



## DEVELOPING OPEN AREAS TOWARDS INTRODUCING A SMART CHILD-FRIENDLY ENVIRONMENT AS PART OF 2030 VISION IN SAUDI ARABIA

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### ABSTRACT

A decrease in direct interaction between children and their surroundings world, which is conducive to both learning and play, has resulted from the rapid development of technology. Children have a preference for remaining indoors and utilising intelligent applications to avoid interacting with the outside world. Furthermore, an observation made by the researcher during the rehabilitation of outdoor open spaces reveals a dearth of appealing outdoor educational entertainment choices in the Kingdom of Saudi Arabia. This dearth impedes the development of children's cognitive and physical capabilities and prevents them from actively engaging with the external environment. This study investigates how, by incorporating the nine types of intelligence and using artificial intelligence applications and geographic information systems software, we may construct outdoor play places for children based on David Sobel's concepts with the goal of achieving the goals specified in Vision 2030.

**KEYWORDS:** Child-Friendly, Learning, Smart Applications, Artificial intelligence, Geographic Information System.

## تطوير المناطق المفتوحة لتوفير بيئة ذكية صديقة للأطفال تحقيقاً لرؤية 2030 بالمملكة العربية السعودية

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### الملخص

أدى التقدم التكنولوجي السريع إلى انخفاض التفاعل المباشر بين الأطفال والعالم الخارجي، الذي يعد بيئة مناسبة للعب والتعلم على حد سواء. حيث يفضل الأطفال البقاء داخل البيئات المبنية واستخدام التطبيقات الذكية بعيداً عن التواصل مع البيئة الخارجية، بالإضافة إلى أنه نتيجة لعمل الباحثة في إعادة تأهيل المساحات المفتوحة الخارجية، فقد تم ملاحظة ندرة في الخيارات الترفيهية التعليمية الخارجية الجذابة والمحفزة لتفاعل الأطفال مع المحيط الخارجي في تصميم وإنشاء الحدائق في المملكة العربية السعودية، مما يعيق تعزيز قدرات الأطفال البدنية والمعرفية. تبحث هذه الدراسة في كيفية بناء أماكن لعب خارجية للأطفال بناءً على مفاهيم ديفيد سوبل، وذلك من خلال دمج أنواع الذكاء التسعة واستخدام تطبيقات الذكاء الاصطناعي وبرمجيات نظم المعلومات الجغرافية، وذلك بهدف تحقيق الأهداف المحددة في رؤية 2030.

**الكلمات المفتاحية:** صديقة للطفل، التعلم، تطبيقات ذكية، الذكاء الصناعي، نظم المعلومات الجغرافية

## 1. INTRODUCTION

The swift advancement of technology has resulted in children having limited exposure to the natural environment, which offers abundant opportunities for play and learning. This has a detrimental impact on the physical and mental growth of today's children, depriving them of the ability to explore, uncover, and enhance their skills in urban settings. The worldwide movement towards designing child-friendly cities aims to enhance children's engagement with their surroundings, ensuring that they may fully exercise their rights.

By studying the design of open spaces in the Eastern Province of the Kingdom of Saudi Arabia, urban spaces in the Kingdom of Saudi Arabia can be improved, resulting in the establishment of a welcoming and suitable urban environment for Saudi children. This, in turn, has a beneficial impact on their cognitive and physical development as an extension of the goals of the National Transformation Program and the improvement of the quality of life in Saudi cities to create child-friendly Saudi cities that meet children's educational and recreational needs.

## 2. METHODOLOGY

This research aims to investigate the meanings of child-friendly cities, their framework and vision, and the contribution of play to the development of children's learning skills. This will be accomplished by identifying the nine psychological categories of intelligence and relating them to the architectural concepts of outdoor educational play places as outlined by David Sobel. Additionally, it will cover the ideas behind the use of geographic information systems (GIS) and artificial intelligence (AI) and how they might be applied to the analysis of children's physical activity data in residential areas in order to enhance neighbourhood urban design and build a smart, kid-friendly community.

This paper adopts three main methodologies:

- 1) Descriptive methodology in defining the nine types of intelligence, discussing David Sobel's principles for designing outdoor educational play spaces with the utilization of geographic information systems and its potential.
- 2) Analytical methodology in establishing a connection between the nine types of intelligence and the associated Sobel principles.
- 3) Applied Methodology in creating intelligent applications with a focus on developing open spaces. These applications will utilise geographic information systems and the artificial intelligence.

## 3. LITERATURE REVIEW

### 3.1. Child-Friendly Cities

A city, township, or other local governing body dedicated to implementing the provisions of the Convention on the Rights of the Child, which outlines the rights of children. A child-friendly city or community is one in which the views, needs, and priorities of children are integrated into public policies, programmes, and choices that have an impact on their lives and future [1].

#### 3.1.1. The UNICIF Child-Friendly Cities Initiative

Ensuring that every child and adolescent have a fulfilling childhood and adolescence, and successfully meet all their needs within their own cities and communities [1].

### 3.1.2. Child-Friendly Cities Initiative Framework

- 1) Each youngster and young individual is esteemed and treated equitably.
- 2) Each and every child and young person have the ability to express their opinions, and their requirements and preferences are acknowledged, considered, and factored in during the formulation of public legislation.
- 3) All children and adolescents have the opportunity to avail themselves of superior fundamental social services.
- 4) Each and every kid and adolescent lives in a secure, safeguarded, and hygienic setting.
- 5) Each and every kid and young person is given the chance to experience the joys of familial life, engage in recreational activities, and have sufficient periods of relaxation [1].

### 3.1.3. Vision 2030 and The quality of life programme in Saudi Arabia.

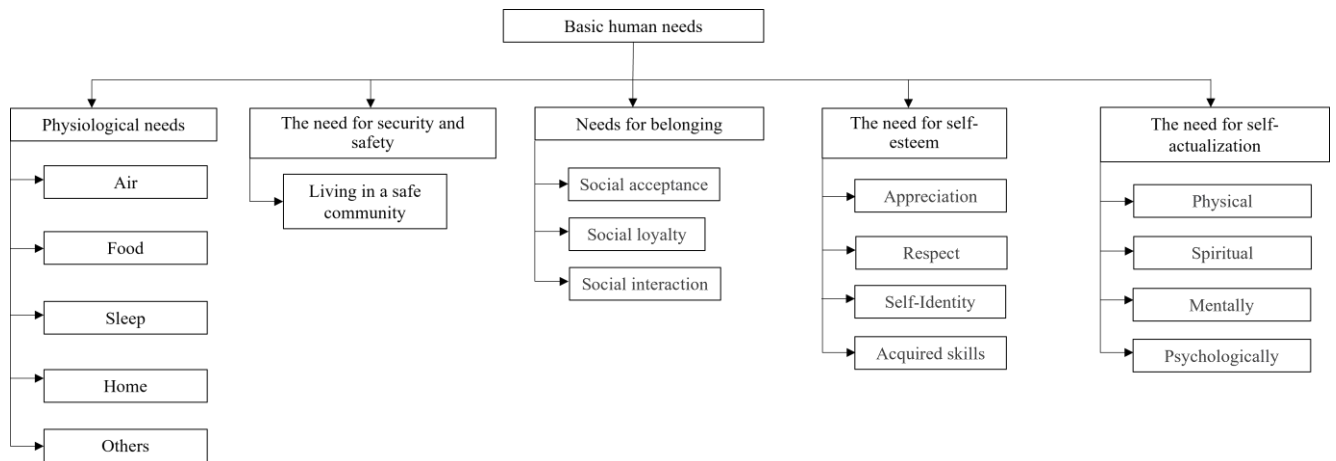
Since the initiation of Vision 2030, Saudi Arabia has established a strong basis for achievement by pursuing groundbreaking changes in the public sector, the economy, and society at large. Despite encountering difficulties, Saudi Arabia has acquired vital knowledge and fortified its determination to achieve these goals. The collective endeavours have resulted in higher efficacy by the government, new prospects for development and investment, more global involvement, and an improved standard of quality for the populace. These accomplishments pertain to all the individuals of this esteemed country. [2].

One of the pillars of vision 2030 is creating a vibrant society. Accordingly, the Quality of Life Program was initiated in 2018 and aims to convert Saudi Arabia into a globally recognised hub for sports and entertainment, a popular tourist destination, and a highly desirable place to reside. The program aims to improve several sectors by empowering arts and culture, promoting sports and a healthy lifestyle, and enhancing the development of livable urban environments. [3].

The constituents of quality of life are a subjective delineation that varies across individuals based on their own requirements for different facets of life.[4].

The elements comprising quality of life are subjectively defined and differ among people based on their specific requirements in various domains: economic, social, and health, as well as the fulfilment of their desires, be they on spiritual, psychological, mental, or physical levels. Thus, the criteria that an individual uses to assess the quality of their life include defining the many elements that contribute to their quality of life, as shown in **Figure 1**. [4].

Scientists, particularly social scientists, are interested in affirming the existence of a right to a high standard of living in both the internal and external environment. They also emphasise the importance of considering the rights of future generations to a sustainable environment. This should be done while balancing the rights of current generations to development using available resources, harnessing potential and latent energies, and promoting participation. The study of society and its many manifestations, including the biological, social, and cultural dimensions [5].



**Fig. 1: Basic Human needs, Source: Modified by the researcher from A spatial sustainability approach and the impact of societal phenomena on the configuration of residential external environment resources in order to enhance quality of life Article, Reference no.3**

### 3.1.4. The nine types of intelligence

In 1983, American psychologist Howard Gardner identified nine types of intelligence as follows:

- 1) Verbal intelligence: refers to the capacity to successfully use language and get pleasure from word-based activities.
- 2) Musical intelligence: refers to the capacity to discern and differentiate various auditory stimuli, such as sounds and tones.
- 3) Logical-mathematical intelligence: refers to the ability to effectively solve a range of mathematical problems and get pleasure from solving puzzles and enigmas.
- 4) Spatial intelligence: refers to the capacity to mentally manipulate and comprehend three-dimensional things, as well as get pleasure from engaging with maps and labyrinth games.
- 5) Bodily-kinesthetic intelligence: refers to the ability to be aware of and proficient in physical abilities, as well as possessing a keen sense of time in relation to different physical activities.
- 6) Interpersonal intelligence: refers to the capacity to discern distinctions among individuals and to examine any subject from several perspectives.
- 7) Internal intelligence: Possessing a satisfactory level of self-awareness and deriving satisfaction from autonomy.
- 8) Natural intelligence: Affection for the natural world, pleasure derived from outdoor activities, and recognition of the significance of living organisms .
- 9) Existential intelligence: the capacity to explore important issues and the will to find solutions. [6].

### 3.1.5. Sobel Principles

David Sobel, a leading figure in the field of environmental science and author of the book "Childhood and Nature," identifies seven categories that serve as a framework for our first life experiences. These categories may be used when designing environments for children. Furthermore, he elucidates that there are no exact demarcations between one principle and another;

instead, they are intricately connected, overlapping, and mutually supportive [7]. These principles are stated as follows:

- 1) Natural adventure: Includes activities that are physically demanding and provide a direct mental-physical connection to the natural environment.
- 2) Imagination and creativity: Young children often immerse themselves in their imagination, gravitating towards storytelling and imaginative play since these activities provide them with the chance to fully experience and engage in their own make-believe worlds.
- 3) Animal Allies: Creating chances in the landscape to encourage creative play and to enable the observation and study of animals and their natural surroundings
- 4) Maps and Paths : Children are naturally curious, and they like discovering new locations and inventive routes to get there.
- 5) Private Places : Children like making things, hiding places, and building things.
- 6) Small worlds: Children construct lifelike scenarios by constructing little environments using various materials, including natural components, and establishing relationships with them.
- 7) Hunting and gathering: Enriching outdoor environments and organising treasure hunts are excellent ways to satiate children's natural curiosity about finding and collecting objects. [7-8].

### **3.1.6. Geographic information System (GIS)**

Geographic Information Systems (GIS) is a set of programs and applications that collect, correct, store, analyze, output, and distribute spatial and descriptive data and information, aiding in planning and supporting decision-making. Additionally, it provides base maps and distributes the infrastructure for any city. Geographic information (maps, aerial imagery, satellite imagery) and descriptive information (names, tables) can be entered, processed, and displayed on a computer, digital maps, reports, graphs, or through a website. [9].

### **3.1.7. The Application of Geographic Information System in Open space Design Research**

Despite GIS being a useful tool for map drawing, planning, and exploring the architectural structures of landscapes to create new designs or improve existing ones, the potential of geographic information systems is still not fully utilized [10]. There is a need to integrate Geographic Information Systems software with landscape designers and architectural engineers' programs to improve the spatial analysis quality of public space designs [11].

### **3.1.8. The Link between Children's Physical Activity and Neighborhood Environments Using Geographic Information Systems**

It is crucial for architects to study the GIS. The systems are of importance for their ability to analyse, simulate, and test architectural, social, aesthetic, functional, environmental, and economic structures. This is achieved using various models, such as temporal geographic traffic and transportation and economic models. The systems provide a broad and more comprehensive understanding and analysis of landscape engineering [10]. The external surrounding environment is a determinant of the increase or decrease of physical activity behaviors and indicators in children. Therefore, the field of improving neighborhoods for children's outdoor and safe access to nearby

services can be developed through geographic information system databases based on measuring the environmental indicators of neighborhoods along with the behavioral results of the population [12]. A study titled (Associations between Children's Physical Activity and Neighbourhood Environments Using GIS: A Secondary Analysis from a Systematic Scoping Review) was conducted to measure the level of children's physical activity after analysing the data input using Geographic Information Systems in close neighbourhoods to the child. The results found that children's walking ability to access nearby services and open spaces is affected by the quality of connectivity between surrounding streets, distance to schools, safety of traffic infrastructure, land use, and population density in each neighbourhood.

### **3.1.9. A Qualitative Geographic Information Systems Approach to Mapping Urban Neighbourhoods with Children to Enhance Physical Activity and Child-Friendly Community Planning.**

The design of neighbourhoods impacts children's cognitive perception. Involving children in urban design processes provides effective solutions and insights into the design and planning processes. This is to achieve optimal use of public open spaces and increase children's physical activity rates. Moreover, by understanding living reality and community mapping, children will be able to express their use of the neighbourhood and its components and develop their visions. This is translated into a Geographic Information Systems database for spatial analysis and compared with traditional planning and design datasets for neighbourhoods [13].

### **3.1.10. Artificial Intelligence (AI)**

This word was first used in 1956 by John McCarthy, who is regarded as the founder of artificial intelligence. As to his statement, artificial intelligence is defined as the scientific discipline of creating intelligent devices, particularly computer programmes. This field of study focuses on developing computer hardware and software that can think similarly to the human brain. You make decisions like we do, you learn as we learn, and you act as we act.

Artificial intelligence may be defined as the process of using computer systems to mimic human intellect. It is a simulation that mimics human thought processes, decision-making processes, and behaviour. It is accomplished by conducting behavioural studies on people, placing them in certain scenarios, and observing their responses and thought processes. After handling these circumstances, they attempt to replicate human thought processes using intricate computer networks. [14].

## **4. Results**

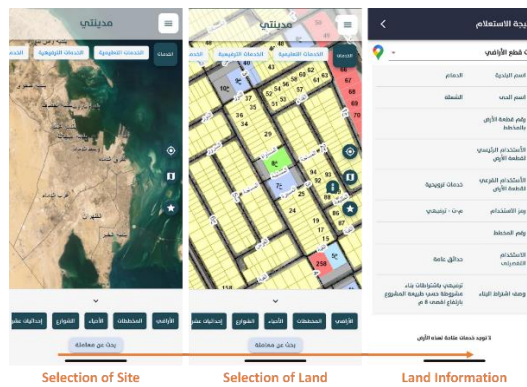
### **4.1. Community Involvement in Decision Making and Development (Benefit Sharing).**

Community participation is the key factor in making design decisions. In order to improve the quality of services provided by the municipal sector and achieve the Saudi Arabia 2030 vision of implementing a vibrant community, it is possible to collaborate with the Municipal Innovation Center, established at the beginning of 2019, to hold workshops for exchanging experiences and expertise. Additionally, community memoranda of understanding can be made with private sector specialists such as non-profit organizations and universities (student graduation projects) to participate in presenting design proposals based on transforming public outdoor spaces into educational and recreational areas for children. Moreover, utilizing the experiences of teachers, artists, and those involved in Montessori educational theory in schools in the Kingdom of Saudi

Arabia. These people of expertise are concerned with improving the urban landscape of the city to promote the mental and social growth of children and create new educational opportunities outside the built environment.

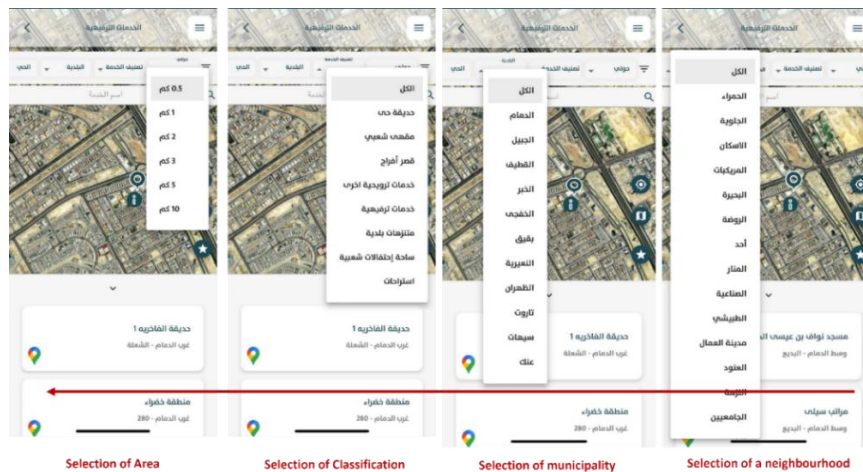
#### 4.2.Madinaty "My City" Application

The application Madinaty "My City" is part of the Eastern Province Municipality in the Kingdom of Saudi Arabia. It is an effective application that uses the Geographic Information System (GIS), it contains data and records on all land plots in the cities of the Eastern Province. It provides detailed information of the land plot (residential, commercial, park, mosque) when inquired, as shown in **Figure 2**.



**Fig. 2: Inquiring about land plot data, Source: Modified by the researcher from Madinaty Application**

It is possible to customize the search options in the application to include a wider range of services, as shown in **Figure 2**.



**Fig. 2: Customizing search options for neighborhood and municipal services, Source: Modified by the researcher from Madinaty Application**

#### 4.3.Linking Sobel's principles to the nine types of intelligence

Expanding upon the previously given definitions, the combination of Sobel's design principles and the nine categories of intelligence, as shown in **Table 1**, may provide intelligent design systems that enhance children's cognitive and physical skills while generating urban open spaces in Saudi Arabia.



**Table 1 : Linking Sobel’s Principles to the nine types of intelligence, Source:Modified by the researcher**

Sobel Principles	The nine types of intelligence
The Principle of imagination and creativity	Interpersonal intelligence
	Verbal intelligence
	Musical intelligence
The principle of maps and paths	Spatial intelligence
The Principle of Adventure	Bodily-kinesthetics intelligence
	Logical-mathematical intelligence
The Principles of Animal world	Natural intelligence
The principle of small worlds	
The principle of private places	Internal intelligence
Existential Intelligence	

The previous table demonstrates that Existential intelligence, as it is defined, intersects with all of the previously mentioned forms of intelligence because children are naturally curious and passionate about learning new things. They ask questions about what life is like, how things work, and other related topics.

**4.3.1. Existential intelligence, Interpersonal intelligence, verbal intelligence –Principle of Imagination and creativity:**

Example: A mural was created by the General Administration of Community Participation and the Visual Landscape Improvement Unit in the Eastern Province Municipality in Dammam, Kingdom of Saudi Arabia. It was designed by Engineer Nasser Al-Jamea and located in the Al-Hamra neighborhood of Corniche. The mural was created to commemorate the 90th Saudi National Day and express gratitude to the nation's heroes during the Corona pandemic in 2020. **Figure 3** displays the information..



**Fig. 3: Alhamra Mural Designed by Arch.Nasser Aljamea, Source : Imaged by the researcher**

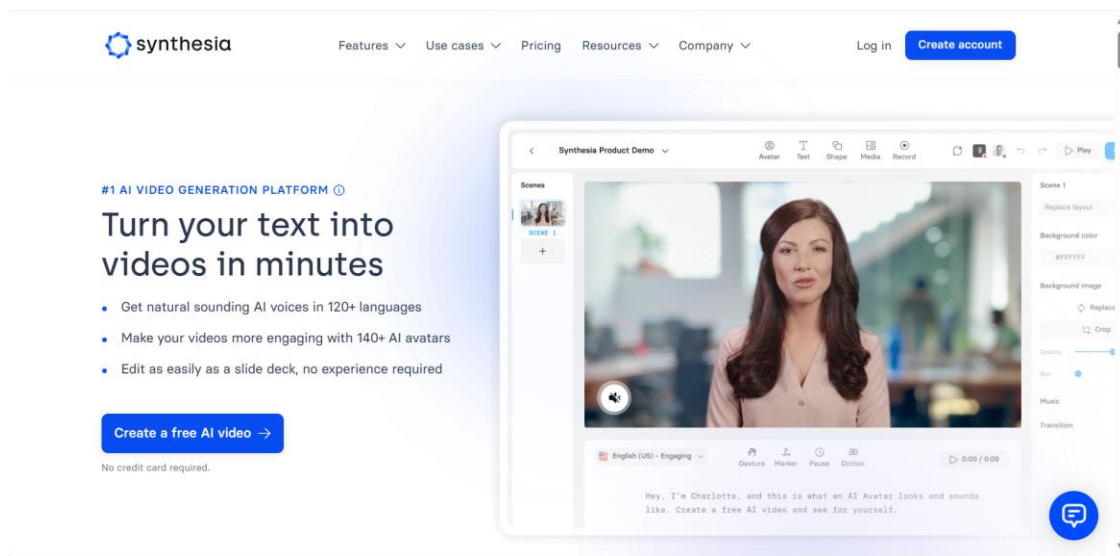
Design Suggestion 1: By integrating personal intelligence and verbal intelligence, the mural can be redesigned to create an interactive experience. This involves having the drawn characters interact with children by stating their tasks in a simplified manner through different sounds when pressed. Additionally, simple linguistic terms related to the characters can be incorporated to seamlessly introduce children to various professions. This concept was implemented in the design of an interactive tactile wall at the ARA Art Centre in Seoul, South Korea, as shown in **Figure 4**.





**Fig. 4: Interactive wall at Netmarble Game Academy Exhibition , Source : Netmarble GameAcademy Exhibition, 2020 [www.img-lab.co.kr/10](http://www.img-lab.co.kr/10)**

Design Suggestion 2: By using artificial intelligence applications and a projector, the characters shown on the wall may be animated and given the ability to talk via the presentation of individual character videos. Furthermore, the exhibited characters can be modified to suit different circumstances. **Figure 5** illustrates the use of artificial intelligence in this particular application utilising the website [www.synthesia.io](http://www.synthesia.io) .

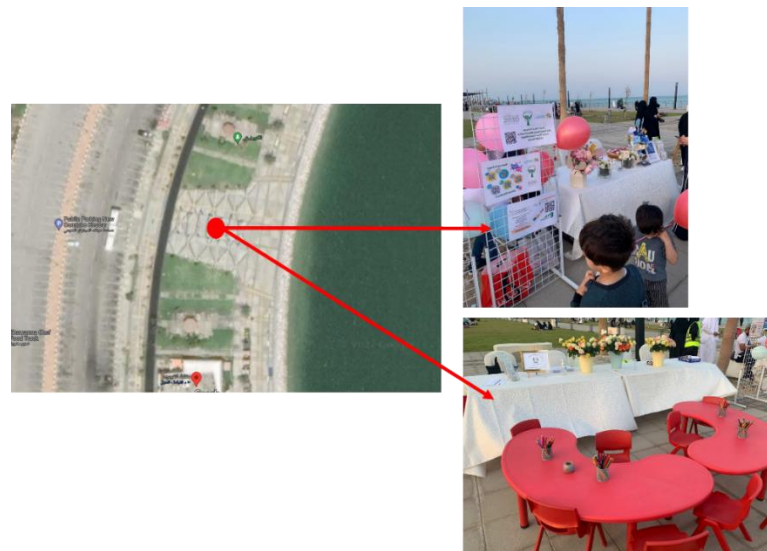


**Fig. 5: Developing speaking characters through the use of artificial intelligence, Source : Synthesia application , 2023 [Synthesia - #1 AI Video Generator](https://www.synthesia.io)**

Skills that the child will acquire include: The following abilities will be acquired by the child in accordance with the previous design suggestions: the capacity to identify distinctions proficient language use and awareness of word sounds, meanings, and rhythms proficient verbal and nonverbal communication capacity to understand other points of view.

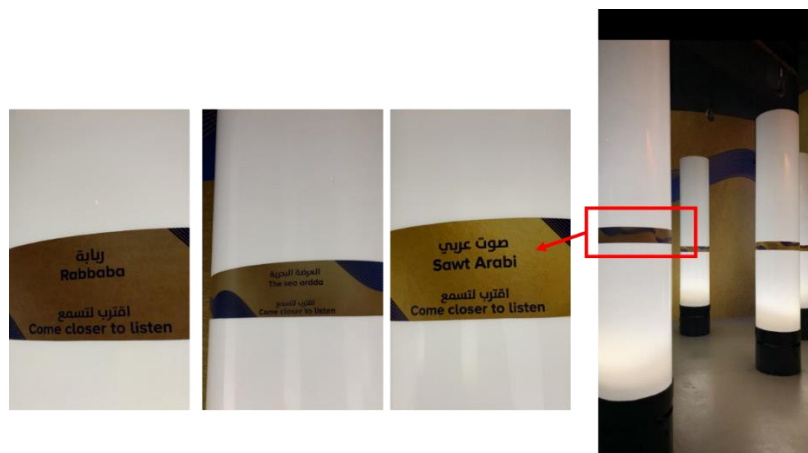
#### 4.3.2. Existential intelligence, Musical intelligence – Principle of Imagination and creativity:

Example:Under the theme "Safe Childhood Festival 2021," Al-Khobar Municipality celebrated International Children's Day in collaboration with a number of groups and volunteers. As shown in **Figure 6**, each organisation created a children's area with a variety of activities, such as face painting and colouring.



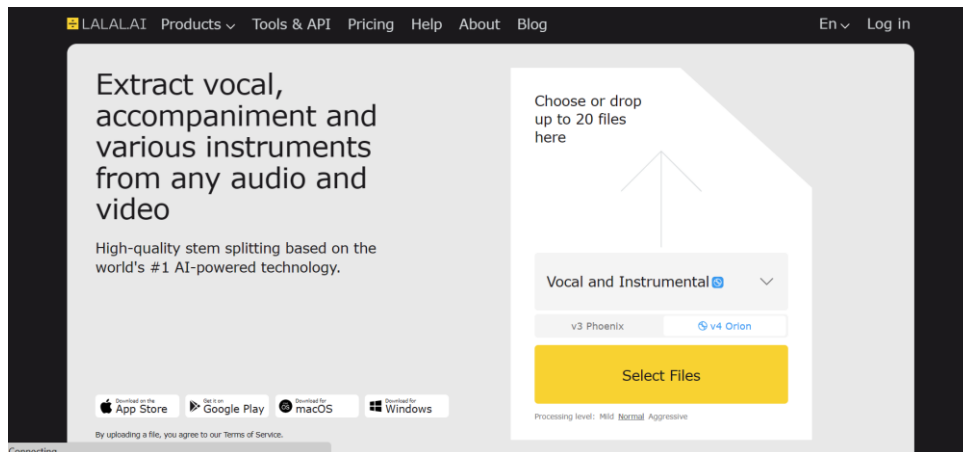
**Fig. 6: Safe Childhood Festival 2021, Source : Imaged by the researcher**

Design Suggestion 1: Because the mentioned location is a significant site in the Eastern Province and is well-known for being a place to activate a variety of occasions and celebrations, events can be planned in a way that is both contemporary and clever and draws in children by creating musical columns that interact with kids when they approach them and play different music depending on the occasion, like the columns that were created for the State of Kuwait Pavilion at Expo Dubai 2020, which are shown in **Figure 7**.



**Fig. 7: Music columns featured in the pavilion of Kuwait at Dubai Expo 2020, Source : Imaged by the researcher**

Artificial intelligence programmes enable the creation of musical compositions utilising the instruments shown in each music column. This allows children to listen to a whole song specifically tailored for each instrument. **Figure 8** shows one of the musical creation applications that utilise artificial intelligence.



**Fig. 8: Using artificial intelligence in the composition of music, Source : [Vocal Remover & Instrumental AI Splitter | LALAL.AI](#)**

Design Suggestion 2: The Playdodo Center is a children's playground that was created by combining modern technology with creative ideas to create a new experience for children. Raonsquare, a company that combines hardware, programming, and developing research related to this and dealing with technological techniques related to perception and simulation, designed an interactive wall that contains pictures of musical instruments. This wall allows children to interact with the pictures, allowing them to distinguish between the different sounds of musical instruments and create their own music using methods of "concrete experience" grounded in many forms of intelligence, as shown in **Figure 9**.



**Fig. 9: Musical Interactive wall , Resource :Playdodo Music playing wall, 2016 [raonsquare – Interactive · Creative · Innovative, raon means 'Vibrant'](#).**

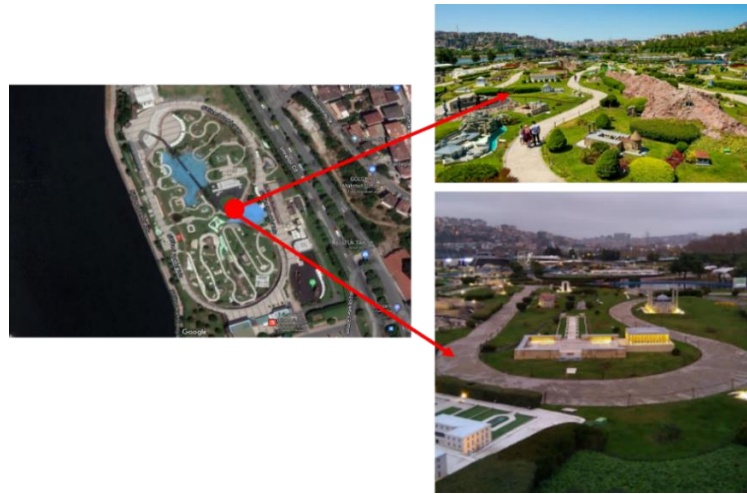
The child will gain the following abilities based on the design ideas mentioned above: identifying various musical genres, composing, recreating, and reflecting on music.

#### **4.3.3. Existential intelligence, Spatial intelligence- Principle of Imagination and creativity, Principle of Maps and paths.**

Example: Children in the Kingdom's schools are exposed to the numerous landmarks, and they can potentially activate this knowledge by creating little models or drawings of the sites. Children can find it challenging to identify every landmark in the Kingdom due to its geographical variety.

Design Suggestion 1: By conceptualising landmark models that faithfully replicate the natural environment in open parks and implementing them as a comprehensive map of their geographic locations across all regions of the kingdom, the child can navigate through these regions as if he

were in a car. By interacting with the sensors and traversing from one region to the next, he gains an understanding of their distinctive attributes. As illustrated in **Figure 10**, interact with children in models while providing an overview of each landmark, as is the case at the Miniaturk Park in Istanbul, Turkey.



**Fig. 10: Miniaturk Park in Istanbul, Turkey, Source : Designed by the researcher from Google map**

Example 2 : King Fahd Park in Dammam, also known as Life Park, is notable for its expansive size, spacious pathways, and abundant green areas. **Figure 11** demonstrates that the absence of a residential neighbourhood allows for an unobstructed visual link between the park and its surroundings.



**Fig. 11: King Fahd Park in Dammam, Saudi Arabia, Resource : Designed by the researcher from Google map**

Design Suggestion 2 : As illustrated in **Figures 12 and 13**, develop animated characters that interact with the child by having him or her construct various designs and characters from his or her imagination in the passing open spaces using a lasercube projector.





Fig. 12: Characters are moved by use of a lasercube Projector,Source:modified by the researcher from laser cube by wicked laser feature Natural Art [Features | LaserCube | World's First Portable Laser Show \(laseros.com\)](#)

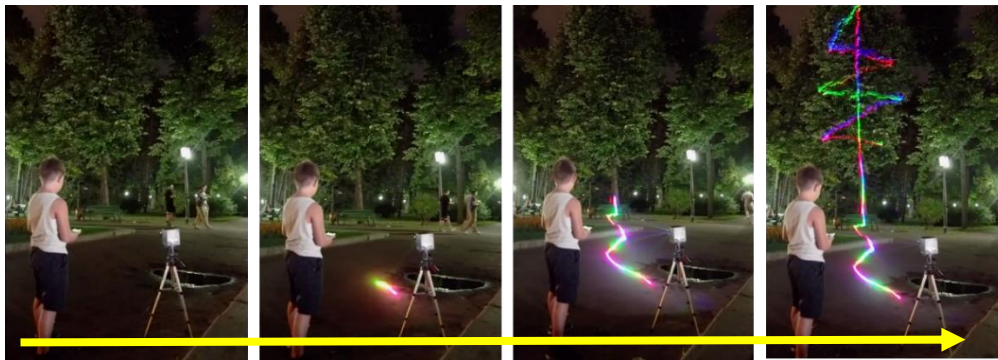


Fig. 13: A child creates his own forms using lasercube Projector,Source: modified by the researcher from laser cube by wicked laser feature Christmas light,2023 [Features | LaserCube | World's First Portable Laser Show \(laseros.com\)](#)

Skills that the child will acquire include the ability for three-dimensional thought as well as creative composition, drawing abilities and spatial awareness.

#### 4.3.4. Existential intelligence, Bodily-kinesthetics intelligence, Logical-mathematical intelligence- Principle of Natural adventure.

Example:As the design of Al-Hamra Park in Dammam's **Figure 14** illustrates, creating children's play areas in open spaces does not aid in the mental and physical development of children today. As a consequence, children become reluctant to play in these areas and are happy playing video games in virtual reality, which raises the risk of obesity, social isolation, and poor interpersonal skills.



Fig. 14: Al-Hamra Park in Dammam city,Source:Imaged by the researcher

Design Suggestion: By incorporating pre-existing electronic games, such as the chess game illustrated in **Figure 15**, into mobile phone applications, using Artificial intelligence such as Google Bard or Chat-GPT as shown in **Figure 16**, users can engage in cooperative or computer-based game play.



Fig. 15: Chess Game on IOS mobile system ,Source:Apple Store

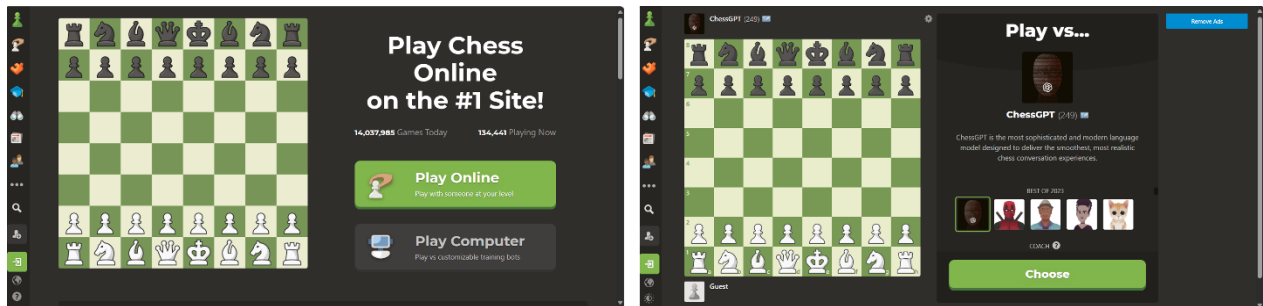


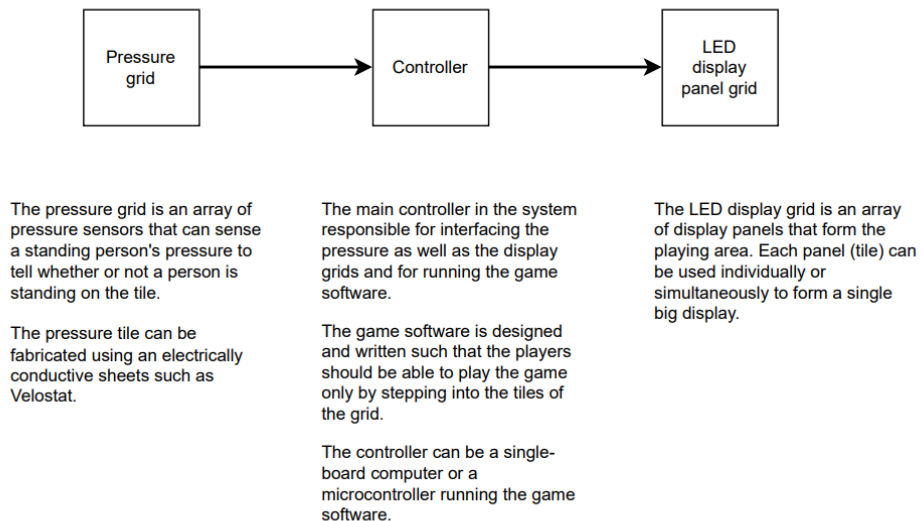
Fig. 16: Online chess Game with Chat-GPT ,Source: [www.chess.com](http://www.chess.com)

To illustrate, consider the design of a floor chess game inspired by the Malampuzha Garden, where the child's movement determines which piece of the game (soldier, horse, king) is active, as illustrated in **Figure 17**.



**Fig. 17: A ground chess game in Malampuzha Garden,Resource: World's Largest Chess Board Giant Chess Board,2013 <https://youtu.be/F9aJJAqJeM8?si=2Z-CBw6g13rSHEli>**

Children may engage in interactive play utilising a Smart System that incorporates the interactive system shown in **Figure 18**.



**Fig. 18: A smart interactive technique for creating a chess game on the floor. ,Source: modified by the researcher**

Skills that the child will acquire include the capacity for coordinated movement of the body and mind, the knowledge of links and interconnections, and the capacity for sequential thought.

**4.3.5. Existential intelligence, Internal intelligence -Principle of Animal Allies,Principle of Small worlds**

Example: **Figure 19** illustrates how the Eastern Province of the Kingdom of Saudi Arabia's zoos are not child-friendly because of their antiquated layout, lack of amenities, and isolation from residential areas.





Fig. 19: Zoo in Saihat,Saudi Arabia,Resource: modified by researcher from Google map

Design Suggestion 1: One can select a garden from the nearby gardens, such as the Al-Hamra neighbourhood garden in Dammam. This garden is situated in a residential area and in close proximity to a school complex for children, as shown in **Figure 20**. It is possible to create designs of various animal and plant shapes in different colours using energy-efficient lamps and fabrics, similar to the models found in the garden. The image labeled **Figure 21** depicts the Garden Glow in Dubai, with sensors placed between the kid and the animal. These sensors generate the sounds of the animals and provide an auditory display with basic information about the animals and plants.



Fig. 20: Al-Hamra Park neighbourhood,Dammam,Saudi Arabia,Source: modified by the reasearcher



Fig. 21: Gkow Park in Dubai garden glow,Dubai,UAI,Source: [Dubai Garden Glow](http://Dubai Garden Glow)

Design Suggestion 2: Utilizing interactive animal-themed robots in expansive public parks and events, such as the Expo 2020 Dubai event, as seen in **Figure 22**, to engage with children.



**Fig. 22: Interactive robot at Expo Dubai 2020,Resource:Imaged by the researcher**

Design Suggestion 3: Sand areas, often known as sandboxes, are thought to be among the most crucial components of children's games since children use them to construct the many worlds that they imagine. **Figure 23** illustrates an interactive sandbox known as iSandBox that may be used. It is a crucial component of games for children and has several uses, One of its benefits is that it may be used in open spaces for children's play areas as well as indoor and outdoor settings.



**Fig. 23: Interactive Sandbox iSandBox,Source:modified by the researcher from Augmented reality sandbox [www.ar-sandbox.com](http://www.ar-sandbox.com)**

Skills that the child will acquire include: The child will learn how to differentiate between living things, recognise the features of natural formations, and be able to think in three dimensions based on the design concepts mentioned above.

#### **4.3.6. Existential intelligence, Internal intelligence – Principle of Private places**

One of the best places for kids to improve a variety of talents is the King Abdulaziz Centre for World Culture (Ithraa) in Dhahran. In order to foster direct engagement with the elements of nature, the centre offers workshops on a variety of subjects in an enclosed outdoor children's museum. As seen in **Figure 24**, one of the center's recurring workshops teaches Children how to safely disassemble and assemble existing tools to construct their own models.

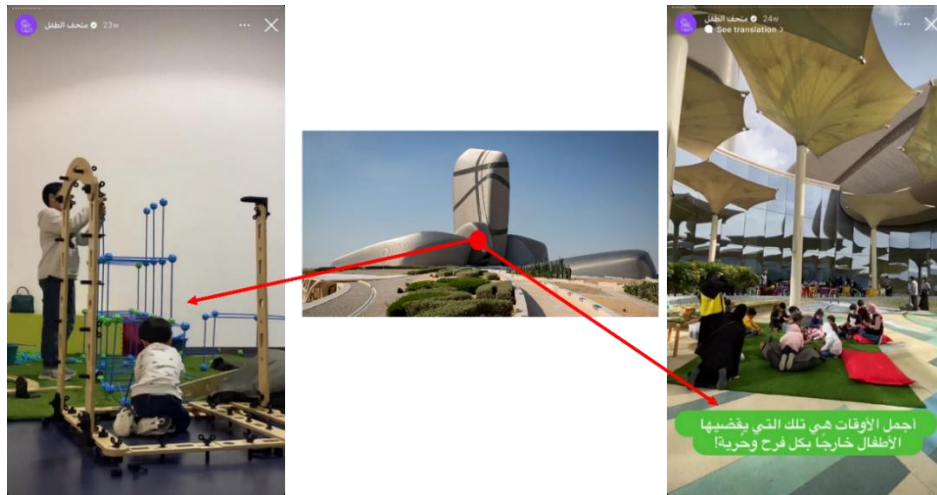


Fig. 24: King Abdulaziz Centre for World Culture (Ithra),Source: Modified by the researcher from Ithra instagram account [www.instagram.com/ithra/](http://www.instagram.com/ithra/)

Design Suggestion : The technology in **Figure 25** illustrates how virtual reality technologies may be utilised to assist children in creating their own models and structures and being able to move around within them before they are installed.



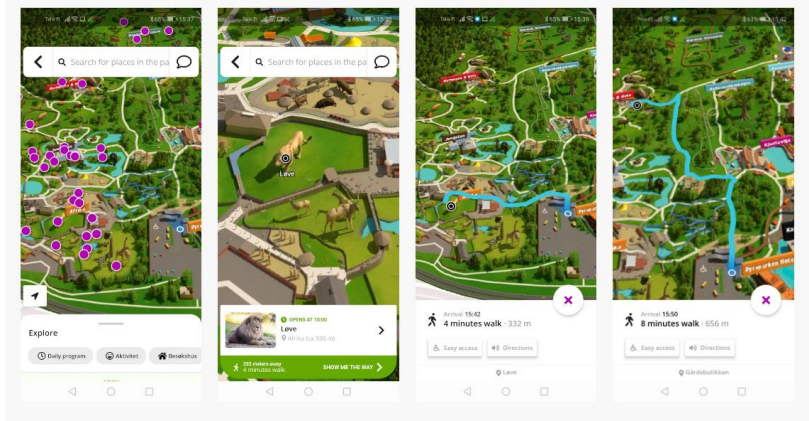
Fig. 25: Augmented Reality Education,2015, Source: modified by the researcher from Augmented Reality Education Solar System on CARpet video <https://youtu.be/UkWuVVVUD4Q?si=qD6IN8jd2KvLCIAB>

Skills that the child will acquire include: The following abilities will be acquired by the child in accordance with the aforementioned design suggestions: Having enough understanding of what a child should feel and do to enjoy freedom.

#### 4.4. Interactive Maps

The interactive maps approach, as implemented in the "Proximi.io" application, can be utilized to access locations and services within parks and public squares. It converts the site plan into a 3D map to display points of interest and access routes in an attractive visual way. This improves the user experience and enhances the flow of visitors to prevent overcrowding, as shown in **Figure 26**.





**Fig. 26: An application for providing a 3D plan for parks and public squares, Source:Modified by the researcher from Award-winning technology for location and navigation for amusement parks [Interactive maps and navigation for amusement parks \(proximi.io\)](https://proximi.io)**

**4.5.Achieving the element of safety and protection by applying Sobel’s principles in designing children’s open spaces.**

Children can be connected to GPS technology through their watches, and parents can download a tracking programme on their mobile phones, such as Find my Kids. This allows parents to monitor their child's movements within a certain range. This technology gives children the freedom to play and move around without feeling limited by their parents, which increases their confidence in exploring and moving. The application also offers additional services.as shown in **Figure 27.**

The image displays the Find My Kids app website and its key features:

- Receive notifications about the locations that your child visits:** You'll receive notifications when your child comes home, goes to school, or visits any set location. You'll know where they are and won't have to check it as often.
- Track your child's location history:** See the exact history of locations for the day so that you know where they walk and what route they take to school.
- Receive an SOS signal from your child:** If your child is in danger and cannot call you. You'll receive their exact location and your child's phone will begin to record its surroundings.

**Fig. 27: Find my kids app,Source:Modified by the researcher from Find my kids website [www.findmykids.org/en](https://www.findmykids.org/en)**

The simplified method for establishing a connection with the programme is shown in **Figure 28** as follows:

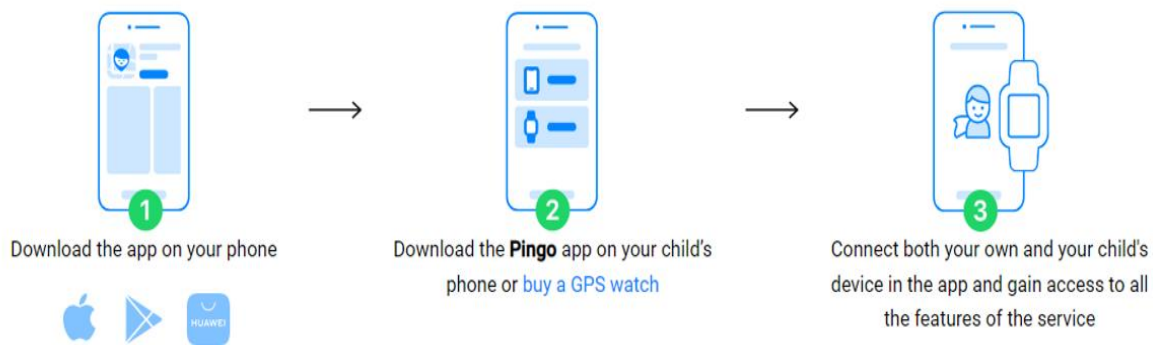


Fig. 28: Installing Find my kids app, Source: Find my kids website [www.findmykids.org/en](http://www.findmykids.org/en)

#### 4.6. Establishing (Tafa'al) Application

The Eastern Region Municipality aims to achieve a pillar of Vision 2030, which is digital transformation. This is achieved by introducing smart solutions to provide services to all beneficiaries, such as the "My City" application, and launching a service portal for the agencies of the services agency. The portal facilitates external parties to apply for specific services. Based on that, the "Tafa'al" (Interact) application can be proposed, and the preliminary logo for the application is shown in **Figure 29**. The application is currently under construction and operates on the data entered through the Geographic Information System (GIS). It connects beneficiaries (children, parents, and teachers) with concerned parties (governmental and investment entities) by using GIS to create an information network demonstrating the recreational services available in the neighborhoods of Dammam (parks, public squares) and determining the best and safest routes to access them. The application permits users to identify the services provided in parks and squares, upcoming events, and the possibility of educational groups booking outdoor classes. Additionally, it features the reservation of individual children for games to enhance their communication skills with the external environment or in groups to promote social relationships among children outside the built environment

The application relies on the following:

- All data related to parks and public squares are available within the application.
- An attractive visual interface for children, similar to gaming applications, as shown in **Figure 31**.
- A personal account to register the child in the application.
- A map that uses GPS technology to locate nearby parks and investment sites in public squares and parks.
- The ability to select the desired location and view details of its events and facilities.
- Naming the elements and options of the application with attractive and easy-to-understand names that appeal to children.
- The child can play audio of the available options inside the application to develop their verbal intelligence skills.
- When selecting investment sites, it is possible to reserve the desired game or activity and receive a special booking code.
- Bookings for educational classes are available in locations created as outdoor classrooms that depend on the creation of smart educational components.

- Providing a visual virtual safe path for children to reach the exact location of the element, and in case they wish to experience another activity, they can choose another option and proceed to it.
- Linking the application with children's smartwatches to send notifications, updates, and alerts to their parents regarding their child's movement route.

The "Tafa'al" application promotes important fundamentals, as follows:

- Forming community friendships among children in open spaces in the Kingdom of Saudi Arabia.
- Developing skills for interacting with the external environment using all senses.
- Attracting children to learn through physical activities.
- Allowing freedom of movement and independence within the safe limits of open spaces by constructing a suitable environment.
- Diversifying educational opportunities through practical learning, where each park has different constituent elements, by introducing designs that develop physical and mental skills in children.
- Utilizing school activity periods by visiting nearby open spaces instead of traditional recreational trips.

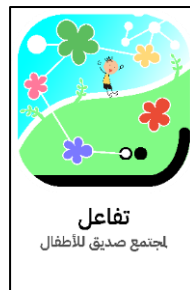


Fig. 29: The logo of (Tafa'al) application, Source: Designed by the researcher

As shown in **Figure 30**, this is a preliminary chain for the operation of the application, which can be further developed after its experimental launch by beneficiaries.

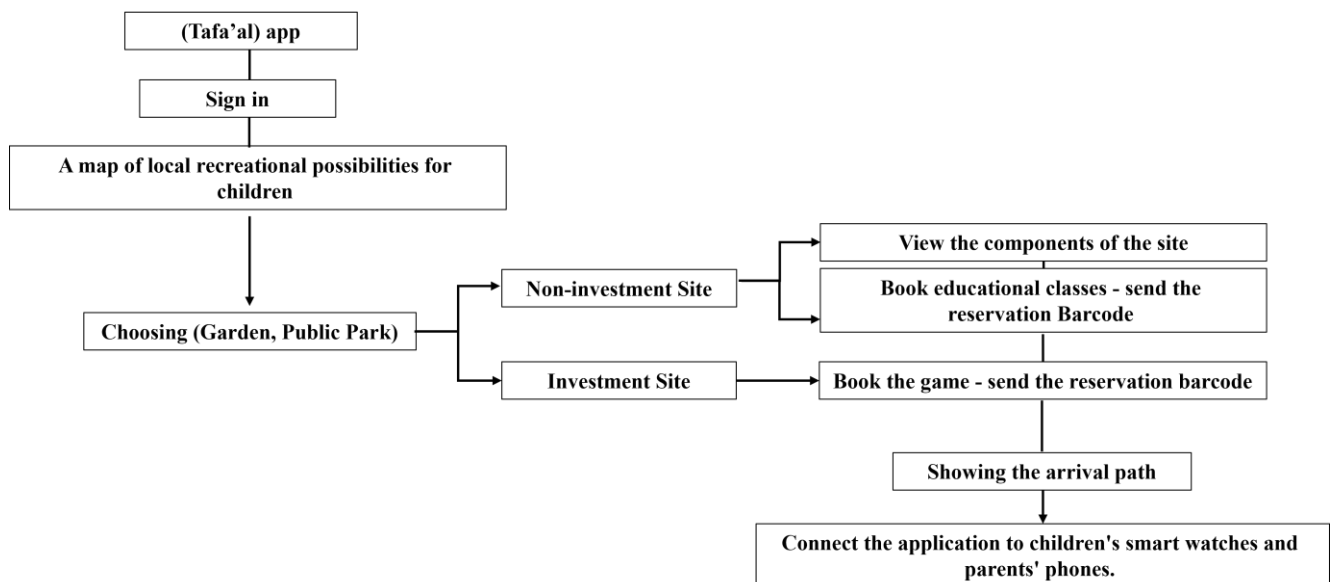


Fig. 30: A preliminary operational chain for the "Tafa'al" application, Source: Designed by the researcher

**Figure 31** illustrates the method of using the application:



Fig. 31: The method of using the "Tafa'al" application, Source: Designed by the researcher

An integrated illuminated dashboard with an easy-to-use touch-screen TV can be placed in parks and public squares to display information and pictures about the park. This dashboard is used to measure the child's satisfaction with the provided services and experience and to enhance the quality of performance. The beneficiaries' satisfaction can be measured through the selection of an expressive face indicating their satisfaction with the provided service, as shown in **Figure 32**.



Fig. 32: An informative dashboard in parks and public squares, Source: Designed by the researcher

## SUMMARY AND CONCLUSIONS

This study aims at integrating the nine types of intelligence and Sobel principles into the design of open outdoor spaces for children along with geographic information system applications and Artificial intelligence applications to establish outdoor smart workshops where children will



cultivate positive relationships with outdoor environments. Based on the results and the above discussions, the following conclusions can be derived:

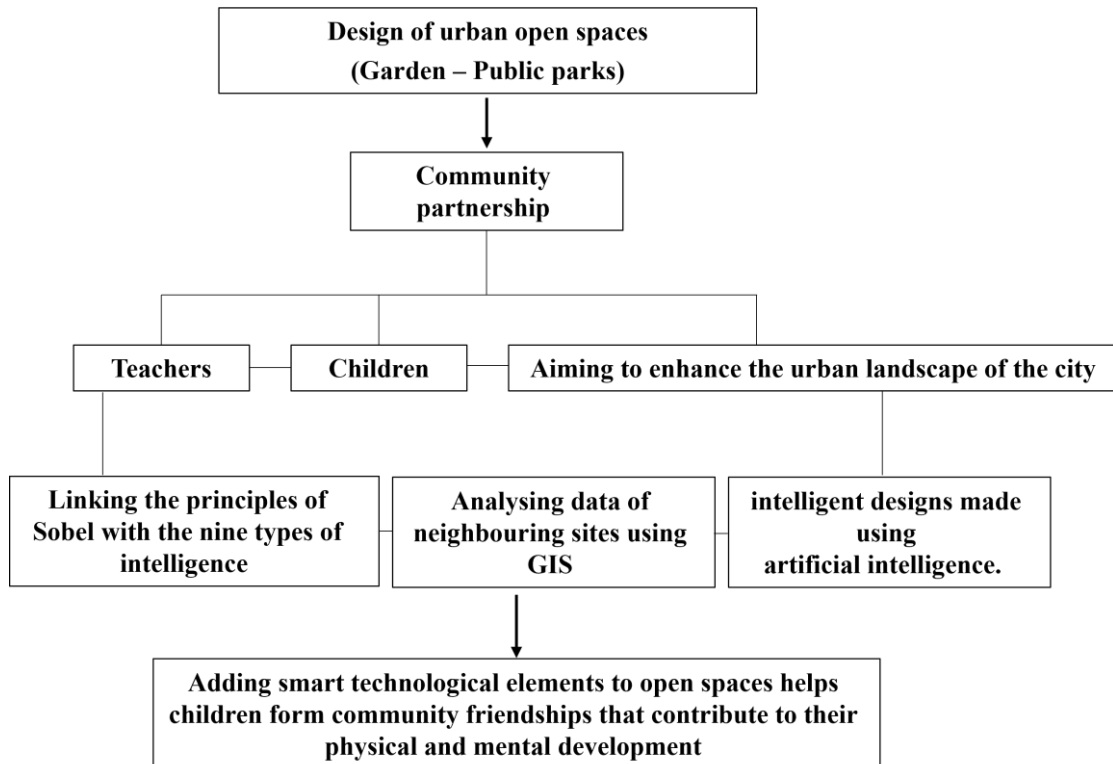
Children in the Kingdom of Saudi Arabia can develop special skills that contribute to the creation of a child-friendly environment in urban spaces. These skills align with the goals of Vision 2030 and focus on smart technical and technological development. The skills can be summarized in **Table 2**.

**Table 2: Integrating Sobel's principles with the nine types of intelligence and skills that will be developed in the child**

Types of intelligence	The Sobel Principles	Smart applications in outdoor spaces	skills being developed.
1 Existential intelligence, Interpersonal intelligence	Imagination and Creativity	Interactive Murals	Ability to notice differences - Effective verbal and non-verbal communication - Ability to accommodate multiple perspectives - Developed verbal skills and sensitivity to the sounds, meanings and rhythms of words.
2 Existential intelligence, Verbal intelligence			
3 Existential intelligence, Musical intelligence		Musical Columns, Interactive Murals	
4 Existential intelligence, Bodily-kinesthetics intelligence	Natural adventure	Interactive floor Games	The ability to coordinate both mental and physical actions, use sequential thinking techniques, recognise connections and interconnections, and design experiments.
5 Existential intelligence, Logical-mathematical intelligence			
6 Existential intelligence, Natural intelligence	Animal Allies	Robotic animals and luminous interactive figures	Differentiating between creatures and identifying characteristics of natural structures.
	Small Worlds	Sandbox	Ability to think in three dimensions
7 Existential intelligence, Spatial intelligence	Maps and Paths	Sculptures of the Kingdom's landmarks	Ability to think in three dimensions - graphic and artistic skills - spatial thinking.
	Imagination and Creativity	Laser Box	
8 Existential intelligence, Internal intelligence	Private places	Virtual reality technologies and AI Applications.	Having enough understanding of what a child should feel and do to enjoy freedom.

By maximizing the potential of the public sector and collaborating with diverse segments of society, communities will stimulate and develop towards realizing the concept of smart cities. This can be achieved by providing geographic information system applications integrated with educational and

recreational elements. Moreover, it is an approach to developing and improving urban spaces that creates a child-friendly, smart environment. The work plan for this approach is shown in **Figure 33**.



**Fig. 33: Improving Chil-friendly urban spaces using Educational and Smart Systems, Source: Designed by the researcher**

## Recommendations

1. The researcher recommends activating the principle of community participation by creating memorandums of understanding to train the employees of the Eastern Region Municipality responsible for improving the urban landscape of the city in collaboration with relevant parties, to achieve an appropriate design for children in open urban spaces.
2. The proposals should be included in the requirements and specifications for investment projects proposed by municipal sectors, to qualify the Kingdom of Saudi Arabia among child-friendly countries, thereby achieving the goals and aspirations of Vision 2030.
3. Continuing research and scientific additions in this field is vital to assist children to form social relationships in open spaces.
4. Updating the current urban code with consideration of the needs of children in open spaces to contribute to the development of a conscious and healthy generation. This is acquired through diverse learning sources and achieved the future objectives of the Quality-of-Life program by involving children in urban design processes.
5. The researcher advises his colleagues, who specialise in the subject of climate, to seek solutions that enhance the climate in open areas in order to use the suggested designs outlined in the research.

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## CONFLICT OF INTEREST

The authors have no financial interest to declare in relation to the content of this article.

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