

SONIA: AN INTEGRATED INDONESIA ONLINE TOURISM SYSTEM IN NEW NORMAL ERA

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ABSTRACT. *Indonesian travel and tourism have grown to become one of the largest economic sectors in the world. Tourists are the main source of income for gross domestic income in Indonesia. However, although Indonesia as a beautiful archipelago country has so much offer to foreign and local tourist, until now it fails to give their potential to the country. Furthermore, the COVID-19 situation made Indonesia tourism worse. Travelling is banned as a consequence of lockdown in Indonesia. Business and economic need to adjust into their new normal. Unfortunately, in the midst of the current era of Internet technology and new normal, Indonesia's tourism promotion is considered to be uneven and unwell targeted. Many tourist destinations are very interesting and clean but not yet known by potential tourists both from domestic and abroad due to the lack of targeted promotions and re-branding of a safe place to visit. Seeing to this problem, this study aims to propose an integrated tourism system called SONIA, by using a Service-Oriented Architecture (SOA) and an Artificial Intelligence (AI) model to build a personalized recommender system. Through this system integration model, a significant socio-economic benefit can be made for tourism sector in Indonesia. The results of the research will be exploited for the tourism industry and Indonesia's participation in the global tourism competition market.*

Keywords: e-tourism, Recommender system, Personalized AI, Mobile applications, Integrated information system, Service-oriented architecture

1. **Introduction.** Indonesian travel and tourism have grown to become one of the largest economic sectors in the world. Tourists are the main source of income for gross domestic income in Indonesia. This is due to the strategic position of Indonesia which is an archipelago between two continents and two large oceans. The variety of cultures and natural beauty that are spread throughout the archipelago offers a variety of interesting choices for local and international tourists visiting Indonesia. In many international ranking, including most beautiful countries in the world index, the global muslim travel index, Indonesia always ranked highly [1]. In addition to that, a survey conducted by Suara.com in June 2019 [2] said that since 2014 travel became a trend among young people and older people in Indonesia, where 86 percent of Indonesians preferred to travel domestically.

According to data from the World Travel & Tourism Council (WTTC) 2018, the total contribution to the Gross Domestic Product (GDP) of the travel and tourism sector in

Indonesia has only reached 6.6% of total GDP in 2018. The travel and tourism sector not only contributed to total GDP, but also increased employment rates in Indonesia. It is predicted that there will be an increase of 3% per year for the next ten years. In 2028, it is predicted to reach 6,258,000 jobs related to the travel and tourism sector [3]. At the 50th anniversary of Indonesian Hotel and Restaurant, President of Republic of Indonesia, Joko Widodo, highlighted the tourism industry had the potential to become the biggest foreign exchange earnings for Indonesia.

However, Indonesia with more than 17,000 islands still fails to give their potential to the country, despite the acknowledgement from both international and local community to Indonesia's beauty. Indonesia tourism growth also still falls behind other regional counterparts such as Thailand, Malaysia, Singapore, and soon behind Vietnam. Furthermore, there are increasing preferences for domestic travelling from local Indonesian people, but the number of local tourists is still considered low when compared to the number of Indonesia population that reached almost 300 million.

Furthermore, the COVID-19 situation made Indonesia tourism worse. Travel is banned as a consequence of lockdown in Indonesia itself and most countries in the world face threatened situation of tourism and hospitality industries sustainability as well as in Indonesia. Although, we believe sooner the danger of COVID-19 will be less, such condition will change into new normal. And this means, to survive, the tourism and hospitality industries have to adjust into a new normal life. New normal is the current state of being after some dramatic changes, such as 9/11 tragedy and COVID-19 pandemic, have occurred. The new normal encourages people to deal with current situations rather than wailing what could have been. According to McNamee and Diamond, the first person who coined the term "new normal", it is totally a new era in terms of business and economics to play the new rules for the long term [4].

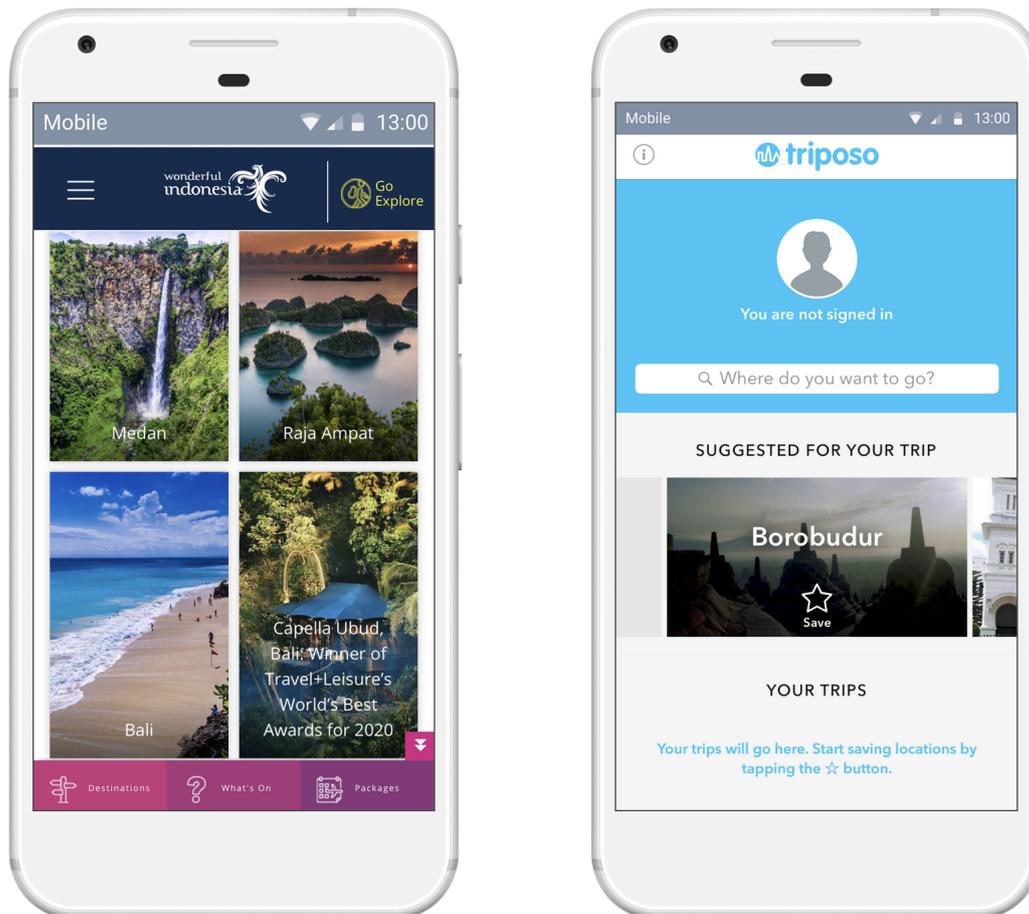
The challenges of Indonesia tourism are poor infrastructures including information and technology system, and the lack of investment on necessary infrastructure projects. The 2019 Travel and Tourism Competitiveness Report by the World Economic Forum (WEF) revealed tourist service infrastructure was the worst performing area for Indonesia tourism industry. With a score of 3.1 out of seven, in South East Asia average, Indonesia's tourist service infrastructure is worse than that of Cambodia and Philippines and only slightly better than Vietnam [5]. Therefore, the development of infrastructure including information technology and the Internet today not just can be an attractive opportunity, but become a must for various industries to develop their markets in the new normal era.

In accordance with the 2015 Strategic Planning of Indonesia Ministry of Tourism [6], developing and strengthening tourism marketing is a need. So it can be directed to increase the number of tourist trips in the archipelago with the approach of personal market segments, business market segments and government. There are three main products that need promotions: (1) natural tourism consisting of marine tourism, ecological tourism, and adventure tourism; (2) cultural tourism consisting of heritage and religious tourism, culinary and shopping tours, and city and village tours; and (3) creation tours consisting of Meetings, Incentives, Conferences and Exhibitions (MICE) & event tours, sports tours, and integrated regional tours. The development of the archipelago tourism marketing strategy is developed through a focused strategy that integrates marketing aspects or Destination, Original, Time (DOT), promotion aspects or Branding, Advertising, Selling (BAS), and media aspects or Pade, Own, Social media (POS).

However, in the midst of the current era of Internet technology and new normal, Indonesia's tourism promotion is considered to be uneven and unwell targeted. Many tourists destinations are very interesting and clean but not yet known by potential tourists both

from domestic and abroad due to the lack of targeted promotions and re-branding of safe place to visit.

Some online tourism systems that have been developed in Indonesia include indonesia.travel¹ (Figure 1(a)) owned by Indonesia government which was developed in the website platform and Triposo² travel guide for Indonesia (Figure 1(b)) which was developed in a mobile application. However, unfortunately, those two applications are still standing alone, not integrated with other data/information, so that many tourist targets are still untouched by local and foreign tourists as well as do not give information regarding the cleanliness, health standard and safe level to visit.



(a) Indonesia.travel website on mobile version

(b) Triposo mobile application

FIGURE 1. Existing solutions for Indonesia e-tourism

Seeing to the problems, the implementation of Artificial Intelligence (AI) to handle the targetted promotion and gather the information from others to recommend tourist destinations may be necessary. It will provide a boost to the promotion of Indonesia tourism as well as re-branding safe place to visit. If this system is successfully used intensively by tourists, the Indonesian Ministry of Tourism or the tourism industry will be able to do profiling and gaining trust back of potential tourists who are interested in Indonesia so that more targeted promotions can be carried out.

¹<https://www.indonesia.travel/>

²<https://play.google.com/store/apps/details?id=com.triposo.droidguide.indonesia>

One technology in AI which we can use here is a personalized recommendation system that is able to present vast amounts of information on the Internet in a form that is more targeted to specific segments. This is made possible by filtering information based on the needs and preferences of system users. Further, AI will also help to gather information from other tourists in the form of reviews and ratings regarding cleanliness, health standard, and safe place to visit.

This study aims to overcome the above problems by designing an integrated online tourism model (e-tourism) both in terms of tourism data and tourist data in Indonesia as well as location maps, level of cleanliness and health standard, places to eat, money changers, etc. with the enhancement of a personalized AI system. In addition the problem of ineffectiveness and inappropriate targeting of Indonesian tourism promotion can be addressed by applying AI technology in this e-tourism system integration model. The integrated system model will be very helpful for data collection on tourism in Indonesia and measuring the potential for its development in the future.

Through this system integration model, a significant socio-economic benefit by increasing community awareness on level of cleanliness, health and safety both locally and internationally, can be made for tourism places in Indonesia. Further, the increasing interest of tourists from home and abroad to intensify the promotion of Indonesian culture will be achieved. The results of the research will be exploited for the tourism industry and Indonesia's participation in the global tourism competition market.

The contributions of this study are as follows: (1) proposed an integration model of e-tourism in Indonesia, (2) proposed a personalized recommender system model for e-tourism in Indonesia, and (3) proposed an integrated AI-based solution for promoting tourism in Indonesia and other similar archipelago countries in general. The rest of this paper is organized as follows. In Section 2 we explain the related work in e-tourism management, comparing our solution with the existing systems, Service-Oriented Architecture (SOA) system, and personalized recommender system. It followed by Section 3 that describes the research method used for this study. In Section 4 we show our proposed system design, and then finally conclude our work in Section 5.

2. Literature Review.

2.1. Tourism management strategy in new normal era. Following COVID-19, it was doubted the tourism sector which helped the Indonesia economy to a quick rebound without radical change in any part of the tourism system. The success of the efforts undertaken is clearly reflected in the encouraging results on the collaboration between government and institutions or organizations that make up and/or influence the Indonesia tourism system [7].

Government through ministry of tourism and creative industry as well as private institutions should develop new strategic planning system of Indonesia tourism. Pandemic COVID-19 has created fear among tourist local and international to visit places, restaurant, hotels, merchant etc. that are unknown for the level of safety, cleanliness, and health. Neuhofer et al. [9] stated that tourist memorable experiences become essential to win competitiveness. And this memorable experience has not just been recalled when the tourist decides to travel and seek information to select destination [10], but they will also share the experience to the public along with social-media and IT development.

Therefore, it may be important for Indonesia government and hospitality industry to eliminate the fear and deliver pleasantly memorable tourism experience for local and international tourist in the new normal era. The strategy aims to gain the trust of tourists through sustainable development by preserving the beauty of the natural environment

and the quality of life of the indigenous people, especially by making the best use of the available resources without consuming or draining their energy as suggested in [11]. In addition to that, the implementation standard cleanliness, health and safety in any tourist place and hospitality organizations are also needed to increase the level of trust of tourists in travelling in the new normal era.

Another big homework is to gain tourists' trust by delivering trustable information and image regarding the destination place (including a city/countryside, a region, or even the country). Zhang et al. [7] argue when the destination is an entire country, the nation image may become an important factor to influence the international tourist in choosing the destination. While many tourists usually have limited knowledge of the city/place to visit and are unaware of the local artistic, social or entertainment places [12]. Another recent study by Jung and Shin published in 2020 [8] mentioned that the use of Social Networking Services (SNS) for tourists to gather information about spots/places has a positive impact on the attractiveness of cities and behavioural intention through evaluation of some aspects, e.g., usefulness, interaction, reliability, and spread. The study also shows that the city attractiveness is an important factor which can affect the tourists' behavioural intention, such as to revisit, recommend and spread positivity about the tourism destination to their family and friends. Thus, we argue that in this digital world, an application that is not just able to deliver trusty information in a short time about the city/region, spot area, transportation, infrastructure, accommodation, and health standard to eliminate unwillingness of traveller to visit the place, but also able to give a service for tourist to become deeply familiar with the city and plan leisure activities has become essential.

SONIA (pariwiSata ONline IndonesiA) or Indonesia Online Tourism is a mobile application that delivers necessary information regarding the city/region/place as well as able to generate recommendation about personalized tourist tour. SONIA is intended to give service for local and international tourist based on user's taste, demographic classification, interest, current visit preferences, and level of cleanliness and safety from the place visited by the user in former trips. Another thing SONIA can deliver is developing recommendation travel itinerary for the users based on their visit duration, the opening hours of the place, geographic distance between users' hotel and the places to visit, and between places to places. Thus, SONIA output is real information over the places, and real travel itinerary that reflects users' taste or preference as well as provides detail on how and when to perform the recommended safe activities.

2.2. Comparison of SONIA and existing solutions. We mentioned in the previous section about similar solutions available for Indonesia tourism: Indonesia.travel and Triposo. Triposo is an online travel content platform that allows users to access maps, local tips, bookings and personalized recommendations. Triposo is headquartered in Amsterdam, Noord-Holland. Indonesia Ministry of Tourism has an official website about general information on tourism in Indonesia which is called Indonesia.travel. We will not analyze the other available tourism applications, such as TripAdvisor, Viator, Minube, Agoda or local booking application such as Traveloka, Tiket.com, Pegipegi, which only provide information about places and/or transportation with reviews and booking system. This study aims to promote Indonesia tourism with complete information about local culture and explore more about hidden potential. Some local regions such as Java and Lombok have their own application, such as Travel to East Java Indonesia³ developed by Mahoni

³<https://play.google.com/store/apps/details?id=com.mahoni.eastjava29>

TABLE 1. Comparison of existing solutions and our proposed system (SONIA)

Feature	Indonesia.travel	Triposo for Indonesia	SONIA
Platform	Website	Mobile	Mobile
Booking system	No	Yes	Not Yet
Information for foreigner to visit Indonesia*	Yes	No	Yes
Local culture information	Yes	Yes	Yes
Merchant*	No	Yes	Yes
Travel spot	Yes	Yes	Yes
Places to eat	No	Yes	Yes
Accommodation	No	Yes	Not Yet
Regions*	Major regions	Limited to some famous regions	Covering major as well as infamous regions
Phrasebook (English-Indonesia)	No	Yes	No
Travel plan with AI*	No	No	Yes

*Features highlighted in bold are the new features we contribute in this paper.

Global, and Lombok Travel Guide⁴ developed by eTips. Until recently, there is no application which provides integrated information from all regions in Indonesia. We explain the comparisons of two major applications with our proposed system to make it clearer for the reader to mention our contribution in this paper. The comparison is shown in Table 1.

2.3. Service-oriented architecture and microservices architecture. Service-Oriented Architecture (SOA) is useful in system/application integration implementation. An integrated application that began because of data/information exchange between an application and the other. SOA is an approach to system design (architecture) where service exists in each sub-system so it can integrate. In this case, those components give a certain business service type (service) such as do payment, payment transfer, and check bank account status [13]. In other words, SOA is an architecture that supports business integration as a service and becomes a way of innovation. SOA is also a technology-based business strategy and evolution for integrating various information from different source codes or platforms. Service-Oriented Architecture (SOA) is an architectural approach that improves business agility by building systems with reusable, and loosely coupled services [14]. Microservices Architecture (MSA) has been explained in [15] to compare Microservices Approach and Traditional Application (Monolithic Architecture). Domain Driven Design (DDD) is an approach to design and develop systems based on microservices architecture [16], and is an approach of software development that focuses on the application domain [16]. A tactical phase is part of MSA, it can help for the stage of designing MSA, and it is loosely coupled and cohesive [17].

2.4. Personalized recommender system. Implementing a recommender system for online system nowadays is inevitable as this is considered one of the most powerful tools in the recent digital era. Recommender system itself is not a new research field. It has been around for about more than 40 years. The first implementation of recommender

⁴<https://play.google.com/store/apps/details?id=guide.lombok.app>

system was called Grundy in 1979 [18], a librarian system which can generate recommendation of books. In general, a recommender system can provide personalized and non-personalized [19]. For a personalized recommender system, each user will receive different lists of product that match his/her preferences only, while for the other method, non-personalized, all the users will receive the same list of recommendation. The most common techniques used in building a personalized recommender system are content based filtering, collaborative filtering, hybrid model and classification machine learning model. The output of each technique will generate a specific list of recommendation based on a user's preference. The personalized recommender system for e-tourism has been proposed by several studies. In 2005, Rabanser and Ricci [20] mentioned that the market of recommender systems for e-tourism is still very broad. It can improve services offered by many parties, such as suppliers (hotels, restaurants, organizers), intermediaries (travel agencies), and customers (the tourists). Recommender system for e-tourism will still perform well in the future. Noguera et al. in 2012 [21] proposed a hybrid recommendation system by using a mobile 3D-map based GIS data to allow users to experience from real-time surrounding recommendation. Garcia et al. [22] also proposed a tourism recommender system where the user's taste can be elicited from their demographic classification and places visited in their past trip. The proposed recommender system can be used for either an individual or a group of people who share the same tastes. Another implementation of recommender system in e-tourism domain has been proposed by Kenteris et al. [23] in 2010 which exploits other users with similar interests. They used collaborative filtering method for generating recommendation. The existing work in recommender system for e-tourism has not proposed the personalized recommendation system with integrated architecture, which now becomes our motivation to conduct this study.

3. Research Method. Performing this study requires several phases which include analyzing the problem with e-tourism implementation in Indonesia with regard to the data and system integration, performing a systematic literature review, interviewing with some users in e-tourism industry stakeholder and proposing an integrated e-tourism system using prototyping approach.

Prototyping model. It is very common in software development methodology to have changes in the requirements. One suitable approach to tackle this situation is called prototyping paradigm which can cater the need from both user and developer. It is also often that the user defines the requirements without identifying the specific requirement for features and functionality [24]. The process is started with communication with the user discussing the requirements. In this step, the system objectives are usually agreed between both parties. The process is followed by quick planning of building the system prototype to be evaluated by the user. The process of developing prototype is iterated until the user requirements are satisfied. The cycle of prototype software development approach is shown in Figure 2. The detail of each step conducted in this research is described as follows.

1) Requirements

In this step, we interviewed the users, i.e., a company that wants to implement this application and a group of people who travel a lot. We also discuss the initial requirement with potential stakeholders of this application, i.e., Indonesia Ministry of Tourism, academia, and some local tourism industries, such as restaurants, hotels and gift shops. From this step, we received quite a lot of idea of what is lacking in the existing tourism system nowadays. Results of this step were then combined with literature review about existing technology suitable for building this application.

2) Quick Plan

After the initial meeting with the potential stakeholder and users, we created a quick plan on how to implement our solution. In this step, the development timeline and the team workload was prepared as guidance for the current phase of developing the prototype.

3) Modelling Quick Design

At this stage, the design was built. This was an important step for the developer team to work on the prototype. This stage should not take too long, as the users need to see the prototype as the mean of their requirement.

4) Construction of Prototype

This is the main part of our software development lifecycle. At this stage, the developer teams worked on building the prototype of the application.

5) Deployment, Delivery and Feedback

After the development of the prototype has been performed, the process will be continued with delivery and feedback. At this stage, we could get the feedback from the users about our proposed application.

6) Communication

This is the last step of each cycle, which is also essential to ensure that the prototype and the user requirement has matched. After this stage, if the users still want to refine their requirement we can iterate the process again and refine the prototype.

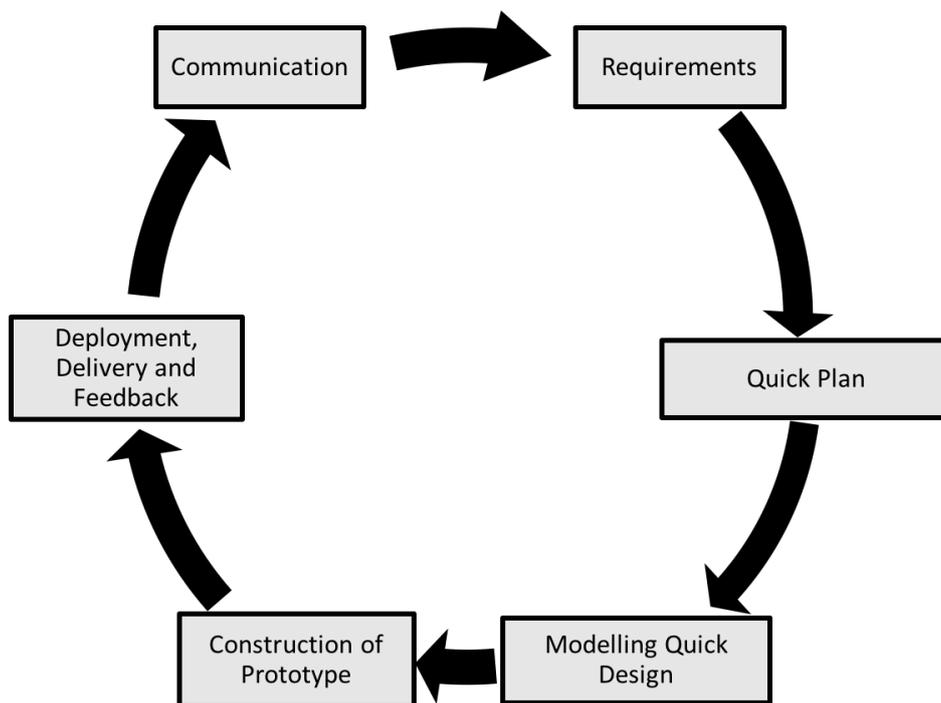


FIGURE 2. Prototyping software development method

4. Proposed System. In this section, we explain our proposed system. SONIA system is described by using a UML use case diagram to provide the ability of the system and the different actors which can interact with the system. We also provide the proposed personalized recommender system as the complement of the system. Finally, we propose the integration model of the whole system which also includes the third party systems.

4.1. Integrated system architecture. SONIA system is an integrated system that can bridge the ecosystem in the travelling domain area. SONIA system provides the mechanism of integration including internal systems and external or third party systems. We propose a system design of SONIA using Service-Oriented Architecture (SOA) approach. We propose SOA layers that consist of interfacing layer, business services layer, services layer, integration layer, and resources layer. The services layer can be divided into front-end service layer and back-end service layer. Back-end service layer will focus on the integration among the resources layer. SOA layer for SONIA system is shown in Figure 3.

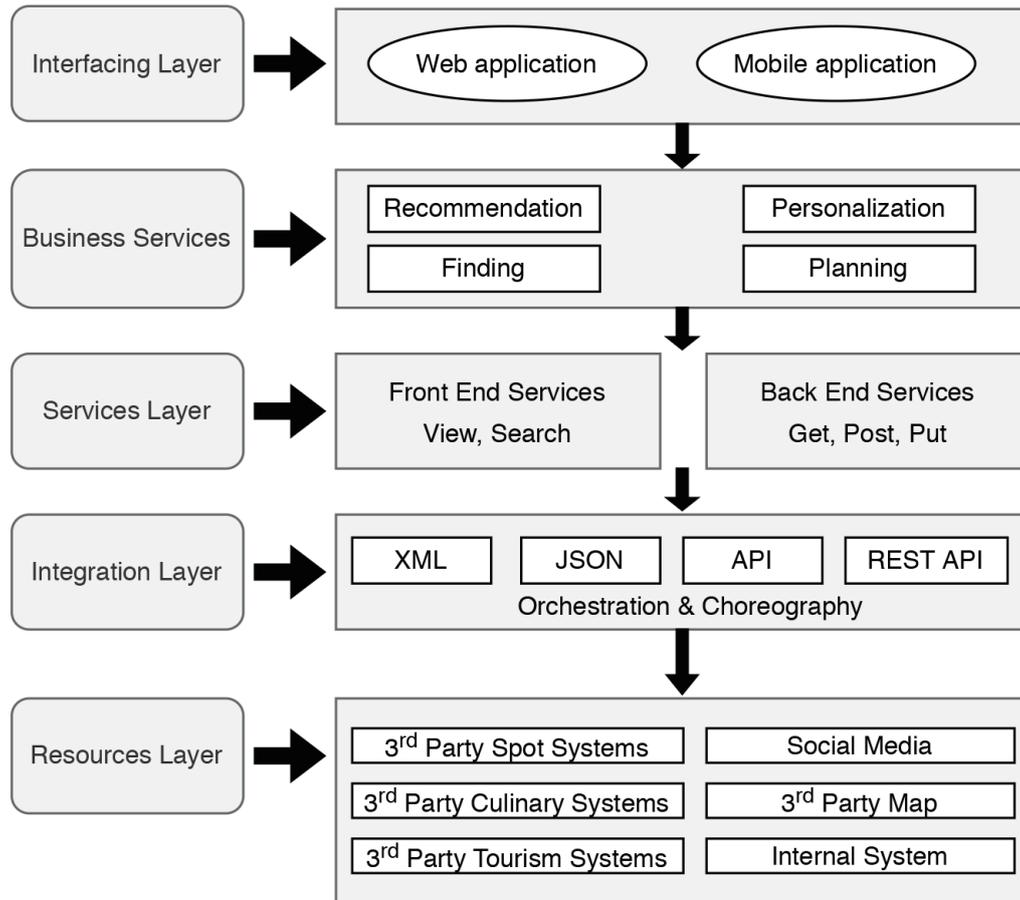


FIGURE 3. SOA layer for SONIA system

In order to model the services, we use Domain Driven Design (DDD) [25] to create a high level of microservices architecture design. The first stage in DDD is domain analysis. In this study, we analyze the tourism system as a domain. The second stage is to define the bounded context to map the boundary of the context. The third stage is analysis and defining entities and aggregates. The last stage is identifying microservices architecture design. Microservices architecture allows more convenience in software design than monoliths system, because of its independence and loosely coupled characteristics. Related to it, the process of analysis in aggregate, can make the identification of service candidates easier. We propose the microservices architecture design in Figure 4.

4.2. Use case model. In this paper, we propose an integration of online tourism platform which consists of national tourism and tourist data in Indonesia, location maps,

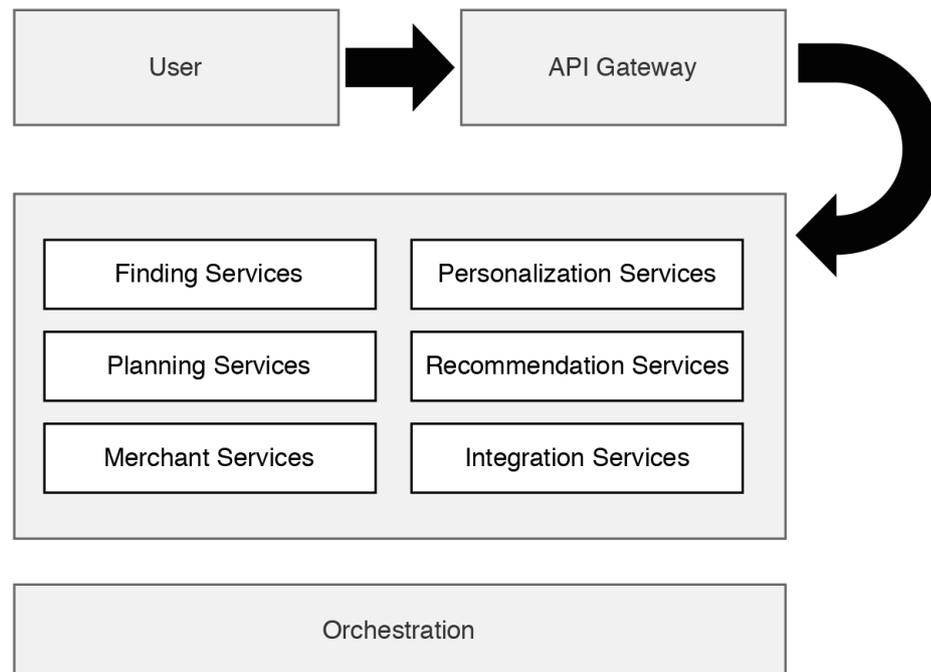


FIGURE 4. Services modeling for SONIA system

point of interests, money changer and an enhanced AI system to provide a personal recommendation. We provide the use case diagram in Figure 5. In the figure, it is shown that the system will have three different types of actors: user, admin and merchant. Regular users are able to find specific spots, places to eat, create a travel plan by the help of a personalized recommender system, and see the general information about tourism in Indonesia. The admin can maintain information from the back-end system, and the merchant can update information about their business in places to eat. In this paper, we only limit the merchants which have culinary businesses. In the future, this module can be developed for other possible tourism businesses, such as accommodation and hospitality, transportation services, tour agency, money changer and tourist guide.

4.3. Entity Relationship Diagram (ERD). Our proposed ERD for SONIA is shown in Figure 6. In the figure, it is shown that our proposed system will have seven primary tables as follows.

- 1) Users table is used to store user information.
- 2) Tourism information table is used to store general information about tourism in Indonesia, for example, local culture, currency, weather, special events, and visa application.
- 3) Spots table is used to organize information about point of interest in specific area/region; here we can also include details about the entrance fee, characteristics (outdoor, indoor, beach, mountain, sports), and descriptions.
- 4) Rating and review table is used to store ratings and reviews from users who have visited the places or eat the foods.
- 5) Places to eat are used to store information about the restaurants, culinaries and catering services available nearby owned by some merchants. We connect this table to the merchant directly so that they can manage up-to-date information about their businesses.
- 6) Merchant table is used to store information about registered merchant.

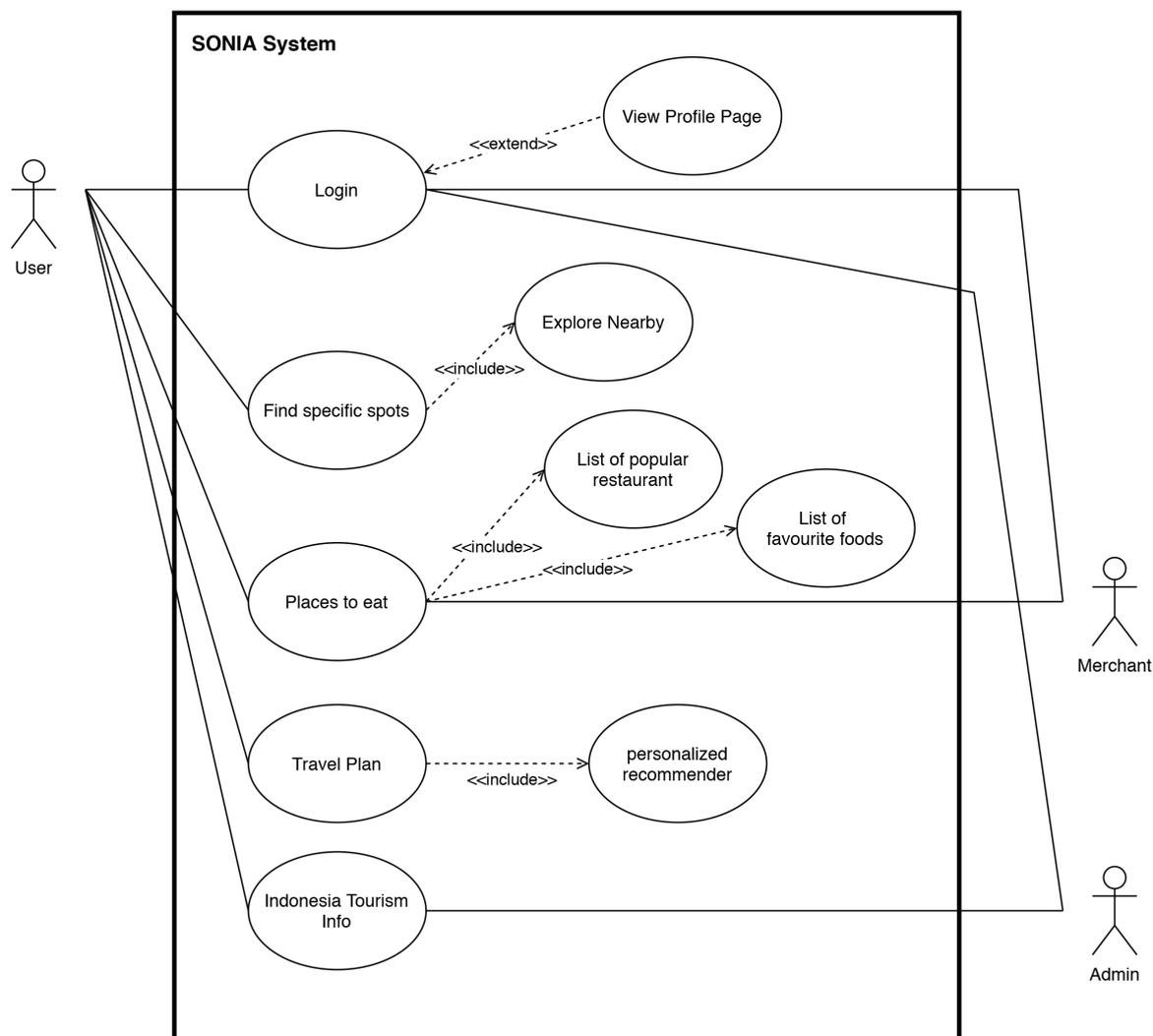


FIGURE 5. SONIA use case diagram

- 7) Travel plan option table is used to organize the detail of plan arranged by the users, and we also provide personalized recommendation for this feature and provide some feasible options according to their budget, preferred activity, number of persons in the group and duration.

4.4. Travel plan personalized recommendation. When planning a trip, people usually have some constraints regarding the travel, such as budget, theme, travelling with children or not; therefore, they may have several alternatives. Sometimes choosing the best one from some possible choices can be complicated when people still want to explore everything. The latest technology developed in the recommendation system includes content-based recommendations, collaboration-based (similarity of profiles between users) and combined methods. Whereas to get user preferences, we can use product reviews, ratings or choose between two options.

We propose the use of AI to handle this problem. We use a novel framework called APARELL (Active Pairwise Relation Learner) introduced by Qomariyah and Kazakov [26] in combination with a Decision Support System (DSS) which can provide the best alternatives for the users. APARELL is a framework based on logic approach to learn binary

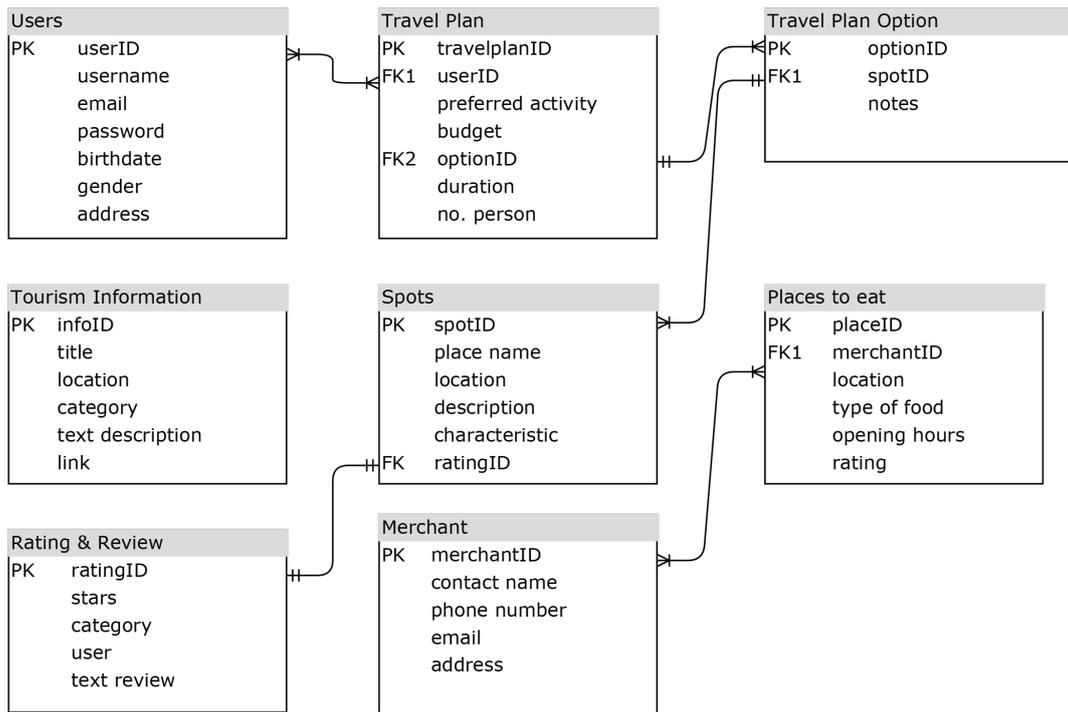


FIGURE 6. Proposed entity relationship diagram

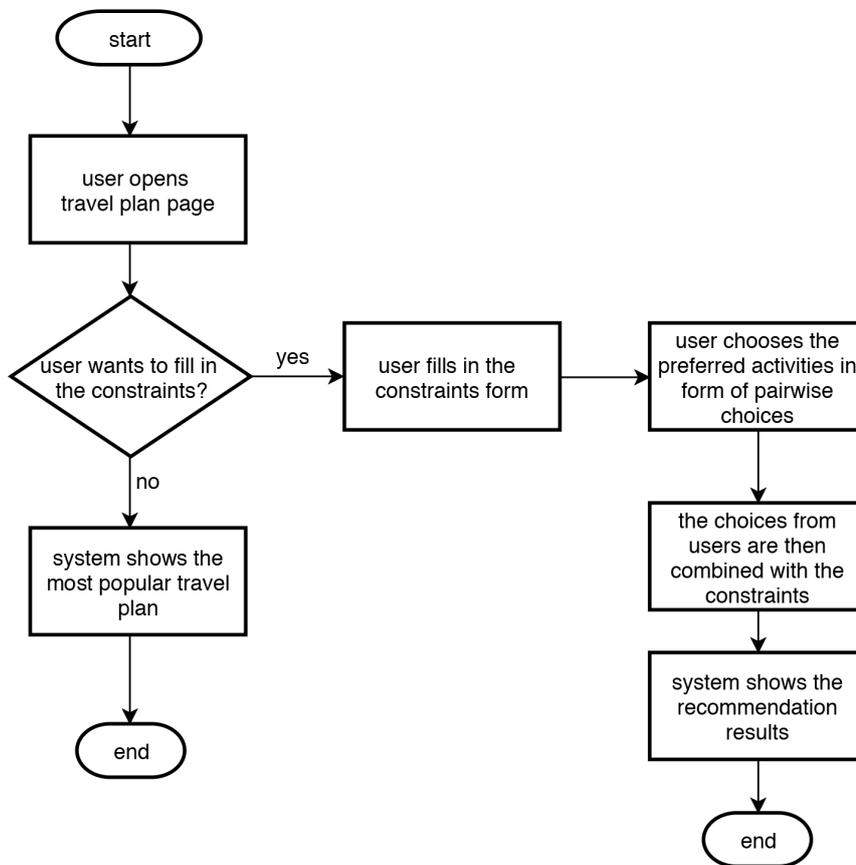


FIGURE 7. Flowchart diagram of generating travel plan recommendation

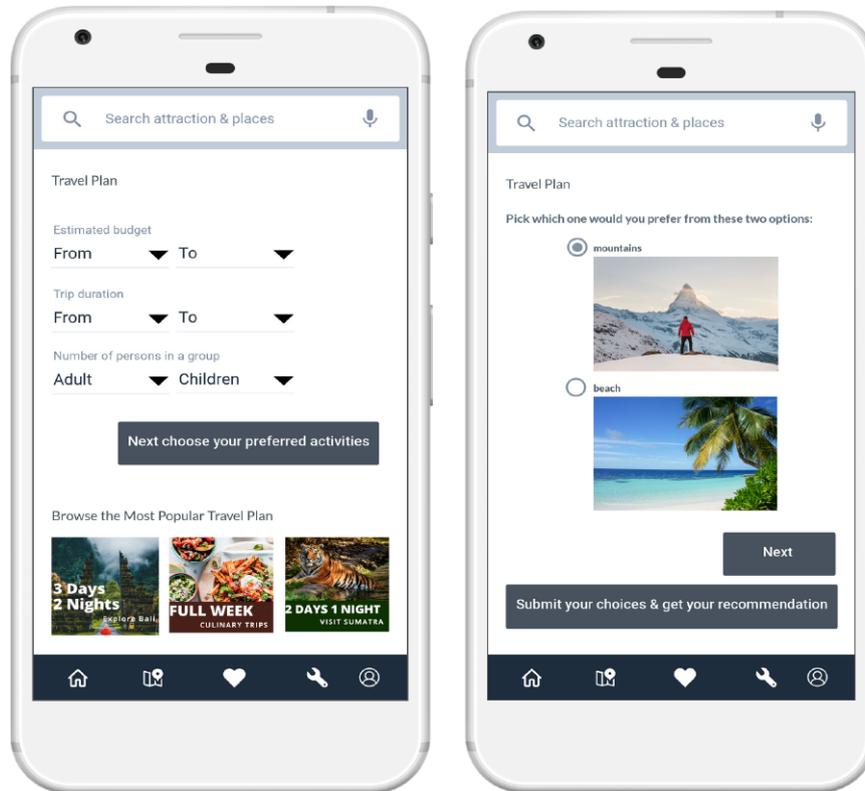


FIGURE 8. Travel plan with AI interface design

preferences. We can provide users with two options to be chosen for expressing their preferences, for example, they can choose which one they like better between highland-s/mountains and seaside/beach, or they can choose between indoor activities and outdoor activities. The proposed system flow of using APARELL in combination with DSS to build personalized travel plan recommendation is shown in Figure 7. The interface design shows how the users can input their preference before generating travel plan recommendation is shown in Figure 8. The detailed implementation of the travel plan will not be described in this paper.

4.5. User interface design. We propose the development of SONIA on a mobile platform because this is the easiest way for tourists to keep mobile while searching their favorite destinations and find useful information about local tourism. The proposed main interface design is shown in Figure 9.

5. Conclusion and Future Work. In this paper, we have analyzed the problem faced by Indonesian tourism which is mostly about travel infrastructure and lack of promotions. Some places have great potential with their beautiful nature which can be exploited more to attract both local and international tourists. Currently, there is no integrated information which can provide knowledge about local culture, heritage and other interesting facts. Here we propose an integrated system which also includes the use of AI to address the mentioned problem. This proposed solution can also offer an opportunity for the potential investors to examine the possible tourism business in Indonesia and other similar archipelago country. In the future, we plan to expand each module proposed in this paper to have more complex capabilities, for example, we can offer different services provided by merchants, such as accommodation, transportations, and tour guides. We also plan to implement games and gamification for spots and places so that tourists can get reward

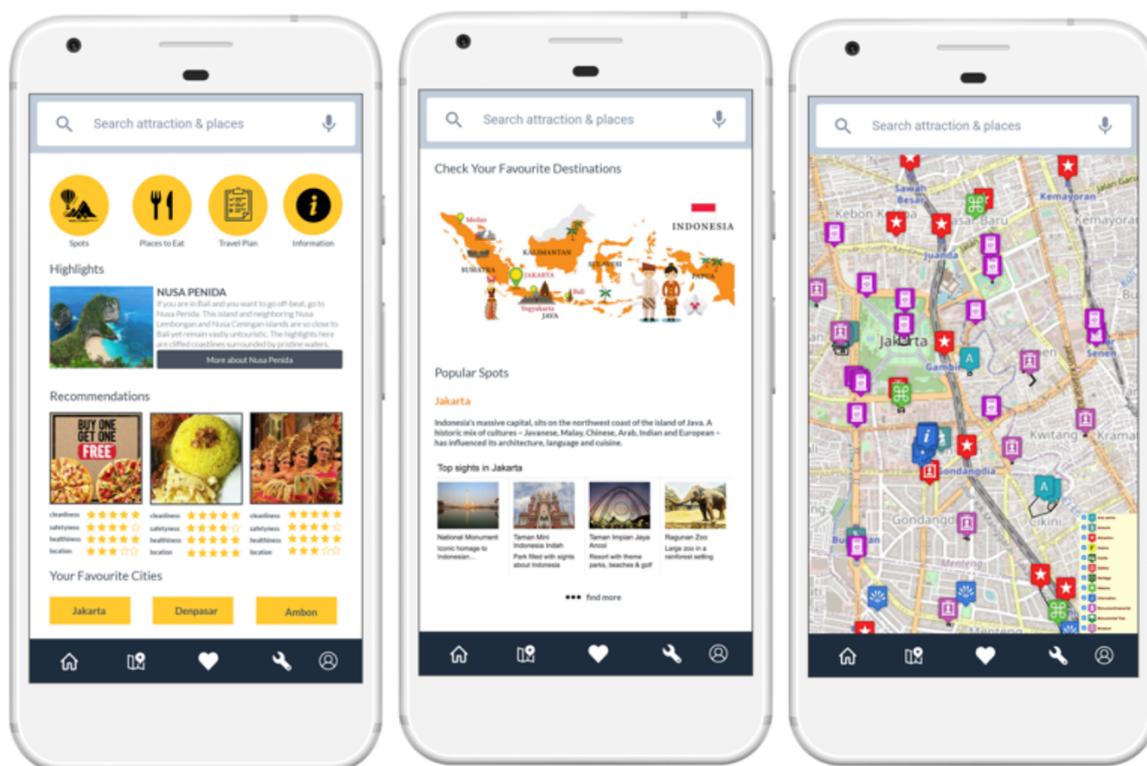


FIGURE 9. Main user interface design

after visiting each tourism destination. Another feature to be explored is agriculture, plantation, and farming tourism as this is the major potential in Indonesia.

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