those spaces and the possibility of converting them into smart urban spaces as part of a development plan.
The research employs the inductive method to study the elements of urban child's activity spaces and their relationship to the child's needs. The deductive approach is then used to derive a model for measuring the performance of these spaces and applying it to a local model by analyzing some global and regional experiences.

3. Theoretical Studies

3.1 Child's needs in urban spaces

It is necessary to provide attractive elements for the child in urban spaces, so that he can enjoy his time, feel secure and meet his needs. The needs of the child the urban spaces are classified into psychological, social and functional needs as follows:

3.1.1 Psychological needs

Family support: Furniture and comfortable and appropriate seating areas must be provided so that the

child can participate with his family in the activities that he practices in the urban space. [1]

The need to feel the intimacy: the appropriate scale for the child in terms of height and space must be taken into account, so that the child does not feel negative feelings such as a sense of fear or dread. In the event that the space or height exceeds the required scale for the child, it is preferable to use furniture or items of a larger scale in order for the child to feel balanced.

Self-reliance: In order for the child to acquire the skill of self-reliance and gradually develop and be his personality, the child needs several non-slip elements and surfaces suitable for his movement to practice activities so that he is not exposed to danger and becomes able to make his decision, share with others and experience activities. [2]

Understanding the Surrounding Environment: the child needs a space that he can perceive and form with his individual vision, through the use of colors as a guide for the child in the space and expressing it, and the use of understandable signs with easy ways to find things within the space.

Self-expression: This is achieved by encouraging the child to express his and his family's performance and express his needs. [3]

The need for calm: the child feels comfortable and active in quiet places away from noise due to the child's need for calm. Therefore, it is necessary to provide spaces surrounded by green spaces and plants. [4]

3.1.2 Social needs

Privacy: If there is a space in which the child feels a sense of belonging, privacy is achieved and that helps the child to preserve his and his family's secrets. [5]

Social interaction and communication: There must be a space that allows the formation of relationships and interaction with others for the child, with the possibility of the child participating with others in the activities. Providing group places that include children to do many activities such as playing. [1]

3.1.3 Functional needs

Activity: the presence of safe spaces from dangerous factors those are commensurate with the practice of multiple activities such as artistic, musical and theatrical activities.

Design need: The design must be suitable for children and take into account the flexibility of the child's movement while providing an appropriate atmosphere that helps him to remain calm and reassured. [6]

Lighting and shading: taking into account exposing the child to natural lighting to the required extent, with shaded places while the sun's heat reaches its peak, so as not to cause vision problems. And the presence of lighting during the night in case of presence, bearing in mind that it is appropriate to encourage the child to play.

Climatic need: Providing safe spaces from climatic fluctuations, ready in case of rain, wind, humidity and high temperatures, with a flexible design that suits the child. [3]

Security: The urban space must be designed with security and safety in mind, and appropriate means should be provided, such as a fire extinguishing network in case of fire, as well as a first aid box in case a child falls and is injured. In addition to using suitable materials for the movement of the child and avoiding what may cause him to be injured, such as falling on a material that falls on the ground, causing blows to the head, fractures and scratches. Also use materials for toys that the child uses that do not cause slipping. Rough edges should also be avoided as they can be dangerous for the child. [7]

Basic needs: The basic needs of the child must be available in the urban space, such as eating places and places for washing hands, such as toilets.

Play need: Play and movement are among the most important activities that a child needs. Therefore, it is necessary to provide suitable urban spaces for these recreational activities, taking into account their flexible designs and the sensitive nature and needs of the child.

3.2 Urban child activity spaces

3.2.1 Urban child's activity spaces definition

It is an urban space of green areas that contains areas for children's games and sports activities, pedestrian paths, and places to sit at the level of residential groups, and its area does not exceed 200 square meters, and is equipped with recreational uses and landscaping elements for entertainment, and it must be safe. [8]

3.2.2 Urban child's activity spaces importance

Urban children's play areas contribute to their growth and development by enhancing their physical and mental well-being and enabling them to develop a variety of skills through outdoor play. Due to the presence of trees and plants, the park also helps to improve the city's aesthetic appeal and social cohesion while lowering air pollution. By its urban, environmental, social, economic, and cultural roles, it also contributes to the achievement of sustainable urban development. [8]

3.2.3 Urban child's activity spaces elements

3.2.3.1 Basic elements [9]

- **Design elements**

Age separation: Play areas are separated according to the child's age group with flooring materials, paths,

landscape furnishing and plant elements to reduce injury to young children by older children. [10]

Conflicting activities: The playing areas are separated according to the play nature, quiet play zones (water -Dramatic –Sand-Comfort & Social), noisy play zones (Hard Surface-Gross Motor-Natural).

Sight lines: While designing the space, visual barriers must be reduced while keeping in mind the privacy and freedom of the child, so that parents and responsible staff can follow up and monitor to intervene to disengage the children.

Interaction with the surrounding: The child interacts with the surrounding during the presence of terrain, botanical and water elements by using them in the design to represent a challenge and adventure for the child, working to reduce the heat and enhance the mental health of the child. [11]

Scale: Use the familiar and appropriate scale for the child, so that he does not become intimidated. [12]

Degree of containment: There is a direct relationship between the degree of space containment and the child's sense of safety, so the appropriate containment ratios for the child must be taken into consideration.

Pedestrian paths: It is the main artery of the space, and its design depends on the type of user (the child) and the way he moves. [13]

Ease of access: It is to see the entire space and approach it and the possibility of entering and navigating in it through plazas, corridors and slopes. [14]

Colors: It has a psychological impact on the human with positive and negative feelings, so it is preferable to focus on the child's favorite colors. [15]

Special needs requirements: It is one of the conditions for the success of the space to ensure the participation of all, and it has two main elements: accessibility and use through transportation elements and play equipment suitable for the special needs' requirements. [16]

Children's play area: Providing children's play areas with an area ranging from (2023-6091) m^2 per 1000 children, including play equipments suitable for all ages to reduce injuries and allow children to enjoy their time.

- **elements Complementary** [9]

Fencing: It defines the playing area, and it must be of safe materials for the child and free from sharp protrusions to give the child a sense of safety.

Gates: Its place is important to guide the child and give him a sense of safety.

Seats: It is there for parents and children to sit to support social communication and promote child protection.

Bike & car parking: Bicycle parking spaces are designed to make it easy to find the bike and organize the space, while car parking help to put the car in the nearest point to the park.

Lighting elements: It has different sizes and attractive shapes that are used to illuminate the space to see while staying in it, give a sense of safety and to move without fear.

Signage & labeling: Used to guide the space users to clarify instructions for staying in the space.

Sun Protection: Putting shading structures to protect children and avoid diseases resulting from exposure to harmful sunlight.

Litter bins: Containers for collecting garbage and keeping the space clean.

Drinking water & w.c.s: Providing drinking water and W.C.s to meet the basic needs of the space user.

Cafeteria: It is there to serve various foods and drinks while providing a beautiful view.

Play equipments: The appropriate play equipment is selected for each age group to reduce injuries and increase the enjoyment of being outdoors. Play Equip.: slides-swings-climbing structures-merry go round-balance equipments-rocking equipments intended for sitting-seesaw-multi play structures.

Kiosks: To offer a variety of services and activities such as eating food, drinking beverages, listening to music, and booking tickets.

3.2.3.2 Smart elements

The tool of this age is technology, which offers several advantages and can significantly enhance the environment by making spaces more useful. Humans use it to make it easier for tasks to be completed correctly and swiftly. Also, it can maximize the effectiveness of urban areas. As a result, the research presents the intelligent components that may be used to change the area designated for urban children's activities into a smart space that has a significant influence and a high level of participation in enhancing quality of life as follow: [17], [18]

- **Spaces of activities**

Interactive play structure: Look similar to traditional play structures, but they include an integrated computer and game system with which children can interact. Interactions can take place through the use of buttons, sensors, lights, sounds, colors, and images. It can also be set to play one or more virtual games.

Ozone pool: It is a water purification technology that consists of two parts: ozone generation and an ozone management system. It removes organic and inorganic compounds and sterilizes water (similar to chlorine) without causing health effects, and it dissolves ozone with water so that there is no excess ozone gas outside the pool surface. This is beneficial to human health

because ozone inhibits the growth of water-damaging microorganisms such as Cryptosporidium and Giardia, which can cause infection or serious illness in humans.

Energy generating exercise equipments: To generate clean energy, training equipment converts friction and body heat into electrical energy via generators. It is used to light up the site, charge devices, and send energy to others for use. If a person rides a stationary bike, it is expected to generate (50-150) watt per hour, which is enough to power a TV for about an hour. It is also designed to be long-lasting and low-maintenance.

High performance track surfaces: They are two-layer weather-resistant rubber running tracks with efficient traction and shock absorption. Because the top layer of high performance track surfaces is relatively hard, traditional tracks are combined into one layer. Runners' spikes do not need to penetrate the surface and can be used with shorter screws. Shorter booms allow runners to exert less physical energy on the track, resulting in faster running. High-performance track surfaces reduce stress on the feet and joints during low-speed activities by increasing foot comfort.

Outdoor DJ booths: They are strong structures that are powered by solar panels installed above the shade structures (kiosks), and they can be handled and loaded with music via interactive mobile phones or Internet connections. DJ booths are vandal-proof, dust, snow, and ice-resistant, and are intended to provide positive and creative spaces in youth hangouts.

Surface hardness testing equipments: Designed to test surface hardness by imitating a child's head with electronic sensors, providing accessible data on impact, velocity, and potential head injuries, and used to test the integrity of the hardness of surfaces under stadiums.

Interactive floors: A collection of hardware and software. The hardware consists primarily of a projector, a mini PC, and a motion camera. The mini PC will react once the motion sensor detects infrared light. Designed for low maintenance and ease of use for non-technical users.

Interactive climbing walls: The Interactive Climbing Wall is a play structure that combines cutting-edge technology, educational activity, and physical movement. Users traverse the wall and climb up and down while participating in climbing wall activities.

- **Furniture & urban amenities**

Smart seats: Solar-powered multi-person benches, USB charging ports for electronic devices, pedestrian activity sensors, and Wi-Fi hotspots are all available. They can assist in adjusting air quality and noise levels, as well as gathering useful garden information.

Solar shades structures: Solar panel shade structures, some of which are portable, are used to generate clean energy. It enables users to charge USB devices from the canopy's front. Awnings that are more complex use sensors and actuators to move with the sun's rays to maximize solar energy harvesting and cooling benefits.

Solar powered garbage compactors: Garbage compactors have Wi-Fi internet-connected software to improve garbage collection methods and are powered by solar energy to compress waste and place it in compost bins for recycling, use clean energy produced by solar panels, determine the appropriate time for emptying, and follow up on maintenance if necessary.

Toilet occupancy sensors: When the bathroom is in use, occupancy sensors appear and provide information with colored lights (red for occupancy and green for available), and the information is displayed in a (mobile) app for mobile users, or on a screen outside the bathrooms.

Smart water fountains: Solar panels to cool or condense water from the atmosphere, filters to remove contaminants or improve service, amplifiers to engage visitors, and sensors to monitor water quality and alert staff when maintenance is required are all technologies associated with smart water fountains.

Digital signs: LED screens connected to the Internet are installed in a variety of locations. They are powered by solar energy to reduce costs and save energy, and they frequently display images, text, and videos that can be updated.

Automatic bikes & treadmills: Bike and pedestrian meters, which are battery-powered and can be found underground, above jobs and activities, or at street level, collect data about pedestrians in their various locations and activities. It gathers data from sensors, video cameras, amplified tubes or metal tapes (to detect bikes or pedestrians passing over them) and stores it in a database to aid in the development of future park design.

- **Lighting**

Motion sensors: Kinetic sensors use microwave or ultrasonic energy to detect changes in movement and then activate mechanically, acoustically, or optically. It is used to activate lights, doors, and alarms.

The art of painting with lighting & optical fibers: When connected to an electric current, emit light. Fiber optics is light-transmitting flexible glass or other transparent solids. They are a technological advancement that results in more secure and reliable data transmission. This technology can be computerized and shaped in various ways to produce stunning visual displays.

Off-grid light bulbs: They obtain their energy from renewable energy generating devices such as solar

panels or wind turbines and are independent of local power grids.

LED digital add-ons: Light, noise, weather, air quality, pedestrian, and vehicle traffic data can all be recorded and tracked using digital technologies. It contributes to the improvement of internet connectivity quality. They can be added to LED fixtures via digital upgrades.

Lighting shields: It can be used on existing fixtures throughout the park by placing a cover over each light source. It can be an important component of a light pollution reduction and control strategy.

- **Digiscapes**

Wi-Fi: Allows the Internet to connect to many electronic devices without a wired connection, such as a phone, camera, or printer and to send and receive data. It serves a large number of people concurrently via modem.

Geographic information systems (GIS): Creating, storing, processing, analyzing, managing, and displaying a descriptive spatial database (GIS) for climate, air quality, and human health. To derive trends and potential relationships for a given point on the map from land use, social, economic, environmental, and other factors.

Software applications: Programs that can be run on computers, tablets, smart phones, and other electronic devices, and they may require an Internet connection. It has many functions and two-way communication capabilities, such as keeping calendars, making calls, and taking pictures.

Sensors networks & the internet of things (IOT): Digital sensors (which may be multiple) connected with or without wires are used to record, store, and wirelessly transmit data about light intensity, temperature, humidity, air and water quality, resource consumption, and movement.

CCTV: For protection and safety, closed circuit television (CCTV) records images of people in public places such as city centers, roads, airports, and public transportation.

- **Landscape**

Automatic lawn mowers: It is a self-propelled lawn cutting machine that is powered by clean electricity and can be charged, as well as solar energy. It has sensors and can be controlled remotely via programming.

Near infrared imaging: Pictures can be taken with a near-infrared camera or set to change to a traditional digital camera. Analyses are performed on images using post-processing software to determine the health status of metabolic parts of the botanicals. This provides the staff with a detailed report on the health of the plants as well as the option of taking appropriate actions to protect the plants and prevent trees from falling.

Green roofs: It is a large or dense space located on a building's roof. Roofs are built to support a specific amount of weight, which influences the type of green roof that can be installed. Integrated green roofs are the lightest, require the least amount of maintenance, have shallow soil buildup, and no permanent irrigation system.

Green walls: It is a smarter, lighter, and less maintenance-intensive landscaping technique used in smart parks. It incorporates irrigation and drainage systems as well as lightweight containers filled with soil or other growing substrates that are attached to the wall.

Air purification in plant containers: Fabric or plastic temporary containers, either purchased or handmade, are used to promote root growth. They force the root to reach the perimeter in order to be exposed to air, indicating dehydration, forcing it to split and turn inward.

Sifting seeds & pollinators: They are battery-powered tools that vibrate at the same frequency as pollinator wings to induce plants to release pollen, allowing them to be manually pollinated.

- **Irrigation**

Smart water controllers: Subsurface sprinkler and drip irrigation patterns, soil moisture and weather sensors are used in devices to determine the amount of irrigation required.

Low pressure & rotating water sprinklers: Rotating sprinkler heads provide 360° coverage while using low pressure to allow water to penetrate the ground rather than being carried away by wind.

Subsurface drip irrigation: Subsurface drip irrigation (SDI) uses embedded drip irrigation tubes (or "drip irrigation tubes"), pumps, water release tubes (exit holes along underground tubes), valves, and actuators to move water slowly and directly to plant roots, resulting in a more uniform distribution of water with less evaporation and runoff. SDI systems require air release and system flow valves to prevent soil, bacteria, and other contaminants from accumulating on the equipment.

Smart water meter: Smart meters contain digital communication components and are used to measure water consumption and communicate data via the Internet to control real-time meter readings and water flows, allowing the manager to identify opportunities for water conservation and overflow prevention.

Gray water recycling: It is the process of recycling wastewater that was previously used in sinks or bathrooms. It may contain moderate amounts of

nitrogen, phosphorous, and potassium, all of which are required for plant health, and it acts as a natural fertilizer, reducing the need for synthetic fertilizers.

4. Analytical study

In order to create a useful model for measuring the performance of urban child activity spaces based on what was explained in the theoretical study and what was implemented when these smart parks were built; a global and regional comparative analytical study was conducted on a number of smart parks around the world as shown in table (3). The " Gardens by the Bay " in Singapore were chosen because they are near the latitude of Egypt, the "Dubai Miracle Garden" and the " AL Mamzar Park " in the United Arab Emirates in the Arab region, which is similar to us in climate, traditions, customs, and Arab culture. The "Child Park" in Egypt was chosen to apply the results to a local garden because it is a garden for children and their various activities. [19]

Gardens by the Bay-Singapore

On 100 hectares (250 acres) of reclaimed ground in the heart of Singapore, there is a nature reserve. Bay South Park, East Bay Park, and Bay Central Park are its three coastal parks. The South Bay Park, which covers 54 hectares and has smart components that offer various services, is the biggest of these parks.

Al Mamzar-United Arab Emirates

Al Mamzar Park is situated on the Gulf's eastern strand, close to the Emirate of Sharjah's coastline and the park's beaches on the western side of Dubai's beaches. It has a 99-acre surface area. The area offers a variety of cutting-edge services, including Smart Bands so that Families can track their children inside the park with the aid of waterproof smart watches with GPS that are available.

Miracle Garden - United Arab Emirates

The park opened its doors on February 14th of that year. The garden is the biggest natural flower garden in the world, with over 50 million flowers, and it spans over 17.8 acres. Akar Landscaping and Agriculture Corporation later carried out and finished the Dubai Miracle Garden at a cost of approximately $11 million (AED 40 million).

Child Park– Egypt

It is a 22.8-acre children's play park with green places and open areas for participating in a variety of sports and activities that is situated in Nasr City, Cairo Governorate.

5. Results and Discussion

As a result of what has been studied about the elements of urban child's activity space design and complementary elements, in addition to the smart elements and their impact on the needs of the child in the open spaces, the research has created a matrix to determine the number of needs achieved by each element of the urban space for the child activities as a keeping performance indicator to determine the relative weight of each element, which determines The priority of having this element in the space and emphasizing its importance as shown in table (1) & (2) and figures (1), (2) & (3).

According to the analytical studies, comparing the examples of smart parks in table (3), the addition of smart elements helps meet a variety of children's needs. It is also a development of the space, increasing the efficiency of that space's performance and making it more welcoming to the child, causing the child to spend more time there, resulting in a greater opportunity for learning and development on both the physical and mental levels. As a result, the primary goal of establishing a space for urban child activities has been achieved in Gardens by the bay, AL-Mamzar and Dubai Miracle Garden, but the Child Park in Egypt needs a development strategy to cope with the same category.

6. Conclusions

The research developed a proposed model for measuring the performance of urban children's activity spaces through theoretical and analytical studies. The model included (23) basic elements, (28) smart elements, total (51) key performance indicators (KPIs).

The relative weight of each indicator was determined by conducting analytical studies on one global and two regional parks, totaling 100%.

The proposed model was also applied to Child Park in Cairo to assess its performance as an urban child's activity space, and it was discovered that it only meets about 27.5% of the smart park indicators. The deficiencies were identified through indicators in which the park received a 0 score, and these indicators were evaluated and improved using smart governance to improve the performance of this park and transform it into a smart park.

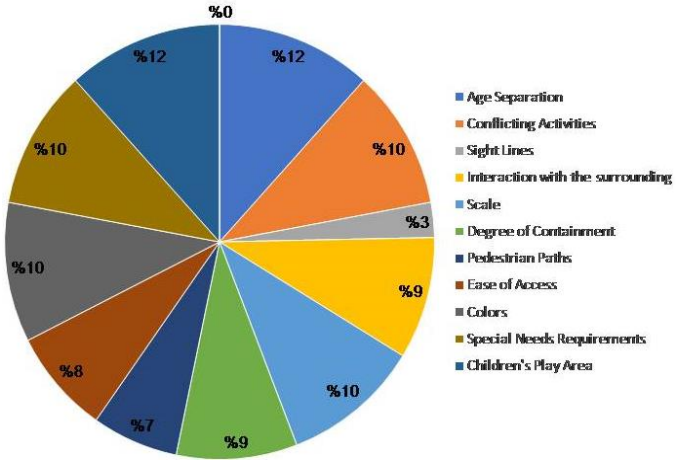

Figure 1- Represents the relative weight of each design element in urban child's activity space
Source: authors

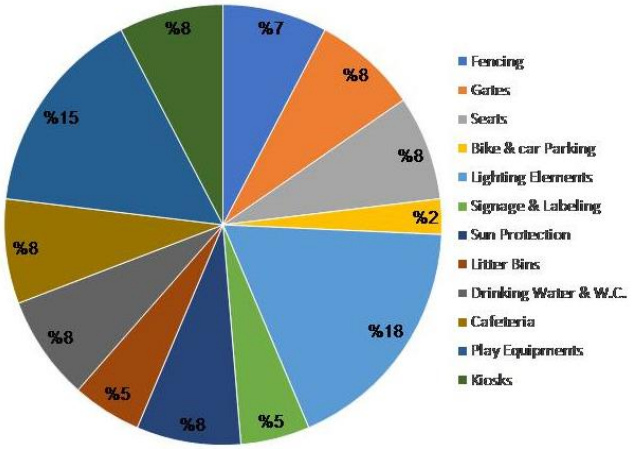

Figure 2- Represents the relative weight of each complementary element in urban child's activity space
Source: authors

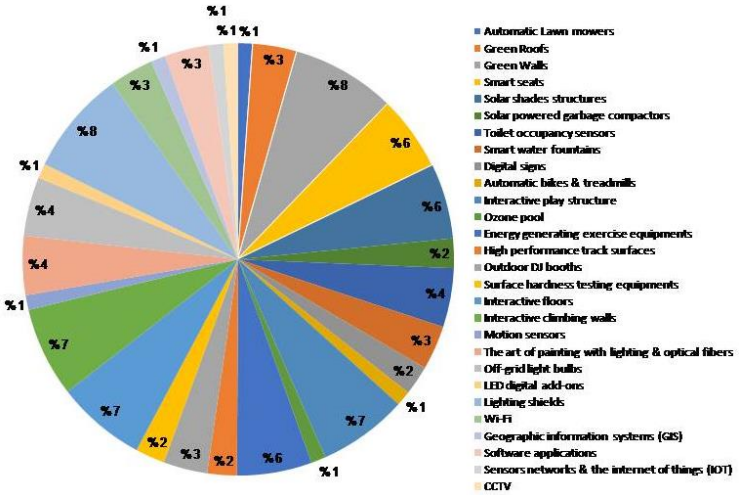

Figure 3- Represents the relative weight of each smart element in urban child's activity space
Source: author

Table 1- The relative weight of each basic element in urban child's activity space

Urban child's activity space basic elements (KPI)		Child's Needs															N.O of needs achieved (15)	Frequency of each element (773.3)	Relative weight of each element (100%)
		Psychological						Social		Functional									
		Family Support	To feel the intimacy	Self-reliance	Understanding the Surrounding Environment	Self-Expression	The need for calm	Privacy	Social Interaction and Communication	Activity	Design Need	Lighting & Shading	Climatic Need	Security	Basic Needs	Play Need			
Design Elements	Age Separation	1	1	1			1	1	1		1			1		1	9	60	11.7
	Conflicting Activities			1			1	1	1	1	1			1		1	8	53.3	10.4
	Sight Lines	1												1			2	13.3	2.6
	Interaction with the surrounding			1	1		1			1		1	1			1	7	46.7	9.1
	Scale		1	1	1	1		1		1	1			1			8	53.3	10.4
	Degree of Containment		1		1	1	1	1			1			1			7	46.7	9.1
	Pedestrian Paths			1					1	1	1					1	5	33.3	6.5
	Ease of Access	1		1					1		1			1		1	6	40	7.8
	Colors		1		1	1	1		1	1	1					1	8	53.3	10.4
	Special Needs Requirements	1	1	1	1				1		1			1		1	8	53.3	10.4
	Children's Play Area		1	1	1	1			1	1	1			1		1	9	60	11.7
Complementary Elements	Fencing							1			1			1			3	20	7.7
	Gates							1			1			1			3	20	7.7
	Seats	1					1		1								3	20	7.7
	Bike & car parking			1													1	6.7	2.6
	Lighting Elements		1				1			1	1	1		1		1	7	6.7	17.9
	Signage & Labeling			1	1												2	13.3	5.1
	Sun Protection										1	1	1				3	20	7.7
	Litter Bins			1							1						2	13.3	5.1
	Drinking Water& W.C.s			1							1				1		3	20	7.7
	Cafeteria			1					1						1		3	20	7.7
	Play Equipments			1		1			1	1	1					1	6	40	15.4
	Kiosks			1					1						1		3	20	7.7

Table 2- The relative weight of each smart element in urban child's activity space

Urban child's activity space smart elements (KPI)		Child's Needs															N.O of needs achieved (15)	Frequency of each element (600)	Relative weight of each element (100%)
		Psychological						Social		Functional									
		Family Support	To feel the intimacy	Self-reliance	Understanding the Surrounding Environment	Self-Expression	The need for calm	Privacy	Social Interaction and	Activity	Design Need	Lighting & Shading	Climatic Need	Security	Basic Needs	Play Need			
Spaces of Activities	Interactive play structure			1		1			1	1	1					1	6	40	6.7
	Ozone pool													1			1	6.7	1.1
	Energy generating exercise equipments			1		1			1	1						1	5	33.3	5.6
	High performance track surfaces										1			1			2	13.3	2.2
	Outdoor DJ booths					1	1		1								3	20	3.3
	Surface hardness testing equipments										1			1			2	13.3	2.2
	Interactive floors			1		1			1	1	1					1	6	40	6.7
	Interactive climbing walls			1		1			1	1	1					1	6	40	6.7
Furniture & Urban Amenities	Smart seats	1		1			1		1		1						5	33.3	5.6
	Solar shades structures	1									1	1	1		1		4	33.3	5.6
	Solar powered garbage compactors			1							1						2	13.3	2.2
	Toilet occupancy sensors			1				1			1				1		4	26.7	4.4
	Smart water fountains				1		1						1				3	20	3.3
	Digital signs			1	1												2	13.3	2.2
	Automatic bikes & treadmills										1						1	6.7	1.1

Table 2-continued The relative weight of each smart element in urban child's activity space

Lighting	Motion sensors		1														1	6.7	1.1
	The art of painting with lighting & optical fibers			1		1			1	1							4	26.7	4.4
	Off-grid light bulbs		1				1					1		1			4	26.7	4.4
	ons -LED digital add													1			1	6.7	1.1
	Lighting shields		1				1	1		1	1	1		1			7	46.7	7.8
DIGISCAPES	Fi - Wi			1		1			1								3	20	3.3
	Geographic information (GIS)systems										1						1	6.7	1.1
	Software applications	1		1					1								3	20	3.3
	Sensors networks & the internet of things (IOT)			1													1	6.7	1.1
	CCTV													1			1	6.7	1.1
Landscape	ersAutomatic Lawn mow				1												1	6.7	1.1
	Green Roofs				1							1	1				3	20	3.3
	Green Walls		1		1		1	1				1	1	1			7	46.7	7.8

Table 3- The number of elements (KPIs) in each park

Urban child's activity space basic elements		Examples			
		Gardens by The Bay (Singapore)	Al-mamzar (U.A.E)	Miracle Garden (U.A.E)	Child Park Egypt
Design Elements	Age Separation	1	1	1	0
	Conflicting Activities	1	1	1	0
	Sight Lines	1	1	1	0
	Interaction with the surrounding	1	1	1	1
	Scale	1	1	1	1
	Degree of Containment	1	1	1	0
	Pedestrian Paths	1	1	1	1
	Ease of Access	1	1	1	1
	Colors	1	1	1	1
	Special Needs Requirements	1	1	1	0
	Children's Play Area	1	1	1	1
Complementary Elements	Fencing	1	1	1	1
	Gates	1	1	1	1
	Seats	1	1	1	1
	Bike & car parking	1	1	1	0
	Lighting Elements	1	1	1	0
	Signage & Labeling	1	1	1	1
	Sun Protection	1	1	1	0
	Litter Bins	1	1	1	1
	Drinking Water& W.C.s	1	1	1	1
	Cafeteria	1	1	1	1
	Play Equipments	1	1	1	0
	Kiosks	1	1	1	1
Total basic elements		23	23	23	14

Total KPIs of "Gardens by the bay" is 39 (76%).
Total KPIs of "Al Mamzar" is 38 (74.5)
Total KPIs of "Dubai Miracle Garden" is 47 (92.2%)
Total KPIs of "Child Park" is 14 (27.5%)

Urban child's activity space smart elements		Examples			
		Gardens by The Bay (Singapore)	Al-mamzar (U.A.E)	Miracle Garden (U.A.E)	Child Park Egypt
Spaces of Activities	Interactive play structure	1	1	1	0
	Ozone pool	1	0	0	0
	Energy generating exercise equipments	1	0	0	0
	h performance track surfacesHig	1	0	1	0
	Outdoor DJ booths	0	0	1	0
	Surface hardness testing equipments	0	0	1	0
	Interactive floors	0	1	0	0
	allsInteractive climbing w	0	0	1	0
& Furniture	Smart seats	1	1	1	0
	Solar shades structures	1	1	1	0
	Solar powered garbage compactors	0	1	1	0
	Toilet occupancy sensors	1	1	1	0
	Smart water fountains	1	1	1	0
	Digital signs	1	1	1	0
	Automatic bikes & treadmills	0	0	1	0
Lighting	Motion sensors	0	1	1	0
	The art of painting with lighting & optical fibers	1	1	1	0
	Off-grid light bulbs	1	1	1	0
	ons -LED digital add	0	0	1	0
	Lighting shields	1	0	1	0
DIGISCAPES	Fi - Wi	1	1	1	0
	(GIS) Geographic information systems	0	1	1	0
	Software applications	1	1	1	0
	Sensors networks & the internet of things (IOT)	1	0	1	0
	CCTV	0	0	0	0
Land	ersAutomatic Lawn mow	1	1	1	0
	Green Roofs	0	0	1	0
	Green Walls	0	0	1	0
Total smart elements		16	15	24	0

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