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Enlivening Urban Nodes After Hour: Approach to Recreation Through Interactive Technology

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ARTICLE INFORMATION

ABSTRACT

We are living in an era of urbanization. One of the problems we commonly see but decide to ignore in the current scenario is dead urban nodes during off-peak hours. This setting appears unsafe because of the lack of social connection and enjoyable gatherings, which usually result in social uneasiness and unpleasant accidents. These days, interactive architecture and installations are a growing field. Numerous works have included interactive technology. This article looks into using interactive technology to address this problem by reviving the neighborhood, establishing a safe urban node, and providing a venue for public participation among people of all ages and genders. In order to address the problem of urban dead nodes and transform them into lively, secure, and welcoming public areas, especially ones that may be presented in the context of Dhaka, the study examines case studies and proposes viable solutions.

1. Introduction

In certain instances, specific areas within urban environments may exhibit low productivity and limited activity, thereby creating an unfriendly perception and diminishing the overall living quality of the locality. The previously mentioned tendency was observed by Dekel et al. (2005) in several locations, namely commercial areas, characterized by high levels of activity during operational hours while seeing a decline in appearance during non-operational hours. Urban nodes that function as communal focal points for social meetings and interactions encompass plazas and the intersections of roadways. During off-peak hours, specific locations, such as transit hubs and nodes, may witness a decline in pedestrian activity, resulting in a reduction in their liveliness. Addressing these issues is necessary in order to enhance the functioning and quality of urban areas.

The transformation of urban nodes into dead spaces presents a safety concern, particularly with regard to women. According to the findings of Joonsang and Yoshida (2018), incidents of harassment and robbery are observed with high frequency on sidewalks. A significant number of individuals experience unease and a sense of insecurity when engaging in solo nocturnal travel inside public spaces, regardless of gender. In order to enhance safety, prosperity, and sustainability of cities and neighborhoods, it is fundamental to activate urban hubs during non-peak hours as well.

The revitalization of urban areas can be accomplished by implementing creative strategies, such as the utilization of interactive technology, as highlighted by Cravalho (2015). Interactive architecture and installation utilize technological advancements to develop dynamic feedback systems between individuals and the urban environment, enabling cost-effective enhancements without the need for significant renovations. This methodology, driven by personal contributions, has the ability to revolutionize and enrich architectural elements, converting dead areas into lively, secure communities with an increased pedestrian

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movement and community involvement, thus mitigating instances of illegal activity.

This research investigates the potential of interactive technologies to revitalize and enliven urban public places that often experience a lack of liveliness during off-peak times. Additionally, this study examines the potential of these technologies to enhance security and safety in these environments. This study encompasses a series of case studies that examine the previously mentioned problems through the lenses of technology, aesthetics, psy-chology, and society. This paper examines the rising popularity of interactive technology in urban environments and its historical role in land utilization. This will be achieved by reviewing the underlying motivations and strategies employed to revitalize urban areas that have become stagnant. Additionally, the study will investigate the potential of utilizing interactive technologies to enliven urban dead spaces in Dhaka, our local context, with a focus on creating vibrant, safe, and inviting public areas. This study offers innovative strategies to meet the in-creasing need for dynamic, efficient, and aesthetically pleasing public places. Furthermore, it offers feasible op-tions that can influence the pattern of both urban and landscape evolution for the years ahead.

2. Materials and Method

This study explores multiple case studies that look into various aspects that can be integrated to address the highlighted problems. This study performs a thorough examination of the characteristics of urban nodes and how they are able to stimulate during off-peak periods. The suggestion is to modify these regions and improve their functionality and quality of life by implementing interactive technologies. This correlation demonstrates a connection between innovative approaches and the challenges posed by metropolitan regions with limited vitality.

3. Literature Review

This comprehensive review explores the relevance of urban nodes as essential centers for development, transit, and many other activities inside cities. The study also examines urban dead areas, which possess the potential to be hazardous, socially isolating, and conducive to undesirable conduct during off-hours. Additionally, explores the background, utility, and the potential of interactive technology.

3.1. Understanding Urban Nodes and Existing Problems

Urban nodes play an integral part in facilitating growth and development, as well as providing connectivity to transportation and a diverse range of activities throughout an urban area. These regions often exhibit impressive economic performance, a substantial population size, and an abundance of diverse services and amenities. According to

Ferati et al. (2019), urban nodes can be described as certain locations within the urban structure wherein the public area is fully actualized. Public spaces, whether extensive urban plazas or smaller sections of neighborhood streets, function as central nodes for communal activities and interactions. The term "node" was introduced by K. Lynch (Lynch, 1960), who emphasized the psychological efficacy of a node's navigational function in conjunction with other components of a city's image.

Urban nodes have a substantial influence on the whole arrangement and functioning of a city or urban area. According to Dekel et al. (2005), transportation hubs such as rail stations, bus stops, metro or train stations, and airports serve as nodes that enable the flow of individuals and goods within and between different areas. Educational institutions, such as colleges and universities, have the potential to serve as hubs for learning, innovation, and cultural activities. They provide valuable resources such as research facilities, libraries, and student housing. Urban nodes frequently incorporate parks, recreational areas, and green spaces with the intention of augmenting the overall quality of life for both residents and visitors. Urban nodes commonly promote the implementation of mixed-use developments, which integrate various purposes such as commercial, residential, institutional, and recreational activities within a concentrated area. This phenomenon fosters pedestrian-friendly environments, diminishes dependency on personal vehicles, and often integrates communal spaces, green areas, and plazas that function as communal meeting spots. These locations foster social engagement, recreational activities, and a sense of communal belonging .Urban nodes serve a crucial role in supporting the integration of different transportation networks, enabling the connection between long-distance traffic and regional as well as local transportation systems. According to Duxfield (2023), the integration and operation of local, regional, and national transportation networks are greatly influenced by urban nodes.

The term "urban dead space" denotes places within urban environments that have been abandoned, left out, or are underutilized, hence lacking the necessary conditions to facilitate human activity, economic growth, or social engagement. Dekel et al. (2005) observed various instances wherein certain locales, such as commercial and business districts, exhibit high levels of activity during daytime hours but see a significant decline in occupancy during evening hours, hence creating an unwelcoming and lonely ambiance. Likewise, transportation hubs encounter a decrease in pedestrian activity during off-peak periods, leading to a sense of insecurity and a reluctance among individuals to utilize public transit during nighttime hours. Insufficient visibility and an absence of nocturnal recreational opportunities can likewise result in a diminished nighttime park audience, thereby engendering safety worries and constraining leisure alternatives. University campuses often possess underutilized open areas during non-class hours, hence contributing to a perceived

lack of vibrancy in the surrounding community. Urban nodes refer to specific locations within urban areas where individuals assemble and engage with their surroundings. These nodes encompass many spaces, including plazas, squares, marketplaces, parks, and transit hubs. Street nodes, located at the intersections of streets and roads, have a significant impact on promoting urban connectivity by enabling smooth movement between different streets, neighborhoods, and modes of transportation. Nonetheless, in the event that these regions are deficient in proper planning, public engagement, or sustained activity, they may undergo a state of inactivity and pose a risk to their users. Certain regions within the urban landscape see diminished levels of activity during nocturnal hours as a consequence of community engagements that predominantly occur during diurnal periods. This phenomenon leads to a decrease in pedestrian movement and an escalation in the likelihood of accidents, criminal incidents, and general unease. Insufficient lighting in urban nodes can contribute to a perception of unfriendly and potential danger during the night, hence diminishing the level of natural surveillance and compromising safety. During the course of commuting, transit nodes, such as train stations and bus stops, may also experience periods of inactivity, restricting accessibility for individuals. In the context of approaching metropolitan nodes during late hours, women have expressed a predominant concern over the safety of dark streets, corners, and places. Individuals have a sense of unease when navigating public spaces, such as parking lots, during nighttime hours, leading them to exhibit avoidance behaviors towards specific regions or parts. Women prefer living in familiar places or places with quick access to help or escape in case of assault. Individuals exhibit a negative sentiment towards environments in which the probability of their social invisibility is heightened. The inclusion of familiar personalities, vendors, sellers, or commercial activities within public spaces has the potential to enhance the overall safety aspect of a given area. On the other hand, involvement in drug abuse, involvement with criminal groups, and occurrences of theft present substantial risks to public safety in different settings. According to data sourced from the Office of National Statistics (ONS), it is evident that a significant proportion of women, approximately 49%, and a notable proportion of males, around 19%, experience a sense of discomfort when engaging in solo travel during nighttime hours within public spaces such as high streets or train stations in the United Kingdom. Similarly, according to the Brazilian Institute of Geography and Statistics (IBGE), a significant majority of 51.7% of respondents express feelings of unease or acute unease when wandering around after sunset.

The revitalization of urban areas is necessary to foster the sustainability, safety, and prosperity of cities. The presence of inactive areas within urban environments can give rise to many challenges that have the potential to negatively affect the overall quality of life and sustainability of the urban fabric. The aforementioned concerns encompass matters about safety, limited accessibility to facilities, social isolation, and the utilization of inactive spaces for illicit activities. It is imperative to acknowledge and tackle the distinct obstacles presented by metropolitan regions with low levels of activity to foster meaningful community engagement.

3.2. Interactive Technology

The introduction of interactive technology is bringing about a significant transformation in numerous sectors, including architecture and the urban landscape. This study explores the significance of recent concepts that employ real-time interaction capabilities, data-driven insights, integrated services, efficient navigation, and safety measures to enhance urban nodes.

3.3. Evolution and Applications

Interactive technology incorporates the utilization of technological tools that facilitate active engagement between individuals and digital content or applications in a coordinated way. This technology employs several user interfaces, such as touchscreens, voice recognition, and gesture-based interfaces, among others, enabling individuals to manipulate and alter digital elements. Interactive technology is extensively utilized across various industries, including but not limited to commerce, entertainment, the media, healthcare, and education, to generate appealing and user-centric encounters.

Cravalho (2015) states that interactive architecture is a novel architectural idea that involves the active engagement of users through physical or virtual reactions, responses, and exchanges. The architectural design responds suitably to the activities of the person participating, facilitating ongoing interaction until the intended outcome is attained. This previously mentioned repetitive interaction remains, with each subsequent outcome assuming a unique character. The progress of computers in the domains of science and building technology throughout earlier periods resulted in the emergence of intelligent architecture during the 1960s and 1970s. The field of architecture has undergone an extensive transformation, switching from a rigid and immovable structure to one that exhibits enhanced adaptability and flexibility. Interactive architecture is a contemporary concept that has experienced a surge in widespread acceptance during the 21st century. According to Sparacino (2002), the contemporary environment is characterized by the presence of sensors and monitors, which signifies a general inclination towards the integration of information into our physical surroundings. The integration of interactive technology into many sectors has yielded novel designs, enhanced functionality, and elevated user experiences (Hassan, 2021). The convergence of large-scale public and small-scale individual digital displays, along with distributed intelligence in computing and sensing, presents unparalleled prospects for integrating virtual and

physical realms. Due to the prevalence of internet-based information platforms and the urban environment of the city, digital animated content has the potential to serve as narrative tools for both public displays and personal consumption. According to William J. Mitchell, the Dean of MIT's School of Architecture and Planning, the field of architecture and interactive technology has progressed beyond the conventional understanding of the interplay between masses and light. Instead, it now recognizes the significance of digital data inside physical space and endeavors to engage and react to it. According to Roussou (2001), the integration of several disciplines and the advancement of techniques in new interactive technologies can fascinate the general public and enhance communication. The utilization of interactive technology presents a distinctive methodology for revitalizing urban environments that have fallen into disuse or decay. According to Cravalho (2015), interactive architecture employs technology to establish a real-time feedback mechanism between individuals and the constructed environment. This interaction alters the shape and function of architecture through the incorporation of distinct inputs from players, hence yielding a distinctive outcome for each input. This strategy integrates interactive technology, planning principles, and community engagement to establish immersive and adaptable environments that are responsive to human input. To accomplish this goal, the Internet of Things (IoT) devices and other interactive technologies can be employed. The implementation of strategies aimed at revitalizing lackluster regions by fostering more pedestrian activity and community surveillance has the potential to mitigate instances of criminal behavior. Augmented reality (AR) and virtual reality (VR) offer the ability to offer immersive and interactive experiences, such as guided tours that integrate historical, cultural, or artistic elements. The utilization of immersive sensor art installations that are responsive to human contact has the potential to foster creativity and facilitate cultural expression. Sensor-based accessories that are capable of detecting touch, sound, and movement have the potential to offer a pleasurable and engaging experience for individuals of all ages, including both children and adults. Individuals can manipulate lighting, music, and images by utilizing distinct gestures or mobile applications in conjunction with installations that respond to bodily movement, resulting in an interactive and enjoyable experience. The utilization of LED-lit walkways and gesture detection technology has the potential to generate interactive experiences for individuals visiting urban areas, contributing to a heightened sense of excitement and fulfillment within the environment. By incorporating interactive technology into urban nodes, it is possible to promote rejuvenation on a neighborhood-wide scale, attracting investment and enhancing the overall urban environment. To enhance the safety and usability of urban nodes, it is imperative to incorporate interactive technology and foster community engagement. According to the study conducted by Dekel et al. (2005), the configuration of these spaces plays a significant role in shaping the activities that occur within them, as open areas tend to facilitate public interaction.

3.4. Urban Computation

Urban computation and the idea of "smart cities" utilize technological advances to enhance urban infrastructure, monitor urban activities, improve navigation, maintain safety, and offer beneficial solutions to inhabitants. Smart cities employ a diverse range of sensors and data analytics to effectively monitor the level of activity within urban regions, encompassing transit hubs and public spaces. For example, sensors have the capability to monitor pedestrian activity, vehicular mobility, and air pollution levels. According to Nam and Pardo (2011), the utilization of real-time data has the potential to enhance the decision-making process of city planners and other related parties by providing them with more comprehensive and accurate information. Kitchin (2016) states that the integration of navigation applications with smart city technology enables efficient guidance of individuals throughout urban networks. This encompasses several aspects such as the availability of parking spaces, real-time information on traffic conditions, and even internal navigation within large buildings in cities. Costa and de Oliveira (2020) state that prioritizing safety holds major importance within the realm of smart cities. The integration of surveillance cameras and artificial intelligence algorithms facilitates the detection and recognition of unexpected behaviors or occurrences within urban environments. In the event of a physical altercation occurring within a communal open space, such as a public plaza, the automated system might immediately alert law enforcement authorities. Energy-efficient intelligent lighting systems adjust their brightness settings in response to detected activity levels. To conserve electricity during periods of low demand, the lighting in unoccupied areas is dimmed. According to Chew et al. (2017), the illumination levels of lights increase automatically in order to enhance safety and visibility in response to heightened activity levels. In smart cities, an effortless combination of diverse public transit options facilitates enhanced mobility throughout metropolitan regions. Yin et al. (2015) assert that the availability of real-time data on bus, rail, and subway timetables enables the facilitation of efficient passenger route design. Mobile applications and digital kiosks are accessible to both residents and tourists in urban areas. According to Yovanof and Hazapis (2009), these features contribute to the overall urban experience by providing information on surrounding businesses, cultural events, and emergency services. Albino et al. (2015) states that a fundamental smart city system establishes connections among these many components. Data from various sensors and sources are collected, analyzed, and utilized together to enhance the efficiency and security of urban areas .The incorporation of technology within urban environments has greatly improved its operational effectiveness, security, and

convenience. Smart cities contribute to enhancing the quality of urban areas by effectively addressing the needs of both residents and tourists, leading to an overall improvement in the quality of life.

3.5. Summary and Findings

This section brings out the significance of urban nodes and the challenges they encounter in contemporary societies during off-peak times. Some of the challenges encompassed in this context consist of reduced pedestrian activity resulting from an absence of recreational opportunities, concerns regarding safety and security arising from inadequate lighting and limited visibility, as well as reduced social interactions and gatherings. One possible solution for enlivening and revitalizing dead urban nodes calls for the implementation of interactive technology. The implementation of interactive technology enables real-time interactions, resulting in captivating environments that efficiently address and overcome such problems.. Moreover, interactive installations have the potential to promote positive social interactions among individuals, especially families, and contribute toward improving urban experiences by providing navigational assistance, ultimately leading to an improved quality of life in urban areas. This approach offers a means of transforming urban nodes into vibrant spaces that effectively address psychological aspects associated with darkness and safety concerns, while additionally encouraging community involvement and enriching the overall urban living experience.

4. Case Studies

To fully understand the effects of interactive technology on the urban environment, it is fundamental to analyze case studies. Through the facilitation of experiential learning, comprehensive analysis, appropriate explanation, problem-solving experience, and the ability to compare and evaluate prevailing ideas, these resources contribute to the process of decision-making. The examination of these case studies provides novel perspectives on strate-gies for improving urban centers through the utilization of interactive technology.

4.1. City Fireflies on the digital façade, Madrid

The initial development of City Fireflies took place during the inaugural session of the Global Game Jam in 2011. The metropolitan Fireflies game in Madrid successfully grabs the interest of individuals with its immersive and expansive gaming experience in an urban setting. As to the statements made by the game's creators, Victor Diaz and Sergio Galán, the primary objective behind its development was to explore novel forms of interaction inside expansive environments. The primary purpose of the City Fireflies game is to be played on the smartphone at the Medialab-Prado facade in Madrid.
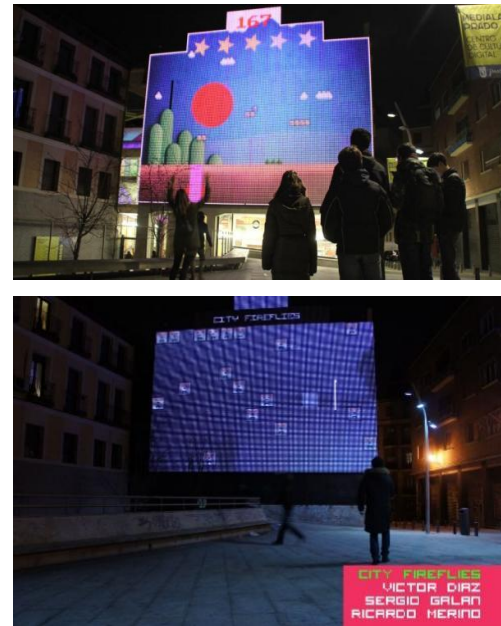
Figure 1: People interacting with the billboard, playing together creating mutual understanding (City Fireflies / Uncoded, 2012).

As to Fast Company, the primary goal of the game is to eliminate the square of diminutive 8-bit figures that possess a malevolent appearance. In order to accomplish this task, it is necessary to engage in bodily locomotion and perform the action of "sweeping" the avatars depicted on the expansive video display. The likelihood of effec-tively eliminating the "threats" within the square in the game is positively correlated with the number of partici-pating players, as the game is specifically intended to accommodate many participants. Furthermore, the establishment of a good crowd can be facilitated. The City Fireflies game does not necessitate players to download a mobile application for the gameplay; rather, it just tracks the luminosity emitted by the player's smartphone screen. The entire procedure comprises the popularity of large, interactive smartphone games designed for public settings, which is steadily increasing. This phenomenon is commonly referred to as "interactive urban gaming." Innovations in screen-tracking technologies have led to the development of novel mobile gaming experiences. The phenomenon of mobile multiplayer gaming is currently gaining traction as a prominent trend within the realm of multiplayer gaming, particularly in large public venues. The creator prioritized the cooperative game and the relationships among participants. For example, the game requires the participation of multiple players and the development of various strategies to achieve victory. Additionally, the game offers an opportunity for individuals to acquire expertise in playing independently and with a group of unknown people. (TrendHunter, Billboard Smartphone Games)

4.2. Billboard turning word into poetry, London

Google has developed an innovative interactive art installation that generates poetic compositions from distinc-tive words. These poetic creations are consequently displayed on interactive billboards located in the northern region of London. The Poetics project comprises a collection of 17 LED panels that employ a random algorithm to generate poetic compositions based on the spoken words captured by street-level microphones. The display acknowledges the successful use of Google's voice search engine and the Google Speech platform to identify words that are spoken, which are then incorporated into newly composed poetry. According to Peter Barron, a representative from Google, a significant number of individuals pass by the building site located in Kings Cross on a daily basis. Consequently, the firm endeavored to develop an encounter that would facilitate a sense of con-nection among these individuals.

Figure 02: The poetry board turns any sentence or word into a poem (Bailiwick Express, n.d.).

The individuals involved found the idea of encouraging especially children to freely compose poems as individ-uals walked the exhibit to be exceptionally admirable. Several microphones have been strategically placed to fa-cilitate user engagement with the project. The microphone captures the speaker's verbal communication as an audio input when it is used for speaking purposes. Once the audio has been acquired, it undergoes processing using speech recognition software. Google possesses the ability to perform sophisticated natural language pro-cessing, which it can utilize to decode spoken phrases. The process involves the conversion of spoken words into written text

after their recognition. To generate expressive or imaginative statements, this text may undergo additional processing. During this step, algorithms and creative programming techniques are employed to trans-form spoken words into written poetry or prose. Subsequently, the generated text or poetry is exhibited on LED billboards. To enhance the aesthetic impact, the display incorporates dynamic typography, a diverse color pal-ette, and animated elements (Bailiwick Express).

4.3. Illuminating Art, Newcastle (AR)

The renowned artworks housed in the Newcastle Art Gallery's collection will be utilized as an interactive nighttime activity, aimed at revitalizing underutilized public spaces across the city. The exhibition will feature a collection of artworks displayed on 15 illuminated light boxes, each equipped with augmented reality capabili-ties and interactive elements designed to provide further insights and explanations about the artworks. The light boxes were assembled at the location using durable, environmentally friendly materials, and they are equipped with solar panels and an internal battery that supplies electricity to the sensor-driven lighting components. The integration of augmented reality displays, designed for individual artworks, introduces a supplementary level of digital engagement. Light boxes have the potential to be relocated for utilization in other settings or significant events. The utilization of interactive smart city technologies to illuminate urban spaces with artistic displays during the night represents a new and unique approach to enriching the urban environment and fostering com-munity engagement. The fundamental basis of this concept comprises the implementation of an intelligent light-ing infrastructure strategically deployed in critical regions within the urban environment. Motion sensors have the capability to activate animations or modify the lighting arrangement upon detecting the presence of individu-als. Smart lighting solutions are specifically engineered to optimize energy consumption.

Figure 03: The art installation displays famous art and paintings (The City of Newcastle's 2021/2022 Annual Report, 2022).

The brightness levels of these devices can be modified in accordance with the surrounding ambient light condi-tions. Additionally, they have the capability to

automatically power down when there is no presence detected in the surrounding area. Furthermore, these devices can be set to optimize energy usage and minimize consump-tion. While the primary objective of these systems is to achieve an aesthetically beautiful and dynamic user expe-rience, they also place significant emphasis on ensuring safety and security. Surveillance cameras are employed for monitoring, and adequate protocols are implemented to mitigate the risk of abuse. (NAG, Newcastle Art Gal-lery Art Illuminates City Spaces at Night through Interactivity.)

4.4. Interactive kiosks, South Korea and Philadelphia

SK Telecom, the prominent wireless carrier in South Korea, has teamed up with QVOSS, a digital signage supplier, to establish a network of intelligent city kiosks in Daegu, the nation's third-largest urban center. The city has im-plemented modern smart kiosks strategically placed to enhance its disaster preparedness. These kiosks serve as vital communication channels, providing key public information in times of disasters such as floods, temblors, and fires. In addition to their flexibility, these kiosks can broadcast the local news and offer location information to both residents and visitors. The project's success is contingent upon the employment of advanced capacitive touch sensors supplied by Zy-tronic, a reputable company based in Newcastle. The implementation of the ZXY500 controllers in this project represents a significant milestone in commercial operations, signifying Daegu's dedication to advanced technology and preparedness for potential emergencies. The joint initiative has not only enhanced the disaster management skills of Daegu but has also established a groundbreaking precedent in the incorporation of advanced touch sensor technology into smart city infrastructure. The project shows the city's commitment to improving public safety and emergency communication, as well as delivering vital infor-mation and services to its inhabitants. Philadelphia, the most populous city in the United States, is actively em-bracing technological advancements by implementing advanced smart city kiosks. The local government aims to establish a contemporary and appealing public infrastructure that accommodates the requirements of both inhab-itants and tourists. Intersection, a prominent media and smart city technology business, assumes an essential role in this undertaking. Intersection has established a partnership with the Office of Transportation, Infrastruc-ture, and Sustainability (oTIS) to strategically install 100 LinkPHL kiosks in the Central Business District (CBD) regions, which experience significant levels of pedestrian activity. The smart kiosks have been specifically built to provide a wide array of services, hence improving the overall urban experience.

The LinkPHL kiosks offer a range of essential functionalities, such as the provision of mobile device charging facilities, complimentary high-speed WiFi connectivity, the ability to make phone calls, as well as access to maps and directions. Furthermore, these platforms function as a means of access to local emergency services as well as a source of artistic and historical knowledge, all of which are offered without any cost to users. These kiosks facilitate active engagement of both inhabitants and visitors in the city's current state by offering up-to-date information about local events, news, weather-related matters, and public initiatives. An aspect deserving special attention is the interactive maps, which serve the dual purpose of assisting users in locating the nearest LinkPHL hotspot and potentially serving as an essential tool in emergencies. The kiosks are equipped with an emergency alert function, enabling individuals to transmit an assistance code, facilitating a prompt response from local authorities during hazardous situations. Moreover, the LinkPHL kiosks fulfill a dual function by serv-ing as digital display platforms and exhibiting advertisements. This innovative approach assists the city in miti-gating the expenses related to the construction, maintenance, and regular updates of these intelligent kiosks. (Smart City Press, Digital Kiosks: Benefits).

Figure 04: Interactive kiosks (Smartcity, 2018).

4.5. The Solar Powered Interactive Light Installation in Croatia

The installation of LED lights Saudao ao Sol, also known as Welcome to the Sun, is a great example of public art that effectively integrates technical components, as designed by the Croatian architect Nikola Baic. The round flooring installation has three hundred multilayered glass panels that are equipped with photovoltaic cells. These panels have been engineered to collect direct sunlight during the day and exhibit an impressive light display dur-ing the night. The dynamic light work serves to augment the aesthetic appeal of Zadar, a scenic coastal destina-tion in Croatia. The artwork creates a mesmerizing experience that overcomes a mere mechanized exhibition of illumination. The design of the installation has been purposefully crafted to enhance engagement with the Sea

Organs, an accompanying audio artwork conceived by Baic and situated in close proximity. Photovoltaic cells are strategically placed at a specific location to provide environmentally friendly energy that is harnessed from solar radiation.

The Greeting to the Sun installation offers enough stored energy to illuminate the entire shoreline at a muchreduced cost. The exhibit employs many sensors to detect and identify motion and the presence of individuals. The above-mentioned sensors encompass cameras equipped with AI features, infrared motion sensors, and prox-imity sensors. Sound sensors are employed to capture ambient sounds in close proximity to the installation.

vertical movements. The movement of the seesaws triggers the activation of integrated lighting and audio sys-tems, resulting in a dynamic interaction of sound and light. This combination generates a continuously evolving and engaging encounter for every individual that visits. It promotes a collective sense of community and unity, facilitating the interaction of individuals from many backgrounds and age groups to participate in a mutually en-joyable experience. It functions as a central hub for social engagement, facilitating encounters, integration, and the formation of connections between individuals.To enhance the overall seesaw experience, the design team has developed a series of movies that are projected onto adjacent buildings.

Figure 05: Interaction between technology and people (Noorata, 2016).

Figure 06: Interactive lighting and wall display (McKnight & McKnight, 2020).

The installation utilizes live data from the audio sources to generate visual patterns of light. A variety of LED lights or other light sources are strategically arranged in a visually appealing pattern as an integral component of the project. Each of these lights can display a diverse range of colors and patterns, and they can be programmed accordingly.

4.6. Glowing Seesaws, Montreal

The joint efforts of Lateral Office, CS Design, and EGP Group resulted in the creation of an urban installation known as "Impulse" in Place des Festivals. The work comprises a collection of 30 seesaws, characterized by di-verse dimensions and each fitted with integrated sensors, light-emitting diodes (LEDs), and audio speakers. The standard approach employed by visitors to set the see-saws in motion is to assume a seating position and engage in

The movies get inspiration from the rhythmic motions of a seesaw, integrate architectural elements, and create a captivating visual sense of depth.

The selection of Impulse was the result of a public design competition to provide residents of Montreal with a unique winter experience in the Quartier des Spectacles. This innovative project not only boosts the visual appeal of the urban environment but also promotes active participation and involvement within the community. The Impulse project is an urban art initiative that relies on active engagement from individuals to initiate the sensory and acoustic experiences it presents.

4.7. Light Touch Wall, Canberra Centre

To transform the plain hoarding at Canberra Centre into a vibrant and immersive light installation, a fascinating

interactive artwork, "A Light Touch," has been skillfully developed. This creative project, which debuted at Canberra's Enlighten Festival, invites regular visitors to experience a new kind of communication via touch and light. An amazing 1,200 bright lights make up this piece, which is interactive thanks to custom-programmed circuit boards embedded with capacitive touch sensors. To boost the interactive factor, 1,200 specially created silicone light fixtures were strategically mounted to the hoarding, thrusting out at varied depths to induce tactile curiosity and dimensionality.

The power supply was used to wire each light panel individually, and a master electrician carefully coordinated this process using a centralized control system. The circular light fixtures cleverly include capacitive touch sensors, allowing visitors to enchantingly transform the LED colors with the touch of a fingertip, with a palette of up to seven unique hues. This rapid and unpredictable reaction broke age boundaries, allowing users to touch the wall as a canvas for building their unique, bright displays. Combining computational expertise, innovative lighting technology, and immersive user involvement, "A Light Touch" inspires creativity and helps many people who visit Canberra Centre feel more connected to one another. The dynamic interaction of sensors, color schemes, and user-generated displays gives the installation a feeling of emotion, optimism, and interactivity, making it a model of the merging of art and technology. Further, the Internet of Things (IoT) controls and app-based management increase the user experience, bringing in a new era of collaborative creative creativity (Canberra Center Light Wall).

5. Findings

Several examples of interactive technology in the form of art installations that fulfill their objectives of attracting attention and encouraging social interaction were found in the case study. The study indicates how playing a game on a billboard may inspire good conduct, raise understanding, educate morality, and develop connectivity among individuals of all ages and genders. The poetry wall is an excellent illustration of how innovative interac-tive technology can amaze people, particularly young people, by transforming text into poetic patterns and even facilitating organized thought. As an alternative to utilizing a mobile device, it may be a fun way to pass the time while waiting for public transit. A piece of art can tell you a lot about a nation's history and culture. Artworks are designed to do more than just look nice; they want to prevent crime with the use of cameras and sensors. The solar-powered light project utilizes solar energy, the crowd dynamics, and ambient sounds to provide illumina-tion within the public space during nighttime hours, thereby enhancing its overall ambiance and safety for com-munity gatherings. Smart kiosks are two examples of urban installations that contribute significantly to the quali-ty of city life in a variety of ways. They provide a variety of public services in

addition to offering essential tools for disaster management, such as real-time emergency information. In addition to promoting community in-volvement and safety, these initiatives also help bring in money that may be used to pay for public services. Fur-thermore, works like the lighting wall and interactive seesaws encourage positive interaction between people of all ages, improving connectivity, strengthening a sense of community, and making public places more lively and engaging.

6. Discussions

By installing sensors and adaptive lighting in urban areas, we can make them seem more alive and secure at all hours. The use of sensors to track foot movement and lighting conditions enhances security, particularly at night and during periods of low foot activity. Automatically brightening in response to nearby humans, "responsive lighting" increases visibility and decreases security problems. Programmable LED lights not only increase secu-rity, but also produce eye-catching displays with varying hues, intensities, and patterns, adding to the urban hub's aesthetic appeal. Connecting individuals using social media enhances the node's reach and appeal, with visitors sharing experiences and enticing additional people to the region. Kiosks serve as a central point for in-formation and amusement for the city's citizens as well as tourists. The use of music and interactive elements, such as dynamic seesaws, contributes to the creation of positive relationships and a lively atmosphere. In addi-tion, sensor data may help in risk management by monitoring pedestrian behavior, traffic patterns, and environ-mental conditions. Movement gestures provide useful information for urban planners as they work to improve the quality of public places and the safety of their residents. In conclusion, incorporating these technologies and factors may turn urban nodes into dynamic, inclusive hubs, enhancing the urban experience, increasing their at-tractiveness, and ensuring a lively environment even during off-peak hours.

7. Design Possibilities

The use of interactive technology, as shown in earlier case studies, may help revitalize and enliven "dead" or in-active urban areas. Visual art installations, interactive flooring, listening stations, speech functions, and billboard games are all examples of such technology. Visual art projects, for instance, may use projections to cast interac-tive artwork onto the exteriors of buildings, resulting in a lively and enjoyable visual experience. Visitors may have a more sensory and interactive experience with sculptures that react to their touch, motion, or sound. Using motion-sensitive LED flooring to encourage natural movement, normal gestures, and activity and improve the environment is a great idea. Especially in the dark, people may be guided down planned courses by sensors that project patterns or designs into the pavement. Interactive lighting that brightens as people approach it improves visibility and, in

turn, reduces the likelihood of accidents and increases people's sense of security. Having well-lit public spaces additionally discourages potential criminal activity. These engaging features may enhance security unexpectedly by encouraging users to share their stories on social media. Social media posts may serve as crowd-sourced monitoring, informing individuals of potential threats or significant events. Visitors may engage with music, sound effects, or recorded messages at listening stations or kiosks, which not only creates a more immersive auditory experience, but also serves as a safety function by picking up on distress signals and notify-ing authorities. By using Google Translate's voice capabilities, you may provide data and offerings in a variety of languages to meet the needs of a varied community. Interactive games employing augmented reality (AR) tech-nology on billboards may engage people and promote a sense of community through interactive activities. Public safety and community participation may be enhanced by using digital display boards to notify locals of future events, activities, and gatherings. In addition, public service announcements, such as updates to public health rules, may be successfully communicated to a large audience via digital screens. Participating in community-based art projects or challenges develops a sense of pride and ownership in the urban environment. This emo-tional connection motivates individuals to take better care of and better protect their natural surroundings. Areas of constant flux in conclusion, the incorporation of these interactive technologies may revitalize stale urban are-as, increasing activity, participation, safety, and a sense of community.

8. Conclusion

The utilization of interactive technology has played a substantial role in the revitalization of urban areas that previously lacked vibrancy, leading to the establishment of dynamic, safe, and engaging spaces that promote community engagement. The rapid urbanization and population increase in Dhaka, Bangladesh, has required the prioritization of public safety, community engagement, and the use of technology to improve urban spaces. To address these challenges, the use of interactive technology is an innovative and effective approach. To fully har-ness the potential of interactive technology, urban planners, legislators, and community leaders need to engage in collaborative efforts with technology specialists, artists, and the general public. By implementing these measures, Bangladesh has the potential to revitalize its metropolitan areas, enhance safety and security, and fos-ter a society that is more inclusive and interconnected for everyone who lives there.

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References

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initia-tives. *Journal of Urban Technology*, 22(1), 3-21.

An, J., & Yoshida, T. (2018). Use of Omnidirectional Images to Analyze Elderly People's Feelings of Insecurity about Snatch Occurrences on Roads. ISSN: 1346-7581, 301.

Cravalho, N. D. J. (2015). Revitalization Of "Dead Space" Through The Use Of Interactive Interventions, 1-20.

Dekel, A., Simon, Y., Dar, H., Tarazi, E., Rabinowitz, O., & Sterman, Y. (2005). Adding Playful Interaction to Public Spaces, 1-3.

Ferati, A., Saidi, A., & Limani, A. (2019). The Urban Node: Configurational Properties Of Urban Nodes In Tetovo. *Proceedings of the 12th Space Syntax Symposium.*

Costa, D. G., & de Oliveira, F. P. (2020). A prioritization approach for optimization of multiple concurrent sensing applications in smart cities. *Future Generation Computer Systems*, 108, 228-243.

Hassan, S. (2021). Interactive Architecture: Concepts, Objectives, Applications Review.

Joonsang, An., & Yoshida, T. (2018). Use of Omnidirectional Images to Analyze Elderly People's Feelings of Inse-curity about Snatch Occurrences on Roads, 301.

Yin, J., Chen, D., Yang, L., Tang, T., & Ran, B. (2015). Efficient real-time train operation algorithms with uncertain passenger demands. *IEEE transactions on intelligent transportation systems*, 17(9), 2600-2612.

Yovanof, G. S., & Hazapis, G. N. (2009). An architectural framework and enabling wireless technologies for digital cities & intelligent urban environments. *Wireless personal communications*, 49, 445-463.

Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institu-tions. In *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Govern-ment Innovation in Challenging Times*, 282-291.

Roussou, M. (2001). Immersive Interactive Virtual Reality in the Museum
.
Sakhi, W. R. (2011). Are Cities in Kerala Safe for Women? Research findings of the Study Conducted in Thiruvan-anthapuram and Kozhikode cities, Kerala 2009-11.

Sparacino, F. (2002). Narrative Spaces: bridging architecture and entertainment via interactive technology. MIT Media Lab.

Vishwanath, K., & Mehrotra, S. T. (2007). 'Shall We Go Out?' Women's Safety in Public Spaces in Delhi. *Economic and Political Weekly*, April, 1542-1548.

Kitchin, R. (2016). Getting smarter about smart cities: Improving data privacy and data security.

Chew, I., Karunatilaka, D., Tan, C. P., & Kalavally, V. (2017). Smart lighting: The way forward? Reviewing the past to shape the future. *Energy and Buildings*, 149, 180-191.

City streets turn unsafe at night. (n.d.-b). New Age | the Most Popular Outspoken English Daily in Bangladesh. https://www.newagebd.net/article/164442/city-streets-turn-unsafe-at-night

News | Eltis. (n.d.). https://www.eltis.org/in-brief/news/urban-nodes-and-freight-sector-key-challenges-and%20opportunities

German Press Agency - DPA. (2021, August 24). Nearly 50% of all women in UK feel insecure walking alone at night. Daily Sabah. https://www.dailysabah.com/world/europe/nearly-50-of-all-women-in-uk-feel-insecure-walking-alone-at-night

Brazilians feel unsafe to walk alone at night. (2022, December 11). Agência Brasil. https://agenciabrasil.ebc.com.br/en/geral/noticia/2022-12/half-brazilians-feel-insecure-walk-alone-night

Morshed, A. Z. (2018, February 21). Reimagining urban nodes in Dhaka. The Daily Star. https://www.thedailystar.net/supplements/rethinking-urban-spaces/reimagining-urban-nodes-dhaka-1538062

Report, T. (2023, January 29). Dhaka isn't safe after midnight: DMP. The Business Standard. https://www.tbsnews.net/bangladesh/dhaka-isnt-safe-after-midnight-dmp-576250

Katherinev. (2011, December 28). Billboard Smartphone games. TrendHunter.com. https://www.trendhunter.com/trends/billboard-smartphone-games

City Fireflies / Uncoded. (2012, January 27). The Superslice. https://thesuperslice.com/2012/01/27/city-fireflies-uncoded/

Bailiwick Express. (n.d.). Google has created a billboard that turns your words into poetry. Bailiwick Express Jersey. https://www.bailiwickexpress.com/jsy/life/technology/google-has-created-billboard-turns-your-words-poetry/

Art illuminates city spaces at night through interactive smart city technology. (n.d.). Newcastle Art Gallery. https://www.nag.org.au/about/media/art-illuminates-city-spaces-at-night-through-inter

Wikipedia contributors. (2023, July 7). Listening Post (artwork).
 Wikipedia.
 https://en.wikipedia.org/wiki/Listening_Post_(artwork)
S1T2. (2021, June 21). Canberra Centre Light touch wall. https://s1t2.com/projects/canberra-centre-light-wall

Smartcity. (2018, December 18). smartcity. https://smartcity.press/digital-kiosks-benefits/

City of Newcastle's 2021/2022 annual Report. (2022, November 29). Issuu. https://issuu.com/cityofnewcastle/docs/annual_report_21-22-issuu

Noorata, P. (2016, June 16). Croatia's Solar Powered Interactive Light Installation. My Modern Met. https://mymodernmet.com/nikola-basic-greeting-to-the-sun/

McKnight, J., & McKnight, J. (2020, May 8). Designers create winter installation for Montreal featuring 30 glowing seesaws. Dezeen. https://www.dezeen.com/2015/12/17/impulse-lateral-office-cs-design-installation-montreal-glowing-seesaws/

X-TRA. (n.d.). https://www.x-traonline.org/article/mark-hansen-and-ben-rubin-listening-post