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AI-Augmented Eco-Didactic Communication in the Public Space through Science Fiction Storytelling

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ABSTRACT

Artificial Intelligence (AI) is rapidly spreading across various aspects of the urban built environment. The opportunities presented by AI facilitate operational dimensions, encompassing the generation of personalized content, and the utilization of real-time data for environmental communication in the public sphere. While the future applications of AI can be forecasted to a certain extent, how these technologies will be integrated into the urban environment to enhance public communication remains uncertain. Conversely, science fiction storytelling has often proven prescient in anticipating future developments. This study aims to forecast the prospective applications of AI within public communication channels, employing science fiction narratives as a framework. The methodology involves qualitative analysis of a speculative scenario based on current trends and emerging technologies for exploring potential future applications of AI in urban public communication. As a result, the study highlights the need to explore AI technologies further and consider potential challenges and opportunities. Also, the study underscores the significance of science fiction storytelling in anticipating future developments. By drawing on science fiction narratives, researchers were able to project potential AI applications and their implications for public communication.

Index Terms—Artificial Intelligence, Eco-Didactic, Public Communication, Science Fiction

I. INTRODUCTION

Artificial Intelligence (AI) technologies are being rapidly utilized across many applications in the built environment [1], [2]. According to Precedence, AI's global market size expected to reach around 2,575.16 billion USD by 2032 [3]. They observed a transition from a global perspective to digitalization, which has a positive impact on the market. Efforts towards accessibility of AI are also expected to foster this growth. The report highlights that The Government of India, along with other countries, raised the budget allocation for Digital India to 477 million USD, aiming to enhance AI, big data, IoT, machine learning, cyber security, and robotics initiatives. Given these, harnessing AI technologies in the built environment is crucial for gaining insights into future applications. More specifically for enhancing environmental communication in the public sphere through sustainable applications. This research investigates the implementation of AI in the built environment, focusing on how users will interact with it in their daily lives and how these technologies can be more sustainable.

This quantitative study employs a scenario planning methodology to facilitate consensus-building regarding the likelihood of specific future developments [4]. Therefore, a futuristic scenario has been constructed in this study, drawing upon predictions from three science fiction TV series: Black Mirror, Westworld, and Altered Carbon.

When considering intelligence within the built environment, it is imperative to delve into the realm of smart cities. Studies have put forth frameworks for the transformation of smart cities [5], including considerations for technical standards [6], privacy, and security concerns [7]. Additionally, there are ongoing pilot projects focused on the development of smart cities [6]. Similarly, though on a smaller scale, Copenhagen-based architecture firm Bjarke Ingels Group (BIG) designed an AI-operated campus known as "Terminus AI City" [8] in China, laying the groundwork for the next-generation of urban environments and technology. Science

fiction storytelling has frequently depicted futuristic cities throughout the years. For instance, classic movies like Blade Runner, Ghost in the Shell [9], as well as novels such as 1984 [10], envisioned futures ahead of their time, with some aspects even becoming reality. For example, China's point system [11] bears resemblance to the mass surveillance depicted in Orwell's 1984. Technological features such as smart mirrors [12], smart lenses [13], and holograms [14], constantly shown in science fiction, are either already developed or currently in development. Furthermore, visual realities such as Augmented Reality [15], Parallel Reality [16], and Mixed Reality provide diverse avenues for public communication engagement of the future cities.

This study was conducted within the on-going Eco-Didactic Experiences in Built Environment project, multidisciplinary research, that focuses on diverse engagement modes in raising environmental awareness and encouraging dialogues about sustainability in the public realm. The main objective of the project is to improve the impact of the eco-didactic engagements leading to behavioral change and eco-action, particularly utilizing AI and digital technologies, and interactivity. The initial findings of the research indicate that interactivity and playfulness play a crucial role in enhancing engagement, suggesting that AI and digital technologies could further augment the experience [17].

Following sub-sections contain the literature review on eco-didactic communication in the public realm, AI representations in science fiction storytelling, and sustainable applications.

A. Eco-Didactic Communication in the Public Realm

"Eco-didactic" pertains to educational materials or experiences designed to promote ecological awareness and sustainability education [18]. This term merges ecology and didactics, which pertains to the science of teaching, but follows the artistic approach of Eco-Art to endorse informal learning. Eco-didactic experiences are geared towards educating and involving individuals, fostering community discussions on environmental issues, and motivating action towards sustainable development. In an eco-didactic experience, the given eco-message requires relativity and clarity. Weintraub (2012) states that eco-artists experiment with the boundaries of the art's endurance for change and they create artworks by inquiry, exploration, and experimentation [19]. Eco-art draws attention to interconnections in environmental matters, addresses tainted environments, educates people about environment, by mainly utilizing naturally sourced and sustainable materials [20]. Eco-art has a excessive emotional impact on the public which could result in behavioral change towards sustainability and engaging in eco-action [21], [22]. This impact is amplified by the artwork's location, which is often in the public realm, recognized as more effective than in a museum or an art gallery due to excessive human traffic. Public realm could offer diverse types of places for eco-artwork demonstrations, such as streets, gathering places like squares, and façades of landmarks or architecture. Each of these places offer different communicational engagement, for instance, streets provide daily contact, while gathering places creates an atmosphere to encourage people to engage in communication. Lastly, architecture and landmarks offer a canvas for visual engagements, which increase the significance of the experience [23]. Therefore, public spaces could be centers for raising awareness, community interaction, and promoting environmental action [24].

B. AI Representations in Science Fiction Storytelling

Although AI is predominantly known for its real-world applications in natural language processing, computer vision, and pattern recognition [25], science fiction narratives often highlight more captivating features and their societal impacts. These include intelligent humanoids [26], virtual and simulated realties [27], and driverless cars [28]. Recent productions in the genre offer a nuanced portrayal of AI and robots, emphasizing a complementary and cohesive interaction among humans, robots, and AI [29]. These stories explore the potential for the collective existence, depicting scenarios where technology seamlessly integrates with daily life and societal functions. This imaginative approach not only entertains but also provokes thoughts about the future implications of AI on human society.

C. Sustainable Applications for Communication through Building Façades

Building facades serve as crucial interfaces between urban environments and their inhabitants, offering significant potential as communication platforms within cities. Cucuzzella et al. [30] classified facade types, and here are some selected ones that could serve as communication tools.

1) Media façade

Utilizing the building façade as a canvas is an effective method to communicate messages to passersby [31] [30]. This type of building façade is classified as a media façade [30]. Employing building façades as canvases requires various techniques and technologies to convert stagnant architectural surfaces into vibrant and communicative mediums for artistic expression. Here's some examples of how it works:

Projection Mapping: Projection mapping (PM) involves projecting computer-generated imagery onto tangible surfaces through projectors, such as facades, seamlessly blending the virtual and physical realms to construct an augmented reality (AR) environment [32]. To align the architectural features of the façade with the projected content, specialized software needs to be used to map the contours and dimensions of the façade. This results in the perception of dynamic and three-dimensional visuals [32] that harmoniously blend with the architectural elements of the building.

Digital Displays: Building exteriors can incorporate digital screens, LED panels, or projection surfaces capable of presenting dynamic content instantaneously [33]. These displays are programmable to exhibit diverse media forms like images, videos, animations, and text, offering adaptability and versatility in conveying messages or crafting visual encounters [33].

Lighting Design: Lighting on facades is crucial in emphasizing building façades and enhancing visibility and dynamics [34]. There are some strategic lighting design examples, like architectural lighting fixtures, colour-changing LEDs, and dynamic lighting effects, which can transform the appearance of the façade and create captivating visual experiences [34].

By employing these techniques and technologies, building façades can be transformed into dynamic and engaging canvases that captivate audiences, convey messages, and enrich the urban environment with art and creativity.

2) Smart façade

A smart façade is called a building envelope structure that combines state-of-the-art technologies and sensors to enhance multiple facets of building functionality to adapt to environmental situations while encompassing energy efficiency, natural light utilization, thermal comfort, and the welfare of occupants. [35]. Another way to interact more with the building façade and the surrounding people is by utilizing smart skins. Essentially, smart skin is composed of smart materials, which have been the subject of extensive scientific research in recent years [36]. Incorporating these materials into architecture reduces the energy and material costs of buildings, enabling the creation of tailored environments that offer improved living conditions for people [36]. Schwartz [37], classified smart materials into three main categories as follows:

1. Property-changing
2. Energy-exchanging
3. Energy-exchanging (reversible)

Smart materials have the capability to alter their initial properties in response to environmental changes. They absorb energy and transform it based on the prevailing conditions. These materials can revert to their original properties when the environmental conditions change and can return to their initial form if necessary [36].

3) Parametric façade

The term "parametric" finds its roots in mathematics, denoting the utilization of specific parameters or variables that can be adjusted to influence the outcomes of equations [38]. Parametric design is a mathematical approach that represents design elements as adjustable parameters, yielding complex geometries [39]. Modifying these parameters creates new shapes concurrently.

Parametric façades offer a multifaceted enhancement to building design. Not only do they optimize performance in daylighting and energy efficiency [39], but they also elevate the aesthetic appeal of structures. These façades can dynamically create parametric patterns by incorporating kinetic elements, fostering engaging interactions with passersby (see Figure 1).

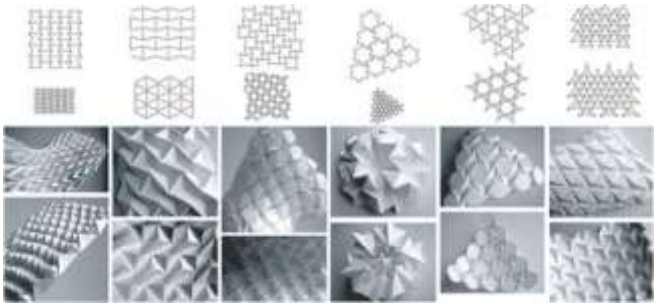

Figure 1 Example of parametric design of facades using origami forms [39].

Rather than using parametric tools for designing the facades, there are also some types of materials which are designed parametrically:

Aluminum foam: Open-cell metal foam possesses highly efficient qualities for heat exchangers, along with distinctive appearances and unique characteristics [40].

Open cell foams: The new (patented) process entails creating a "molding wafer" with a proprietary pellet material, followed by high-pressure injection casting of aluminum to form a solid block [40] (see Figure 2).

Figure 2 Example of parametric material [40].

II. MATERIALS AND METHODS

This research employs a qualitative scenario building approach, drawing upon emerging technologies and current trends to discover potential future applications of AI in digital communication within public spaces based on science fiction storytelling [4]. Especially during periods of swift transformation and uncertainty, scenario planning becomes crucial for shaping and envisioning several futures. It involves creating a range of structurally diverse, plausible, and potential scenarios that reflect the complexities, uncertainties, and diversities of future developments [41], [42], [43]. The types of scenarios this study adopts are defined as "explorative scenarios" which poses the question of what potential future events may unfold [44], [45]. Scenario building is a "storytelling discipline" [42, p. 736] that tells the stories for the development of possible worlds rather than forecasting the future [42], [43]. This study shares the outcomes of a science fiction storytelling-based scenario-building process, which formulated two conceivable scenarios concerning the future AI applications in the public realm, along with their societal implications. Three science fiction TV series were chosen due to their extensive portrayal of AI technologies: Black Mirror, Westworld, and Altered Carbon.

The research pattern follows several phases (see Figure 3), consisting of mixed method approaches such as background work, interviews, and survey.

Figure 3 Research design of science fiction-based scenario-building.

Upon selecting and watching the three TV series, five categories of futuristic features were identified: displays, services, transportation, social structures, and the built environment (see Table 2). These features were than compared among the TV series to identify similarities in their utilization.

1) Data Collection

To formulate the scenarios, insights on AI applications were obtained through both a stakeholder interview and a public survey.

a) Interview

An interview was conducted with Ozgur Ozkan, a stakeholder in computational practice and CEO of "Keymate.AI," a software company specializing in AI-based natural language processing. The interview focused on four key questions (see Table 1). The objective of this interview is to gather insights about the future of Artificial Intelligence technologies and their environmental impact.

Table 1 Stakeholder interview questions.

1. Could you provide a brief overview of your company and the Keymate.AI product?
2. Considering science fiction examples such as Black Mirror, Westworld, and Altered Carbon, to what extend do you think the AI depictions portrayed in science fiction will materialize in reality? Could you provide some examples?
3. Do you believe AI will promote individualization among people, or is there potential for it to serve as a platform to foster conversations? If so, do you have any ideas on how it could facilitate this platform?
4. In terms of environmental impact, AI technologies have the potential to reduce waste through consumption optimization, promoting more sustainable applications. However, it's important to consider the significant energy consumption associated with AI, as well as concerns related to privacy, biases, and the lack of regulations. Do you anticipate that these technologies will be used in a more sustainable manner in the future, or do you think there is a risk of further energy waste?

b) Survey

A public survey was conducted to assess the extent to which individuals desire the realization of AI and other futuristic technologies depicted in science fiction. The survey consisted of five categories, as shown in Table 2, and included images from TV series in the questionnaire. A Likert scale was used for the responses, with 1 being "not at all likely" and 5 being "very likely," to assess the participants' preferences regarding the likelihood of wanting the demonstrated smart technologies to become reality. Images from the selected TV series were included to illustrate the features under consideration.

Table 2 Futuristic features from the selected TV series.

Futuristic Features	
Displays 1. Lenses / Goggles 2. Mirrors 3. Screens 4. Holograms 5. Transparent devices (phones, tablets, control devices) 6. Augmented Reality	**Transportation** 1. Self-driving electric cars 2. Human drones 3. AI-operated electric ambulance **Social Structures** 1. Social media rating system 2. AI-operated prediction machine
Services 1. Smart assistants 2. Voice activated AI operation systems 3. Importing human consciousness into an android 4. AI humanoid servants / entertainers 5. AI humanoids for imitating/replacing deceased people 6. Stimulated Reality for elderly, disabled, and deceased	**Built Environment** 1. Minimal and naturalistic design 2. Spacious indoors and outdoors 3. Green spaces inside buildings 4. Vertical greenery on façades

III. Results and Discussion

Two scenarios were developed to anticipate potential futures for AI-augmented eco-didactic communications in the public realm, precisely within the next 5-15 years, considering some of the technologies could become reality faster than others. These scenarios delve into the future prospects based on science fiction contexts, as well as data gathered from both stakeholder interview and the survey. The scenarios are framed within a North American context, as both the interview and public survey were conducted in English in Montreal, QC. In this section, the interview and survey results are presented first, followed by the scenario-building analysis.

1) Identification of AI Features and Comparison

After reviewing the three TV series, five categories of futuristic features were identified: displays, services, transportation, social structures, and the built environment (see Table 2). These features were than compared across the TV series to identify similarities in their usage. The comparation revealed common features such as smart lenses, screens, and mirrors, Augmented Reality, smart assistants, and AI humanoids. The representation of smart technologies was largely consistent in terms of functionality and design, as well as their regulation in society.

2) Interview Results

The interview conducted with software engineer Ozgur Ozkan, CEO of Keymate.AI[1] which is an "information source collection software," provided insightful perspectives on the integration and future implications of AI in society.

Keymate.ai idea was born as a Google Search tool integrated in ChatGPT, enhancing the model's ability to access and utilize global information for more accurate and comprehensive responses during interactions. He explains their product as "It gives every brain, whether human or AI, essential tools to retrieve the right information in order to produce better insights and meaningful knowledge work."

When asked about the likelihood of science fiction examples becoming reality, he cited Black Mirror as the most realistic, given its alignment with actual technological advancements. He explained how ideas from popular culture influence technological inventions, emphasizing that these innovations "require public demand and investor interest." He noted that for substantial investments to occur, the public must be swayed by popular culture. This underscores the need for popular culture to way in the public to secure significant investments.

When asked whether AI will promote individualization or foster conversations, he emphasized that AI primarily empowers individuals by enhancing their reasoning abilities, thus promoting individualization. He argued that AI lacks the potential to serve as a platform for collectivist conversations due to two main reasons. First, AI cannot provide a common ground to dictate specific viewpoints on global issues. Despite this limitation, AI is designed to assist individuals effectively but cannot and arguably should not dictate human actions. However, he noted that some people have started mentioning ChatGPT on platforms like X during controversial discussions. This trend, though interesting, should not be seen as a ground truth since AI is trained to be helpful and can easily generate responses that align with users' desires.

For the last question about the environmental impact of AI technologies, particularly in terms of their potential to reduce waste through consumption optimization versus their significant energy consumption, he expressed a skeptical view on future sustainability. He highlighted that energy is a critical resource for those in power and that sustainability often functions more as a marketing slogan rather than a genuine practice when it comes to products. In a capitalist system, he explained, individualism dictates what is considered waste or sustainable. Sustainable brands tend to be more expensive, and thus, AI might become less sustainable as influential individuals and corporations prioritize cost reduction. He underscored that the core

[1] Keymate.ai, official website, https://www.keymate.ai

issue will be the drive to lower expenses for those leveraging AI, rather than a genuine commitment to sustainability.

The interview with Ozgur Ozkan, CEO of Keymate.ai, sheds light on the multifaceted role AI is poised to play in the future. His insights highlight both the potentials and the pitfalls of AI integration within our societal framework. Ozcan's perspectives underscore the realistic portrayal of AI in popular culture, especially in shows like Black Mirror, reflecting current technological advancements. He emphasizes the critical role public demand and investor interest play in bringing these technologies to realization. Moreover, Ozkan's views on AI's promotion of individual empowerment over collective dialogue highlight the nuanced reasoning abilities, its capacity to foster meaningful collective conversations remains limited. Finally, Ozkan's skepticism regarding the sustainability of AI technologies calls attention to the pressing need for a balanced approach. He highlights the tension between the marketing of sustainability and the real-world practices driven by economic incentives. This raises important questions about the future direction of AI development and the ethical considerations that must accompany it. In conclusion, Ozkan's insights provide a valuable framework for understanding the potential trajectories of AI. They highlight the need to critically assess how these technologies are developed and deployed, ensuring they serve the broader good while navigating the complexities of public demand, investor interest, and sustainability.

3) Survey Results

Thirty individuals participated in the survey, which was divided into five categories and thirteen sub-categories. Several sub-categories, as shown in

Table 2, were combined for analysis. A Likert scale was adopted with 1 being "not at all likely" and 5 being "very likely." Participants' ages ranged from 18 to 54, with over 50% falling within 25-34 age group (see Figure 4).

The most three desired sub-categories were smart screens and mirrors, smart assistants and voice activated operation systems, along with futuristic and naturalistic design. These were closely followed by self-driving cars and flying vehicles. This preference indicates that people tend to choose the safest and least risky options regarding the level of impact on their lives. Conversely, the least desired sub-categories were simulated reality, AI-operated behavioral prediction machine, social media rating system, and AI humanoids. This indicates that individuals are hesitant about artificial intelligence intervening in social life.

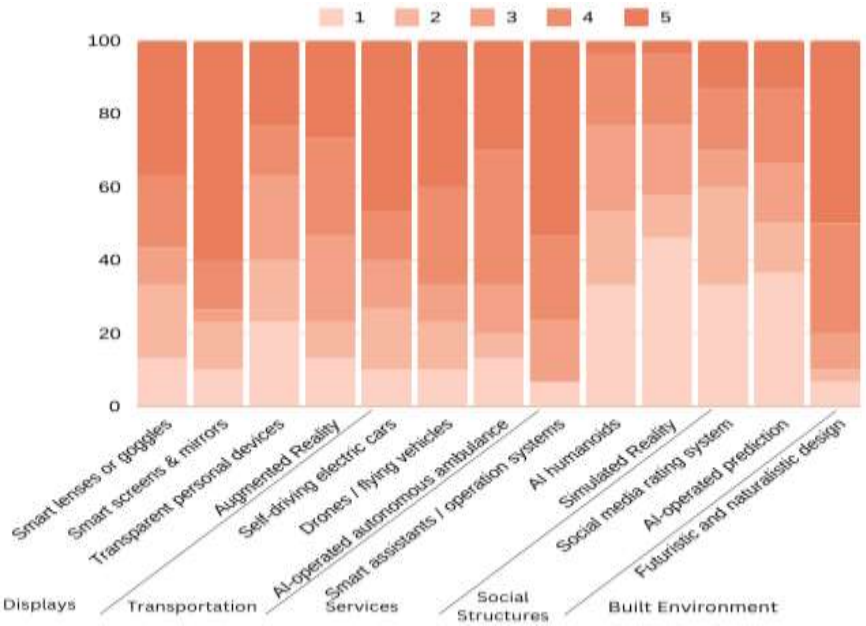

Figure 4 Survey results.

4) Scenario-Building Results

Two scenarios were developed following the framework crafted by Gudowsky et al. (2023) in their study, "Augmented futures? Scenarios and implication of augmented reality use in public spaces" [15]. These two scenarios explore potential applications and implications of AI technologies over the next 5 to 15 years, specifically within the context of the North American public environment. Based on the survey results and insights from the stakeholder interview, two contrasting scenarios were crafted. The first scenario represents a low-risk approach, emphasizing applications that prioritize individual control and are subject to stringent and proper regulation. The second scenario depicts a less regulated environment, focusing on surveillance. The mutuality between the scenarios is the eco-didactic context.

a) Scenario 1 – participatory communication in the public realm

Summary: In this framework, public spaces are transformed into participatory common grounds for eco-didactic communication. The use of AI technologies is restricted to contributing to into social constructs, with privacy safeguarded through regulated applications. Public communication about environmental issues and sustainability will enhance and expand informal sustainability education among citizens.

Regulation: The use of AI technologies, particularly in applications involving data collection, is governed by strict regulations emphasizing data protection and privacy. These regulations ensure that AI applications promote diversity and serve the common good while safeguarding individual autonomy and preventing bias. Moreover, these guidelines are designed to prevent the misuse of AI by mandating transparency and accountability in AI development and deployment. To further enforce these principles, big technology companies are subjected to exceptionally high tax payments, ensuring that they contribute fairly to the public infrastructure and societal welfare.

AI and other digital technologies: Smart public displays, including screens, mirrors, and projectors, as well as personal displays such as smart lenses or goggles are available for public use. Additionally, augmented reality technology enhances the public experience. These displays offer a participatory experience, enabling interaction through motion or voice-controlled systems. Furthermore, real-life data collection and generative AI algorithms are employed to enhance relatability and personalize the context even further. Voice-activated smart assistants and operation systems, along with mechanical applications are also integrated to support citizens with special needs, such as mobility assistance. The operating systems additionally optimize energy consumption by implementing efficient algorithms and automated power management features in public spaces. Predictive AI algorithms are employed to calculate the energy consumption for events, aiming to minimize waste effectively. Sustainable and renewable energy sources such as solar power are harnessed, while waste is minimized through design strategies such as parametric design and smart façade applications.

Sustainability and environmental content: Informal educational content promoting sustainability is collaboratively produced by artists, educators, and other professionals under the supervision of institutions. This multidisciplinary approach ensures a rich and we right perspective, enhancing the overall effectiveness and reach of the educational material. The arts, music, and event industries contribute by organizing creative events that raise awareness about environmental issues and encourage proactive behavior. These events range from eco-themed art exhibitions and music festivals to interactive theatre performances and immersive environmental workshops. By engaging the public in unique and memorable ways, these industries help translate complex sustainability concepts into tangible, relatable experiences. AI technologies, particularly generative AI, are instrumental in personalizing this content, making it more engaging and accessible to a wider audience. Generated AI can create tailored educational materials that cater to individual preferences, learning styles, and interests. For instance, a person with a keen interest in marine conservation might receive personalized content focusing on ocean health and the impact of plastic pollution, while someone else might engage with interactive simulations on renewable energy and sustainable agriculture. By leveraging AI, messages about sustainability are not only tailored to individual preferences but also dynamically updated to reflect the latest research and trends. This ensures that the content remains relevant and impactful, fostering a more informed and active citizenry committed to environmental stewardship. Furthermore, AI-driven platforms can facilitate interactive and adaptive eco-didactic experiences. For example, virtual reality and augmented reality technologies can transport learners to endangered ecosystems or simulate the effects of climate change, providing immersive experiences that deepen understanding and empathy. These technologies can also enable real-time feedback and assessment, helping educators refine their approaches and better address learners' needs. In addition to enhancing individual learning, AI technologies support broader community engagement by creating platforms for collective action. Social media campaigns powered by AI can mobilize communities, encouraging them to participate in local sustainability initiatives and share their experiences. This creates a ripple effect, where informed individuals inspire others to adopt sustainable practices, amplifying the impact of educational efforts.

Public space and society: As technological advancements progress, individuals increasingly seek personalized experiences and interactions, driving a trend toward greater individualization. Consequently, people expect public spaces to adapt to their specific needs and preferences, reflecting a shift towards a more tailored and customizable environment. In this evolving landscape, public spaces are equipped with advanced technologies that cater to individual preferences and facilitate seamless interactions. For instance, smart benches that charges devices using solar power, interactive information kiosks that provide real-time updates, and augmented reality-enabled navigation systems that guide users based on their interests are becoming commonplace. These innovations not only enhance convenience but also promote public engagement by offering immersive and context-aware experiences. The data-driven approaches of AI technologies, help create environments that are responsive to the needs of individuals, ensuring that public spaces remain relevant and user-friendly. As public spaces become more individualized, there is a potential for increased social fragmentation, as people may prefer virtual interactions over face-to-face communication. However, there is also an opportunity to foster community engagement through shared digital experiences and collaborative projects. By balancing personalization with inclusivity, public spaces can become vibrant hubs of social interaction and cultural exchange, promoting a sense of community and belonging.

b) Scenario 2 - AI-operated social structure

Summary: In this framework, public spaces are also converted into participatory forums for eco-didactic communication. The use of AI technologies is privatized and subject to a minimum regulation. Public discussions on environmental issues and sustainability are actively encouraged to disseminate knowledge and foster community engagement.

Regulation: The use of AI technologies, especially in applications involving data collection, is subject to minimal regulation. Data protection and privacy measures are weak, allowing companies to collect and utilize vast amounts of personal data with modest oversight. These lenient regulations do not prioritize diversity or the common good and offer limited safeguards for individual autonomy, leading to potential biases and misuse of AI systems. Transparency and accountability in AI development and deployment are not mandated, resulting in a lack of public trust. Additionally, big technology companies face low tax obligations, enabling them to maximize profits with minimal contribution to public infrastructure and societal welfare.

AI and other digital technologies: AI and digital technologies are deeply integrated into everyday life. Smart displays, virtual assistants, and AI-operated systems provide seamless and intuitive interactions for users. AI humanoids, designed to resemble and behave like humans, offer a range of services, making sophisticated human-robot interaction a common occurrence. Simulated reality and virtual reality headsets became more advanced and user friendly, allowing for immersive experiences in entertainment, education, and professional training. These headsets are widely adopted, offering users the ability to create and explore limitless virtual worlds. Augmented reality and mixed reality technologies will overlay digital information onto the physical world, enhancing real-world experiences with interactive elements. Generative AI plays a significant role in creating dynamic and personalized content for public spaces. This technology will be used to design engaging attractions, such as interactive art installations and customized advertisements, that adapt to individual preferences and behaviors. Predictive algorithms will optimize various aspects of urban living to allocate resources efficiently, however the computational power required for these advanced AI systems will be substantial leading to significant energy consumption.

Sustainability and environmental content: Educational or artistic content designed to raise awareness about sustainability is produced by a diverse group of contributors, including educators, artists, professionals, and even individual enthusiasts. This collaborative approach ensures a rich variety of perspectives and expertise, enhancing the overall quality and impact of the content. Workshops and interactive sessions are organized in both virtual and simulated realities to educate people on sustainable solutions and practices. These digital environments allow for immersive learning experiences that can be tailored to different audiences, making the education process more engaging and effective. For instance, participants can virtually explore eco-friendly buildings, engage in simulated waste management activities, or experience the impact of climate change through augmented reality scenarios. Personalized learning paths are being created to cater to different learning styles and preferences. Utilizing advanced AI algorithms these paths can adapt to individuals process and interests, providing customized content that maximizes understanding and retention. For example, someone interested in renewable energy might receive tailored modules focusing on solar and wind power while another learner might explore sustainable agriculture or water conservation techniques. In addition, a social media rating system is employed to evaluate the sustainability efforts of companies and individuals. This system allows the public to rate and renew entities based on their environmental practices, promoting transparency and accountability. High ratings can boost a company's reputation and encourage others to adopt more sustainable practices, while low ratings can highlight areas needing improvement. This fear driven feedback mechanism fosters a culture of sustainability, where everyone is encouraged to contribute to environmental stewardship.

Public space and society: Public spaces have become more vibrant and responsive, offering tailored experiences that cater to the needs and interests of diverse populations. Advance AI technologies enable these spaces to dynamically adapt to the preferences and behaviors of individuals, creating engaging and interactive environments. For instance, smart displays and interactive installations can provide personalized information, entertainment, and services, enhancing the overall user experience. However, this increased personalization comes at a cost. The utilization of data to deliver these tailored experiences is often not transparent, leading to significant privacy concerns among individuals. There are concerns among individuals about how their data is collected, stored, and used. Furthermore, the concept of public space has shifted towards virtual environments. Virtual and augmented reality technologies have created new digital public spaces where people can interact, socialize, and collaborate. These virtual spaces have the potential to facilitate interactions among strangers, breaking down geographical barriers and fostering new forms of social engagement. Virtual environments can host a wide range of activities, from virtual concerts and art exhibitions to collaborative workspaces and educational events.

IV. CONCLUSION

This study presented the results of a scenario-building, grounded in science-fiction storytelling, focused on AI-augmented eco-didactic communications in public spaces. Due to the limited number of survey

participants, the scope of this preliminary study was narrow and does not represent a broader population. However, the results of this study emphasize the significance of community dialogues around sustainability regarding which futures are deemed desirable. This study demonstrated two different scenarios illustrating the implementation of various AI features. These scenarios were: (1) participatory communication in the public realm, (2) AI-operated social structure in which features more and less desirable technologies. Scenario 1 highlights a future where public spaces are enhanced by AI technologies and creative collaborations to foster sustainability education, community engagement, and personalized experiences, while ensuring privacy and data protection through strict regulations. Scenario 2 envisions public spaces transformed into participatory forums for eco-didactic communication, with AI technologies deeply integrated into everyday life but subject to minimal regulation. This minimal oversight raises significant privacy concerns as vast amounts of personal data are collected and used without strong protections. Advanced AI technologies, such as smart displays, AI humanoids, and immersive virtual and augmented reality experiences, provide personalized interaction and optimize urban living. Sustainability education is promoted through collaborative efforts and innovative AI-driven content, but the overall approach emphasizes individual convenience and corporate profit over strict data privacy and collective welfare. Scenario 1 strikes a balance between technological advancement and social welfare by creating an inclusive environment that respects individual rights while leveraging AI for sustainable development.

Involving diverse stakeholders, including artists, educators, and professionals, in producing educational content could create more engaging and impactful sustainability messages. While personalized experiences could enhance user engagement, it is essential to maintain transparency in data utilization to address privacy concerns. Balancing these aspects is key to creating a trustworthy AI ecosystem. AI technologies have the potential to support sustainable practices. However, the significant energy required for advance AI system needs to be managed carefully to avoid negating the environmental benefits. Virtual and augmented reality technologies can create new digital public spaces that may facilitate interactions and collaborations. These virtual environments offer unique opportunities but also pose challenges related to the nature of social interactions. Ensuring that AI-enhanced public spaces promote inclusivity and community engagement is vital. Public spaces should cater to diverse populations and foster a sense of belonging, counteracting the trend towards individualization.

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