



**Aalborg
University**

FUTURE SCENARIO OF TOKYO

**URBAN LIVABILITY FOR FOREIGNERS IN TOKYO
THROUGH MOBILE TECHNOLOGIES AND AR**

Group:
MSc04 group 19

Delivery:
May 2024

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Project Title:

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Page numbers with appendix:

71

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Abstract

This research investigates the role of emerging mobile technologies in enhancing urban environments, with a particular emphasis on Tokyo, from the viewpoint of foreign visitors and residents. The primary question it addresses is whether Tokyo can leverage these technologies to improve its hospitality for foreigners, and if so, what a strategically envisioned future Tokyo might look like. The study delves into examples of emerging mobile technologies in global urban settings, and evaluates their impacts, opportunities, and challenges within Tokyo. Additionally, it seeks to understand the long-term perspectives, expectations, and needs of foreigners in Tokyo, aiming to integrate their views into planning and development strategies.

The study reveals that currently smartphones are essential for navigation and language translation for foreign visitors. While Tokyo is currently perceived as clean and safe, but also as being strongly crowded with difficulties of navigating complex transportation networks as non-Japanese speakers. Looking to the future, there is an expectation for technologies that improve, especially navigation and communication engagement. In urban context, for the city of Tokyo in 2035, Livable City scenario is seen as the most desirable future, due to its feasibility and the perceptions of the Japanese urban landscape with a highly transit-oriented urban system and adequate green spaces.

Moreover, as an example of usage of AR glasses in urban settings in the future, it should meet specific needs in each different setting. Although it is crucial that enhancing user experiences while preserving human interactions. Strategic urban design scenarios include creating AR community spaces as an example. These strategies aim to make urban spaces more inclusive and enjoyable for foreigners.

By focusing on these aspects, Tokyo can leverage emerging mobile technologies to become a more comfortable and attractive destination for foreign visitors and residents.

Table of Content

I. Introduction.....	6
Context of the research.....	6
Research Question.....	9
II. Research Design.....	10
Philosophy of science.....	10
Pragmatism.....	10
Hermeneutic.....	10
Theoretical Framework.....	12
Studying Future.....	12
Human-Centered Design.....	14
Methodology.....	15
Literature Review.....	15
Survey.....	15
Scenario.....	15
III. Literature Review.....	17
Emerging mobile technologies.....	17
Mobile Technologies and Internet of Things:.....	17
Metaverse.....	18
Extended Reality and Augmented Reality.....	18
Emerging mobile technologies and Tokyo.....	20
Smart City and Tokyo.....	20
Tokyo Metaverse and AR.....	21
Personalized Push notification.....	21
Gamification.....	21
IV. Survey.....	24
Data Collection.....	24
Survey Design.....	24
Analysis Methods.....	25
Survey Result and Analysis.....	27
Demographic Overview.....	27
Current Usage of Mobile Technology.....	30
Current Perspectives of Tokyo.....	33
Future Scenarios for Future City.....	35
Future Expectations for Technology in Tokyo by 2035.....	39
Future AR Interaction in The City.....	41
Qualitative Research.....	46
Future Scenarios for Future City.....	46

Future Expectations for Technology in Tokyo by 2035.....	51
Future AR Interaction in The City.....	54
V. Conclusion.....	60
Translation and Navigation Needs for Foreigners in Tokyo.....	61
Concerns Over Human Interaction and Community Among Foreigners.....	62
Strategic Scenario with AR for Urban Design.....	63
VI. Reflection.....	66
References.....	68
Appendix.....	75

List of Figures and Images

Figure1: Changes in Japan's total population.....	6
Figure2: Age and Gender.....	26
Figure3: Length of Stay.....	27
Figure4: Nationality.....	28
Figure5: Daily Smartphone Usage.....	29
Figure6: Most Frequently Used Mobile Applications in Tokyo.....	30
Figure7: Perception of Tokyo.....	32
Figure8: Challenges of navigating Tokyo.....	33
Figure9: Likelihood and Preference of different scenario.....	37
Figure10: Expectation of technology by 2035.....	39
Figure11: Preferences for AR Glasses Interaction at Train Stations.....	41
Figure12: Preferences for AR Glasses Interaction at Shopping Street.....	44
Figure13: Preferences for AR Glasses Interaction in Parks.....	43
Figure14: Combined Preferences for AR Glasses Interaction Across Settings.....	44
Figure15: Open ideas for AR Glasses Interaction in Parks.....	54
Figure16: Open ideas for AR Glasses Interaction in Shopping Street.....	55
Figure17: Open ideas for AR Glasses Interaction in Parks.....	56
 Image1: Tokyo Station.....	 5
Image2: Pokémon GO screen.....	21
Image3: Fast-Mobility City.....	34
Image4: Digital City.....	35
Image5: Livable City.....	35
Image6: Fortress City.....	36

I. Introduction

Context of the research

Tokyo is one of the most densely populated cities in the world with 37 million people (*DEMOGRAPHIA*, 2023). In terms of transportation, Tokyo's public transportation system is extensive and efficient but can become overcrowded during peak hours. Traffic congestion and complexity are also a problem for tourists.



Image1: Tokyo Station

Despite being populated, it faces challenges related to declining population rates and the necessity to attract more visitors and potential inhabitants as a whole country. According to projections by Japan's National Institute of Population and Social Security Research, by

2070, Japan's population is expected to decrease to 87 million from the current 126 million. In this future demographic, non-Japanese residents are anticipated to make up 10.8% of the population, a significant increase from 2.2% in 2020 (Nakamura, 2023).

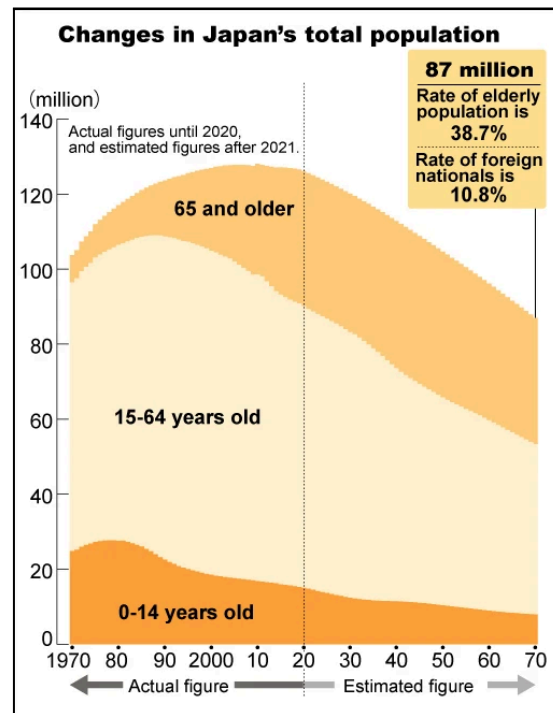


Figure1:Changes in Japan's total population (Nakamura, 2023)

Moreover, in September 2023, inbound tourism to Japan reached 96.1% of pre-pandemic levels, with 2.18 million tourists arriving from overseas. The COVID-19 pandemic significantly impacted global tourism, halting travel as countries imposed restrictions. With improving conditions and easing restrictions, there is now a widespread expectation of a tourism resurgence, often described as "bouncing back" (Swift, 2023).

Furthermore, there is a limited number of mobility research projects and urban designs that focus on the perspectives of foreign visitors and residents in Japan, including in Tokyo. This is due to its unique historical and political context as an isolated island nation with a predominantly mono-racial society (Yamashiro, 2013), unlike other global cities. Japan's immigrant population is extremely low, at about 2% of the total population. Although over 30% of them reside in Tokyo, the city's immigrant population is only 3.98% (Nippon Communications Foundation, 2019), much lower than in cities like New York and Paris, where immigrants make up over 30% of the population (City of New York, 2024; OECD,

2024). Therefore in this project, I would like to focus on the “perspective of foreigners,” emphasizing creativity and human-centered urban design, which aligns with the aforementioned background.

In recent years, Society 5.0 is a concept developed by the Japanese government, aimed at integrating digital technology into every aspect of society to achieve inclusive society and solve social problems. This concept is particularly significant for addressing challenges such as Japan’s declining and aging population. Key features include a human-centered approach, blending digital and physical worlds, fostering innovation, sustainability, and collaboration among people. Ultimately, Society 5.0 aims to create a future where technology empowers individuals and improves society's quality of life (Cabinet Office, 2024; Deguchi et al., 2020).

Mobile technologies, particularly smartphones, play a role in collecting and transmitting real-time data, thereby facilitating connectivity with other Internet of Things (IoT) infrastructure (Harari et al., 2016). For example, real-time data connectivity can provide up-to-date information on public transportation schedules, allowing individuals to plan their journeys more efficiently. Experts are increasingly discussing the potential impacts of emerging mobile technologies such as Augmented Reality (AR); as noted that (Franklin, 2017; Telecom Review, 2022),

“Everyone begins using AR glasses instead of their smartphone.”

Additionally, AR technologies have the potential to significantly transform urban environments. They enhance even more navigation, promote exploration, and enable informed decision-making for travelers (Archangelskaya et al., 2022).

This research aims to understand and foresight how these emerging mobile technologies can be leveraged to enhance the attractiveness of Tokyo as a destination for foreign tourists and residents. By focusing on technology's role in urban development and its impact on foreign visitors, this study will contribute valuable insights into the integration of diverse visitors through digital innovations in Tokyo.

Research Question

This research explores the impacts of mobile technologies in urban environments, with a specific focus on Tokyo and foreign perspectives. The research was guided by the following questions.

Main Question: Can Tokyo make it a more comfortable place for foreign visitors and foreign residents with emerging mobile technologies? If so, what is the strategic scenario of the future city of Tokyo?

Sub-questions:

1. What are examples of emerging mobile technologies in urban environments?
2. What are the impacts associated with emerging mobile technologies for foreigners in Tokyo currently?
3. What are the perspectives, expectations and needs of foreigners in Tokyo in the long term?

II. Research Design

This section describes the overall approach to the research, including the philosophical underpinnings, the theoretical framework, and the methodology. It sets out the rationale for the chosen methods and how they will help to answer the research questions.

Philosophy of science

I begin with the Philosophy of Science, specifically exploring Pragmatism and Hermeneutic to illustrate the philosophy that are grounded in this project.

Pragmatism

This research employed a mixed-methods research design to explore the research questions. The primary research question involves a practical problem, that is making Tokyo more comfortable through mobile technologies for foreigners. This question requires a solution-oriented approach. Therefore pragmatism works well (Hammersley, 1990), as it allows to identify effective strategies. Sub-questions are examples of technologies and their impacts can be investigated through systematic literature review and quantitative methods with survey to gather broad patterns. Qualitative methods with open questions can explore strategic scenarios, adapting insights from multiple contexts to Tokyo's unique environment.

Hermeneutic

Understanding the perspectives, expectations, and needs of foreigners in Tokyo requires qualitative research methods grounded in the hermeneutic approach. This methodology helps uncover deep insights thinking through back and forth into the subjective experiences and social contexts of these individuals. This interpretive process leads to a "fusion of

horizons" where different perspectives and interpretations converge, creating a shared understanding of the complex reality (Gadamer, 2006). Exploring the impacts of technology use in Tokyo also benefits from this interpretative approach to grasp the subtle experiences of foreigners influenced by cultural, social, and personal factors.

Overall, this approach facilitated an in-depth understanding of both the quantitative and qualitative aspects of mobile technology utilization and the perceptions of foreigners in the dynamic city of Tokyo. This combination ensures that the research is anchored in practical outcomes and sensitive to the complex human factors that influence the success of technological interventions in urban environments.

Theoretical Framework

I discuss Theoretical Framework next, presenting key concepts as called lenses for this project such as Studying Future and Human-Centered Design. These lenses are instrumental in exploring the evolving dynamics of emerging mobile technologies and urban environments, particularly focusing on foreign perspectives regarding Tokyo.

Studying Future

Complexity

This research is anchored in John Urry's complex systems theory as articulated in his work, "What is the Future?" (Urry, 2016). Urry advocates for understanding the future as an emergent property of complex, interdependent systems involving social, technological, and environmental factors. These systems are inherently unstable, subject to sudden shifts, and their outcomes are unpredictable.

Tokyo, as one of the most populated city globally, Japan's declining population necessitates attracting more visitors and inhabitants to sustain its urban vibrancy. This research investigates how technologies such as AR glasses can transform Tokyo's urban landscape, making it more attractive to foreign visitors and residents. It faces multiple challenges with various factors. This framework is particularly relevant for examining the challenges but also potential of emerging mobile technologies to enhance the urban experience and urban design.

This theory facilitates a multidisciplinary analysis that bridges insights from social, urban planning and technology studies. This concept is meaningful for addressing urban futures, which are complex issues without straightforward solutions.

Mobility Turn

"Mobility Turn" posits that mobility goes beyond mere physical movement from A to B, encompassing the flow of information, capital, and culture among different societal networks. Urry argues that understanding these flows is crucial for comprehending modern societies, particularly in how they adapt to and are shaped by various forms of mobility. However, an essential aspect of the Turn is called the tipping point is unpredictable. It cannot be read off from linear changes in existing systems. Just as the internet and the mobile phone emerged unpredictably, as noted,

“Just as the internet and the mobile phone came from ‘nowhere’,”

so too will the tipping point towards the future (Urry, 2012).

Moreover, it generally happens from not large-scale system change but “small” change. New technologies, however, take center stage in people's urban lives eventually and redefine how individuals interact with their environment, commute, communicate, and access services (Urry, 2012). In this project, this concept provides a foundational perspective of the technology's impact on the urban landscape and design of Tokyo for the future.

Scenario

As discussed above, in urban settings, new technologies are increasingly dominant and redefine human mobility unexpectedly. This highlights the importance of exploring "what if" scenarios, that asking the ‘what if?’ question, the imaginary question, stretching our minds, exploring what would happen if so. It helps to imagine potential futures and prepare for the unpredictable ways in which technology might reshape urban life (Shearer, 2015).

Scenario Planning, a strategic planning method originally developed by Royal Dutch Shell, involves constructing multiple, plausible future contexts in which today's decisions might play out. This method is particularly valuable in fields like new technology forecasting, where it contends with uncertainties (Cornelius et al., 2005; Hussain et al., 2017). In this project, Scenario Planning is instrumental for examining different future scenarios for urban spaces.

This approach not only aids in envisioning potential futures but also assists in preparing adaptive strategies that can handle emerging technological trends and the Turn.

John Urry developed four scenarios -Fast-Mobility City, Digital City, Liveable City, and Fortress City (Urry, 2016) that offer diverse visions of the future, each highlighting different societal values and their implications for urban landscapes. These scenarios assist in understanding the broader implications of technological adoption in urban spaces (Urry, 2016). In this project, I utilize these scenarios in our survey. It will be detailed in the Survey section.

Human-Centered Design

Cities for people (Gehl, 2010), advocated by urbanist Jan Gehl, focuses on designing cities that cater to the needs of their inhabitants. This people-centered approach emphasizes the importance of understanding the human scale and interactions in urban spaces. Gehl's principles of urban quality, such as connectivity, inclusivity, and aesthetic enjoyment, serve as a guideline for developing urban spaces that are not only functional but also nurturing.

In the context of Society 5.0, as I introduced in Introduction, human-centered design becomes even more important. This approach can reconcile people and technology. Urban design within Society 5.0 would focus on creating spaces that enhance quality of life without overshadowing human needs (Streitz, 2019).

The project values this as it aligns with the goal of transforming Tokyo into a city that prioritizes the comfort and satisfaction of its residents and visitors. The research underscores the importance of creating urban spaces that are not only technologically advanced but also human-centered.

Overall, these theoretical frameworks collectively provide a valuable lens through which the future of Tokyo, especially in the context of emerging mobile technologies and their impact on foreign visitors, residents in urban design, can be critically understood.

Methodology

Finally, this section details the processes employed to gather and analyze data.

Literature Review

Firstly, the foundation of this study is an extensive literature review. Current trends and state of art were examined to gather insights into the deployment and impact of emerging technologies in global urban settings, with a specific focus on Tokyo. The case studies provided an understanding of current trends. This dual approach helped establish a baseline of existing knowledge and real-world examples of technology integration.

Survey

Next, utilizing the data from the Literature Review, the survey was designed to capture both quantitative and qualitative data. These questions were mainly framed from an understanding of the current situation, and then the future expectation around four urban scenarios, with an additional focus on AR glasses as a case study of emerging technology. The data collection was facilitated through online platform and direct interviews. Quantitative responses were statistically analyzed for prevalent patterns, while thematic analysis was applied to open-ended responses to extract deeper insights into personal expectations and concerns.

Scenario

Lastly, using the insights gained from the Literature Review and the survey data, strategic scenarios for Tokyo were discussed with additional literature review. This process is formulated using a “what if” technique and Science-Fiction Prototyping methods, that considers current trends and uncertainty, potential impact feedback from participants, particularly regarding the use of AR glasses. It can motivate the research into new high-tech environments and lifestyles by combining narratives with science fact (Graham et al., 2013).

Therefore, to detailed implementation, I introduced specific questions for future scenarios with AR glasses in the survey. This phase was for understanding how emerging technological deployments could shape the living conditions of foreigners and the future urban landscape.

Overall, this multifaceted approach ensures a comprehensive exploration.

III. Literature Review

The Literature Review section examines the current technologies and case studies from Tokyo. This section aims to identify key trends and areas for further research.

Emerging mobile technologies

Mobile Technologies and Internet of Things:

Mobile technologies include devices like smartphones, tablets, and wearables, along with network infrastructure that enable wireless communication. These devices often act as control centers for the Internet of Things (IoT), a network of interconnected physical devices that share data over the internet. The widespread use of smartphones significantly advanced IoT by serving as control hubs recently (Talavera et al., 2015).

This revolutionized mobility and tourism. It facilitates real-time traffic information, enabling users to identify the most efficient routes. Smart public transport systems benefit from real-time updates on schedules, delays, and routes, enhancing travel efficiency. Additionally, mapping services such as Google Maps provide detailed, up-to-date maps with information not only on road conditions but also points of interest. Furthermore, it has enhanced social media connectivity by enabling location-based interactions, allowing users to share experiences and receive recommendations based on their current location. This has led to the creation of more dynamic and interactive platforms, improving user engagement, and content personalization, thereby significantly impacting travel experiences (Guo et al., 2022).

Despite the interest in digitalizations, these new technologies have a dark side. Closely linked to fashion trends, this rapid spread of reviews leads to rapid overcrowding and overbooking of tourist attractions (Bourliataux-Lajoine et al., 2019). Moreover, IoT devices often collect sensitive information such as users' location information, health data, and consumption behavior. Data leakage and privacy violations are pervasive issues and are often discussed in research as a downside of IoT usage (Bourliataux-Lajoine et al., 2019; Zheng et al., 2018) .

Metaverse

The concept of the metaverse has garnered considerable attention in recent years, representing a virtual shared space resulting from the fusion of diverse physical and virtual realms. The transition from the current Internet landscape to the metaverse is propelled by several enabling technologies, including artificial intelligence as well as immersive technologies like virtual and AR (Ritterbusch & Teichmann, 2023).

The metaverse, often dubbed as the "post-reality universe" slated for maturation by 2030, holds considerable potential for reshaping interactions between individuals and brands. According to Gartner, by 2026, a quarter of the population is projected to spend at least an hour daily in the metaverse, engaging in activities ranging from work and shopping to education, entertainment, and socializing (Jaimini et al., 2022).

Metaverse will also impact on Urban Design in the future (Dorostkar & Najarsadeghi, 2023) and improve urban sustainability, reducing greenhouse gas emissions and improving living conditions for future generations (Allam et al., 2022).

Extended Reality and Augmented Reality

Extended Realities (XR) encompass a range of technologies that merge real-world elements with virtual environments, crafting immersive, interactive experiences. Among these technologies are virtual reality (VR), augmented reality (AR), and mixed reality (MR). VR

immerses users in entirely simulated environments, while AR overlays virtual elements onto the real world. MR blends VR and AR, enabling users to interact with both virtual and real environments simultaneously. These technologies find applications across various sectors like tourism, entertainment, education, healthcare, and retail (Dwivedi et al., 2022).

The swift evolution of XR technologies holds promise for revolutionizing tourism, providing visitors with immersive, interactive experiences even when physically distant. Research indicates that AR, in particular, could revolutionize tourism by enhancing visitor experiences with captivating content (Chung et al., 2015; Cranmer et al., 2020). Indeed, with AR becoming more accessible via mobile devices, smart destinations are employing this technology to promote sustainability while creating novel visitor experiences in the emerging metaverse era. AR enables destinations to craft engaging, interactive experiences previously unattainable, potentially mitigating issues like over tourism in popular destinations. Consequently, the adoption of immersive technologies in tourism is expected to continue growing in the foreseeable future.

Moreover, a study shows that the efficiency of the AR navigation interface was proven, allowing people to find their destination up to 263% faster in comparison to the conventional way, depending on the complexity of the route (Archangelskaya et al., 2022).

Emerging mobile technologies and Tokyo

Smart City and Tokyo

Tokyo metropolitan has been promoting the Smart Tokyo project in recent years, which is relatively later than the western global cities. "Smart City Tokyo" refers to initiatives and developments in Tokyo aimed at using technology to improve various aspects of urban life for residents. These initiatives often involve integrating emerging technologies like IoT, AI, and big data analytics into urban infrastructure and services.

These efforts may include projects related to efficient public transportation systems, smart energy grids, waste management, environmental monitoring, and the use of digital platforms for citizen engagement and service delivery. The goal is to create a more efficient, sustainable, and livable city by leveraging the power of technology and innovation (Tokyo Metropolitan Government, 2024c).

However, the concern is in case of emergency such as outage of these connectivity. In 2022, KDDI, which is a major telecommunications company in Japan, experienced a significant communication failure that lasted for a few days, affecting customers nationwide. Approximately 22.78 million voice service users and over 7.65 million data service users were impacted. The outage disrupted various industries, including logistics, automotive, administrative services, banking, and transportation (KDDI CORPORATION, 2024). Moreover, Japan is a country prone to many earthquakes due to its location at plate boundaries, accounting for 17.9% of the world's earthquakes. At the time of the Great East Japan Earthquake, many local municipal websites went down due to the effects of the earthquake and tsunami, and access to them became difficult due to high traffic (IIJ, 2024).

Tokyo Metaverse and AR

Firstly, one of the examples that has been implemented is Tokyo Metropolitan government has introduced tourism content using Metaverse and AR technology. In February, 2024, this initiative transforms Tokyo's tourist spots into a virtual space where users can engage in activities such as treasure hunts and quizzes. Limited items are available at checkpoints in real tourist spots via an AR app. Users access the service through a special website, downloading the app and registering for an account. The initiative includes a commemorative event featuring VTubers (Tokyo Metropolitan Government, 2024b).

Personalized Push notification

Another example is personalized push notification. Tokyo fish market area called Toyosu is full of attractive commercial facilities and leisure spots, but the problem is that it is difficult to get around due to the scattered locations. In response to this current situation, NTT Data is providing a more comfortable and high-quality stay experience for visitors throughout the area, which will not only promote ease of movement but also increase the number of visitors to the area and be connected. This demonstration experiment analyzes visitors' behavioral attributes and intentions, and delivers recommendation information in real time according to the visitor's behavior to encourage behavior change and improve motivation for visiting the town. This will be carried out with the purpose of confirming whether it has an effect on promotion and improving migration (NTT Data, 2024).

Gamification

Furthermore, a mystery-solving game is happening in Tokyo's waterfront area. The game involves visiting seven locations and solving puzzles using AR technology. During the business hours of participating facilities. The game is free to play, has no fixed starting point or time limit, and aims to help the area's tourism mascot ambassador, fulfill his dream of swimming in the sky (Tokyo Metropolitan Government, 2024a).

Lastly, "Pokémon GO" is a mobile game that blends the real world with the virtual through AR technology. It quickly became a cultural phenomenon due to its innovative use of AR and its encouragement of physical activity and exploration. It has also been praised for promoting social interaction, as it often brings players together in real-life locations, which reimagines publicness and fostering new modes of emplaced meaning and urban navigation (Woods, 2020).



Image 2: Pokémon GO screen (Niantic, 2024)

Summary

Current advancements in mobile technology, including the rise of the metaverse and AR, are rapidly transforming urban environments and tourism. Gartner predicts that by 2026, a quarter of the population will spend at least an hour daily in the metaverse, highlighting the growing integration of digital experiences. AR, in particular, is set to revolutionize tourism by significantly enhancing visitor experiences and improving navigation efficiency by up to 263%. However, privacy concerns are considered.

Moreover, Tokyo is actively promoting its Smart Tokyo project, leveraging technologies such as metaverse to enhance urban living. However, this development also brings challenges, such as overreliance on digital technologies, especially in case of emergencies.

IV. Survey

This section outlines the survey which constitutes the principal component of this project. Firstly the Data Collection outlines the survey methodology, building on the insights gathered from the Literature Review on current trends. This is followed by the Data Results and Analysis, where the findings are explored in depth.

Data Collection

Data collection for this thesis was conducted in April 2024, utilizing an integrated approach that combines quantitative and qualitative research methods. The primary data were gathered through the survey, which was meticulously designed to collect a wide range of information relevant to the research questions. The survey was administered both online and directly on the streets of Tokyo, using Google Forms as the medium for data input.

The survey aimed to include a diverse group of 40 participants. This target was set to ensure a manageable yet sufficient sample size for obtaining meaningful insights while considering the logistical constraints of conducting in-depth qualitative research.

Survey Design

The questionnaire began with essential demographic information, including age, gender, nationality, length of stay in Japan and Tokyo. The survey questions were divided into four key areas to facilitate ease of response for the participants:

1. Use of Mobile and AR Technologies:
 - Frequency of smartphone and AR goggles use
 - Most frequently used mobile applications in Tokyo

- Satisfaction ratings to assess contentment and identify areas for improvement
2. Perceptions of Tokyo:
 - Open-ended question describing Tokyo in three words
 - Main challenges faced while navigating Tokyo, highlighting urban mobility issues or cultural barriers
 3. Future Expectations For Technology in 2035:
 - General expectations for mobile and AR technologies by 2035
 - Envisioning Tokyo in 2035 with AR glasses
 4. Scenario Exploration:
 - Rating the likelihood and preference for each proposed future scenario: Fast-Mobility City, Digital City, Livable City, and Fortress City.

All questions are developed responding to the sub-questions for research questions as follow:

Survey question 1 is responding to the sub-question of “What are the impacts associated with emerging mobile technologies for foreigners in Tokyo currently?”, focusing on the current situation.

Survey questions 2, 3, 4 and 5 are responding to the sub-question of “What are the perspectives, expectations, and needs of foreigners visiting and residing in Tokyo in the long term?”, focusing on the future expectation.

Analysis Methods

The quantitative responses were subjected to statistical analysis to identify prevalent trends and patterns. This analysis helped quantify the general attitudes and usage patterns.

Meanwhile, the qualitative data from open-ended questions underwent thematic analysis.

This process involved coding the responses to identify common themes and deeper insights, providing a rich narrative context to the numerical data.

This comprehensive data collection approach allowed for a robust examination of the impacts, perceptions, and potential future of mobile and AR technologies in Tokyo, as experienced and anticipated by foreigners.

Survey Result and Analysis

This section presents the results and analysis of the survey. It begins with demographics and follows the current situation by examining current mobile technology usage and the existing urban conditions. The analysis progresses to the future. It explores broader future scenarios for the city. Then participants' expectations for technology in Tokyo by 2035, detailing anticipated scenarios for AR interactions. This structured approach reveals a comprehensive view of both current realities and forward expectations from the participants.

Demographic Overview

1. Gender Distribution

- Male: 35 respondents
- Female: 5 respondents

2. Age Distribution

- 30-39 years: 25 respondents
- 20-29 years: 11 respondents
- 40-59 years: 4 respondent

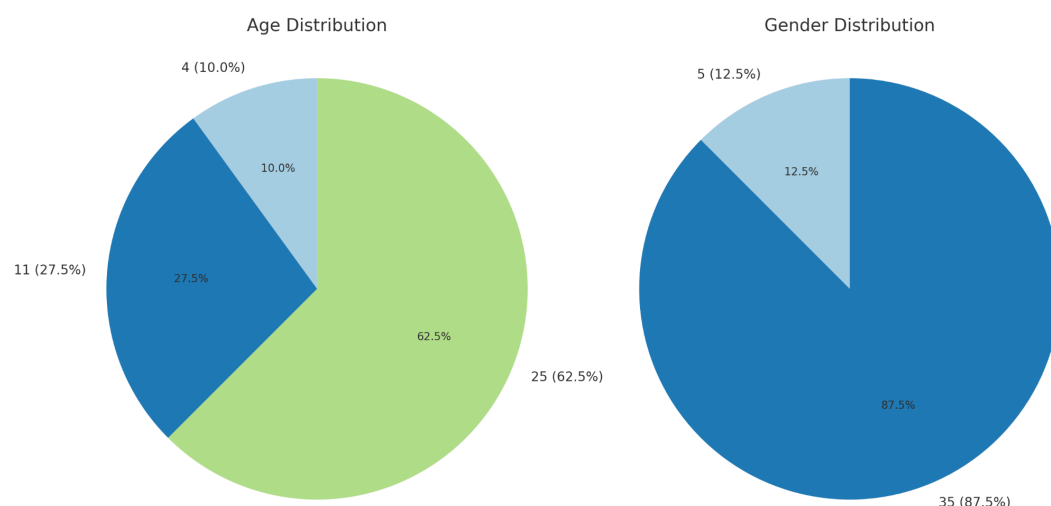


Figure 2: Age and Gender

3. Residency Duration

- In Japan
 - Never to A few weeks: 15 respondents
 - More than 5 years: 9 respondents
- In Tokyo
 - Never to A few weeks: 17 respondents
 - More than 5 years: 7 respondents

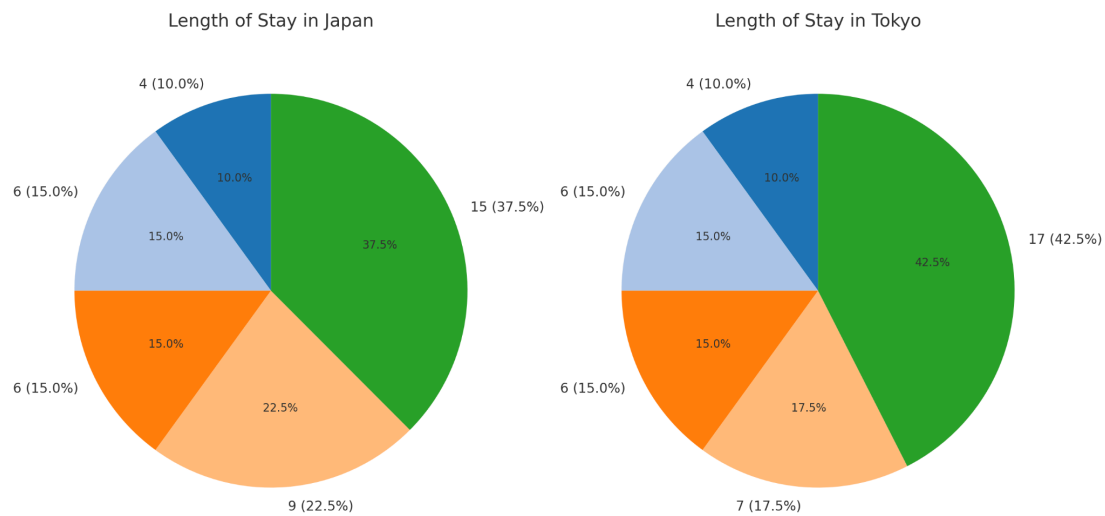


Figure 3:Length of Stay

4. Nationality Distribution

- France and the United States: 6 respondents each
- Australia: 4 respondents
- Spain and Brazil: 3 respondents each

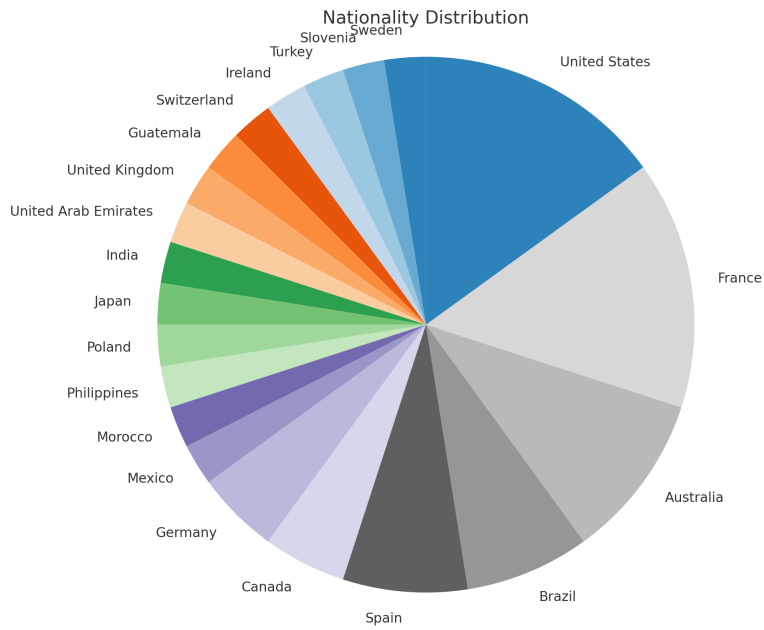


Figure 4: Nationality

Summary

The demographics shows a diversity of respondents, exploring from a mainly male group aged 30-39, with varied residency durations in Japan and Tokyo, and a broad spectrum of nationalities represented mainly from the United States, France and Australia.

Current Usage of Mobile Technology

Firstly I explore the current situation to investigate this research question “What are the impacts associated with emerging mobile technologies for foreigners in Tokyo currently?”

Daily Smartphone Usage

The figure illustrates the daily smartphone usage among respondents.

- Most people, 17 respondents (42.5%), use their smartphones for 4-5 hours a day.
- Usage decreases as the duration increases, with 9 respondents (22.5%) using their phones for 6-7 hours, and only 4 respondents (10.0%) using them for over 8 hours daily.

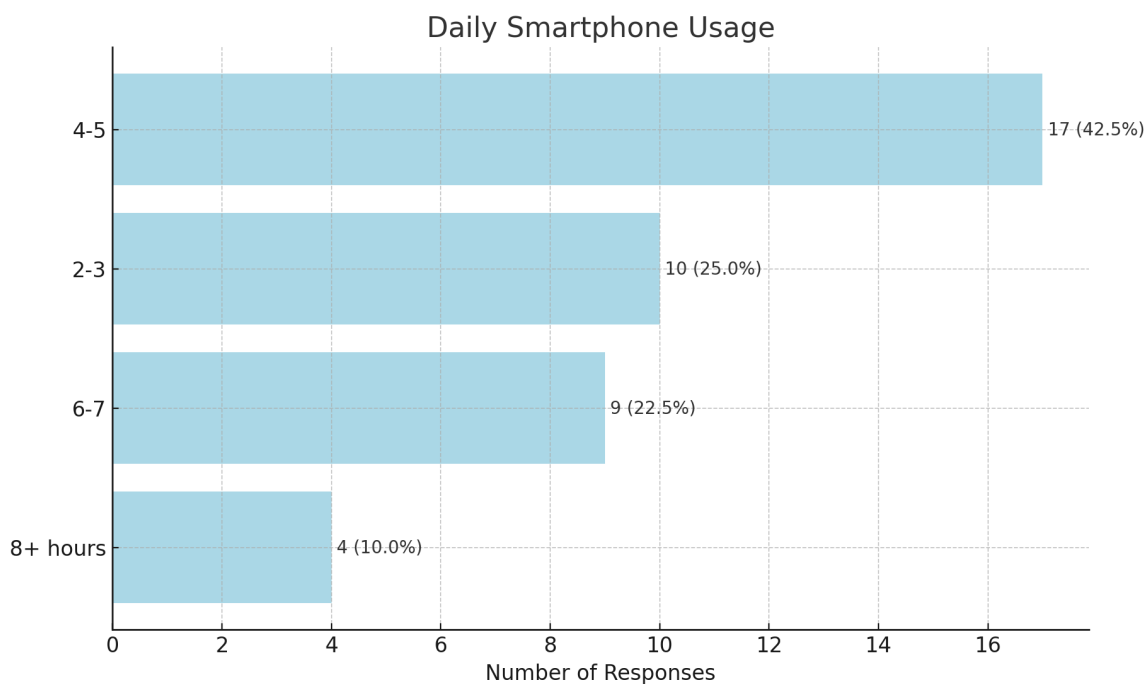


Figure5:Daily Smartphone Usage

Most Frequently Used Mobile Applications in Tokyo

The graph shows the most frequently used mobile applications.

- Navigation apps are the most popular, used by 28 respondents (23.3%).
- Social media and communication apps follow closely, with 24 (20.0%) and 23 (19.2%) users respectively.
- Language translation apps are also quite frequently used, by 21 respondents (17.5%).

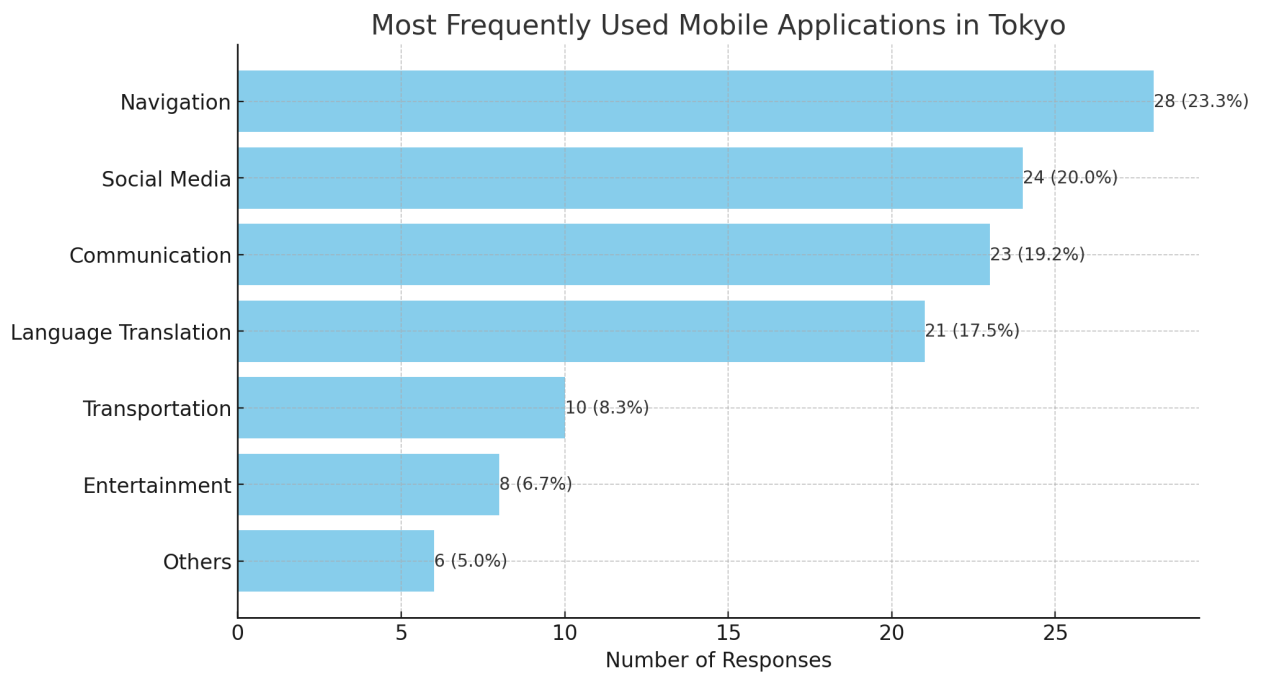


Figure6: Most Frequently Used Mobile Applications in Tokyo

Although the survey investigated AR technology usage with the same questions. However, most participants never used AR in their travel or trip in Tokyo.

Summary

It is clear that smartphones are an integral part of daily life even for visitors in Tokyo, with uses ranging from navigation and communication to language assistance. The emphasis on navigation and language translation apps might reflect a city that hosts many visitors and

where getting around efficiently is a priority. Moreover, AR technology is almost never used among the survey participants currently.

Current Perspectives of Tokyo

In this section, the survey aimed to explore perceptions of Tokyo. The responses were summarized as follows by using word cloud.

Current Perception of Tokyo



Figure 7: Perception of Tokyo

The word cloud highlights the top three descriptors: "clean," "safe," and "busy," reflecting a mix of positive and negative perceptions.

- **Positive Attributes:** "clean," "safe," "modern" indicate a perception of Tokyo as a well-maintained and sustainable city. Also "efficient" and "technology" are shown as advanced city.
- **Negative Attributes:** "busy," "crowded," "overcrowded." and "big" highlight the challenges of having a comfortable environment.

Current Challenges of Navigating Tokyo



Figure8:Challenges of navigating Tokyo

This word cloud shows:

- Language and Communication: "language," "translation," "kanji"(Kanji are characters used in the writing systems of Japanese), and "communication" indicates that language barriers are a significant challenge for many foreigners.
- Navigational Challenges: "walking," "area," "metro," "stations," and "finding" highlight the complexity of navigating the city's network.

Summary

The results provide a dual perspective on Tokyo, showing its appeal as a clean, safe, and efficient metropolis while also bringing attention to the navigational challenges posed by its language barriers and complex public transportation network. Understanding these perceptions and challenges is crucial for visitors to ensure a more accessible experience.

Future Scenarios for Future City

Now the discussion is moving on to the future, answering the research question of “What are the perspectives, expectations and needs of foreigners in Tokyo in the long term?”

To understand perspective of future more in urban context, in next questions participants were investigated:

"How likely do you think each scenario is to happen in Tokyo by 2035?"

"Why do you think so? Please explain and give your insights."

I present the overview of answers for both likelihood and preference, and then, explore comparison of likelihood and preference. Deep Insight will be explored in the next section in the Qualitative Research.

Scenario

For these questions, I utilized John Urry’s scenarios as I stated in Scenario in Theoretical Framework. The four scenarios are presented with AI generated images (Open AI, 2024)as below:

1. Fast-Mobility City



Image3:Fast-Mobility City

A scenario in which “Fast-mobility City” will emerge that assumes rapid movement based on a new mode of transportation using aerial vehicles such as drones and self-driving cars, and a post-petroleum fuel infrastructure centered on hydrogen fuel.

2. Digital City



Image4:Digital City

Digital encounters are talked about on a par with physical encounters, physicality disappears, and people become pieces of information floating in a sea of electronic data. As a result, physical movement activities such as commuting will decline, and a scenario in which anti-urban “Digital City” will emerge.

3. Livable City



Image5:Livable City

A more public mobility system that is open to many people will be introduced, and private car ownership will decrease, resulting in lower carbon and lower energy consumption of

transportation. A scenario in which “Livable City” will emerge where people are directly connected.

4. Fortress City



Image6:Fortress City

A scenario in which the gap between the ultra-rich and the rest of the world widens, leading to wars and the construction of security citadels to protect the profits and interests of the former will emerge. A wild zone appears on the outside, and the center becomes a “Fortress City” protected by high walls and numerous surveillance cameras.

Overview of quantitative data:

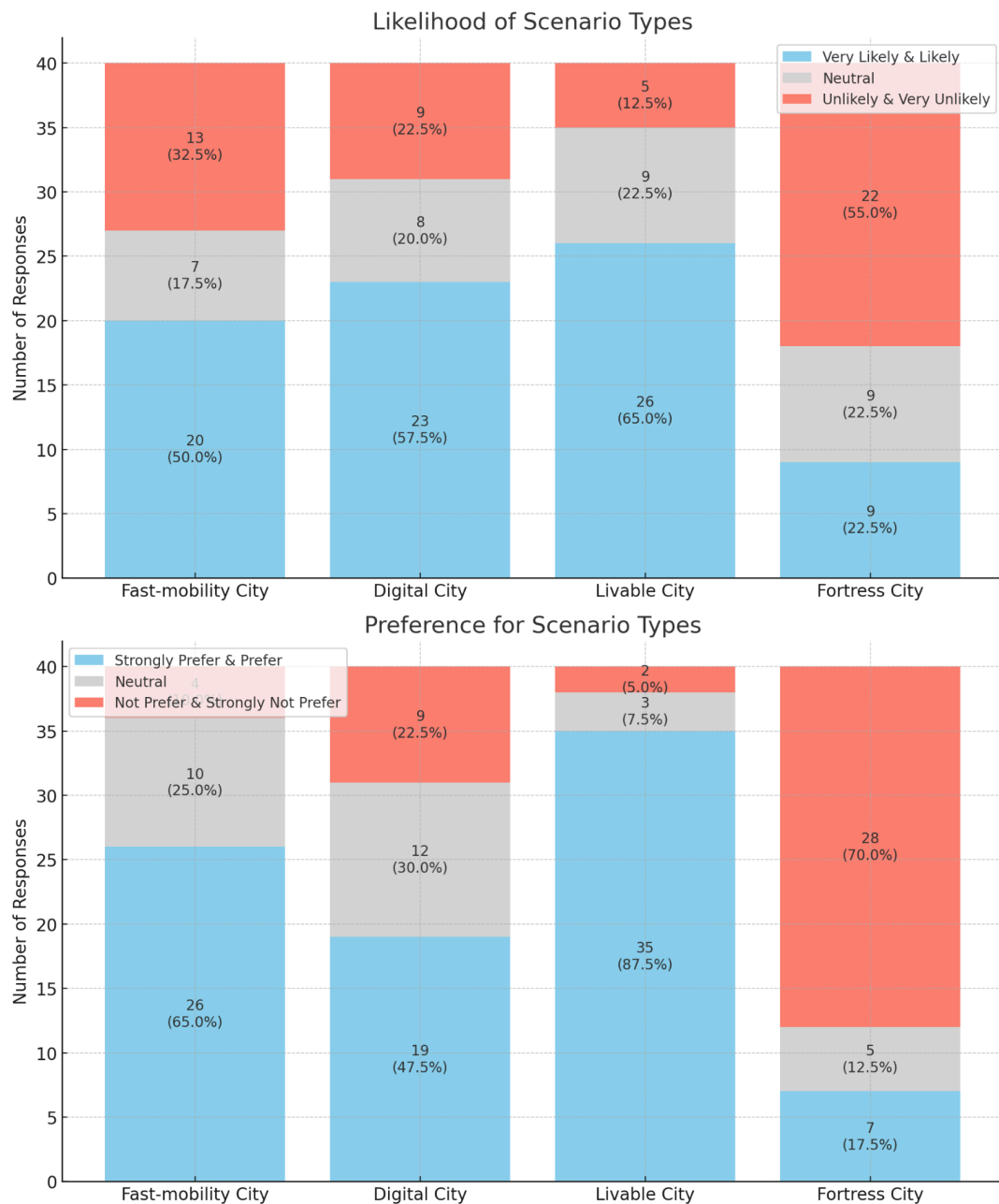


Figure9: Likelihood and Preference of different scenario

Likelihood:

The survey results suggest that respondents are most optimistic about the "Liveable City" scenario, with a majority considering it likely. The "Fast-mobility City" and "Digital City"

scenarios received more neutral responses, indicating less consensus. The "Fortress City" scenario seen as unlikely with more than half across all response.

Preference:

From these results, it's evident that the "Liveable City" scenario is overwhelmingly preferred by respondents, with a high percentage expressing a strong preference. Conversely, the "Fortress City" scenario is predominantly not preferred. Preferences for "Fast-mobility City" and "Digital City" show a mix, with "Fast-mobility City" being more favorable among participants.

Summary

The survey results show a strong preference for the Liveable City scenario, deemed both desirable and probable. The Fast-mobility City and Digital City scenarios received mixed reactions, with the former slightly more favored despite feasibility concerns, and the latter seen as likely but not as enthusiastically preferred. Conversely, the Fortress City scenario was least favored, with significant disapproval and doubts about its likelihood, indicating a clear rejection.

Future Expectations for Technology in Tokyo by 2035

Now the discussion is moving on the perception and expectation associated with technologies. To explore the future general needs for Tokyo, the survey posed questions that

"How do you envision the evolution of the technologies in Tokyo by 2035?".

The options selected are below in qualitative ways and the reasons of that are explore in Qualitative Research section;

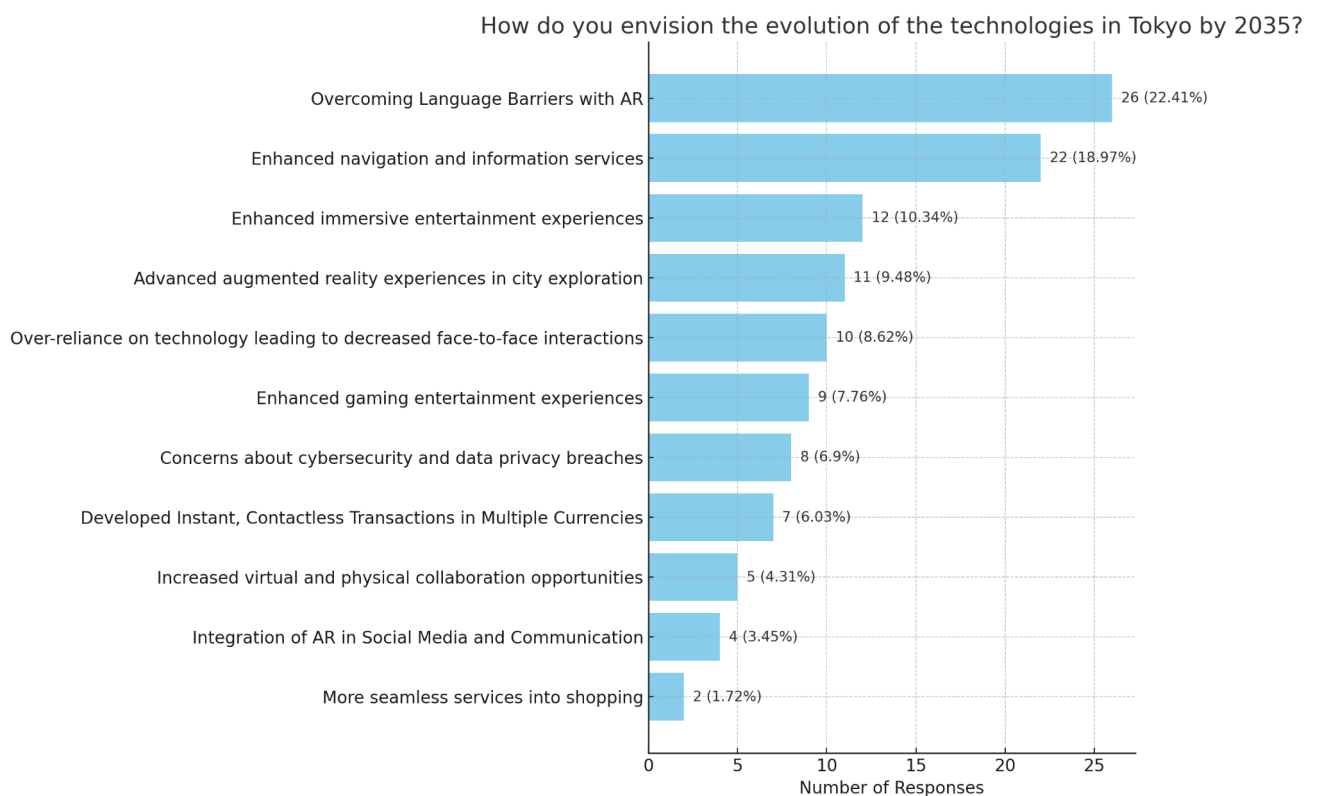


Figure10:Expectation of technology by 2035

The chart details respondents' needs and concerns for technological evolution in Tokyo in the future:

- Overcoming Language Barriers with AR is seen as the most anticipated technological development
- Enhanced Navigation and Information Service is the second most anticipated technology
- Over-reliance on Technology is the concern about decreased face-to-face interactions is relatively high.

Summary

It highlights a strong anticipation for overcoming language barriers and enhancing navigation and information access. However, concerns about the potential decrease in face-to-face interactions emphasize the need for a balanced approach to technology adoption. I will develop deeper insight in the Qualitative Research section.

Future AR Interaction in The City

In this section, I explore the detailed perception and expectation with new technology implementation. In particular I set up with AR glasses, which is relatively effective on travel experiences. The survey posed the following question to respondents:

"How would you like to interact with your environment, or what would you like to see through the AR glasses in each of these settings?"

Here is an overview of the answers in three different settings:

Overview of quantitative data:

Train Stations:

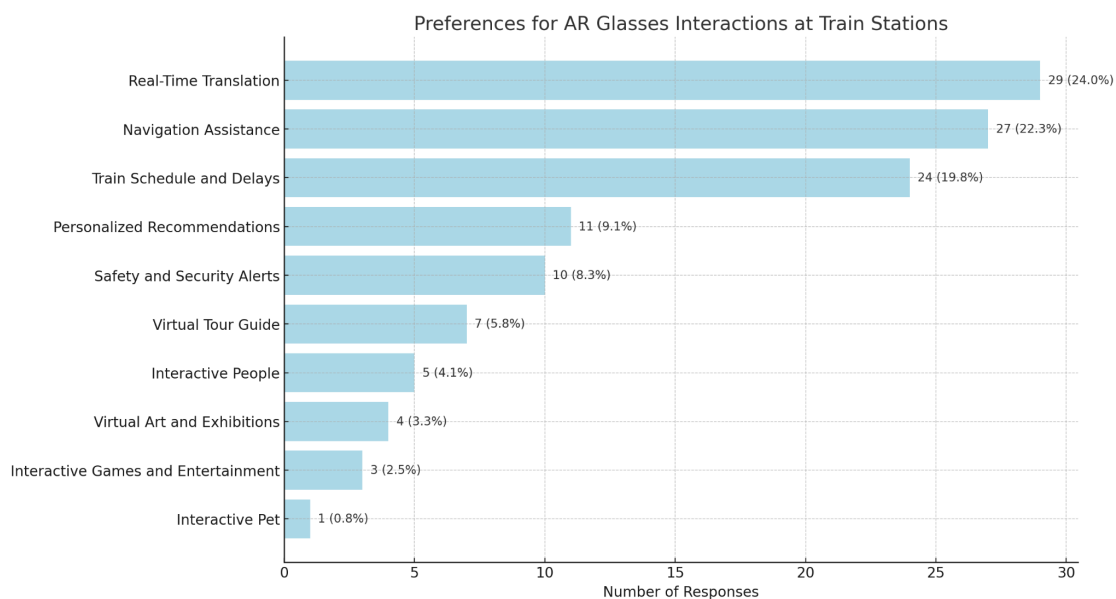


Figure11: Preferences for AR Glasses Interaction at Train Stations

- Highest preference for Real-Time Translation, Navigation Assistance, and Train Schedule and Delays, emphasizing the need for timely and accurate travel information.
- Lower interest in Interactive Games and Entertainment or Interactive People.

Shopping Streets:

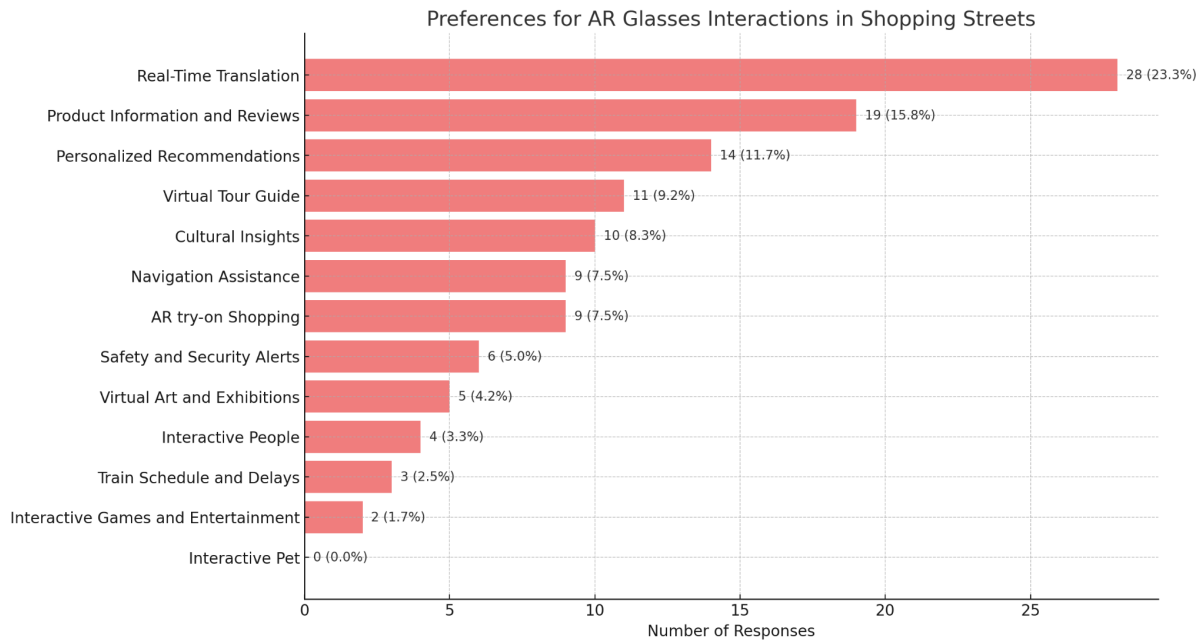


Figure12: Preferences for AR Glasses Interaction at Shopping Street

- High preference for Real-Time Translation and Product Information and Reviews.
- AR try-on Shopping and Personalized Recommendations are more relevant here than others.

Parks:

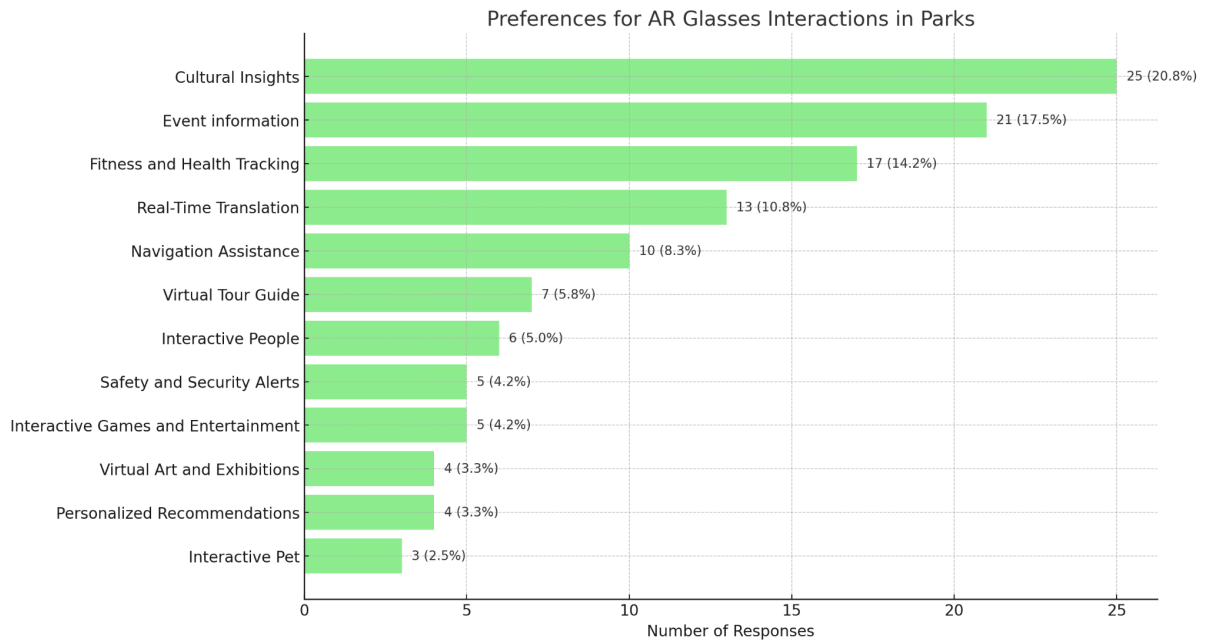


Figure13: Preferences for AR Glasses Interaction in Parks

- Cultural Insights, Event Information, and Fitness and Health Tracking are more preferred
- Lower demand for real-time critical updates like Train Schedule and Delays or extensive navigation help

Combined Trends Across All Settings:

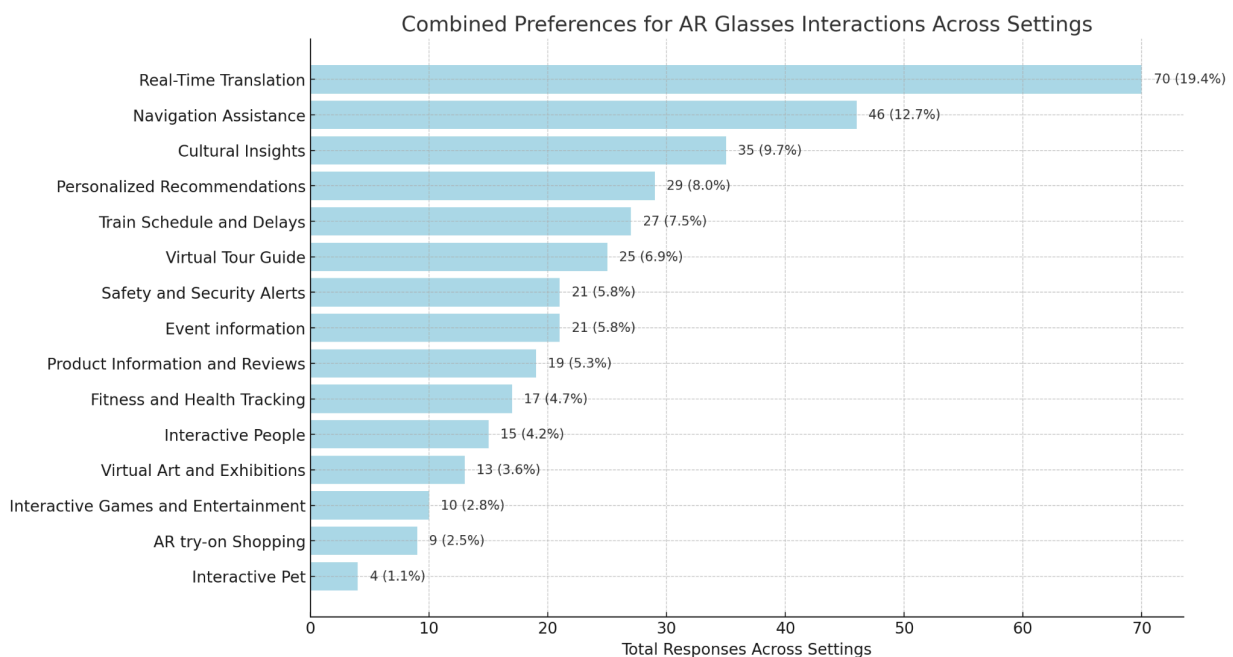


Figure14: Combined Preferences for AR Glasses Interaction Across Settings

I've combined and analyzed the preferences for AR glasses interactions across three settings: Train Stations, Shopping Streets, and Parks. The data shows "Real-Time Translation" and "Navigation Assistance" are extremely popular across multiple environments for visitors in Tokyo.

Analysis Across All Settings:

- Real-Time Translation is highly valued in both Train Stations and Shopping Streets, showing its importance in environments where understanding and communication are key for visitors.
- Navigation and informational assistance are also consistently important across settings, indicating a broad utility of AR for providing situational awareness and facilitating movement.
- Preferences in Shopping Streets and Parks tend more towards enhancing the leisure and cultural experience.

Summary

Preferences for AR interactions differ notably across settings such as Train Stations, Shopping Streets, and Parks, highlighting context-specific utility. In Train Stations, users prioritize Real-Time Translation, Navigation Assistance, and Train Schedule updates, focusing on efficiency and timely travel information, with less interest in social or entertainment features. Shopping Streets see a preference for Real-Time Translation and Product Information, alongside AR try-on and Personalized Recommendations to enhance the shopping experience. In contrast, Parks favor Cultural Insights, Event Information, and Fitness and Health Tracking, enriching recreational and cultural experiences without the need for urgent updates. Overall, it illustrates the different priorities and preferences for AR technology in varying urban settings, highlighting how AR can be adapted to enhance user experiences based on the specific context and requirements of each environment. I will explore deeper insight on this later in the Qualitative Research section.

Qualitative Research

This section focuses on the qualitative research conducted to gain deeper insights into the experiences and perspectives. Through open-ended survey questions, this part of the study aims to explore the subjective aspects. The qualitative findings complement the quantitative data, providing a richer understanding.

Future Scenarios for Future City

Firstly, I will provide an in-depth insight into why some respondents believe in the probability of these scenarios and why others desire them vice and verse, reflecting on quantitative data.

Likelihood Insights

- **Fast-Mobility City:**

This scenario faces skepticism due to technological and infrastructural challenges.

"Relying on automation seems unlikely in 10 years."

"Some ideas are too futuristic and will be almost impossible to achieve by 2035."

"The fast mobility city would be very expensive to not gain a lot over the current transportation methods."

- **Digital City:**

This scenario is seen as feasible, leveraging Tokyo's technological advancements.

Responses include:

"Tokyo is already an advanced city so I see it becoming digital in the near future."

- **Liveable City:**

It is highly favored, aligning with Tokyo's environmental initiatives and efficient public transport.

"Livable city seems to be an option for Tokyo because of their current transportation."

"I think livable city is likely because the accessibility of shops and green spaces in residential areas is already strong."

"Tokyo comes from a long background of strong infrastructure for public transport and recently also has aligned itself to green standard patterns from environmentally friendly construction systems."

- **Fortress City:**

It is seen as unlikely, conflicting with Japanese cultural norms and social dynamics.

"And fortress city I think is more prevalent in other countries outside of Japan. I don't think it's totally outside the realm of possibility but I think it's improbable."

"I think the fortress is very unlikely in Japan because it seems unlikely in Japanese culture."

"Japanese culture I think would restrain a fortress city from happening."

Preferences Insight

- **Fast-Mobility City:**

It has mixed reactions; but people anticipate a more positive impact despite skepticism.

"It is preferred to travel fast as it is more efficient and safer."

- **Digital City:**

It is recognized for its potential but critiqued for reducing human interactions.

"Digital takes away the 'human' aspect of life."

"The more we digitalize our lives, the more alienated and dissociated we become from our human nature."

"Have the option to enter a digital world if you want and share everything with all the world, not just for a small group of people."

- **Liveable City:**

It is most favored for its environmental integration.

"Because I think people need to be more connected with nature."

"Livable city still has an ecosystem where we are living with nature rather than eradicating it."

"We all want to live in a better world, more green, more healthy, more friendly"

"We need a convenient yet healthy life"

- **Fortress City:**

Generally viewed negatively, associated with undesirable social changes.

"Fortress city is what North America is turning into and it's disappointing."

"seem some cyberpunk gone wrong, terrible way of living."

Critical Insights of Japan

- **The Japanese population and economy declining**

"The Japanese population and economy are in decline"

"Livable city would be ideal but with issues like overcrowded mess it's very difficult to achieve as Japan is not doing well economically"

"Tokyo will become a sort of fortress city because of the actual economic situation."

These comments illustrate the challenges facing Tokyo's development. Japan's declining and aging population, coupled with economic stagnation, limits its ability to pursue ambitious urban projects. Moreover, it could eventually accelerate the idea of Fortress City that is currently mostly seen as far from happening.

- **Tradition and resistance to change**

"Tokyo is a city made from tradition. It's not going to change anytime soon. Transportation can only go so far within the confinement of the city and people are always working like they are a part of a factory."

This reflects a view of Tokyo as deeply rooted in its traditions, which may resist rapid or radical changes. It also comments on the physical and cultural limits within which urban transformation can occur.

Summary

The survey data on future scenarios for Tokyo reveals common themes in the preferences and concerns of respondents. Overall, the survey results show a strong preference for the Liveable City scenario, which is seen as both desirable and reasonable. The reason is because of the perceptions of the Japanese urban landscape with a highly transit-oriented urban system and adequate green spaces. The Fast-Mobility City scenario received mixed reactions but is slightly more favored. The reason for this gap is from the concerns about its feasibility. The Digital City is viewed as likely to happen, but it is not as enthusiastically

preferred due to worries about a lack of human interaction. Conversely, the Fortress City scenario is the least favored, with significant disapproval and doubts about its likelihood, largely stemming from Japanese cultural background and norms. On the one hand, there is the possibility that Japan's declining and aging population and economic stagnation limit its ability to pursue ambitious urban projects, making the goal of a livable city difficult due to economic constraints and high population density. Tokyo's deep-rooted traditions also hinder rapid changes, and despite technological advancements, the city's fundamental character may remain unchanged.

Future Expectations for Technology in Tokyo by 2035

Next, in this section, the thematic analysis based on the feedback reveals diverse perspectives towards future technology across three key themes. The analysis emphasized the specific impact on Tokyo and Japan.

Technological Innovations for Urban Experience and Tourism

- **Navigation and communication:**

"If AR becomes commonplace I would assume that there would be assistance in navigation specifically in travelers known languages."

"I like the idea of an AI/AR tour guide. Also easier language translation."

"I would use AR to know information about random people in the street."

- **Cultural immersive guides:**

"In the temples, see images as it was many years ago and see the old people go to the temple."

"I hope that Tokyo can combine his history and traditions with modern technology."

"For tourists like me it would be awesome if we could have an interactive and immersive tour guide through the city and other places, it would be great to be able to travel in time and see epic moments."

These insights suggest a strong desire for technologies that facilitate easier movement within the city and enrich the tourist experience by providing a deeper connection to Japanese cultural and historical elements.

Concerns Over Social Isolation

- **Impact on social interactions:**

"Japan is already a very isolating country where it is hard to interact with the local people if you are not Japanese. Increased technology could make that barrier even bigger."

- **Isolation:**

"This lack of social interaction will only increase issues such as generational gap and lack of communication, fear of others, lack of social classes mixing etc ultimately leading to a more atomized and ruthlessly individualistic society."

These responses highlight a deep-seated concern that technological advancements could lead to less human interaction, increasing the sense of isolation within the urban environment.

Critical Attitude Towards Future Technology

- **Privacy:**

"I also feel like it would be a marketing frenzy for big corporations. They would use more pop up ads that would hover in users' peripherals while using navigation apps and or entertainment applications."

- **Critical concerns:**

"While navigation might become much easier thanks to tech, I see Japanese society being overly interested in convenience and there lacking critical thinking when it comes to adopting new technologies (same goes for personal data use by companies and privacy)."

These insights stress the importance of a critical approach to adopting new technologies in Tokyo, ensuring they enhance rather than detract from the urban living experience.

Summary

Insights indicate a desire for technologies to facilitate translation, navigation and provide immersive cultural experiences, especially from foreigners perspectives. Also, there are concerns that technological advancements could reduce human interaction and increase social isolation for Japan. Moreover, feedback shows the need for critical thinking in adopting new technologies in Japanese society, balancing potential benefits with concerns about commercialization, privacy, and This qualitative research provides a deep understanding of the expectations and concerns about future technologies in Tokyo. It is important to shape the future of Tokyo in a way that is technologically advanced yet socially and culturally harmonious.

Another participant envisioned a more interactive AR experience, suggesting it could help correct simple errors by advising,

“Having AR know your journey can even tell you about things like ‘use this ticket machine, not this one’,”

thus indicating a potential for AR to facilitate more interactive and helping the mistakes.

Shopping Streets



Figure16: Open ideas for AR Glasses Interaction in Shopping Street

Here are some imagined needs of the information from participants:

One participant noted the common practice of looking up product reviews while shopping,

"I often search for pictures and reviews of products while in the store. I see many other people doing the same."

Interestingly, some view shopping malls as art galleries and believe AR could enhance this perspective. One comment noted,

In Park settings, AR technology could provide a rich tapestry of information and entertainment, enhancing visitor experiences by offering insights into:

The word cloud shows a strong interest in cultural and recreational information, with terms like "events," "art," and "cultural" being prominent. Participants expressed a desire for imaginative uses of AR in Parks, with suggestions like,

"It would be nice to see grotesque monstrous alien creatures lounging in a park,"

"Great for a virtual 'art in the park' show,"

indicating a potential for AR to transform natural spaces into interactive and fantastical environments.

Summary

AR applications should be context-specific design, that is tailored to meet the unique needs and preferences of users in different urban settings. People are eager to having detailed, relevant information such as steps and interactive features that enhance user experiences. It is concerned that AR applications overly mediate experiences, and should be more allowing for meaningful human interactions where desired. These insights can inform the development of strategic scenarios for urban design in Tokyo, ensuring AR technology enhances user experiences while maintaining a balance with human interaction.

V. Conclusion

This research aims to understand and foresight how emerging mobile technologies can be leveraged to enhance the attractiveness of Tokyo as a destination for foreign tourists and residents with following research questions:

Main Question:

Can Tokyo become a more comfortable place for foreign visitors and residents through the use of emerging mobile technologies? If so, what is the strategic scenario for the future city of Tokyo?

Sub-questions:

1. What are examples of emerging mobile technologies in urban environments?
2. What are the impacts associated with emerging mobile technologies for foreigners in Tokyo currently?
3. What are the perspectives, expectations, and needs of foreigners in Tokyo in the long term?

In response to these research questions, drawing upon the findings in both the Literature Review and Survey sections, it is concluded that Tokyo can indeed become a more comfortable place for foreign visitors and residents with the integration of emerging mobile technologies.

The Literature Review explained that AR technology can enhance tourism by offering immersive content and significantly improving navigation efficiency. Moreover, in conjunction with the Smart Tokyo project promoted by the metropolitan government, initiatives are showcasing for enhancing navigation and reducing congestion, and also developing new entertainment with gamification. However, concerns persist regarding potential over-reliance on technology and privacy, especially in case of emergencies.

The research reveals that currently smartphones are essential for navigation and language translation for foreign visitors. While Tokyo is currently perceived as clean and safe, but also as being strongly crowded with difficulties of navigating complex transportation networks as non-Japanese speakers.

Looking to the future, in urban context, for the city of Tokyo in 2035, Livable City scenario is seen as the most desirable future, due to its feasibility and the perceptions of the Japanese urban landscape with a highly transit-oriented urban system and adequate green spaces. In the technological realm, there is an expectation for technologies that improve, especially navigation and communication engagement. Moreover, as an example of usage of AR glasses in urban settings in the future, it should meet specific needs in each different setting. Although it is crucial that enhancing user experiences while preserving human interactions. The research underscores the importance of shaping Tokyo's future to be both technologically advanced and socially harmonious. These insights can guide us to make urban spaces more inclusive and enjoyable for foreigners.

Furthermore, here I will discuss three key themes and build a strategic scenario with AR glasses technology for Urban Design, associated with these findings.

Translation and Navigation Needs for Foreigners in Tokyo

It is revealed there is not a trend currently using AR technology while navigating Tokyo. In the future, it could be the center of urban exploration and travel experience as it happened with smartphones. A survey revealed that foreign visitors in Tokyo rely on smartphones for navigation and language translation now. It also highlights the need for more improvement of these services. AR glasses are relatively accepted for this solution. Especially in train stations and shopping areas, AR can significantly improve user experiences.

Tokyo , in fact, ranks as one of the top global cities, following London, New York, and Paris. It is also selected as the top location that people want to visit the most (A.T. Kearney, 2024; Euromonitor, 2023; Sassen, 2001). That is shown as a perception of Tokyo with several positive attributes such as “clean”, “safe”, and “efficient”.

In the realm of urban development, leading up to the 2020 Olympic Games, the Japanese government focused on attracting foreign investment to establish Tokyo as a leading global city. For example, within the National Strategic Special Zones and Urban Regeneration regulations, a one-stop system for urban planning decisions and permits for globalization was created to expedite site development and regulatory reforms, such as building more international innovation centers in the area (Cabinet Office, 2020). English signage has been officially promoted throughout Japan (Ministry of Land, Infrastructure, Transport and Tourism, 2013). However, the problem of language barriers still and also more in local communication with shop staff or local communities.

Therefore, it is also important to continue to improve for the needs of these.

Concerns Over Human Interaction and Community Among Foreigners

However, the integration of emerging technologies like AR in Tokyo raises concerns among foreigners about its impact on social interaction and community engagement, aligned with Japanese cultural attitudes towards technological development that lack critical consideration of risk. Despite potential advantages, survey participants worry that increased isolation and diminished face-to-face interactions could harm the enriching social and cultural experiences in a new environment. This highlights the need for technologies that support communication and foster human connections rather than hinder them.

As an example, Denmark stands out in smart city initiatives, focusing on sustainable urban development and digitalization. The digitalization strategy includes the CPR number – a civil registration number system. Introduced in 1968, the CPR system assigns unique personal identification numbers to Danish citizens, serving as the backbone of Denmark's digital society. The CPR number is integral to accessing various public services, such as

healthcare, education, banking, and taxation, thereby enhancing transparency and security in data management. Although there was an instance of unauthorized access to patient data by a doctor in the past (Yasuoka, 2022), the government has since strengthened data access management. Danish citizens trust their government to manage their personal data. Additionally, to bridge the digital divide, they supported startups that provide technical education to residents. This initiative increased online accessibility for seniors from 61% to 89% between 2015 and 2019, thereby improving overall digital literacy (Yasuoka, 2022).

Denmark's smart city developments are aimed at creating a sustainable and citizen-centered urban environment. The government's ability to engage citizens in these initiatives has been a factor in their success (Nakajima, 2019; Yasuoka, 2022).

Therefore, it is crucial to place citizens, even foreigners, at the center inclusively in planning.

Strategic Scenario with AR for Urban Design

The survey defined the Liveable City scenario as both desirable and reasonable given Tokyo's current perceptions, emphasizing a transportation-oriented system and adequate green spaces. Notably, 84% of commuters into Tokyo use public transportation such as trains and buses (Bureau of Environment. Tokyo Metropolitan Government., n.d.). Japan's forest area is approximately 25.02 million hectares, with forest accounting for 67% of Japan's land area (Ministry of Agriculture, Forestry and Fisheries, 2024). A notable example of integrating green spaces within urban settings is the Meiji Shrine, which is associated with nature worship in Japanese culture. The shrine is surrounded by a vast forest in the heart of Tokyo, planted 100 years ago in response to significant pollution and the dying of large, old trees at that time. Planners, looking 100 years ahead, determined that only evergreen broad-leaved trees could thrive at the shrine, ensuring a sustainable and enduring green space for the future. This foresight has provided a practical contribution to sustainability and offers a significant attraction for visitors to Japan (Meiji Shrine, 2024).

Therefore, respecting traditional urban paths and promoting natural discovery is important.

Moreover, there is an opportunity to leverage urban design principles to mitigate some of the negative impacts of technology. Concerns about social isolation highlight the need for

inclusive design that fosters human connection. Urban designers must consider these preferences in their future projects.

An illustrative example involves the integration of AR glasses within an urban design scenario. This scenario, developed based on survey responses and the previous discussion, employs the "what if" technique and Scenario Planning to explore the potential impacts and benefits of AR technology in urban environments.

Here's more concrete example of strategic scenarios:

1. AR Community Spaces

- **AR Kiosk:** These booths, reminiscent of traditional phone booths, offer a confined, tech-centric space where users can engage with AR for navigation and information without overwhelming the public space. This helps in managing the technological footprint in the city and also serves as a community hub.
- **Multilingual and cultural space:** By utilizing AR for cultural exchange, this space becomes a melting pot of languages and cultures, fostering interaction and understanding among diverse groups, enhancing the social fabric of the city.

2. Road Design that Can Be Used Offline

- **AR-free zones:** Designating areas where AR is unnecessary supports a balanced tech environment, catering to those who prefer or require a break from constant digital engagement. This also ensures accessibility and inclusiveness in public spaces.
- **Clarifying signage:** Installing clear, multilingual signage for routes and emergency procedures ensures safety and orientation for all, particularly in tech-free zones or when AR systems fail, maintaining a resilient urban infrastructure.

These strategies collectively aim to integrate AR technology into the urban landscape without compromising the city's character or the citizens' autonomy over their personal engagement with technology.

VI. Reflection

Upon reflecting on this project, I encountered some challenges. Initially, my objective was to conduct a dynamic survey targeting several hundred participants. However, I faced difficulties achieving this scale and consequently shifted focus towards gathering more qualitative, open-ended responses from a smaller, yet adequate, number of participants. This limited presenting cross-analyses, despite observing some patterns and insights, especially regarding participants' cultural backgrounds—a critical aspect when targeting foreigners.

Additionally, recruiting participants specifically for the AR component proved challenging, which hindered an analysis of AR users and their expectations, which was originally part of the objective of my project. This limitation also affected the Scenario Phase using Science Fiction Prototyping (SFP) with AR glasses. To improve future iterations of this project, hosting a participatory program to create new scenarios and design, involving foreigners in Tokyo as citizens, would be beneficial. Further research should consider recruitment strategies by collaborating with organizations and conducting more targeted studies on AR users. It is also essential to delve into specific challenges such as technical barriers and legal constraints, gathering data from professionals to devise more practical and feasible strategies.

Lastly, I would also like to track and explore other challenges beyond language communication barriers. Detailed research is also needed on how such technologies actually work among foreigners from different cultural backgrounds and what socio-cultural barriers they overcome in the future.

Finally, I am thankful to everyone who supported me during this research. I would like to express my gratitude to my supervisor for your guidance and all the participants whose contributions were essential to this study. Your willingness to share your experiences and thoughts brought invaluable depth to my research.

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Appendix

Appendix A

Survey Results

The detailed results of the survey conducted in this project is provided in an Excel file.

To access the Excel file, please go to the following URL:

[+ Answers_Future Expectations of Mobile and AR Technologies in Tokyo](#)