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DEVELOPMENT MODEL FOR VIRTUAL REALITY (VR) TOURISM IN RURAL AREAS: A GIS-BASED APPROACH

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Abstract

This paper provides an overview of a development model for virtual reality (VR) tourism using Geographic Information System (GIS) data and spatial distribution analysis of potential tourism products. The study employs a mixed-methods approach, combining qualitative and quantitative data collection techniques. Qualitative methods, such as interviews and focus groups, gather insights from stakeholders, including tourists, local communities, and tourism industry professionals, regarding their perceptions, expectations, and preferences. Quantitative methods, such as surveys and data analysis, provide a comprehensive understanding of visitor demographics, preferences, and the economic impact of VR tourism. The findings of the study focus on identifying and analysing the components of tourism products and data information specifically within the rural area of the Perak Tengah District. Information about tourism products is collected and encoded into a GIS database. The introduction of a new classification system justifies the development model and outlines a detailed process for each stage of the framework's methodologies. The originality and value of this research used a mixed-methods approach to gather qualitative and quantitative data, illustrating the overview of VR tourism development using the GIS tool approach specifically for tourism products in rural areas.

Keywords: Virtual Reality Tourism, Geographic Information System (GIS), Spatial Distribution Analysis, Tourism Products, Rural Areas, GIS Database

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INTRODUCTION

Tourism planning plays a vital role in ensuring the tourism industry's successful development and sustainable growth. It involves multiple stakeholders, including government agencies at the district, state, and federal levels and private entities. Integrated planning is crucial to avoid conflicts and balance societal needs, cultural preservation, infrastructure development, environmental conservation, and overall physical development. Well-executed tourism planning boosts the influx of domestic and international tourists and stimulates the local economy, benefiting those directly and indirectly involved in the industry. While virtual reality (VR) tourism is gaining momentum worldwide, its establishment in Malaysia remains relatively nascent (LENS.ORG, 2021). Given the current global context and the new normal brought about by the COVID-19 pandemic, this presents an opportune time to develop a VR tourism model in Malaysia. Several previous studies, such as those conducted by Hashim & Jusof (2010) and Schiopu et al. (2021), have utilised qualitative approaches to explore various aspects of tourism research.

This paper aims to address the gap in VR tourism development in Malaysia by proposing a comprehensive model for implementing VR tourism experiences. By leveraging the unique capabilities of VR technology, Malaysia can tap into the growing demand for immersive travel experiences, attracting both domestic and international visitors. The model will emphasise integrating VR technology into existing tourism planning processes, ensuring a seamless and coordinated approach.

The objectives of this paper is (i) to identify the tourism attractions and products available in the Perak Tengah district, (ii) to analyse the GPS coordinates data and integrate the data into a GIS framework, facilitating the visualisation and mapping of tourism attractions and products in the Perak Tengah district and (iii) to develop a model for promoting tourism attractions and products through GIS-based data.

LITERATURE REVIEW

Domestic Tourism in the new normal

The COVID-19 pandemic in 2020 has significantly impacted the global tourism industry, including domestic tourism in Malaysia. Despite the challenges posed by the pandemic, domestic tourism has remained in demand among Malaysians, as indicated by growth from 7.7% to 8.1% per year (Department of Statistics, 2020). The emergence of the "new normal" has necessitated the adoption of specific guidelines and Standard Operating Procedures (SOP) to ensure the safety of travellers. These guidelines include the implementation of 3Ws (wash, wear, and warn) and the avoidance of 3Cs (crowded, confined, and closed spaces) (Ministry of Tourism, Arts and Culture, 2020). Domestic travel bubbles have also

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been established to facilitate safe travel within the country. However, with the persistent increase in COVID-19 cases and the implementation of controlled movement, there is a need to explore new approaches and models for domestic tourism that can boost the local economy. Malaysia has experienced a surge in COVID-19 cases, reaching four digits daily (Ministry of Health, 2021). In response, it becomes essential to consider innovative approaches like virtual reality (VR) tourism to cater to the changing needs of domestic tourists.

Virtual Reality Tourism in Malaysia

Despite the potential of VR tourism, there has been limited research on this approach within the Malaysian tourism field in the past five years. However, studies conducted in European countries, such as Arnold's research (2005) on virtual tourism in cultural heritage, have highlighted the potential market for cultural heritage in tourism. In Malaysia, a few lesser-known studies have focused on VR or online approaches. For instance, Sharib (2009) explored the use of digital imagery and products through the Online Virtual Malaysia Walkthrough (MAWA). MAWA employs a team of specialists in 3D graphics, instructional design, multimedia, and internet development to visualise complex data and provide access to remote and inaccessible cultural and natural heritage sites in Malaysia. Regarding research methodologies, Vishwakarma et al. (2020) employed a quantitative approach, utilising the Value-Based Adoption Model (VAM), to examine the importance of perceived immersion and physical tourist value in VR tourism. Hashim & Jusof (2010) employed High Dynamic Range Imaging (HDRI) photography to document historical areas and analyse photo images. Similarly, Schiopu et al. (2021) applied the Technology Acceptance Model (TAM) to combine perceived attraction factors and produce an attractive tourism mapping system. Harun (2018) conducted qualitative research using observation, inventory of resources, focus groups, and interviews to assess the potential of cultural heritage as a new tourist attraction. This study aims to combine both qualitative and quantitative approaches to enhance data collection and analysis, thus producing valuable insights. It is worth noting that there needs to be more evidence of scholars applying such research on VR tourism in Malaysia and utilising Geographic Information Systems (GIS) to develop VR tourism models.

Overall, the existing literature reveals the significance of domestic tourism in Malaysia, especially in the context of the COVID-19 pandemic and the new normal. Furthermore, it highlights the potential of VR tourism as an innovative approach to boost the tourism industry. The studies mentioned offer valuable insights into various aspects of VR tourism, including cultural heritage, perceived immersion, physical tourist value, and attraction mapping. However, there is still a need for further research in this field, particularly in the Malaysian

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context, to fill the existing research gap and provide practical recommendations for policymakers, tourism planners, and industry practitioners. Based on the published literature, the following Table 1 and Table 2 show the Distribution of the VR Approach in Tourism Research based on the methodology:

Table 1: Distribution of VR Approach in Tourism Research based on Methodology

Research Study	Methodology Used
Arnold (2005)	A qualitative study on virtual tourism in cultural heritage
Sharib (2009)	Use of digital imagery and products (Online Virtual Malaysia Walkthrough - MAWA)
Hashim & Jusof (2010)	Research modelling using High Dynamic Range Imaging (HDRI) photography
Harun (2018)	Qualitative research using observation, inventory of resources, focus groups, and interviews
Schiopu et al. (2021)	Employed the Technology Acceptance Model (TAM) for analysing perceived attraction factors and producing a tourism mapping system
Vishwakarma et al. (2020)	A quantitative study using the Value-Based Adoption Model (VAM)

The table above presents a distribution of research studies focusing on the VR approach in tourism based on the methodology used. Arnold (2005) conducted a qualitative study on virtual tourism in cultural heritage, providing insights into the potential market for cultural heritage in tourism. Sharib (2009) explored the use of digital imagery and products through the Online Virtual Malaysia Walkthrough (MAWA) platform. Vishwakarma et al. (2020) conducted a quantitative study utilising the Value-Based Adoption Model (VAM) to examine the importance of perceived immersion and physical tourist value in VR tourism. Hashim & Jusof (2010) employed High Dynamic Range Imaging (HDRI) photography for research modelling, specifically in documenting historical areas and analysing photo images. Schiopu et al. (2021) utilised the Technology Acceptance Model (TAM) to combine perceived attraction factors and develop an attractive tourism mapping system. Lastly, Harun (2018) conducted a qualitative study using observation, an inventory of resources, focus groups, and interviews to explore the potential of cultural heritage as a new tourist attraction.

These studies demonstrate the diverse methodologies in VR tourism research, ranging from qualitative approaches to quantitative analyses. Each methodology provides unique insights into different aspects of VR tourism, including cultural heritage, immersion, physical tourist value, and attraction mapping. Researchers can gather comprehensive data and generate valuable findings to inform VR tourism development by combining various research methods.

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Table 2: Distribution of VR Approach in Tourism Research based on methodology (ii)

VR approach in tourism (author / year)	Research Modelling	Quantitative Approach	Tools for cultural heritage site interpretation	No of Method Used
Arnold (2005)	✓	✓	✓	3
Yenganaidu (2005)		✓		1
Sharib (2009)			✓	1
Hashim & Jusof (2010)	✓			
Harun (2018)	✓	✓	✓	3
Vishwakarma et al. (2020)	✓	✓		2
Schiopu et al. (2021)	✓	✓		2
Total No. of Authors	**5**	**5**	**3**	

Source: Author's Calculation

CONCEPTUAL MODEL

The conceptual model presented in this research represents a pioneering empirical study that aims to develop a Virtual Reality (VR) tourism model using a Geographic Information System (GIS)-based approach. This model is designed to enhance domestic tourism, stimulate economic growth, and promote a pro-growth agenda in Malaysia, particularly within the local population. This project aims to target industries, practitioners, stakeholders, and the general public to promote tourism products, specifically in rural areas. The framework for developing an integrated virtual reality (VR) model using the Geographic Information System (GIS) tool approach specifically for applying GIS spatial analysis for tourism products in rural areas as shown in Figure 1.

Development of the VR Tourism Model

The development of the VR tourism model revolves around providing comprehensive data and information on tourism products, with a specific focus on the rural areas of Perak Tengah District. The collection of information about tourism products is encoded into a GIS database, enabling efficient storage, analysis, and visualisation of spatial data.

GIS Data Components

The GIS data for the VR tourism model consists of several components that contribute to the overall functionality and effectiveness of the model. These components include:

1. Base Map:

i. **Administrative Boundary**: This includes delineation of state, local, and mukim boundaries.
ii. **Land Use**: Existing and committed land use information is incorporated to provide context for tourism development.
iii. **Land Use Zoning**: This component highlights the zoning regulations and designations related to land use in the target area.
iv. **Tourism Information**: This category encompasses various types of tourism products, including accommodation, educational institutions, conference facilities, trade and services, food and beverages, and places of attraction.

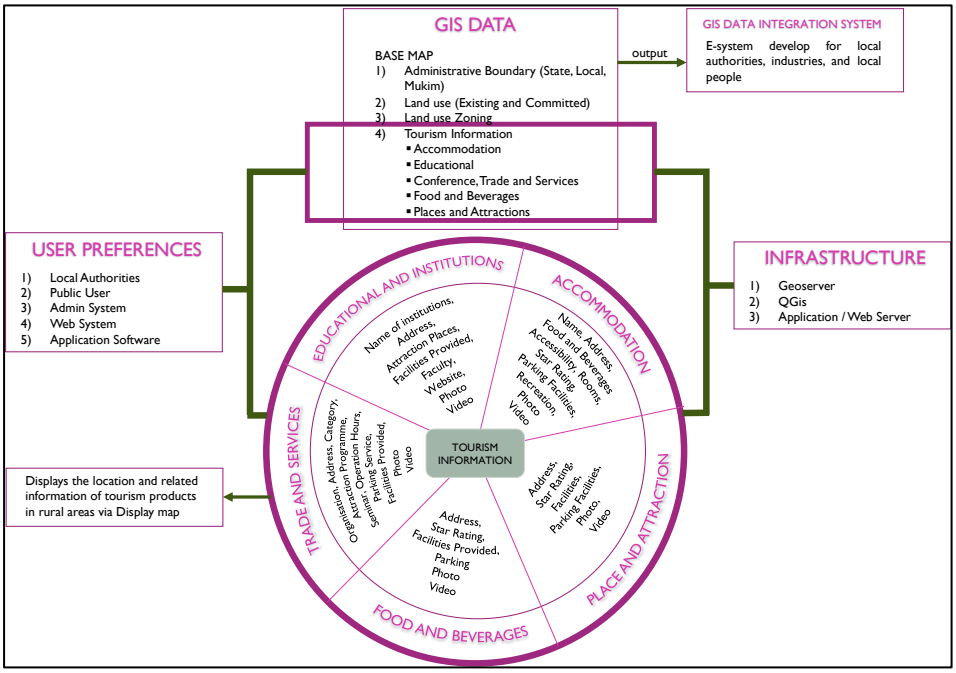

Figure 2: Conceptual Model of Virtual Reality (VR) Tourism Products

2. GIS Data Integration System:
   All the outputs from the GIS data components are integrated into a GIS Data Integration System, which serves as an electronic system developed for local authorities, industries, and residents. This system facilitates efficient access, management, and utilisation of tourism-related data as shown in Figure 2 and 3.

3. Display of Tourism Product Information:

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The VR tourism model showcases the location and pertinent details of tourism products in rural areas through a display map. The display map presents the following categories and associated information on the website application as shown in Figure 3.

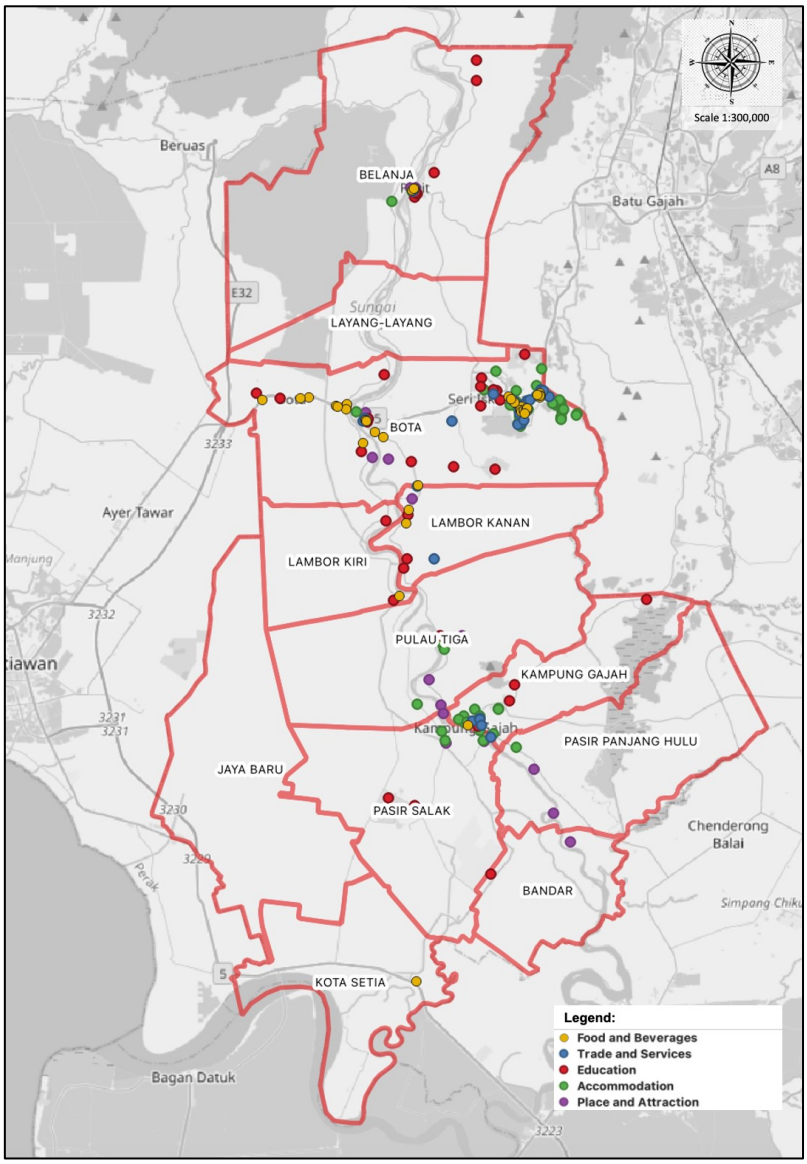

Figure 2: Distribution of Tourism Products in Perak Tengah District

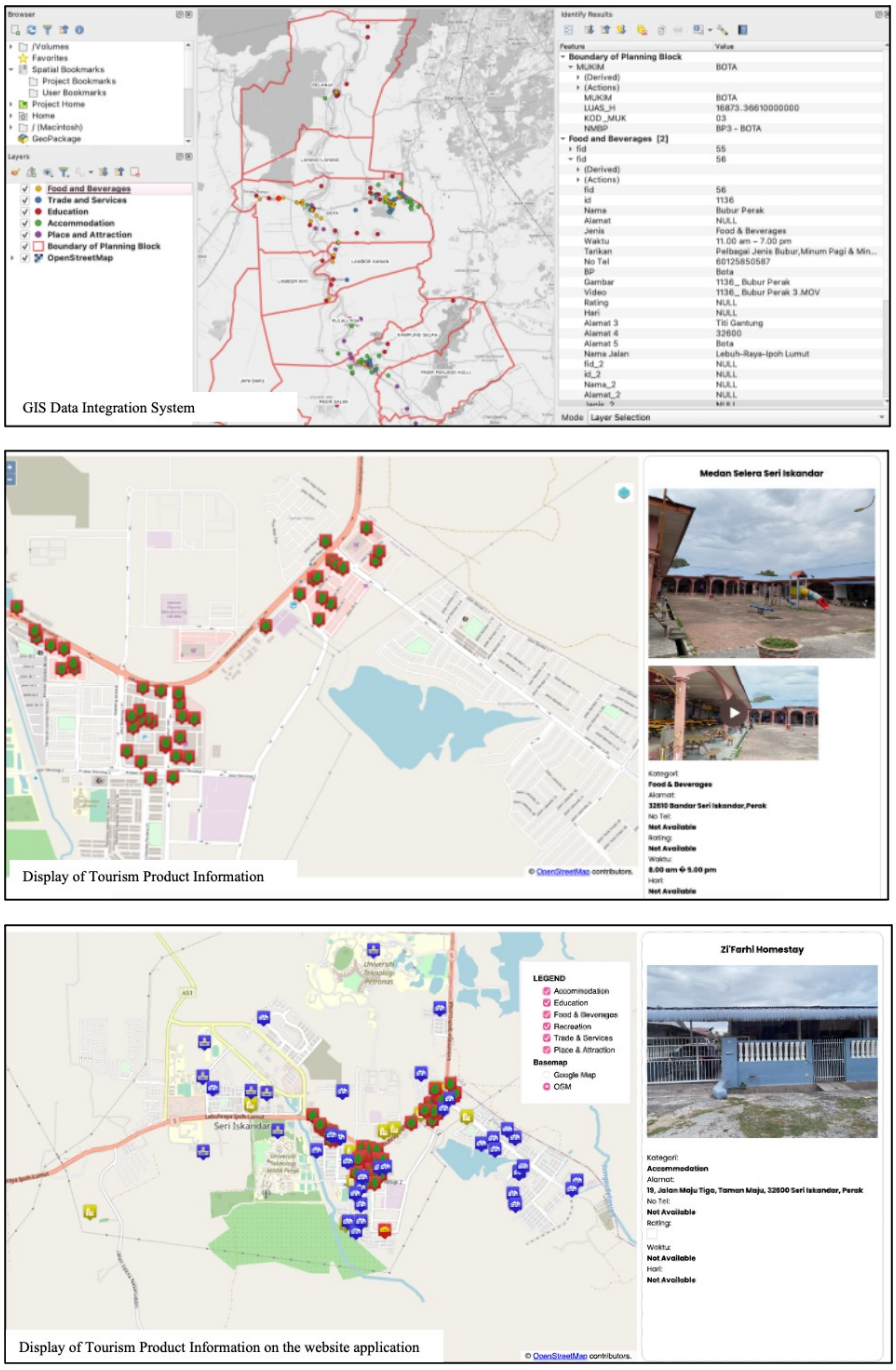

Figure 3: Display of Tourism Product Information

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i. **Food and Beverage:** This category includes address, star rating, provided facilities, parking availability and photos and videos.
ii. **Place and Attraction:** Information related to address, star rating, facilities, and parking facilities, as well as photos and videos, is provided.
iii. **Accommodation:** Name, address, available food and beverage options, accessibility, number of rooms, star rating, parking facilities, recreation facilities, and visual media materials are included in this category.
iv. **Educational and Institutions:** Details encompassing the name of institutions, address, attraction places, facilities provided, faculty information, website link, as well as photos and videos.
v. **Trade and Services:** This category provides information on organisations, addresses, categories, attraction programs, seminar offerings, operation hours, parking services, facilities provided, and visual media materials.

The development of the VR tourism model using GIS-based data distribution in rural areas represents a significant contribution to the field. By providing an overview of tourism products and leveraging VR technology, this model aims to enhance domestic tourism, stimulate economic growth, and promote the development of rural areas in Malaysia. Integrating GIS data components and incorporating user preferences ensure a user-friendly and informative platform for industries, practitioners, stakeholders, and the general public to access and utilise tourism-related information effectively.

RESEARCH METHODOLOGY

The research follows a systematic data processing approach, incorporating qualitative and quantitative methods to gather and analyse relevant information. The study focuses on the Perak Tengah district in Malaysia and seeks to bridge the gap between tourism offerings and online promotion through the implementation of VR technology. Stage 1 Inputs: The research process begins with a comprehensive literature review and the establishment of a content analysis framework. This stage involves reviewing relevant scholarly articles, reports, and industry publications to gain insights into existing knowledge and identify research gaps. The content analysis framework provides a systematic approach to analyse and interpret the collected data.

Stage 2 Data Collection and Analysis: A combination of methods is employed to gather the necessary data. Inventory surveys are conducted to identify and document the tourism attractions and products available in the Perak Tengah district. Questionnaire surveys are administered to the local community, particularly those familiar with the tourism industry in the area. The surveys aim to gather quantitative data on tourists' and residents' perceptions, preferences, and experiences regarding tourism attractions and products. In addition, GPS

techniques are utilised to accurately record the geographical coordinates of the identified attractions and products. This spatial data allows for integrating GIS technology in the subsequent stages of the research. Furthermore, in-depth interviews and focus group discussions are conducted with key informants, including operators, NGOs, local authorities, and tourism organisations. These qualitative methods provide valuable insights into the challenges, opportunities, and perspectives of various stakeholders in the tourism industry.

Stage 3 Key-in Data (updating data information in GIS-based data spatially): The collected data, including the inventory surveys, questionnaire responses, GPS coordinates, and qualitative insights, are inputted into a GIS-based data system. This spatially encodes the information, allowing for efficient storage, retrieval, and analysis of tourism-related data. Integrating data in a GIS framework facilitates the visualisation and mapping of tourism attractions and products in the Perak Tengah district. Stage 4 Output (Developing Model): The final stage of the research involves developing a model using a spreadsheet-based approach. This model utilises the compiled data to generate insights and recommendations for promoting tourism attractions and products through an online system with VR tourism modelling. The model aids in decision-making processes for industry practitioners, local authorities, and other stakeholders, enabling them to enhance the visibility and accessibility of tourism offerings in the Perak Tengah district.

ANALYSIS AND DISCUSSION

Table 3 provides an overview of the total number and distribution of tourism products in the rural areas of Perak Tengah District. These tourism products are categorised into different types: places and attractions, accommodation, services, education, and food and beverages. The data presented in the table were obtained through the research conducted for this study in 2023. According to the study, 22 places and attraction sites exist in the rural areas of Perak Tengah District. These sites offer visitors various types of tourism experiences and points of interest. They showcase the region's natural beauty, cultural heritage, and historical significance.

Table 3: Total and Distribution of Tourism Products in Rural Areas, specifically in Perak Tengah District

Types of Tourism Products	**Total**
Place and Attraction	22
Accommodation	54
Trade and Services	26
Educational and Institutions	36
Food and Beverages	80
Total Number of Tourism Products	**218**

Source: Author's Calculation

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In terms of accommodation, there are 54 establishments available in the rural areas of Perak Tengah District. These accommodations cater to the needs of tourists and provide them with comfortable and convenient places to stay during their visit. They offer a range of amenities and services to ensure a pleasant experience for guests. The trade and services sector in the rural areas of Perak Tengah District comprises 26 establishments that offer different types of services to tourists. These trades and services may include transportation, tour guides, recreational activities, and other tourism-related services. They aim to enhance visitors' overall experience and meet their specific needs.

Education plays a significant role in the tourism sector, and in the rural areas of Perak Tengah District, 36 educational institutions contribute to the tourism offerings. These institutions provide opportunities for visitors to learn about the local culture, history, and traditional practices through various educational programs and activities. Food and beverages are an essential aspect of tourism, and in the rural areas of Perak Tengah District, 80 establishments cater to the culinary needs of tourists. These establishments offer diverse cuisines, from local delicacies to international dishes, providing visitors with a taste of the region's culinary heritage. The study identifies 218 tourism attractions in the rural areas of Perak Tengah District. These attractions collectively contribute to promoting and developing tourism in the region. It is important to note that the data presented in Table 3 are based on the research conducted for this study in 2023. The information provides valuable insights into the tourist attractions of the rural areas in Perak Tengah District, highlighting the diverse range of tourism products available for visitors to explore and enjoy.

The data presented in Table 4 (i, ii, iii, iv, and v) demonstrate the significant presence and variety of tourism products in the rural areas of Perak Tengah District. The diverse offerings, including places and attractions, accommodation, services, education, and food and beverages, contribute to the overall tourism experience and showcase the region's rich cultural and natural heritage. This information is crucial for tourism stakeholders, policymakers, and tourists themselves, as it provides a comprehensive understanding of the tourism potential and opportunities in the rural areas of Perak Tengah District.

Table 4 (i): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Place and Attraction)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Place and Attraction	Bandar	Heritage (1)	1 (4.5%)
	Belanja	Heritage (1); Business Street Arts (2); Recreation (1)	4 (18.2%)
	Bota	Heritage (3); Wildlife (1), Sports and Recreation (1)	5 (22.7%)
	Kampung Gajah	Heritage (1); Motor Sports and Recreation (1)	2 (9.1%)
	Lambor Kanan	Heritage (1); Motor Sports and Recreation (1)	2 (9.1%)
	Lambor Kiri	Heritage (1)	1 (4.5%)
	Pasir Panjang Hulu	Heritage (1)	1 (4.5%)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
	Pasir Salak	Heritage and Museum (1), Nursery (1)	2 (9.1%)
	Pulau Tiga	Agro-tourism (1), Crafts (1), Heritage (2)	4 (18.2%)
Number of Tourism Place and Attraction			**22**

Source: Author's Calculation

Table 4 (ii): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Accommodation)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Accommodation	Belanja	Homestay (1); Resort (1)	2 (3.7%)
	Bota	Homestay (27); Hotel (6)	33 (61.1%)
	Kampung Gajah	Homestay (11)	11 (20.4%)
	Pasir Panjang Hulu	Homestay (1)	1 (1.9%)
	Pasir Salak	Homestay (2); Resort (1)	3 (5.6%)
	Pulau Tiga	Homestay (4)	4 (7.4%)
Number of Tourism Accommodation			**54**

Source: Author's Calculation

Table 4 (iii): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Trade and Services)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Trade and Services	Belanja	Bazaar and Night Market (2); Religious Services (1)	3 (11.5%)
	Bota	Tourism Agency (3); Banking (5); Bus Station and Transportation Services (1); Transportation Rental Services (4); Bazaar and Night Market (3); Religious Services (2); Hypermarket (2); Shopping Mall (1)	19 (73.1%)
	Kampung Gajah	Hypermarket (1); Bazaar and Night Market (2)	3 (11.5%)
	Lambor Kanan	Health Services (1)	1 (3.8%)
Number of Tourism Trade and Services			**26**

Source: Author's Calculation

Table 4 (iv): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Educational and Institutional)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Educational and Institutional	Belanja	Secondary Education (2); Secondary Religious Studies (1); Religious Studies (1); Fully Residential School (1)	5 (13.9%)
	Bota	Private Higher Education (2); Secondary Education (4); Primary Education (9); Secondary Religious Studies (1); Technical Education and Vocational Training (TVET) (3)	19 (52.8)
	Kampung Gajah	Secondary Education (2); Technical Education and Vocational Training (TVET) (2); Fully Residential School	4 (11.1%)
	Lambor Kanan	Primary Education (3); Secondary Education (1)	4 (11.1%)
	Lambor Kiri	Secondary Education (1)	1 (2.8%)
	Pasir Salak	Secondary Education (2); Technical Education and Vocational Training (TVET) (1)	3 (8.3%)
Number of Tourism Educational and Institutional			**36**

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Table 4 (v): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Food and Beverages)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Food and Beverages	Belanja	Hailam Noodles (3); Breakfast and Lunch (2)	5 (6.3%
	Bota	Breakfast, Lunch, and Afternoon Drink (8); Cakes, Bread Shop, Desserts (7); Lunch, Malay Food, and Grilled Fish (5); Western, Johor Laksa, Sarang Laksa (1); Arab Cuisine (1); Western Food (7); Various Types of Food & Beverages (3); Thai Cuisine and Tom Yum (6); Gula Apong Ice Cream (1); Fast Food Restaurant (5); Shellout (1); Indonesian Food (1); Kelantanese Breakfast (1); Malay Food, Village Cuisine (1); Nasi Kandar (1); Chicken Rice (3); Satay (2); Various Types of Porridge (1); Various Rice Mixed Dishes, Grilled Fish, Mee Udang (1); Curry Noodles (2)	57 (71.3%)
	Kampung Gajah	Thai Cuisine and Tom Yum (2); Malay Food, Village Cuisine (5); Afternoon Drink, Laksa (1); Breakfast, Lunch, and Afternoon Drink (1); Various Types of Kopitiam Food (1)	10 (12.5%)
	Lambor Kanan	Curry Noodles (1); Breakfast, Roti Canai (1); Evening Snacks, Hungarian Langos Bread (1); Hailam Noodles (1); Tempoyak Curry (1)	5 (6.3%)
	Pasir Salak	Prawn Char Kuey Teow (1); Breakfast, Lunch, and Afternoon Drink (1)	2 (2.5%)
	Kota Setia	Malay Food, Village Cuisine, Big Prawn Char Koay Teow (1)	1(1.3%)
		Number of Tourism Food and Beverages	**80**

Source: Author's Calculation

CONCLUSION

In conclusion, this study sheds light on the availability and distribution of tourism products in the rural areas of Perak Tengah District. The data collected and analysed provide valuable insights into the region's variety and quantity of tourism attractions. The findings reveal that Perak Tengah District boasts diverse tourism products, including places and attractions, accommodation, services, education, and food and beverages. This signifies the potential for developing and promoting tourism in rural areas. The study emphasises the importance of these tourism products in enhancing domestic tourism, sustaining economic growth, and promoting local development. By focusing on the target audience, which includes industries, practitioners, stakeholders, and the public, the research aims to boost tourism in rural areas and support the growth of the local economy.

The development of a VR tourism model, integrated with a GIS-based data spatial distribution system, is a notable contribution of this research. This model provides a comprehensive overview of tourism products and attractions in the targeted rural area. Incorporating user preferences, such as local authorities, the public, admin systems, web systems, and application software, ensures effective dissemination of information to various stakeholders.

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