Original Article

Audio guide system for small-scale historical buildings

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Abstract
We focus on small-scale historical buildings, which play an important role as local resources, and propose an audio guide system designed to introduce these buildings effectively. Specifically, we aim to create a low-cost, easily updatable system that local volunteer guides and building managers can easily utilize. Compared to conventional guided tours, this audio guide system can be operated with fewer staff members and enables tourists to learn about the history and culture of the buildings at their own pace. One key feature of the audio guide system is its support for multiple languages, catering to inbound demand, and providing audio and text formats. Additionally, the system employs generative AI technology to streamline the creation and updating of guide content. By leveraging generative AI, local volunteers, and staff can easily generate and update the content without needing specialized knowledge. For the demonstration experiment, the Cultural Path Area in Higashi Ward, Nagoya City, was selected as the site to evaluate the effectiveness of the proposed audio guide system. In this experiment, we assessed tourist satisfaction, understanding, and convenience when using the system, and identified areas for improvement and operational challenges. The results confirmed that a low-cost, easy-to-use audio guide system can contribute to the promotion of local tourism. This study proposes a novel approach to guide system development aimed at revitalizing local tourism. It provides a practical framework for collaboration between local communities and the tourism industry to promote the sustainable use of tourism resources.

Keywords
historical building, tourism promotion, audio guides, tourism volunteers, AI

1. Introduction

In recent years, Japan has experienced a significant increase in tourism demand, particularly in inbound tourism. In July 2024, the number of foreign visitors to Japan reached approximately 3.29 million, marking a record high for a single month. In this context, promoting tourism by utilizing regional resources has become increasingly important. According to related survey [Minetoshi, 2017], both domestic and international tourists exhibit diverse travel purposes, with a growing tendency to seek experiences and interactions tailored to the unique characteristics of each region. Tourism is an important growth sector, and efforts toward establishing Japan as a major tourism-oriented nation have long been promoted. By advancing regional tourism, it is expected to revitalize areas experiencing population decline and strengthen connections between regions. Furthermore, in the future development of the tourism industry, it is increasingly emphasized that rather than merely increasing the number of tourists, the focus should be on designing high-quality tourism experiences that stimulate demand from both domestic and international visitors [Kohsaka, 2022].

In regional tourism, scattered historical buildings represent key regional resources worthy of attention. The Japan Tourism Agency emphasizes the importance of promoting the preservation and utilization of historical buildings, advocating for town development that leverages valuable local historical assets [Japan Tourism Agency, 2024]. The utilization of small-scale historical buildings, which exist in many regions, is highly anticipated as a valuable tourism resource for the future. Moreover, regional volunteer tourism guides play an essential role in revitalizing regional tourism. In Aichi Prefecture alone, more than 60 organizations are actively engaged in guiding activities, serving to widely convey the unique appeal of local tourist attractions. However, many groups face challenges such as labour shortages and an aging population, limiting their ability to fully carry out their activities. As a result, there is a growing need to explore effective support measures to address these issues [The Nippon Foundation, 2024]. The promotion of regional tourism requires efficient resource management, making the utilization of information and communication technology (ICT) indispensable. Currently, local governments are actively promoting science and technology innovation policies, along with the use of big data, leading to the widespread application of ICT and data across various sectors [Cabinet Office, 2021]. In the tourism sector, various policies and initiatives have been implemented to promote the revitalization of regional tourism.

This study focuses on small-scale historical buildings in promoting regional tourism and proposes tourism support using an audio guide system. The reasons for this focus are as follows:

- Supplementing Information Provision:
  It is often challenging to have full-time guides available at small-scale historical buildings, which may result in visitors being unable to access sufficient information, potentially lowering their satisfaction. To address this issue, the introduction of an audio guide system allows for the provision of comprehensive tourism information even in the absence of guides, thereby enhancing the overall visitor experience and

satisfaction.

- Enabling Information Provision with Preservation and Protection:
  Small-scale historical buildings are often at risk of deterioration or damage, making it difficult to install physical exhibits or printed materials within the facility. Audio guides, being a non-contact information delivery method, contribute to the preservation of these structures by minimizing physical impact. As a result, the introduction of audio guide systems not only enhances the appeal of the facility but also offers significant advantages for efficient and sustainable tourism management.
- Reduction of Operating Costs:
  Small-scale facilities often have limited budgets and staff compared to larger establishments, making it difficult to implement large-scale personnel or guide systems. By utilizing an audio guide system, these facilities can achieve sustainable operations at a lower cost while simultaneously enhancing the quality of the visitor experience.
- Maximizing the Appeal of Tourism Resources:
  Compared to large-scale facilities, small-scale historical buildings often receive less attention and have lower public recognition. However, they possess significant historical value and unique stories. By effectively conveying their background and anecdotes through an audio guide system, these sites can enhance their appeal as tourism resources and provide visitors with a distinctive and enriching cultural experience.
- Addressing Inbound Demand through Multilingual Support:
  Small-scale historical buildings often face challenges in providing multilingual support, making it difficult for foreign tourists to access information. By implementing an audio guide system capable of delivering multilingual explanations, these facilities can effectively respond to the growing inbound demand within the region.
- Mitigating Congestion and Promoting Tourist Redistribution:
  Distributing tourists from popular large-scale destinations to smaller facilities is essential for the overall development of regional tourism. By enhancing audio guides, tourists can recognize the value of visiting small-scale facilities, contributing to the mitigation of overcrowding at major tourist spots and fostering regional revitalization.

Therefore, the purpose of this study is twofold. First, it aims to develop a practical, low-cost, and easily updatable multilingual audio guide system specifically tailored for small-scale historical buildings. Second, it seeks to conduct a preliminary field experiment to evaluate the usability, visitor satisfaction, and operational challenges associated with the proposed system. Through this study, we intend to provide a foundational framework that supports future large-scale implementations and contributes to the sustainable promotion of local tourism resources.

Based on these considerations, this study introduces a low-cost, flexible audio guide system designed to support volunteer guides and promote regional tourism. Specifically, the goal is to establish a practical support structure that enables local volunteer organizations and management bodies to create and operate multilingual audio guides without requiring specialized technical knowledge. For the field experiment, the “Cultural Path” area in Nagoya’s Higashi Ward has been selected as the target site. This area is characterized by numerous historical buildings and active volunteer guide activities, making it a representative setting for small-scale historical tourism initiatives.

Through this preliminary implementation, the effectiveness and usability of the proposed system will be evaluated, with the aim of contributing to the revitalization and sustainable development of regional tourism.

2. Current state of local tourism

The role of historical buildings in tourist destinations is crucial in shaping the cultural identity of the region and offering unique attractions to visitors. Maximizing the use of these regional tourism resources also contributes to regional revitalization and the promotion of sustainable tourism. However, current challenges include the underutilization of tourism resources and the lack of proper preservation and management. This chapter provides an in-depth examination of the current state of regional tourism centered around historical buildings and the efforts of volunteer guides associated with these sites.

In this study, “small-scale historical buildings” refer to locally rooted, lesser-known historical facilities that preserve the authentic atmosphere of their time. Rather than being nationally famous tourist destinations, these sites primarily serve as regional cultural resources, offering visitors the opportunity to experience the living history of the area. These niche historical sites or hidden cultural gems are typically operated with limited financial resources and receive a modest number of visitors annually (for example, fewer than 10,000). Representative examples include former residences, traditional merchant houses, and small shrines that remain closely connected to local communities.

2.1 Local tourism and historical buildings

In regional tourism, historical buildings serve as essential resources that directly convey the historical background and cultural heritage of the area. Castles, traditional houses, shrines, temples, and sites designated as important cultural properties are particularly attractive destinations for both domestic and international tourists. However, when these historical buildings are not properly preserved or when sufficient information is not provided to visitors, their full potential as tourism assets often remains underutilized. This issue is particularly prominent in small-scale facilities, where limited budgets and personnel frequently result in insufficient tourist information and guidance.

Additionally, in such facilities, visitors may be unable to fully understand the value and historical background of the

buildings, which can negatively impact their overall satisfaction. Therefore, effective information delivery is key to further promoting the tourism utilization of historical buildings within the region. This requires not only traditional means of providing information, such as brochures and information boards, but also the adoption of audio guide systems and multilingual digital technologies to enhance accessibility and understanding.

Furthermore, in some regions, there is an imbalance in tourist distribution, with visitors tending to concentrate at major attractions. To enhance the overall tourism impact across the region, it is necessary to implement measures that direct tourists to small-scale historical buildings. By leveraging technological support, such as audio guides, these smaller facilities can effectively provide information and unlock their value as tourism resources, contributing to the balanced development of regional tourism.

2.2 Current state of volunteer tourist guide

Volunteer tour guides are indispensable in regional tourism. By directly explaining the local history and culture to visitors, they enhance the quality of the tourism experience. In particular, guides with specialized local knowledge provide not only basic information about tourist sites but also unique insights and a deeper understanding for visitors. However, several challenges are associated with maintaining volunteer activities. First, the aging of volunteer guides and the shortage of personnel are significant issues. In many regions, the age demographic of volunteer guides is high, and efforts to train successors have not progressed sufficiently. Additionally, in some areas, the increasing number of tourists has outpaced the availability of personnel, making it difficult to meet demand. Furthermore, with the growing number of foreign tourists, there is a rising need for multilingual guidance, but many regions face challenges in securing guides who can provide such services.

To address these challenges, efforts have begun to implement support tools such as audio guide systems. By using audio guides as a supplementary resource, volunteer guides can create an environment where tourists can listen to information at their own pace, enhancing the overall visitor experience. Additionally, by utilizing new technologies, volunteers can provide information more efficiently, thereby reducing their workload. Furthermore, the digitalization of volunteer activities enables the accumulation of tour histories and visitor feedback, contributing to the continuous improvement of guide quality. The introduction of such digital technologies is expected to support the flexible provision of guide services tailored to the diverse needs of future tourists.

As outlined above, the activities of volunteer tour guides play a crucial role in regional tourism. However, to ensure sustainable operations and continuous improvement in quality, it is essential to introduce ICT tools such as audio guide systems. These tools can support volunteer guides and effectively promote regional tourism.

3. Audio guide system

Guide systems come in various forms, such as applications or printed materials, depending on the target and context of use. Among these, audio guides are one of the most commonly encountered guide systems. While they are frequently used in museums and art galleries to enhance the viewing experience, audio guides have recently been adopted in tourist destinations as well. In parallel with this trend, the application of digital technologies such as VR, AR, and mobile applications has been increasingly emphasized in the field of cultural heritage preservation and tourism promotion. Governmental organizations, including Japan's Agency for Cultural Affairs, have actively promoted the utilization of digital technologies to enhance the accessibility and sustainability of cultural resources [Agency for Cultural Affairs, Government of Japan, 2025]. However, small-scale historical facilities often face limitations in funding and technical capacity, making it difficult to implement large-scale digital solutions.

This chapter introduces related cases of audio guide systems in tourist sites and clarifies the position and feature of the system proposed in this study.

3.1 Practical cases of audio guide systems in tourist facilities

- Mashike Town (Hokkaido Prefecture):
  In Mashike Town, Hokkaido, an audio guide system has been introduced to support walking tours of the preserved historical streetscape. Visitors can access site-specific audio explanations via mobile devices while exploring independently. Although the guide content is currently available only in Japanese, the initiative reflects how digital tools can be leveraged to promote cultural understanding and tourism development in rural areas with limited resources.
- Hamada City (Shimane Prefecture):
  Hamada City has implemented an audio guide system that utilizes QR codes to deliver site-specific information via smartphones. Visitors can freely explore historical and cultural sites at their own pace while accessing concise audio explanations, available in several languages. This low-cost, contactless system serves as a sustainable model for enhancing regional tourism without imposing heavy infrastructure demands.
- Inuyama City (Aichi Prefecture):
  Inuyama City has developed an audio guide system across its historic castle town area, including sites such as Inuyama Castle, Sankoinari Shrine, and the Former Horibe Residence. The system allows visitors to learn about local history and culture independently, offering multilingual support to accommodate diverse visitors while preserving the traditional townscape. It contributes to making cultural tourism more accessible and sustainable at the local level.

  While many initiatives focus on broader street-walking-style tourism, there are also examples that specifically target individual historical buildings, offering unique visitor experiences.

- Modakuro (Japan):

  Modakuro [Modakuro, 2023] is a local initiative aimed at promoting modern architectural heritage in Japan. Through character-driven storytelling combined with digital audio guidance, visitors can learn about lesser-known architectural sites in an engaging manner. Although the content is innovative, its development and operational costs are relatively high, making it difficult for smaller regional facilities to adopt such complex systems widely.

  From these cases, perspectives such as flexible information delivery, digital engagement strategies, multilingual accessibility, and cost-effective promotion of local heritage provide valuable insights for the audio guide system that this study aims to introduce for small-scale historical buildings.

3.2 Development of audio guides in Seto City's tourism promotion

To develop the audio guide system, we conducted an interview survey with the Tourism Department of Seto City, Aichi Prefecture. Seto City has been using the "Listening Museum Guide" since February 2023, and we collected information regarding its implementation and usage.

The guide was created by an external contractor and allows visitors to listen to audio by scanning QR codes placed on information boards near the exhibits without the need to download an application. Additionally, it features an augmented reality (AR) function that includes Seto City's promotional character, "Seto-chan." A corresponding guide map is also provided, enabling visitors to follow designated routes and listen to the audio at specific points. Currently, the system is available only in Japanese, but there is a need for multilingual support. Recent visitor trends in Seto City show an increase in tourists, including foreign visitors, due to the opening of Ghibli Park. According to the officials, they expressed the need for a tracking system to monitor how many people are using the guide, as such data is currently unavailable.

Moreover, a project in collaboration with Nanzan University has developed the "Setomachi Audio Guide," which highlights the appeal of Seto City's shopping streets. This guide features the voices of local shop workers, creating a warm and personal experience. While information is shared via the city's official website, the audio guide aims to convey aspects of Seto's charm that cannot be fully expressed online. Visitors can use this guide by installing the audio guide app Pokke to access the audio content.

3.3 Significance and features of the proposed audio guide system

Based on insights gained from prior research and practical cases, this study focuses on the following key aspects in proposing the system:

- Low-Cost Design Specialized for Small-Scale Historical Buildings:

  Existing audio guide systems are often designed for large-scale facilities, but the system proposed in this study is designed to be feasible for small-scale facilities. It does not require specialized equipment or advanced technical knowledge, allowing volunteer guides to independently operate and manage the system with ease.
- Flexible Information Delivery Using QR Codes:

  The system includes explanatory content for multiple locations within the facility. QR codes are created for each point of interest, allowing visitors to access the audio guide by scanning the code of their chosen location. This setup enables visitors to flexibly obtain information according to their preferences.
- Addressing Inbound Demand through Multilingual Support:

  The system is designed to provide multilingual audio guides easily using QR codes. It supports Japanese, English, and Chinese, with the flexibility to expand to additional languages based on local inbound demand. This adaptability ensures that the proposed system can accommodate future language needs.
- Preservation of Facilities and Optimal Use of Tourism Resources:

  By minimizing physical information displays, the system preserves the aesthetic appeal and historical value of the facility while providing visitors with the necessary information. This non-contact approach enables the coexistence of cultural property preservation and effective tourist guidance.

With these features, the proposed system is expected to serve as a new means of information delivery in small-scale historical buildings, enhancing visitor satisfaction, maximizing the value of the facilities, and contributing to the revitalization of regional tourism. Additionally, feedback obtained after implementation will be utilized to further improve the system, ultimately aiming to develop a sustainable tourism model.

3.4 Considerations for the development of the proposed audio guide system

When proposing the audio guide system, it is important to take the following requirements into consideration.

- Distribution via Printed Materials:

  Historical buildings are often made of materials that are themselves valuable, and many organizations prefer to avoid any damage to them. To provide access to audio guides for exhibits, a map containing QR codes will be distributed at the entrance. Visitors can scan the appropriate QR codes at each location to access the audio guides. The map will be a reused version of an existing map, with QR codes added to the map data. This approach ensures minimal disruption to the site while making the guide accessible.
- Easily Updatable and Cost-Effective System:

  For volunteer guides who may not be familiar with advanced technology, an intuitive and simple system is essential. The

proposed system will utilize existing audio recording applications for creating and managing audio files, eliminating the need for specialized equipment or technical expertise. The recorded audio files will be uploaded to cloud storage services such as Google Drive, and QR codes will be generated using the shared URLs. This process allows volunteer guides to easily add or update new information and audio content.

Additionally, because audio files are small, they can be hosted on various platforms, such as Google Drive or the websites maintained by volunteer guide organizations. This enables efficient system management at a low cost while ensuring quick updates of information as needed.

- Multilingual Support:
  With the growing demand for inbound tourism, multilingual support is a critical requirement. The audio guide system should include audio content not only in Japanese but also in English, Chinese, and Korean, languages that are frequently used by international visitors.

4. Practical experiment

4.1 Townscape preservation area at Higashi Ward, Nagoya

The "Cultural Path" in Nagoya's Higashi Ward, which serves as the field site for this study, is an area extending from Nagoya Castle to Tokugawaen. It is rich in historical heritage representing Nagoya's modernization journey. Nagoya City takes the lead in organizing events and promoting the preservation and utilization of valuable architectural heritage in this area. The Cultural Path features numerous historical buildings, with one of the most prominent being the former Sasuke Toyoda Residence. The Sasuke Toyoda Residence, built in 1923 (some sources suggest 1915), consists of a Western-style house with white tiled walls and a spacious Japanese-style residence. Sasuke Toyoda, the younger brother of the famous inventor Sakichi Toyoda, was a businessman who supported Sakichi's success. The residence, including its guest rooms designed to welcome international visitors, is rich with notable features and historical significance.

The Cultural Path Guide Volunteers of Higashi Ward is an NPO that provides guided tours along the Cultural Path. Its mission is to introduce the diverse history, culture, industry, and notable figures of Nagoya's Higashi Ward to both domestic and international visitors through volunteer-guided tours. By sharing the area's charm, the organization aims to contribute to cultural urban development, foster a healthy civil society, and promote the public good.

The volunteer guides are based at the former Sasuke Toyoda Residence, where they provide regular guided tours three times a week. However, on days when volunteers are unavailable, only staff members without guiding roles are present, resulting in the absence of guided tours and limited visitor information. Providing guided tours enhances visitors' understanding of the facility. Surveys conducted among foreign tourists have indicated a strong desire for expert explanations and communication in languages such as English and Chinese.

The organization currently has around 60 members as of 2021, and aging among its members is becoming a significant challenge. This study proposes a system that enables organizations, such as the Cultural Path Guide Volunteers, which may not be familiar with digital technology, to easily build and implement audio guides. The effectiveness of the system will be tested through field experiments.

4.2 Development of audio guide system

We propose the development of an audio guide system for the former Sasuke Toyoda Residence. First, audio guide files were recorded using the recording function of mobile devices, and the recorded files were uploaded to Google Drive to generate shared links. For multilingual support, an English guide was created with the help of a member of the Higashi Ward Cultural Path Guide Volunteers who is proficient in English. Additionally, to accommodate the growing number of Chinese tourists, the authors translated the content into Chinese and created a Chinese audio guide.

Subsequently, QR codes were generated based on the shared links, and the codes were placed on a map of the former Sasuke Toyoda Residence using image editing tools. The layout was designed to make the locations of each explanation point easily identifiable. Finally, the completed map was printed, mounted on a display board, and placed at the entrance of the residence to enhance visitor convenience (Figure 1).

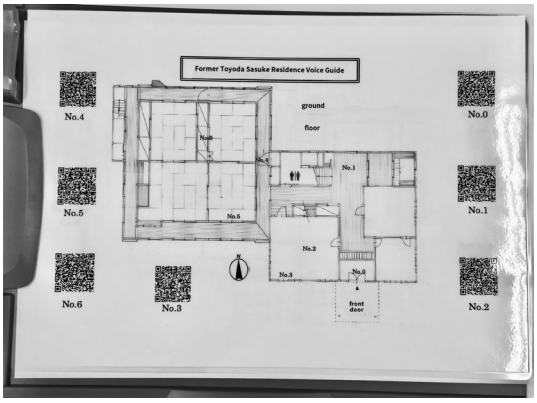

Figure 1: Audio guide map

4.3 Practical use of audio guide system

The survey participants consisted of visitors to the former Sasuke Toyoda Residence during the three-day period from November 2 to November 4, 2024. This period was within the "Let's Walk! Cultural Path" event, which took place from November 2 to 24, 2024. Specifically, there were 40 users of the Japanese guide and 2 users of the English guide, totalling 42 participants. As the former Sasuke Toyoda Residence is a small- to medium-sized facility with fewer visitors compared to other sites like Futaba Museum, the survey was conducted during the event period when a larger number of visitors were expected (Figure 2). Furthermore, to enhance the representa-

Figure 2: Survey in progress

tion of inbound tourists, two additional responses were collected in February 2025, resulting in a total of 44 participants.

The questionnaire on the audio guide consisted of seven questions, and respondents were asked to rate each item on a 5-point scale, ranging from "5-Strongly Disagree" to "1-Strongly Agree" (with some adjustments to the evaluation criteria based on the content of certain questions). Furthermore, since the audio guide system supported multiple languages, the questionnaire was provided in three languages—Japanese, English, and Chinese—to accommodate the diverse linguistic needs of the participants.

4.4 Practical application and discussion of audio guide system

A total of 44 participants responded to the questionnaire. Among them, 40 completed the Japanese questionnaire, while 4 responded in foreign languages. The breakdown of the respondents is as follows: 14 respondents were between the ages of 23 and 39, consisting of 4 males, 9 females, and 1 who did not specify their gender. The largest group, consisting of 23 respondents, was aged 40 to 64, with 7 males, 11 females, and 5 who did not specify their gender. Four respondents were aged 65 or older, including 3 males and 1 female. Additionally, 3 respondents did not provide their age, consisting of 1 male, 1 female, and 1 who did not specify their gender.

In response to the question, "Was the audio guide easy to hear?" 86 % of participants answered "Strongly agree" or "Agree." This result suggests that the audio guide's sound quality was sufficiently clear for most users (Figure 3).

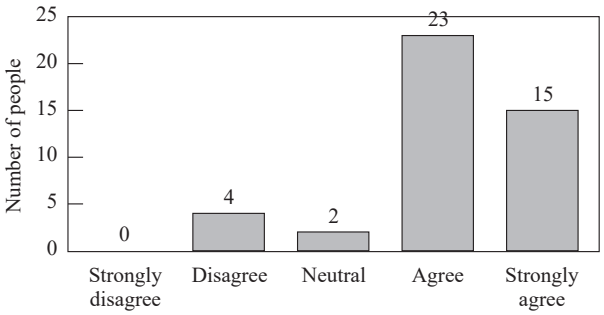

Figure 3: Responses regarding the clarity of the audio guide

In response to the question, "Was the content of the audio guide easy to understand?" 86 % of respondents answered "Strongly agree" or "Agree." This result indicates that the content of the audio guide was sufficiently easy for users to understand. Among them, foreign tourists also provided similarly positive evaluations (Figure 4).

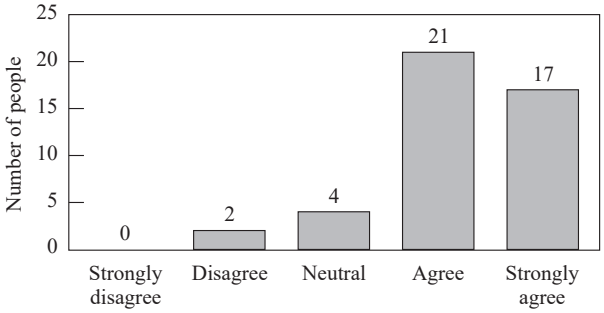

Figure 4: Responses regarding the clarity of the audio guide content

The results of the question, "Do you ask for a guide for your usual trips?" are as follows: Among respondents aged 23 to 39, a majority selected "never" or "seldom," with a total of 8 respondents (approximately 57 %) showing a tendency not to use guides. Similarly, in the 40 to 64 age group, 15 respondents (approximately 65 %) selected "never" or "seldom," indicating a low frequency of guide usage. On the other hand, among respondents aged 65 and older, 3 selected "sometimes" and 1 selected "not sure," showing a greater tendency to use guides compared to the younger groups. Additionally, among the 3 respondents who did not provide their age, 2 selected "usually," reflecting a positive attitude toward guide usage. These results suggest that respondents in the middle-aged groups (ages 23 to 64) show a stronger tendency to select "never" or "seldom," indicating they do not frequently use guides. In contrast, older respondents and those who did not disclose their age tend to select "sometimes" or "usually," indicating a higher likelihood of guide usage (Figure 5). All foreign tourists selected "sometimes," showing moderate usage of guides.

In response to the question, "Have you ever used an audio guide service?" 81 % of the respondents indicated that they had previously used an audio guide. This result suggests that a majority of the respondents have experience using audio guides (Figure 6).

In response to the question, "Was it easy for you to follow

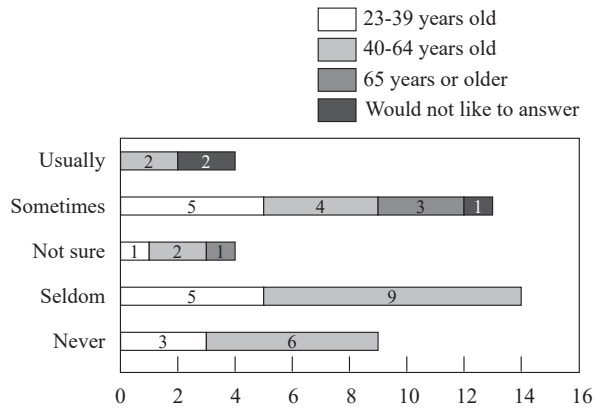

Figure 5: Responses regarding the frequency of guide usage

the map of the audio guide?" 77 % of respondents answered "Agree" or "Strongly agree." Among them, foreign tourists also provided similarly positive evaluations (Figure 7).

In response to the question, "After using the audio guide service, how did you think?" approximately 80 % of the respondents answered either "I definitely want to use it next time" or "I would like to use it if there is one." This result suggests that the audio guide provided a high level of satisfaction among users (Figure 8).

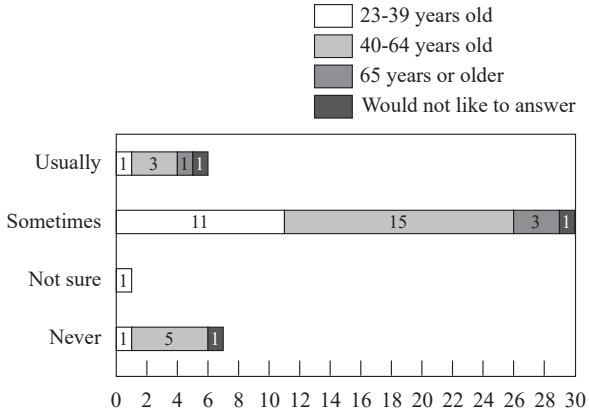

Figure 6: Responses regarding the use of audio guides in the past

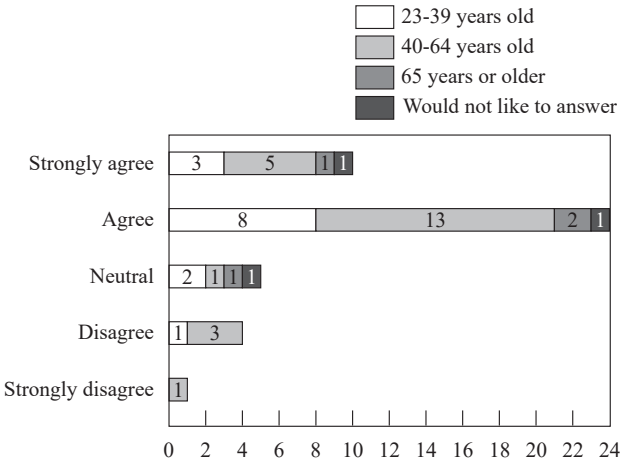

Figure 7: Responses regarding the ease of following the audio guide map

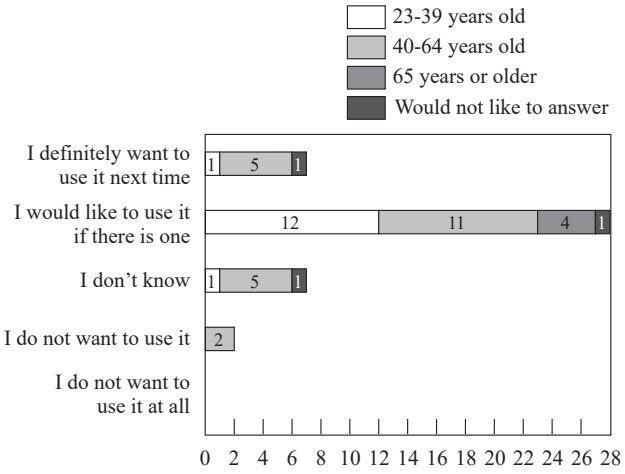

Figure 8: Responses regarding impressions after using the audio guide

The combined results of the questions, "Do you ask for a guide for your usual trips" and "After using the audio guide service, how did you think?" reveal that many respondents who answered "seldom" or "never" regarding their usual guide usage indicated "I would like to use it if there is one" for the audio guide. Meanwhile, those who typically answered "usually" also expressed "I definitely want to use it next time." These findings suggest that the audio guide is well-received across a broad range of users, regardless of their usual habits of requesting a guide (Figure 9).

The responses to the questions "Have you ever used an audio guide service?" and "After using the audio guide service, how did you think?" were analyzed in combination to identify potential correlations and relationships between prior usage and user impressions. The results of the questions "Have you ever used an audio guide service?" and "After using the audio guide service, how did you think?" were analyzed together. The analysis revealed that all respondents who answered "sometimes"

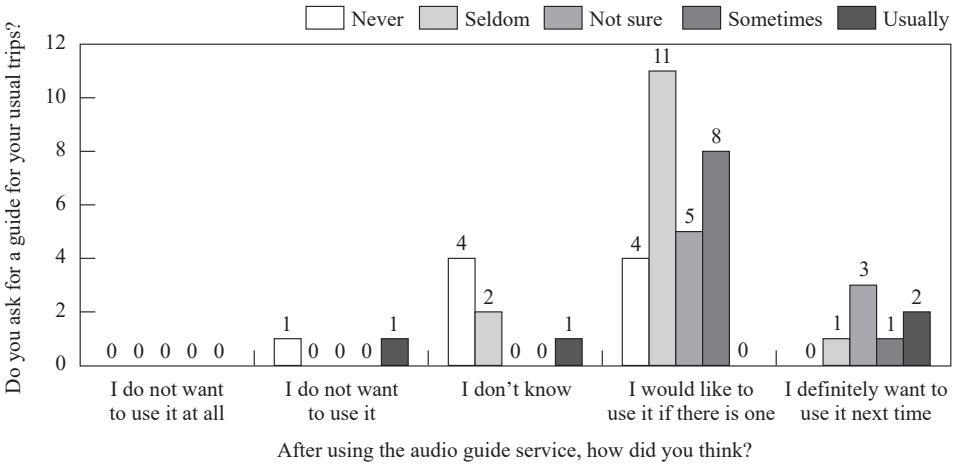

Figure 9: Relationship between "guide request frequency" and "impressions of the proposed audio guide"

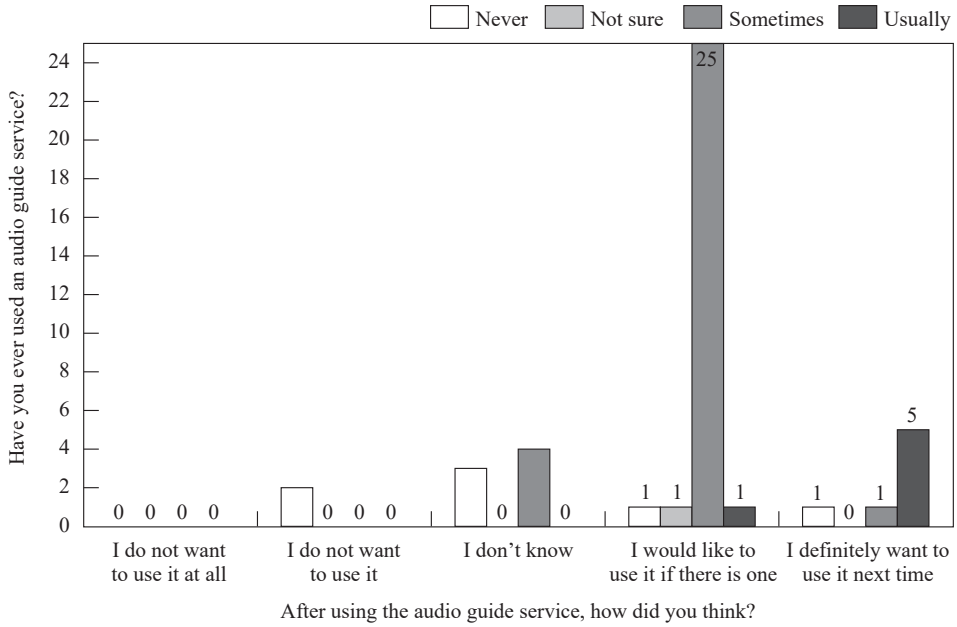

Figure 10: Relationship between "audio guide usage frequency" and "impressions of the proposed audio guide"

indicated "I would like to use it if there is one" for future audio guide usage. Additionally, even among those who answered "never" regarding previous usage, some responded with "I definitely want to use it next time," indicating a potential latent demand for audio guides. On the other hand, negative responses, such as "I do not want to use it at all" and "I do not want to use it," accounted for only two cases in total, showing that negative opinions were in the minority. Moreover, positive responses, such as "I would like to use it if there is one," accounted for more than half of the total responses, suggesting a high likelihood of the audio guide being accepted by users (Figure 10).

Overall, the responses from the Japanese questionnaire showed the same trends as those from the foreign language questionnaires and received similarly positive evaluations.

Acknowledging the limitations of the sample size and inbound tourist representation, a more detailed discussion is provided in the Conclusion section.

5. Improvements to the system for practical use in guide

The analysis of the survey results regarding the proposed audio guide system revealed that it was well-received by users. Therefore, to promote the system's broader application in more small-scale historical buildings, it is necessary to design a highly versatile system that can be widely adopted and to actively encourage its implementation. Through the field experiment mentioned earlier, volunteer guides successfully collaborated with the authors to develop the proposed system. Moving forward, establishing a streamlined process for creating and implementing content more easily will be essential. Additionally, several suggestions for improvement were gathered from the survey responses: (1) "Operating the QR code requires both hands," (2) "It would be useful to have the option to fast-forward through the entire guide," and (3) "It would be helpful to jump to specific chapters as needed." To address these challenges and improvements, discussions will be held with volunteer guides to explore ways to make the system more convenient and user-friendly for tourists.

5.1 Generating audio lists using spotify for creators

In the survey, several respondents mentioned that "scanning each QR code one by one is tedious." On the other hand, many expressed that "a system allowing access to multiple explanations with a single operation would be convenient." Reflecting on this feedback, we considered and implemented two possible solutions.

- Entire Audio Guide:
  This format compiles explanations for the entire sightseeing route into a single audio file. As a result, visitors can enjoy the tour smoothly without interruptions. However, this format may be inconvenient for those who wish to listen to explanations for specific locations only, so careful consideration of its appropriate use is necessary.
- Segmented Audio Guide:
  In this format, scanning a QR code provides access to a playlist of segmented audio explanations, with each segment corresponding to a specific location or point of interest. This allows visitors to selectively listen to the explanations of places they find interesting, offering high flexibility and adaptability to diverse tourist needs. To further enhance convenience, we propose using Spotify as the platform for distributing the audio guides. By utilizing Spotify, uploading and managing audio files becomes easier, and future updates can be handled more efficiently (Figure11).

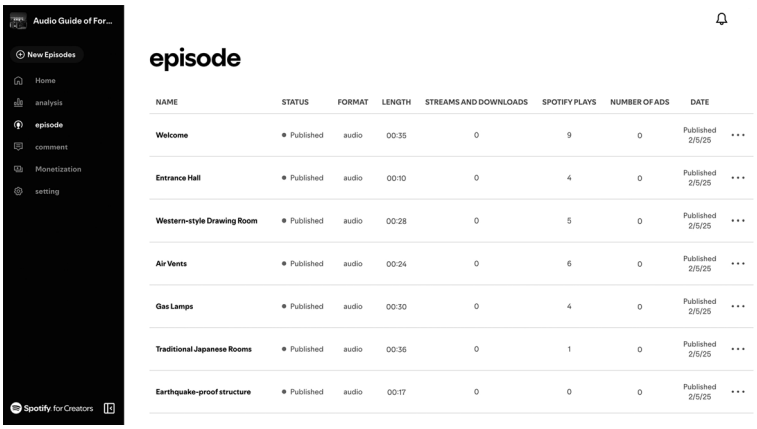

Figure 11: Spotify administrator interface

Additionally, the system offers the following benefits to users.

- Audio Guide Options:
  Users can freely choose between the entire-version guide and the segmented guide, allowing flexible customization based on sightseeing style and time. (Figure 12).

- Text Display Functionality:
  By utilizing the Spotify application, users can view explanatory text synchronized with the audio content, allowing them to comprehend tourist information not only auditorily but also visually. This feature is particularly beneficial for users who may have difficulty hearing or for tourists aiming to learn a language, as it aids in understanding the guide's content (Figure 13).

- Simple Accessibility:
  The system can be easily accessed using only a smartphone, without the need for additional dedicated devices or applications. By designing it to provide direct access to specific Spotify playlists through QR codes, the system offers an

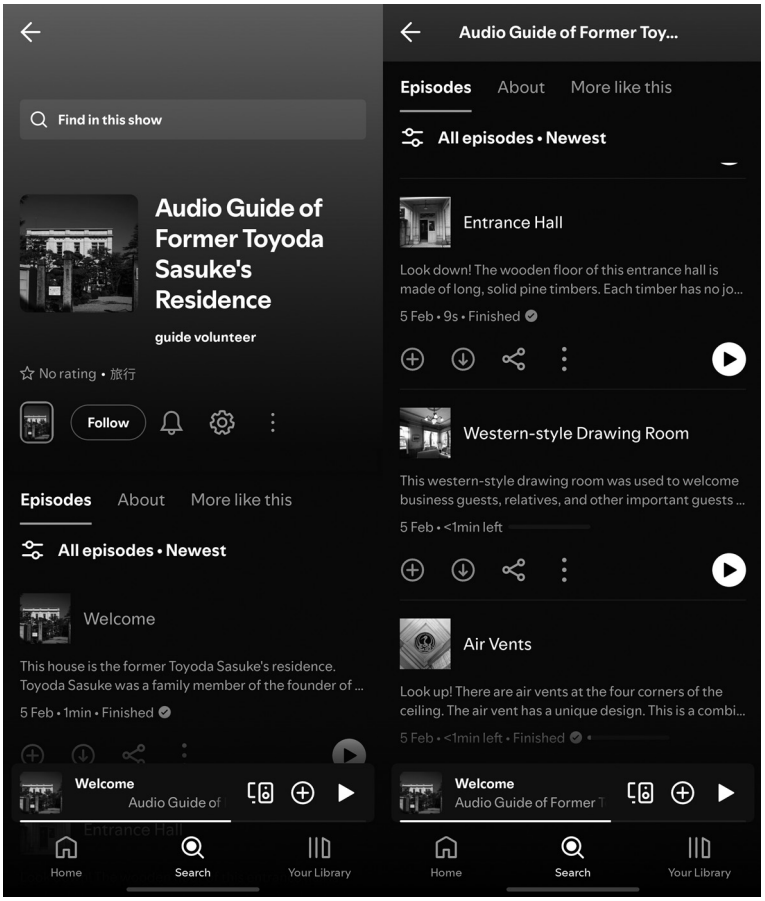

Figure 12: Spotify user interface

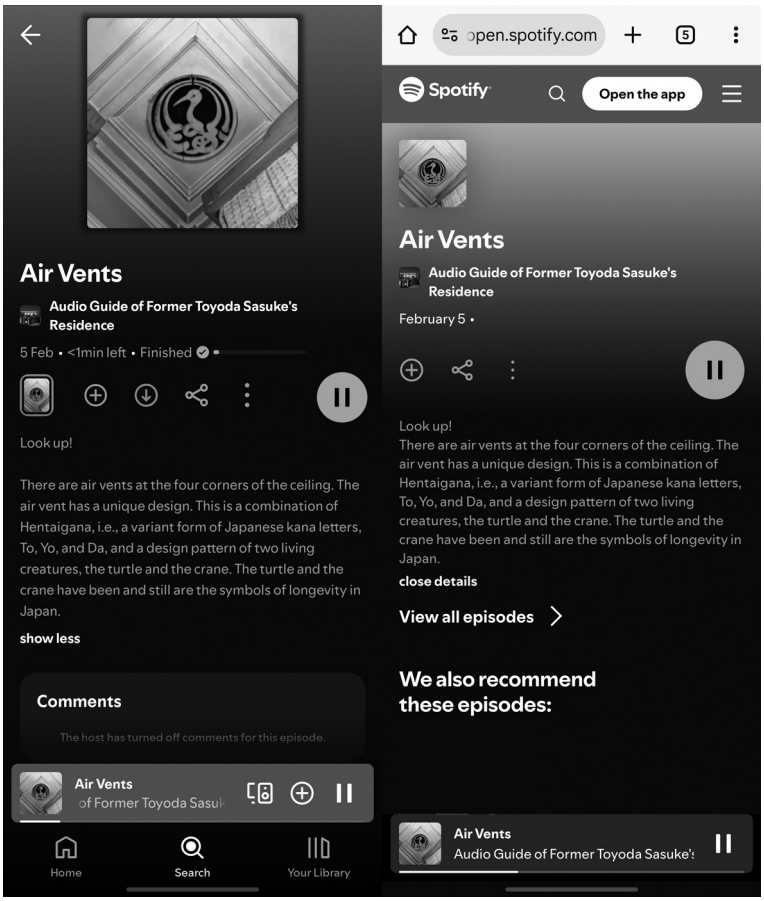

Figure 13: Display of synchronized text and images alongside audio in Spotify

intuitive and user-friendly experience. For users with the Spotify app installed on their smartphones, scanning the QR code automatically launches the app. Even for those without the app, there is no need for downloading it, as Spotify's interface will open directly in the browser, allowing users to start playback seamlessly (Figure 13). Through these efforts, the introduction of audio guides is expected not only to effectively convey the appeal of tourist destinations but also to contribute to improving visitor satisfaction and enhancing the overall value of the destination.

5.2 AI utilization

In the field experiment mentioned earlier, audio guides were created by staff proficient in English and native Chinese speakers. However, it is challenging to ensure the same level of support every time the content needs updating. To enable broader adoption of the proposed audio guide system in more small-scale historical sites, it is essential to introduce a feature that facilitates the creation of highly versatile and easily adaptable multilingual content. To achieve this, we utilize large language models (LLM) for content translation and description generation, along with a Text-to-Speech (TTS) tool [TTSMaker, 2025], based on AI technology, for audio guide production.

- Multilingual Adaptation and Content Creation:
  LLMs are AI models trained on vast amounts of text data, driving breakthroughs in fields like natural language processing and computer vision. As LLM can understand context and generating human-like text, they are widely used for applications such as multilingual translation, content creation, dialogue systems, and summarization. In this study, we propose and implement the use of LLMs for the creation and translation of content. Among the various available LLMs, we adopt GPT-4o mini, a free and accessible model. By leveraging LLMs, accurate translations from Japanese into multiple languages, including English and Chinese (key languages for regions with significant numbers of tourists), can be achieved. Figure 14 presents the results of translating Japanese guide descriptions into English and Chinese.

  Moreover, translation outputs can be refined by using prompts—specific instruction commands that allow further customization of the translation (Figure 15). This approach enables efficient generation of content that closely resembles explanations provided by native speakers, making it highly effective when new content is introduced.

- Efficient Creation of Audio Guides:
  To efficiently produce audio guides, we use the AI-based Text-to-Speech (TTS) tool, TTSMAKER. This application is

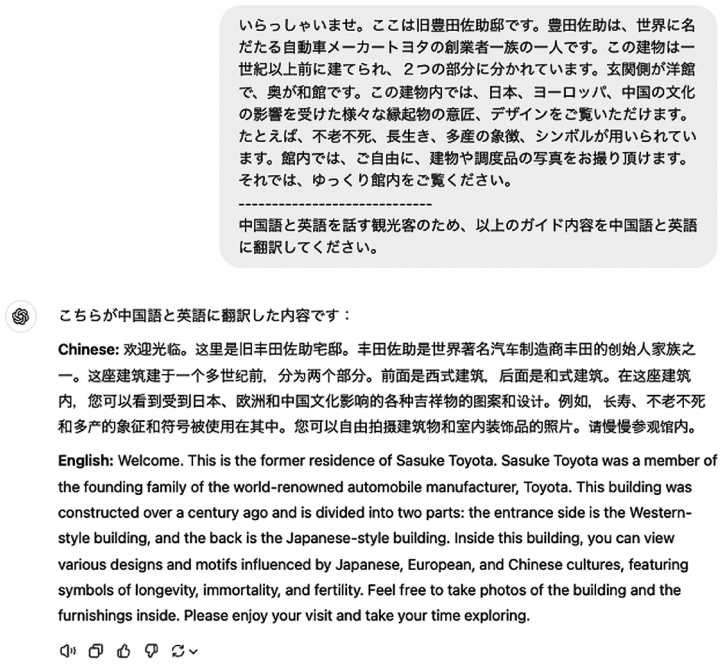

Figure 14: Results of translating Japanese guide descriptions into English and Chinese

Note: The original descriptions were written in Japanese, and the conversation shown demonstrates the output of multilingual translation based on the Japanese text.

Figure 15: Adjustment of translation results through prompts

Note: The original input was in Japanese, and the dialogue illustrates how prompts were used to refine the English and Chinese translation outputs generated by the system.

free to use, and the generated content can be used commercially without copyright issues. Additionally, the audio files generated by TTSMAKER can be directly downloaded for immediate use. The tool supports multilingual pronunciation and covers the major languages commonly used in tourism and international contexts. Moreover, it offers multiple voice options for each language, including male and female voices, as well as voices across different age groups (such as youth and middle-aged individuals), allowing for the selection of the most suitable voice depending on the context. This enhances the audio guides by adding a sense of familiarity and immersion. The process is further streamlined by allowing users to generate audio files simply by inputting text. In the field experiment, while native speakers were originally needed for recording, we were able to input prepared scripts into TTSMAKER and other speech synthesis tools, producing multilingual audio files in a short time. By utilizing high-quality AI-generated speech, we significantly reduced production costs. When updates are necessary, new audio can be created quickly and easily.

6. Conclusion

In this study, we developed an audio guide system for small-scale historical buildings and evaluated its effectiveness through field experiments. The survey results indicated positive feedback from users, confirming that the system left a good impression. A considerable number of respondents expressed interest in using the proposed audio guide if available. However, some users also reported inconvenience in its usage, which led us to propose a method for organizing multiple audio guides. This improvement allows users to listen to the entire guide at once or jump to specific sections using chapters. Furthermore, to enhance the system's convenience and versatility, we integrated functionalities powered by large language models (LLMs) and AI-based speech synthesis tools. This enabled the efficient creation of content while reducing production costs.

Although the field experiment yielded valuable insights, there are certain limitations that should be acknowledged. The Former Sasuke Toyoda Residence, the experimental site for this study, recorded a total of 9,645 visitors throughout 2023, including 1,559 visitors during the peak month of November. Among them, only 35 were inbound (foreign) tourists. Reflecting this actual visitor distribution, the initial survey collected 42 responses during the November 2024 event period, including 2 from inbound tourists. To enhance the representation of inbound participants, two additional responses were collected in February 2025, resulting in a total of 44 participants (40 domestic and 4 inbound). Nevertheless, the overall sample size remains small, and the findings should be interpreted as preliminary results of a pilot study.

Moving forward, future research will involve larger-scale implementations across multiple historical sites, aiming to include a broader and more diverse participant group, particularly focusing on inbound tourists. Expanding the range of facilities and sample diversity will allow for a more comprehensive evaluation of the proposed system's effectiveness and its adaptability to various small-scale historical tourism contexts.

In parallel, we plan to further improve the system by developing personalized audio guides that leverage user behavior data, enabling more tailored and engaging visitor experiences. Continued advancements in technology, such as AI-based speech synthesis and behavior analysis, will be integrated to enhance the overall usability and appeal of the system.

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