Systematic review of mobile travel apps and their smart features and challenges

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Abstract

Purpose – Mobile travel apps (MTA) smart features were identified based on recent travel application (app) trends and a literature review of MTA smart features. Subsequently, the MTA features that could be prioritised to increase user interest in MTA were determined. The MTA smart feature development challenges that should be mitigated were also identified.

Design/methodology/approach – The app identification and selection were based on the one-stop solution characteristics containing the common function of travel apps and eight MTA smart features. A total of 193 Apple apps and 250 Google apps were identified, where 36 apps that met the inclusion and exclusion criteria based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart were selected for evaluation.

Findings – The high user ratings for apps from both app stores revealed the acceptance of smart technology in the tourism industry. Geolocation tracking services, travel itinerary generators, and real-time personalisation and recommendation were the three major features available in the included MTA. The challenges of MTA with smart features were highlighted from the tourism organisation, app developer and user perspectives.

Practical implications – The findings can guide tourism organisations and app developers on the smart features that MTA should offer for user engagement. Technological organisations could optimise their technology stack by considering the identified smart features. The findings are valuable for scholars in terms of MTA aesthetics and usability to gain acceptability. The development challenges included significant investment in technology, location accuracy and privacy concerns when implementing MTA smart features.

Originality/value – The previous literature mainly focused on evaluating app quality, assessing app functionality, and user ratings using the Mobile Application Rating Scale, and scoping reviews of MTA articles. Contrastingly, this study is among the first in which MTA smart features were examined from a developer-centric perspective. Moreover, it is suggested that MTA includes integrated smart features for better tourism services and market penetration in the tourism industry.

Keywords Systematic literature review, Mobile travel apps, Mobile computing, Smart tourism, Emerging technologies

Paper type Literature review

Introduction

Given the increasing smartphone use rate in recent years, mobile applications (apps) can substantially impact businesses. Approximately 80% of Internet users own a smartphone for Internet browsing and spend approximately 89% of their mobile media time on apps (Sukhraj, 2017). Furthermore, approximately 84% of companies target location-based mobile marketing as their marketing strategy, of which 71% believe mobile marketing is essential for their business (Gajić, 2021). For example, mobile cloud computing, Internet of things (IoT), artificial intelligence (AI), blockchain tools and apps are transforming hospitality into a fully

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digital technology-enabled industry. The evolution of smart devices and the rise of AI technology have shifted mobile travel apps (MTA) towards smart features, which are essential for the tourism industry to market its products and services. There are various smart travel apps that aid travel itinerary planning and travel experience improvement. Therefore, tourism organisations, app developers and service providers should tailor key app features to the tourist's needs.

Although there have been numerous studies on mobile apps for other sectors, such as medical health, there is a lack of systematic reviews of MTA with smart features for the travel and tourism sector (Dorcic *et al.*, 2018; Kim *et al.*, 2018; Ukpabi and Karjaluoto, 2017). Moreover, app quality evaluation, app functionality assessment and user rating via the Mobile Application Rating Scale (MARS) to determine the degree of app adoption were the focus in most previous studies. For example, whether gamification is worthwhile for app developers was assessed by investigating the degree of gamification and user rating on mHealth apps (Schmidt-Kraepelin *et al.*, 2019) and gamified mobile tools for destination management organisations (DMO) to enrich tourists' experiences (Garcia *et al.*, 2019). In another study, the efficacy and acceptability of mobile apps for mental health among people of all ages were assessed (Wang *et al.*, 2018). In several studies, the characteristics and quality of mHealth apps, such as those for potential drug–drug interactions (PDDIs) (Kim *et al.*, 2018), mindfulness-based iPhone apps (Mani *et al.*, 2015) and coronavirus disease 2019 (COVID-19), were reviewed and assessed using the MARS dimension scores, which comprised engagement, functionality, visual aesthetics and information (Davalbhakta *et al.*, 2020).

Although favourable characteristics and quality via MARS evaluation are crucial for app adoption, MTA smart feature evaluation is insufficient due to the varying nature of smart features. Mobile technology evolution and constant mobile app growth drive smart travel apps and change travellers' behaviour. Other than managing travel-related tasks, travellers expect an MTA to include planning or thinking features intelligently tailored to their preferences and requirements. Such MTA would provide the tourism industry with a solution that offers high value-added services, namely convenience, interactivity and information searching without geographical and time constraints (Bakar *et al.*, 2019). In this study, the emerging features or functionalities accessible on an app referred to the significant elements of a "good" mobile app that could lead to app sustainability and long-term use.

In this study, the main objective is to review recent travel app trends and the relevant literature to determine the primary MTA smart features. The Apple App Store and Google Play Store feature numerous MTA, of which some were selected for this review based on their one-stop solution characteristics and smart features. Subsequently, the features on the selected MTA were identified to present a clear picture to prioritise specific dimensions to increase user interest in MTA. Furthermore, the challenges that may arise in the development of MTA with smart features for tourist adoption were identified. Thus, this comprehensive review of MTA smart features was aimed at addressing the aforementioned research gap, providing insights and uncovering common threads and gaps to support new challenging, interesting and relevant research directions by answering the following research questions (RQ):

RQ1. What are the general reviews of MTA with smart features?

RQ2. What are the smart features available for MTA?

RQ3. What are the future challenges of MTA with smart features?

The findings may have positive implications for tourism organisations, app developers and academic researchers. Tourism organisations can review the smart features available, challenges arising, platform choice, app development type, technology stack and development

location on various MTA to propose the most effective travel app for tourists and calculate the approximate time and cost required for travel app development. The analysis of MTA smart features can assist app developers in understanding the shortcomings of existing apps and integrating various features and functionalities with cutting-edge technologies to develop future apps. Simultaneously, the potential benefits of MTA with smart features can also suggest future research directions.

This paper is structured as follows: the following section provides an overview of MTA evolution, followed by a review of travel app trends and a literature review on MTA. Moreover, the emerging MTA smart features under the theoretical foundation are outlined. The "Methodology" section describes the research strategy. The "Results and Discussion" section presents and discusses the findings, contributions, theoretical implications and practical implications. The last section concludes the study and highlights the future research directions.

Evolution of MTA

Tech-savvy travellers are increasingly using information and communication tools, such as wearable technologies, smartphones and tablets, even during their holidays. This bring-your-own-devices culture reveals that travellers use their tools to learn about a destination, explore a location, remove the guesswork of locating the best pizza in town, and experience the most adventurous tours by identifying rarely explored locations and discovering the trendiest shops. More than 150 million travellers who own smartphones prefer booking flights and hotel stays via mobile apps. As the growing popularity of apps has revolutionised travelling, approximately 30 million people use their mobile devices to search for travel information. Euromonitor International (Shoutern, 2016) reported that mobile travel sales were expected to reach 25% of the total global online travel bookings by 2019. This estimation was possible by the fact that mobile apps have revolutionised the tourism industry through time-saving automated operations, create greater business collaborations, improve safe data storage, and better customer management systems (CMS) as such apps are becoming a one-stop solution for all travel-related activities.

Apps with AI technology-powered smart features not only deliver information but also provide real-time advice, tips, insights and warnings to travellers via push notifications (Dorcic *et al.*, 2018). These smartphone apps act as reminders and provide suggestions for travellers to experience a smooth and less stressful vacation. For example, the Sygic Travel app makes it easy and fun to create customised or automated trip itineraries. The app also incorporates a global positioning system (GPS) feature for maps and points of interest (POI) to remain updated. The TravelSmart Insurance app assists travellers immediately to search for nearby hospitals, pharmacies, doctors and police in emergencies and locates healthcare providers covered by their insurance policy. The Smart Assistant for Mobile is AI-powered and not only manages flights or hotel bookings but also suggests what to pack based on the weather at the destination. The app also intelligently provides advice on the exact departure gate, flight time changes, luggage drop-off, nearby restaurants, traffic delay alerts and phone chat support with consultants if necessary.

The development and implementation of such innovative technologies involve multiple stakeholders (Saghafian *et al.*, 2021). For example, an organisation stakeholder requires additional effort in terms of technological investment, managerial commitment and work restructure to ensure the successful implementation of new technologies. Meanwhile, app developers are prompted to develop an innovative solution within the stipulated time by designing and delivering an app that is acceptable to users with varying expectations. An app developed to support the tourism industry must facilitate the participation of all

interested stakeholders. Therefore, the distinction of this study is that the potential challenges in smart travel app adoption from the tourism organisation, app developer and user perspectives were identified.

Travel app trends and literature review

Modern travellers' expectations of travel apps exceed the typical requirements that include booking services, social media sharing, reviews, travel forum ratings, or language, currency or world time convertors. Smartphone apps have changed the way travellers arrange for-hire automobile services, plan journeys and access real-time transportation information. The apps are characterised based on six axes: operating system (OS), geography, business model, real-time information availability, gamification and incentives (Shaheen *et al.*, 2016). The travel mobile applications are expected to have a better user interface or user experience (UI or UX) design with important features, which include travel itinerary generator, geo-tracking or location-based emergency services, weather or climate forecasting, in-app language translator, currency or world clock time converter, app service integration, trip reviews and washroom finder (Colorwhistle, 2022). Thus, the most important features to be considered when developing an MTA that increase the appeal of an app to travellers include geolocation, booking or buying services, travel planner, reviews and recommendations, weather forecasting, currency converter, translations and payment gateways (Matyunina, 2020). The key trends that can also be incorporated into strategizing travel planner app development include AI-based travel assistance, integrated personalised recommendations and integrated destination videos for better engagement (Nimbalkar, 2020).

A recent study on smart travel apps identified via Google Scholar determined the recent MTA trends and developments and the challenges encountered by tourism providers in adopting mobile applications in smart tourism (Dorcic *et al.*, 2018). An MTA with augmented reality (AR) features can potentially enhance travel experiences by providing location-based services (LBS) using GPS and information to tourists based on their current location (Chen and Tsai, 2017). The perceived relative advantages, which included location-based recommendations, simpler booking under one platform and customised services, positively influenced user attitudes towards app-based travel shopping on smartphones (Lim *et al.*, 2022).

In Malaysia, Malaysia Airports launched the MYairports mobile app with big data analytics (BDA) capability (Singh, 2018) to enhance the travel experience by providing real-time digital interaction and allowing passengers to intelligently navigate the boarding process in the shortest time possible. In another study, a novel method was proposed for tourists to geographically locate and reroute to a nearby healthcare centre in an emergency (Almobaideen *et al.*, 2017). Among the top 10 journal articles on tourism in Web of Science, virtual reality (VR) and AR to support tourism apps through location-based information and image quality were discussed in four articles, mobile technology use for smart tourism was presented in five articles and AR applications to promote tourism destinations were mentioned in five articles (Loureiro *et al.*, 2020). Travellers are rapidly embracing smart travel planning apps to manage their travel-related activities, obtain their preferred tour itineraries and choose their travel destinations (Ho *et al.*, 2021).

As tourism businesses are developing mobile applications to improve customer satisfaction, marketing and sales performance, an experiment was conducted to evaluate a personalised MTA together with user evaluation based on its usefulness, ease of use and user satisfaction (Tarantino *et al.*, 2019). The personalised MTA could schedule multi-day tourist itineraries based on user preferences and constraints, such as available visit time, POI accessibility and weather forecasting. The TravelBel web app was introduced to process real-time user data for various travel events, create tailored user-optimal tour packages and

complete all travel-related bookings in one location (Gomes *et al.*, 2022). A virtual tour guide app was designed to integrate different functionalities into one app, which included image recognition to provide information on tourist attractions using web-scraping techniques, trip planning with content-based recommendations and optimal routes using generic algorithms, and locating a tour guide virtually to obtain information directly (Maulik *et al.*, 2022). The app implementation aided tourists in obtaining important information and functionalities on one platform without using multiple apps.

In another study (Garcia-Lopez *et al.*, 2021), relevant tourist apps were selected from the Google Play Store and their most common functionalities were identified and evaluated to be considered when designing and developing mobile tourist guides. The functions recommended for inclusion in tourist guide apps were POI list, language selection, location map, offline work and the current location. A mobile app connected to weather conditions to discover a travel route has also been developed and can be used to prepare travel equipment (Ginardi *et al.*, 2017).

Various industries, which include electronic (e)-banking, e-tourism and online merchants, are incorporating gamification tactics into their website interfaces to boost their marketing efforts. Mobile gaming is preferred to boost user engagement, activity, enjoyment and loyalty in various applications from productivity to finance, health and sustainability using a range of tools, such as points, levels, leader boards, badges and challenges or quests (Noorbehbahani *et al.*, 2019). Pokémon GO might influence users' decisions about their travel routes and modes by utilising gamification, AR and social features in mobile apps (Guo *et al.*, 2021). Garcia *et al.* (2019) presented the design, implementation and validation of the Jokotur gamified mobile experience by three DMO in Basque Country, Spain. The authors concluded that the application of gamification and analytics tools on-site during a trip was still in its early stages. Nevertheless, the findings demonstrated that gamified mobile applications could enhance guest visits by rendering destination discovery more enjoyable.

In another example, a mobile app was developed to improve the visitor experience in Avila, Spain, through real-time information on the monuments that were open for visits, a full set of pre-defined circuits with varying visit durations and degrees of difficulty, and the option of creating an optimised or customised circuit depending on user preferences (Amorim *et al.*, 2018). Moreover, tourism applications used a new set of technologies with powerful features to learn about tourists' interests and specific needs to support those with disabilities during their touristic activities by providing them with relevant and personalised information (Ribeiro *et al.*, 2018). Disabled tourists include people with mobility, hearing or visual impairments, allergies, food intolerance and older age. The framework was designed to facilitate disabled tourists' interactions and opinions to support their travel planning by presenting useful information and recommending the best tourism services or products tailored to their preferences and characteristics.

Theoretical foundation

The theoretical basis for this study involved one-stop solution characteristics and emerging MTA smart features. The MTA that includes all aspects of a trip in a one-stop solution is a key to enhance the travel experience (Lim *et al.*, 2022). Instead of making multiple bookings through various websites, the traveller should be able to complete all travel-related bookings on one platform (Gomes *et al.*, 2022). The MTA with common functionalities in an all-in-one platform ensures that travellers are always updated with the best travel destinations and travel times, online booking and reservations, weather updates, communication sources and numerous attractive plans (TravelDailyNews, 2021). The following emerging smart features were identified from recent travel app trends (Colorwhistle, 2022; Matyunina, 2020; Nimbalkar, 2020; Shaheen *et al.*, 2016) and the preceding literature review on smart MTA:

(1) Geolocation tracking or LBS (Almobaideen *et al.*, 2017; Chen and Tsai, 2017; Lim *et al.*, 2022): Helps travellers track their locations and find nearby places via GPS technology. The feature also enables location navigation using the Google Maps software development kit (SDK).

(2) Travel itinerary generator (Garcia-Lopez *et al.*, 2021; Gomes *et al.*, 2022; Ho *et al.*, 2021; Tarantino *et al.*, 2019): Alleviates travel stress when managing travel itineraries, where travellers only need to enter the attractions they want to visit and the app will auto-generate a trip itinerary according to their schedule.

(3) Weather or climate forecasting (Ginardi *et al.*, 2017; Tarantino *et al.*, 2019): Aids travellers in checking weather predictions and forecasts in a real-time climate to avoid natural disasters at the destination.

(4) Gamification and incentives (Garcia *et al.*, 2019; Guo *et al.*, 2021; Noorbehbahani *et al.*, 2019): Offer increased traveller engagement and retention on an app. Establish leader boards, badges, levels and points in an app to encourage traveller participation. Incentives in terms of rewards are another potential strategy to encourage positive behaviours in the mobility context.

(5) Real-time information (Amorim *et al.*, 2018; Gomes *et al.*, 2022; Singh, 2018): Provides real-time information on traffic conditions, roadway incidents and parking availability.

(6) The AR or VR and three-dimensional (3D) printing (Chen and Tsai, 2017; Jung and Dieck, 2017; Loureiro *et al.*, 2020; Maulik *et al.*, 2022): The VR applications provide visitors with a VR experience prior to visiting while AR applications enable visitors to learn during their visit. The 3D printing technology allows visitors to 3D-print souvenirs after visiting.

(7) In-app language or currency convertor (Garcia-Lopez *et al.*, 2021): Enhances UX as it enables travellers to scan unfamiliar regional languages for text messages, voice messages or visual translations.

(8) Real-time personalisation and recommendations (Amorim *et al.*, 2018; Gomes *et al.*, 2022; Lim *et al.*, 2022; Maulik *et al.*, 2022; Ribeiro *et al.*, 2018): With machine learning (ML) services accessible in Big Data technology, an app can deliver real-time personalised recommendations. The ML promotes consumer engagement by providing personalised products, services and content recommendations based on the user's profile information, online activities and focused search.

Methodology

Systematic review design

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline comprising a 27-item checklist is a recommended review approach for a better understanding of systematic review execution, quality and rigour (Saeed *et al.*, 2019). The MARS was the review approach used to measure mHealth applications, specifically app quality checks for PDDIs (Kim *et al.*, 2018) and evaluating mindfulness-based iPhone apps (Mani *et al.*, 2015). The app smart features or functionalities are critical components of a "good" mobile app that lead to app sustainability and long-term use. Therefore, its functionality was extended to determine the MTA emerging features that could be prioritised to increase user interest in MTA and highlight the challenges that may arise in smart travel app development for academicians' and practitioners' future reference. The criteria or components evaluated in this study were MTA

according to OS or platforms and according to country, cost, user rating or smart features. The RQ guided the subsequent selection, extraction and execution processes.

The app search strategy

In this review, the apps available from the two most popular mobile app databases (Apple App Store and Google Play Store), which cover approximately 80% of all mobile apps, were targeted. Figure 1 illustrates the initial MTA search. The Apple App Store and Google Play Store were searched using the terms "travel app", "mobile travel app" and "smart travel app" and yielded 193 and 250 apps, respectively. Subsequently, the apps were identified, screened and listed in an Excel worksheet. Ten duplicate apps were removed to yield a final 433 apps. The 433 apps were filtered according to the inclusion and exclusion criteria based on the PRISMA flowchart to be selected for evaluation.

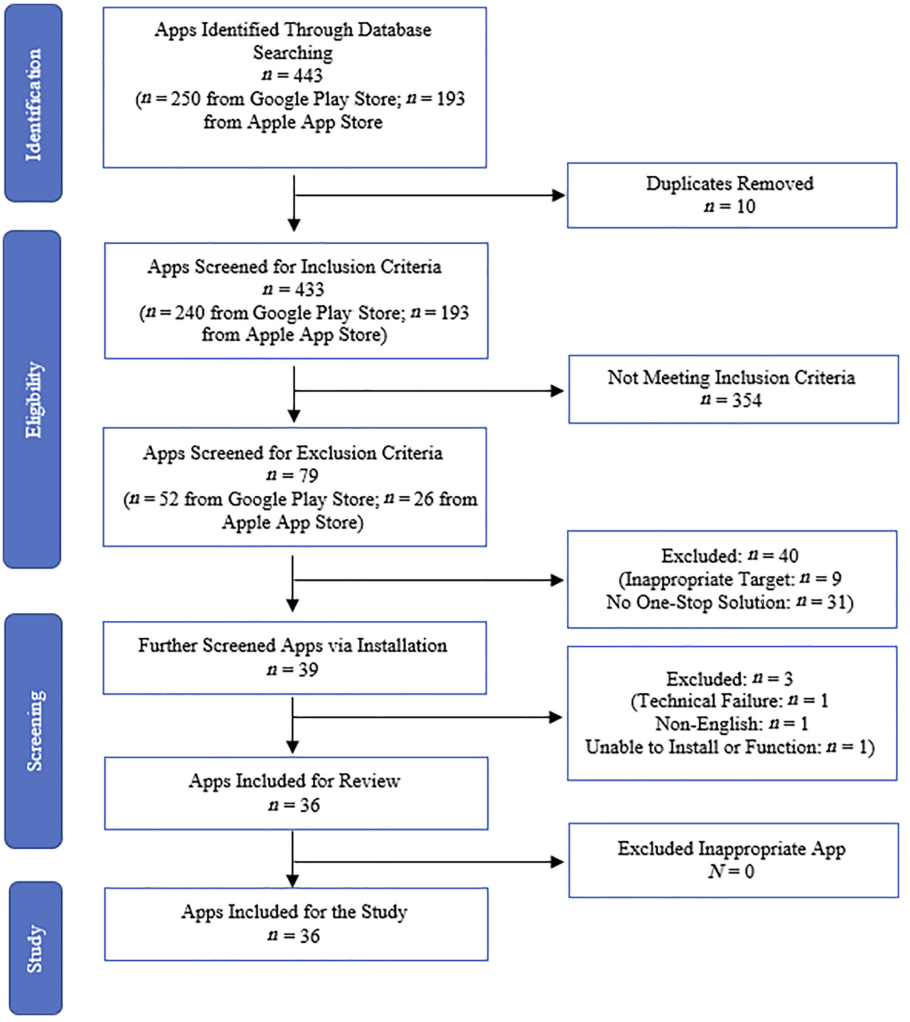

Figure 1.
App selection process

Eligibility criteria

The app inclusion criteria were as follows: (1) mobile-based and primarily used for travel-related activities, (2) free or with in-app purchases with user reviews or ratings and (3) available in English, where app eligibility was verified by reading the about page, detailed description and advertisement in videos or slides. The inclusion criteria identified 354 ineligible apps, which were excluded, leaving a total of 79 apps.

The 79 apps were screened using the exclusion criteria based on the one-stop solution characteristics of the apps, which contained the following functions for travel applications: geolocation, trip planning, booking or buying services, entertainment, attractions, payment gateways, reviews and recommendations, and social media login (Matyunina, 2020). This concept was similar to the Mobility as a Service app, which provides one-stop access to several bundled travel services to make transportation more environmentally friendly (Stopka *et al.*, 2018). Moreover, only apps with smart features, such as geolocation tracking services, travel itinerary generator, weather or climate forecasting, gamification and incentives, real-time information, AR or VR and 3D printing, in-app language or currency convertor, and real-time personalisation and recommendation were selected. In this step, 9 apps that were inappropriate targets and 31 apps with no one-stop solution were removed, leaving 39 apps. Of the 39 apps, three experienced technical failure, contained non-English content, or could not be installed or malfunctioned, leaving 36 apps. The final selection was based on an assessment of the app functionalities. As the assessment identified no inappropriate apps, the 36 apps were retained for analysis and evaluation.

Data collection and measurement criteria

Information was collected in two parts for review and evaluation. In the first part aimed at answering RQ1, general app-related information was collected and included the platform, country, developer or provider, version, pricing and ratings. The second part was aimed at answering RQ2, where the MTA smart features and the overall score of each app feature were determined. To answer RQ3, the potential challenges in the development of apps with smart features were identified.

Results

General information

Table 1 summarises the detailed information of the apps as follows: name, platform or OS, country, developer or publisher, version, cost, user rating and features. The apps were typically rated based on four factors: price, relevancy, functionality, and graphics or appearances. Average and higher user ratings were considered essential factors in selecting mHealth apps (Kim *et al.*, 2018) while customer rating scores [low (1 or 2) or high (4 or 5)] determined the degree of acceptance of the app (Wang *et al.*, 2016). Apple App Store apps had an average user rating of 3.97 with a minimum rating of 3.0 and a maximum rating of 4.5, while Google Play Store apps had an average user rating of 4.24 with a minimum and maximum of 3.8 and 5.0, respectively. The high user ratings were a crucial success component apart from the high enthusiasm levels among users who adopted MTA with smart features.

Of the 36 apps selected for this study, 20 apps (58%) were from the Google Play Store while 16 (42%) were from the Apple App Store (Figure 2). The similar number of apps from both app stores indicated that app developers were taking the initiative to publish MTA with smart features on both OS and platforms. To date, app stores contain more than 500 million AR-enabled mobile devices and more than 2,000 apps that use AR and VR

No	App name	OS/ Platform	Country	Developer/ Provider	App Ver	Cost (US$)	User rating
1	App in the Air	iOS	United States	Aita Limited	8.1.0	29.99	4.5
2	DJ Paradise Tour	iOS	Thailand	Cedric Duchesne	1.2.0	Free	4+
3	Egencia	Android	United Kingdom	Egencia LLC	6.37	Free	4.6
4	ETC Trips	iOS	Australia	Smart Trips Pty Ltd	2.2.2	Free	4+
5	Expedia: Hotels, Flights and Car	iOS	United States	Expedia, Inc	20.15	Free	4+
6	GO Holiday Malaysia–Tour and Travel Packs	Android	Malaysia	eWallz Solutions	2.1	Free	5.0
7	Guides by Lonely Planet	Android	Australia	Lonely Planet	2.5.0.58	39.99	4.5
8	Hopper–Book Flights	Android	Canada	Hopper Inc	4.40.0	Free	4.5
9	Japan Official Travel App	Android	Japan	Japan National Tourism Organization	2.3.8	Free	4.6
10	KAYAK Flights, Hotels and Cars	iOS	United States	Kayak Software Corp	133.0.0	Free	4+
11	Kiwi.com: Best Travel Deals	Android	United States	Kiwi.com	5.42.0	Free	4.0
12	Live Satellite View GPS Map Travel Navigation	Android	United Kingdom	Appscourt	4.8	9.49	4.2
13	My Travel Itinerary	iOS	Australia	Freedom Road Travel Group	1.7.1	Free	4+
14	Nevr Lost	iOS	Austria	Dominik Gail	1.0	Free	4+
15	Planhop–Travel Planning and Holiday Booking App	Android	India	Planhop	2.1.9	Free	4.8
16	Roadtrippers–Trip Planner	iOS	United States	Roadtrippers Inc	4.8.2	29.99	4+
17	Skiplagged–Flights and Hotels	iOS	United States	Skiplagged LLC	2.2.1	Free	4+
18	Skyscanner–flights, hotels, car hire	Android	United Kingdom	Skyscanner Ltd	7.12	Free	4.6
19	SMART City Guide	iOS	United States	Edutainment Ventures LLC	1.0	0.99–1.99	3+
20	SMART Country Guide	iOS	United States	Edutainment Ventures LLC	1.0	0.99–3.99	4+
21	Smart Travel App	iOS	N/A	Cedric Duchesne	1.2.3	Free	4+
22	SRS Business Travel Management	Android	Korea	Hotel Shilla Co., Ltd	4.2.3	Free	3.8
23	Sygic Travel Maps Offline and Trip Planner	Android	Austria	Sygic	5.11.3	3.99–29.99	4.4
24	Tours and Travel	iOS	United States	eTips LTD	3.0.18	Free–1.99	4+
25	TravelAce–Smart Trip Planner	Android	N/A	CyberLoft	1.3.5	2.99–23.99	4.2

(*continued*)

Table 1. Listing of mobile travel apps with general information

No	App name	OS/ Platform	Country	Developer/ Provider	App Ver	Cost (US$)	User rating
26	Traveloka: Book Hotel, Flight Ticket and Activities	Android	Indonesia	Traveloka	3.20.2	Free	4.8
27	Trip.com: Flights, Hotels, Train and Travel Deals	Android	Hong Kong	Trip.com	7.6.6	Free	3.8
28	Tripadvisor	iOS	United States	Tripadvisor	36.2	Free	4+
29	TripCase–Travel Organizer	Android	United States	Sabre Traveler Solutions	4.15.5	5.99–6.99	3.9
30	Triplt: Travel Planner	Android	United States	Triplt, Inc	9.3.0	Free	4.4
31	Voice GPS Navigation: Driving Route Planning	Android	N/A	Sibiti Apps	1.6.8	Free	4.5
32	Wego Flights, Hotels, Travel Deals Booking	Android	Singapore	Wego.com	6.0.6	Free	4.5
33	Withlocals–Personal Tours and Travel Experiences	Android	Thailand	Withlocals B.V	8.2.1908	Free	4.7
34	World Travel Guide by Triposo	Android	Germany	Triposo	4.6.0	4.99–6.99	4.3
35	Wow! Wallet	iOS	Australia	Smart Trips Pty Ltd	2.2.2	Free	4+
36	XTVT–Travel Malaysia	Android	Malaysia	CiEdge	2.18	Free	4.8

Table 1.

Note(s): Mobile travel apps extracted from Apple App Store and Google Play Store. N/A - Not Applicable

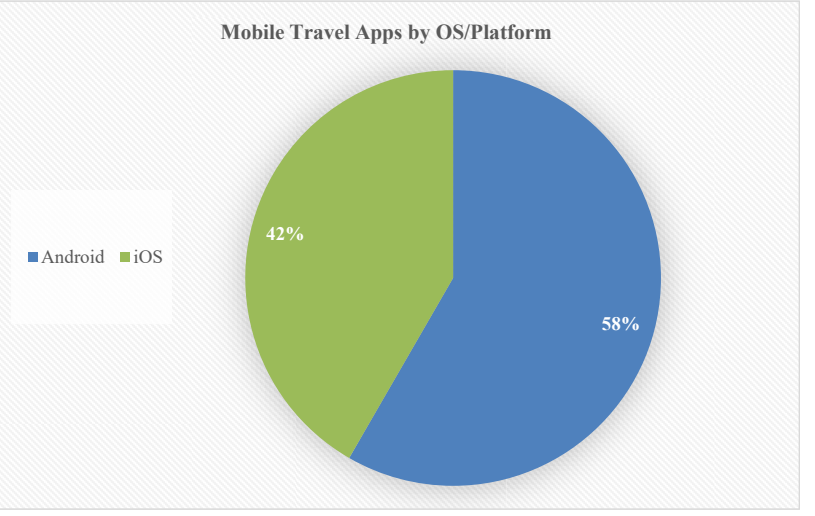

Figure 2.
Mobile travel apps by OS/platform

technologies (MacHale, 2019). In addition, the major technology players Google and Apple have invested massively in technologies that enable the development of easier, cheaper and quicker AR and VR capabilities. Both Google and Apple invested in AR developer tools (ARCore and ARKit) and released them and also dedicated significant resources and effort to AR development (MacHale, 2019). The findings also implied that smart features, such as AR, VR and 3D printing, can aid the co-creation of value for tourists' pre-visit, on-site and post-visit experiences at cultural heritage sites (Jung and Dieck, 2017).

The 33 apps were from 14 countries: the United States ($n = 12$), Australia ($n = 4$), the United Kingdom ($n = 3$), Austria ($n = 2$), Malaysia ($n = 2$), Thailand ($n = 2$), Canada ($n = 1$), Germany ($n = 1$), Hong Kong ($n = 1$), India ($n = 1$), Indonesia ($n = 1$), Japan ($n = 1$), Korea ($n = 1$) and Singapore ($n = 1$) (Figure 3). The number of countries indicated the use of MTA with smart features across different countries. With 12 apps (33%), the United States dominated the development of MTA with smart features, followed by Australia (12%). Most of the other countries only had one or two apps, which indicated that they are still new to MTA and had room to improve. New mobile applications involving AR features appeared slower than expected in some countries, such as Malaysia. The issues mobile AR developers faced included non-standardised applications that limited flexibility, low tracking technology accuracy and UI design variability (Shukri *et al.*, 2017).

Of the 36 included apps (Figure 4), 25 were free (69%: 15 from Google and 10 from Apple). Of the 11 paid apps (31%), 6 were on Android (price range: US$2.99 to US$39.99) and 5 were on iOS (price range: US$0.99 to US$29.99). These findings were inconsistent with other reviews of medical apps (Kim *et al.*, 2018; Mani *et al.*, 2015). Free apps are intended to maintain user engagement to test the app without incurring app promotion costs. When users consider the well-developed app stable and beneficial, they will be more likely to spend money on upgrading or purchasing the full version.

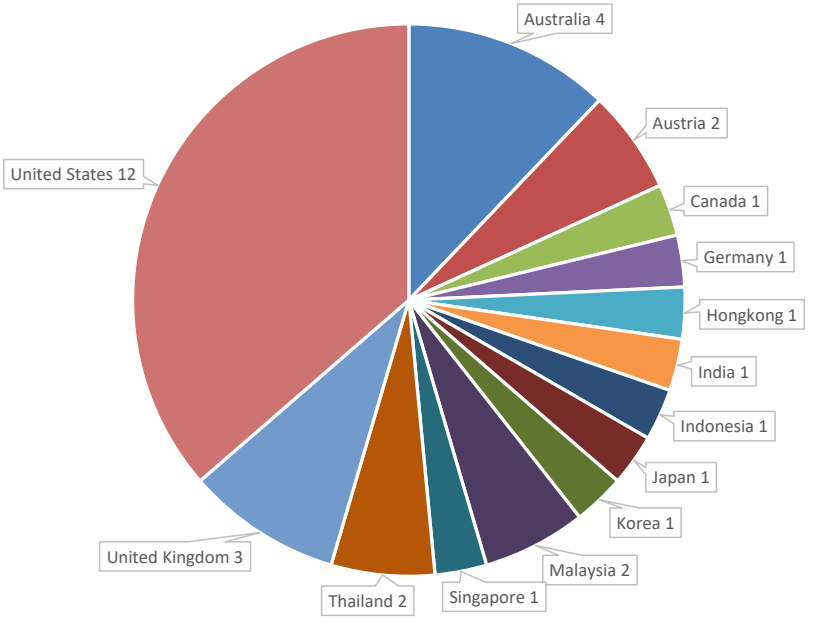

Figure 3.
Mobile travel apps by country

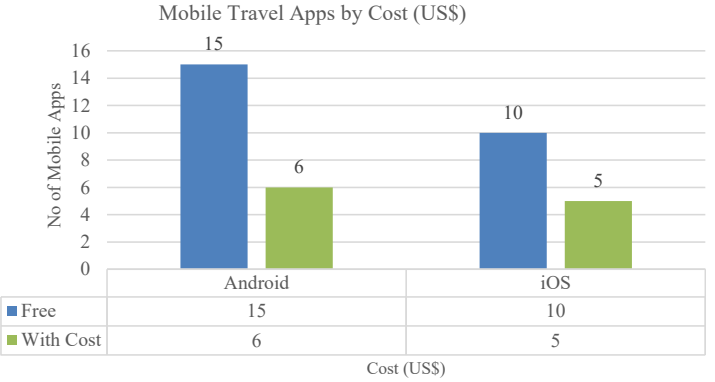

Figure 4.
Mobile travel apps by cost (US$)

The MTA with smart features

Mobile technology is necessary for modern world travellers, where it dominates every aspect of tourism, which includes transportation services, lodging, itinerary planning and other activities. Mobile technology has expanded rapidly due to smartphone ubiquity. Therefore, smartphones are equipped with robust sensors to detect and analyse surrounding information through geolocation, AR and social media integration (Snyder *et al.*, 2019). The smart features embedded in MTA provide smartphones with the capabilities to aid tourists worldwide. Simultaneously, app developers or tourism organisations should consider and prioritise app smart features (Matyunina, 2020) that meet user expectations and increase user interest in such apps.

Table 2 summarises the smart features of each MTA while the number of features available for each app is indicated in the bottom row and is presented in graph format in Figure 5. Among the eight smart features, 18 apps offered geolocation tracking services, 14 apps offered travel itinerary generators, 13 apps offered real-time personalisation and recommendations, 8 apps offered real-time information, 7 apps offered in-app language or currency convertors, 6 apps offered AR or VR and 3D printing, 6 apps offered weather or climate forecasting and 1 app offered gamification and incentives.

As 18 of the 36 apps (50%) offered geolocation tracking services, it was concluded that this smart feature is commonly used in LBS or mobile location services to detect user location with GPS navigation and to provide relevant or real-time information on the places visited. Briefly, integrating navigation and the Internet are the current or future trends of smart tourism to enhance the tourism experience. Such integration enables the display of related real-time web information or surrounding details for a location on a smartphone, which allows tourists to familiarise themselves with the destination regardless of time and place (Chen and Tsai, 2017). With GPS capability to determine the user's location, other information, such as weather, traffic conditions, lodging, parking lots, shopping, restaurants and emergency rescues, will immediately appear automatically on the devices. It enables tourists to immediately change their travel plans, avoid rushing with recommended travel routes and choose scenic spots on the route (Liu and Liu, 2016).

A Google tourism study revealed that 74% of travellers plan their trips online. In this review, 14 of the 36 apps (38.89%) offered a travel itinerary generator. In terms of time savings, convenience, eliminating hassle and keeping costs within budget, users seek an app for planning future trips, sharing travel guides and blogging past trips. The apps with travel itinerary generators enable users to customise their trips based on their budget, personal

Table 2. Listing of mobile travel apps towards smart features

No	App name	Geolocation tracking services	Travel itinerary generator	Weather/ Climate forecasting	Gamification and incentive	Real-time information	AR/VR and 3D printing	In-app lang/ Cury convertor	Real-time personalisation and recommendation
1	App in the Air				√	√	√		
2	DJ Paradise Tour	√	√						
3	Egencia								√
4	ETC Trips			√				√	
5	Expedia: Hotels, Flights and Car								√
6	GO Holiday Malaysia–Tour and Travel Packs								
7	Guides by Lonely Planet							√	
8	Hopper–Book Flights	√							√
9	Japan Official Travel App	√							
10	KAYAK Flights, Hotels and Cars		√	√		√			√
11	Kiwi.com: Best Travel Deals	√					√		
12	Live Satellite View GPS Map Travel Navigation	√				√	√		
13	My Travel Itinerary	√	√	√		√		√	√
14	Nevr Lost	√					√		
15	Planhop–Travel Planning and Holiday Booking App		√						√
16	Roadtrippers–Trip Planner	√	√						

(*continued*)

Table 2.

No	App name	Geolocation tracking services	Travel itinerary generator	Weather/ Climate forecasting	Gamification and incentive	Real-time information	AR/VR and 3D printing	In-app lang/ Cury convertor	Real-time personalisation and recommendation
17	Skiplagged–Flights and Hotels								√
18	Skyscanner–flights, hotels, car hire		√						
19	SMART City Guide	√				√			
20	SMART Country Guide	√					√		
21	Smart Travel App	√	√						
22	SRS Business Travel Management	√	√	√				√	
23	Sygic Travel Maps Offline and Trip Planner		√					√	
24	Tours and Travel	√	√			√	√		
25	TravelAce–Smart Trip Planner		√	√					
26	Traveloka: Book Hotel, Flight Ticket and Activities								
27	Trip.com: Flights, Hotels, Train and Travel Deals								√
28	Tripadvisor	√	√						√
29	TripCase–Travel Organizer	√	√			√			√
30	TripIt: Travel Planner	√	√			√			√

(*continued*)

No	App name	Geolocation tracking services	Travel itinerary generator	Weather/ Climate forecasting	Gamification and incentive	Real-time information	AR/VR and 3D printing	In-app lang/ Cury convertor	Real-time personalisation and recommendation
31	Voice GPS Navigation: Driving Route Planning	√							
32	Wego Flights, Hotels, Travel Deals Booking								
33	Withlocals– Personal Tours and Travel Experiences								
34	World Travel Guide by Triposo			√				√	√
35	Wow! Wallet							√	√
36	XTVT–Travel Malaysia	√							
Count		*18*	*14*	*6*	*1*	*8*	*6*	*7*	*13*

Table 2.

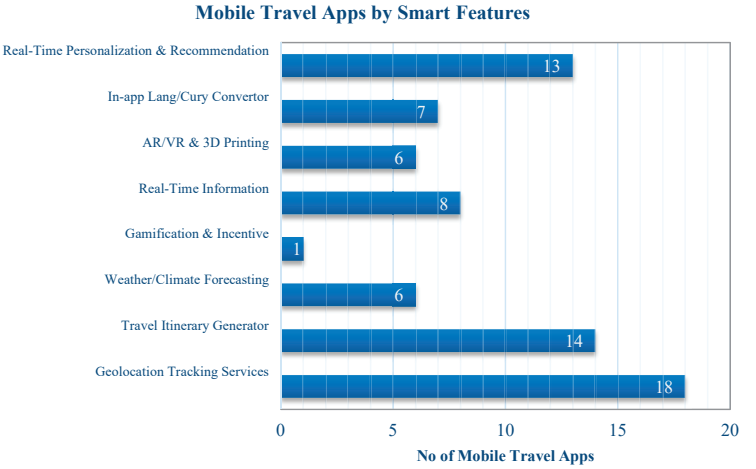

Figure 5.
Mobile travel apps by smart features

interests or needs, group size, time frame and accessibility needs (Ho *et al.*, 2021). The well-known iOS and Android MTA that include trip planning features are Triplt, TripAdvisor and TripCase.

Real-time personalisation and recommendations is another MTA smart feature that users seek and on which app developers focus. This feature was available in 13 of the 36 selected apps (36.11%). The recommendation engines are powered by AI and ML based on the user's profile information, interests, online behaviour, search history, rating data and online activities to predict and auto-recommend suggestions. The personalisation and recommendation feature is useful for users who mainly multitask. For example, the Smart Itinerary app generates personalised recommendations and auto-generates travel itineraries with innovative technologies, such as geofencing, AI and a vast collection of specific site information. A popular solution in tourism destination apps is to route tourists to less crowded areas by prompting push notifications and information on mobile devices (Dorcic *et al.*, 2018).

Real-time information availability distinguishes newer apps from traditional apps by providing real-time information on traffic conditions, roadway incidents and parking availability. Eight of the 36 apps (22.22%) offered the real-time information feature. Smartphone apps that combine mobility matching, mobility networking and real-time data to create a new travel experience recently prompted the re-evaluation of travel patterns and behaviours. Real-time travel tracking mobile apps are increasingly used in the transport sector as they enable users to track the motion of their cars or buses using IoT technology and GPS devices. Seven of the 36 apps (19.44%) offered in-app language or currency convertors while 6 of the 36 apps (16.67%) offered weather or climate forecasting. It could be due to the abundance of apps that include these functionalities, where such apps are easily found and commonly used individually. Although these features are necessary, they do not require embedding into one-solution apps. These features could be stand-alone and run independently without integrating relevant travel data.

The AR or VR and 3D printing feature was newly introduced and is a feature of the future in smart tourism. Although only 6 of the 36 apps (16.67%) offered this feature, it is highly recommended as it substantially improves the UX during travel. AR can be used together with the powerful cameras available in most smartphones. Adding AR to the MTA improves

the UX while creating an interactive means for the user to conveniently gather information on a specific location. In a recent study, it was reported that smartphone AR apps facilitate virtual directional arrow navigation and provide interactive information on unfamiliar or interesting places (Kontogianni and Alepis, 2020).

Only one app offered the gamification and incentive feature, probably due to prioritisation of the app utility. Nevertheless, gamification and incentives is a powerful feature to acquire, engage and retain user app adoption. App engagement and existing user retention are more important than attracting new or potential users. Both the Apple App Store and Google Play Store widely adopted mHealth app gamification, but the app user ratings were high only in the Apple App Store (Schmidt-Kraepelin *et al.*, 2019). Therefore, this feature has the potential to grow in the future.

Challenges of MTA with smart features

The tourism industry has achieved the next level of user engagement and market penetration. Multiple stakeholders are involved in MTA adoption. The challenges of MTA with smart features can be viewed from three perspectives: tourism organisation, app developer and user (response to RQ3).

Based on a tourism organisational perspective, MTA with smart features has the potential to enhance the tourist experience. Hence, tourism organisations should invest substantially in smart technologies to offer better tourism services and gain a competitive advantage in the tourism market. As smart features are comprehensive, their development requires much time, money and effort. For example, including LBS, VR, AR, 3D printing and gamification features in an app would result in an expensive and time-consuming development process (Jung and Dieck, 2017). Typically, developing an app with AR features could cost $50,000 to $250,000 and up to $2,500,000 in some cases. Moreover, this review revealed that more than 50% of apps did not offer smart features. Therefore, more app developers with appropriate skills are required to close the app feature availability gap.

From an app developer's perspective, there is no software or hardware standardisation for Android OS across various devices to provide geolocation tracking services. Therefore, it becomes challenging for developers to ensure that the developed app is compatible across different devices. The different features for differing keyboard forms, screen sizes and camera buttons of each device render app development challenging as they might affect the functionalities intended by the developers across the various devices. Insufficient network bandwidth and recent mobile communication network technology also affect app performance. Most mobile apps have not been fully evaluated for the accuracy of the collected data (Siuhi and Mwakalonge, 2016) on multiple devices. Thus, unreliable data-pulling methods, poor interpretation or outdated data may return inaccurate locations and incorrect information.

From the user's perspective, geolocation tracking services and real-time personalisation and recommendations present privacy and security in-app concerns where the service provider might collect, store and use the user's location or personal information (Kim *et al.*, 2017). The unintended disclosure of current location or personal information may lead to safety issues and information misuse, where such security concerns may result in user reluctance to adopt an app. Although service providers are committed to their promises to only collect necessary information and not use it for other purposes, users may remain suspicious of such claims. Users who are overwhelmed by several services that request location data or other recommended content via notifications are more likely to switch off their location settings. Moreover, mobile apps are limited as compared to computers, for example, they have restricted screen size, fewer keys, small storage space and lower battery capacity.

Discussion and conclusions

Conclusions

In this study, a general literature review overview on the available smart features and challenges of 36 MTA from the Google Play Store and Apple App Store databases was presented. The apps were selected based on their one-stop solution characteristics before they were filtered using the smart features criteria. The three main MTA features were geolocation tracking services, travel itinerary generators and real-time personalisation and recommendation. Fewer than 50% of the apps included smart features, which revealed that most MTA were still in the development stage and that the features AR or VR and 3D printing and gamification and incentives were still lacking in a one-stop solution app.

This review is expected to contribute to the scientific knowledge on MTA by providing insights into one-stop solution characteristics and the smart features accessible in numerous MTA in the Apple App Store and Google Play Store. In this research, it was determined that more review studies were conducted for medical sector apps as compared to the travel sector. Most of the previous literature focused on app quality evaluation, app functionality assessment and MARS-based user ratings to determine the degree of app adoption. In this study, the MTA smart features that should be included and prioritised by extending MARS functionality were investigated.

Travel brands should closely monitor how consumer preferences shift and what new technologies have to offer. The apps with smart features use AI, ML and BDA to increase comfort and convenience by automating processes and making travel experiences easier. The most identified MTA smart features revealed tourists' preferred features and functionalities when adopting MTA, which can render travel even more appealing and accessible based on recent travel trends. Tourism organisations could embed tourists' preferred features in an app as a marketing strategy to increase user MTA adoption to promote their services and products effectively through mobile technology.

This study is also among the first to assess the developer's perspective to explore MTA smart features and simultaneously determine the smart features that should be prioritised and included in newly developed MTA to increase user MTA interest. It is also suggested that various smart features be integrated with innovative technologies on MTA to provide a one-stop solution app without the need to negotiate different portals to improve tourists' travel experiences in terms of time- and cost-saving. Moreover, the identified smart features suggested future research directions to derive the determinants (personal innovativeness and privacy and information disclosure) that influence MTA adoption. Furthermore, the challenges of MTA smart features in developing appropriate strategies to mitigate potential issues were highlighted in this study.

Thus, the findings are significant for tourism organisations to keep up with the most recent hospitality technology trends to expand business opportunities and market penetration through MTA, as tourist expectations and requirements are continually shifting. The findings are a valuable reference for tourism industry practitioners and academicians in terms of the strong aesthetics and usability to gain MTA acceptability with smart features. Additionally, the findings suggest guidelines on app features that smart tourism app developers and designers should prioritise. Meeting these principles will improve app usability, optimise use and increase use by tourists. Furthermore, mobile travel has become increasingly important due to the current COVID-19 pandemic as contactless app usage and digital transformation are preferred in the travel industry for safety reasons. Keeping up with the current trends can help businesses remain operational by maintaining their competitive advantage and catering to tourists' needs.

Theoretical implications

The accuracy and reliability of the results were improved, given that MTA with one-stop solution characteristics (Gomes *et al.*, 2022; Lim *et al.*, 2022) were the fundamental requirement for further evaluation. The apps with specific functions, such as translation, currency conversion and weather forecasting, were excluded. The findings also filled a research gap in comparison to earlier research that used MARS to assess app quality (Davalbhakta *et al.*, 2020) and scoping reviews of MTA articles (Loureiro *et al.*, 2020) rather than the more recent MTA smart features offered. Thus, the results are more feasibly applicable to the travel industry. Additionally, the MTA were selected based on the smart features suggested by current travel app trends, which ensured that the results were the most current and more valuable for future reference.

Practical implications

Reviewing the use of smart features in 443 MTA from the Apple App Store and Google Play Store revealed insights into the current state of MTA smart features. Almost all of the apps reviewed had user ratings, which implied widespread MTA use. In comparison, there was less demand for mHealth apps, where only 50% of mHealth apps had user ratings (Kim *et al.*, 2018). The high user rating of 3.0–5.0 and the high number of apps in both stores (Google Play Store: 250, Apple App Store: 193) indicated the importance of MTA among the users of both OS. Therefore, app developers should leverage the cross-platform mobile development approach to create a mobile solution that is compatible with several OS and platforms (Android, iOS and Windows) so that solutions can be developed quickly while reducing app development costs.

In study, the United States led with 12 apps (33%), which dominated the development of MTA with smart features. Contrastingly, most Asian countries, such as Japan, Korea, Singapore, Thailand, Hong Kong, India and Indonesia, had only developed one app each, which indicated that the technology is still new and hence had room for improvement. Developing MTA with comprehensive smart features requires innovative technologies, additional effort and time. Notably, infrastructure development is crucial for achieving Sustainable Development Goals. Therefore, Asian governments must strive to stimulate demand for digital solutions, such as by investing in sophisticated technologies. Of the 36 apps, 31% were paid and 69% were free, which implied the sophisticated introduction of new innovative MTA. There was high adoption of the "freemium" strategy to attract new users of the newly developed MTA. For example, a review of the characteristics and quality of mHealth apps for PDDIs determined that 78% of the apps were free (Kim *et al.*, 2018). An app that is stable and can benefit the user is more likely to encourage the user to spend money to upgrade or purchase it. Simultaneously, free apps are intended to maintain user engagement without incurring advertising costs. Thus, many apps offer free apps with in-app purchases for this reason.

Based on the results, most MTA offered geolocation tracking services to detect the user's location to deliver real-time information, while travel itinerary generators generate trips based on the user's budget, interests or needs. The real-time personalisation and recommendation feature presents suggestions based on the user's profile, interest, behaviour and online activities while real-time information enables users to access real-time updates on traffic conditions, roadway incidents and parking availability. The availability of these smart features revealed that tourists adopt MTA as they save time and costs and provide personalised content. The findings could also aid tourism organisations or app developers in determining the dimensions that require improvement for user engagement. Moreover, the results provide deeper insights and guide app developers in identifying the smart features that should be made available when developing new MTA.

Technological organisations could optimise technology stack, such as programming languages (Swift, Kotlin, JavaScript, HTML, CSS, PHP and Python), toolkits (Apple Xcode and Android Studio), SDK (iOS and Android) and frameworks (Ionic, Apache Cordova and Laravel) for travel app development by considering the identified smart features.

Travel and tourism practitioners must strategize to mitigate the challenges in MTA with smart features based on the perspectives of tourism organisations, app developers and users. Tourism organisations or app practitioners should invest significantly in technology to offer better tourism services. Such providers should upgrade their offerings with the current technology trends to capitalise on their investment in technology to gain higher returns in the future. The five most recent technology trends that were good investments in 2021 for maximum return were blockchain technology, AI, 3D printing technology, health tech, and AR and VR (Prakash, 2018). Most of the smart features aimed at increasing user engagement (geolocation tracking services, travel itinerary generators, and real-time personalisation and recommendations) required access to the tourist's location. Inaccurate location was another challenge regarding app quality. App developers should focus on this issue as numerous apps continue to be developed. Nevertheless, increased access to user location and personal information can lead to additional concerns regarding personal privacy and data security. Regardless, tourism organisations must fully understand users' privacy concerns by addressing the weaknesses and providing proactive solutions.

Limitations and future research

This study has several key limitations. First, as user ratings are based on personal opinions, the results might be biased as only users who have used an app for a certain duration could accurately reflect on its efficacy. Second, the app search for evaluation might have been incomplete as only two app stores were examined where other app stores, such as the Amazon Appstore, Samsung Galaxy Store and Huawei AppGallery, were not included. Lastly, mobile travel apps that are frequently updated and released may have restricted the generalisability of the results.

The findings of this systematic review of MTA smart features and challenges demonstrated the extensive use of MTA across various platforms, with Android and iOS accounting for 99% of the global market for mobile OS (Statcounter, 1999–2022). Future researchers may examine cross-platform mobile development approaches and frameworks (Flutter, React Native and Kotlin Multiplatform Mobile) to ascertain which is best in terms of app performance, development cost, time, and effort, effective resource management, and user satisfaction and UX. Asian nations should invest in sophisticated technologies to fully utilise technology solutions. Future academicians may predict the results of technological investments, which include whether a technological solution will live up to its promise or fall short of it. The current challenges should be analysed, integration opportunities should be identified, the influence of new technology deployments on the current technology stack should be measured, and the implications of introducing new technologies to the workforce should be considered.

Most MTA smart features required users to disclose their location or personal information via geolocation technology, which has raised privacy concerns and potential privacy risks about how users' location data are gathered, shared, secured and used. As geolocation apps and services are highly valuable to both consumers and businesses, their opportunities and uses will continually expand. Understanding how geolocation works, ensuring that the organisation is aware of the privacy risks and identifying the benefits of geolocation are crucial in future research.

With the growing popularity of smartphones and the application of innovative technologies, app developers are including additional promising features and functionalities to deliver

the ultimate experience to users by fulfilling their desires. In future research, there may be a need to identify novel smart features, such as AI-based voice or message assistance and smart ticketing and payment to optimise transactions, increase sales and reduce costs. As the COVID-19 pandemic has highlighted hygiene, safety and local services while also accelerating contactless payment and remote working to accommodate shifting tourist behaviour, future research could assess the influence of global COVID-19 on tourist behaviour and mitigate threats that arise to improve tourist experiences.

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