

Original Article

An Intelligent Mobile Application for Customizing Travelers Trips

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Abstract - *Ibn Battuta system is a mobile application that helps travellers to construct a customized trip schedule for each day of the travel journey in a short time. The application is a result of developing an intelligent, creative and unique algorithm that fulfil travellers' needs and preferences. There are many factors considered during the construction of the trip schedule to make it as efficient and effective as possible. It integrates with Google map API to save traveller's time by taking advantage of building the daily schedule for the traveller based on the shortest distance between tourist attractions. Budget is another important aspect that is taken into account when building the trip program. In order to have a cost-effective plan, attractions with discounted offers have the highest priority in inserting attractions in the schedule during the discount period. Moreover, the type of attractions preferred by travellers, time dedicated for each type is considered. The most recommended places and landmarks have high priority as well. A number of travellers, including kids and adults, a number of hours spent touring also are included while constructing the trip schedule. Ibn Battuta is ubiquitous with the traveller; it applies the idea of ubiquitous computing by tracking traveller's location and informing him/her when they are nearby some recommended and popular attractions, landmarks or highly recommended restaurants using the use of the "Geofences" feature.*

Keywords - *Decision support system, Mashup technology, Android, Google Map, Travel, Trip Schedule, Traveler Guidance, Tracking, Geofences.*

I. INTRODUCTION

Nowadays, technology has become within reach of everyone in the world. Therefore, no one can spend his/her day without using technology such as television, social networks, etc. In addition, technology has brought the world news in hand, as when you open the television, you can receive real-time news from all over the world. On the other

hand, social media enable people from different countries with different cultures and traditions to make friends. In this context, as technology affects economic disciplines, tourism has benefited a lot from it. People are more excited to visit countries and discover the world since all countries attractions are exported to everybody. As a result, the number of tourists has increased in recent years [1]. However, planning a perfect trip can be a daunting task and consume a lot of time for searching and selecting the best choice among huge resources of information. The process is considered costly as well when a customer consults a travel agent to do this task for him/her. Accordingly, some existing systems have solved these problems by constructing a standard daily trip schedule for popular tourist destinations and suggesting them to users when needed. However, by this standard suggestion, all users will have the same schedule despite their preferences, needs, and circumstances. Therefore, this characteristic is not an efficient solution since no customization is given for people's different preferences and requirements.

To address this weakness, the idea of an intelligent system in the form of mobile applications has been inspired. This application helps and guides the travellers by creating a decision support system (DSS) that constructs a daily touring schedule based on traveller requirements as well as notifying them of the nearest recommended places. The main reason for choosing this solution is the daily touring schedule will be constructed by an intelligent algorithm that considers the famous tourist attractions, saves the traveller's budget, preferences and spend the trip days and time in a professional way. In addition, the daily touring schedule will be available for the traveller in a few seconds with high efficiency and accuracy of customized and fully detailed day-by-day schedule that addresses the traveller's needs. Moreover, it provides detailed and comprehensive information about restaurants and tourists attractions in the targeted destination. The following figure shows the use case diagram for Ibn Battuta application:



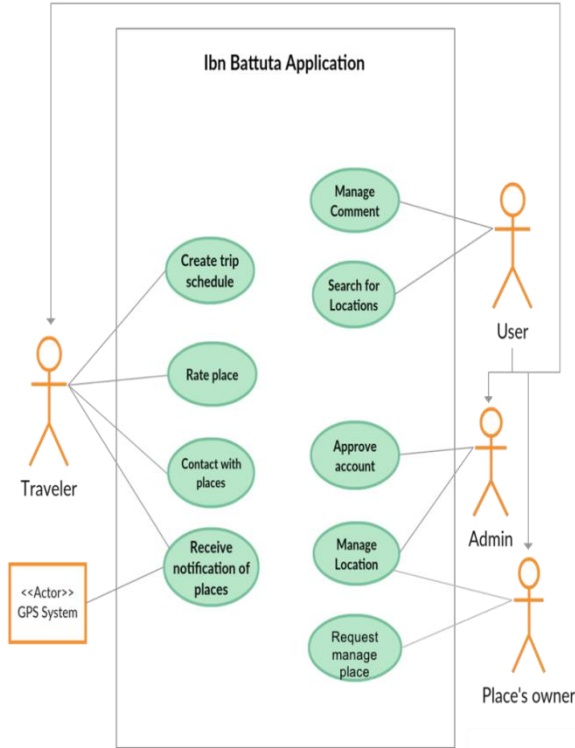


Fig. 1 Use case diagram

This paper will discuss the background of this application, the methodology used and the achieved results. In the end, we conclude our paper with a discussion and future work.

II. BACKGROUND

This section focuses on the existing, similar systems to the “Ibn Battuta” application in aim to analyze and compare the features of these systems. Moreover, it compares the features of these systems with the Ibn Battuta system to realize how their features can be exploited or improved Ibn Battuta application. This section discusses four systems, which are Road Trippers, Tourist Eye, Google Trip, and Trip Advisor.

A. Road Trippers website

As the name indicated, Road trippers is a website (also has an application) that guide the user during a trip on their travel by giving all the attractions, landmarks, and restaurants on his/her route (from source to destination). In other words, Road Trippers enables users to make the Trip schedule, discover, plan, book and navigate locations based on the route from source to destination. In this context, Road Trippers deals with a database containing millions of the world's most interesting locations and represents these locations using “ATLAS” maps. Moreover, there are several

functions that Road Trippers provide in aim to make it unique and different from other travels websites, as shown below [2].

a) Plan a Trip

Road Tripper provides this feature, which is about enabling the traveller to plan a trip schedule from source to destination (the user indicated) by discovering only the places on the route or around. But the problem with this feature is that it's not trying to investigate what the traveller wants or trying to match traveller needs. It only represents what is on the road or around it. Fig. 2 represents how the places on/around the route or represented automatically on the map.

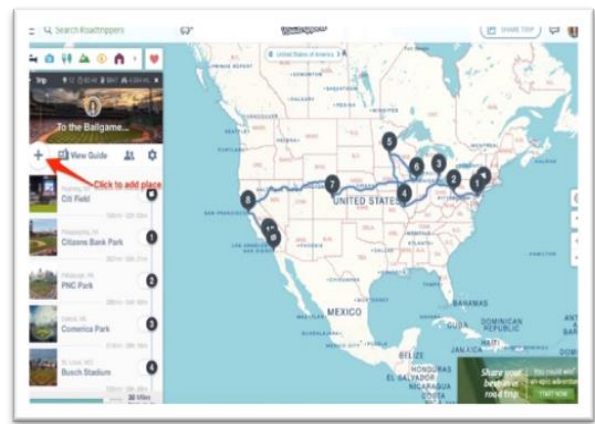


Fig. 2 Places represented in the map

b) Book a Hotel

Search and sort for hotels to stay in nearby the user's route; the website help user to take the right decision by representing reviews and photos of the hotel. Booking hotels is done through transfer users to the hotel's website to make reservations. This feature makes an unnecessary burden to the admins of the website since it has provided a space for comments and reviews on the website. And no need for that because the website will transfer the traveller to booking.com, which provide sufficient comments, reviews, and photos. In this context, the team decides to implement this feature on their application with the aim to provide more features that attract more travellers to the application.

c) Explore and Save

It is better to attract not only travellers but also any user. Explore and save feature allows that by enabling the user to explore and save favourite places on a list if he/she wants to visit in the future

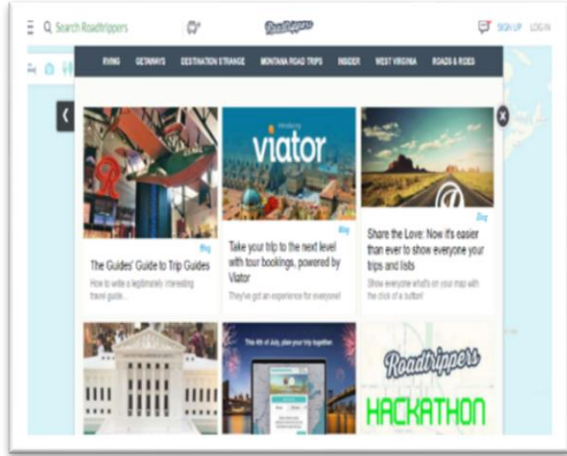


Fig. 3 Home page

d) Blog

The website gives space for bloggers, photographers, videographers, curious humans interested in sharing /her travels; Road Trippers enable them to share their trip plans and the places they love and represent it on the website on the Blog section. It is a good feature because it will enhance the marketing of the website. Thus, the team decides; to enhance the participation of travellers a sharing the good trip schedule they have.

However, there are some issues not considered by Road Tripper, which there is no customized schedule for the traveller, which mean that the traveller is responsible for collecting all the proper places. As well, as Road Tripper does not provide enough features to be a dynamic system means there is no clear interaction between the system and traveller, for example, during the trip.

B. TripAdvisor

TripAdvisor is a detailed and comprehensive travel companion app with a lot of information that helps and guides travellers to plan and book a trip. Users can explore restaurants and reserve tables online, compare hotels' prices and find great deals as what Fig. 4 shows, use the Near Me Now feature to discover places near them and discover sightseeing attractions in any destination Ibn Battuta app will improve this feature by informing the users with the nearest recommended places, rather than using search it.[3]

Moreover, searching is quite straightforward. Simply the traveller can enter the name or postcode of the city, and then it will give a list of places that are sorted via the rating users have previously entered, so the user gets access to the most popular hotels, sightseeing attractions and restaurants. In addition, users can filter their search to make it more accurate for their own personal requirements and save search results under the My Saved section.

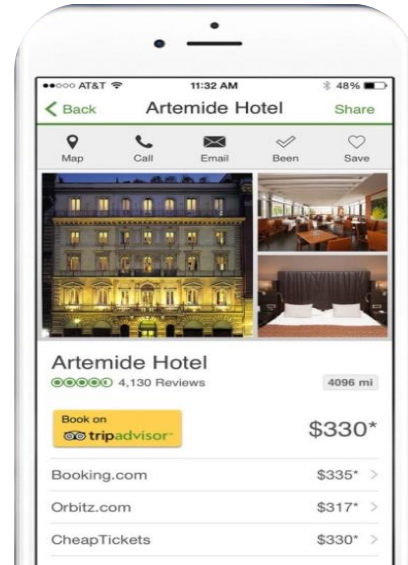


Fig. 4 Compare hotel price

Additionally, each place has a page that provides reviews, ratings, photos from other travellers, and information about the place such as location, working hours, website and more. Fig. 5 represents users' ratings and reviews. It is a useful and great feature. It will be include in the Ibn Battuta app

In addition, the user can get answers to any specific trip questions and download cities' maps, restaurants, or places to avoid using expensive data roaming while travelling. TripAdvisor remembers the places that travellers visited via Travel Timeline feature as what Fig. 6 represents. In addition, it has up-to-date information and a friendly GUI. It is clear, simple to use and nicely presented. However, the application does not provide a function for planning a daily touring schedule which Ibn Battuta will solve this problem by providing a customized daily schedule that satisfies the traveller's needs.



Fig. 5 Uses' ratings and reviews

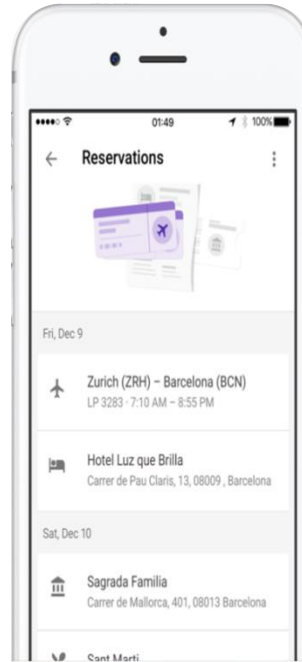


Fig. 7 City Sections interface



Fig. 1 Reservation interface

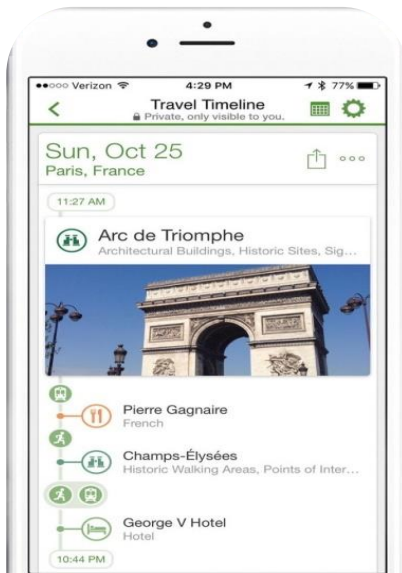


Fig. 6 Travel timeline interface

A. Google Trip[4]

Google Trip makes exploring the world easier by organizing travellers' information in one place. It also provides information to guide the traveller. Travel's reservations are automatically gathered from Gmail and organized into an individual page as what Figure 7 represent, so travellers can see their flight, hotel, rental car, and restaurant bookings in one place without having to search for them individually. In addition, each city page contains the following sections: Fig. 8 represent the city page.

a) Day Plans:

In this section, travellers can find standard and the most popular day plans that travellers can customize based on their interests and available time. They can organize their own daily plans. The problem with this feature is they do not consider the traveller's requirement while suggesting the plan to the traveller. They just save a popular day touring schedule and suggest it if the user searches for it. Ibn Battuta will improve this feature by providing a customized daily schedule that satisfies the traveller's needs.

b) Thinks To DO, Food and Drink

These two sections are separately represented; travellers can find sightseeing attractions in the Thinks To DO section as what Fig. 9 represent, and restaurant and coffee shops in the Food and Drink section. The contents of each section are sorted into useful categories as well as each place has a page that provides reviews and ratings from other travellers and information such as location, working hours, website and more. Furthermore, a traveller can save places or restaurants under the Saved Palaces section and Get activity suggestions based on what is nearby. It is a useful and great feature; it will be included in the Ibn Battuta app.

c) Getting Around:

It provides an overview of transportation information that can be used in the city.

d) Need to Know

This section provides overview information about the city that the travellers may need during their trip, such as emergency numbers, how to find pharmacies or hospitals, buying and selling policies, tipping, currency and more. It is

a useful feature because it gives a traveller important information about cities. Thus, this feature will be included in Ibn Battuta.

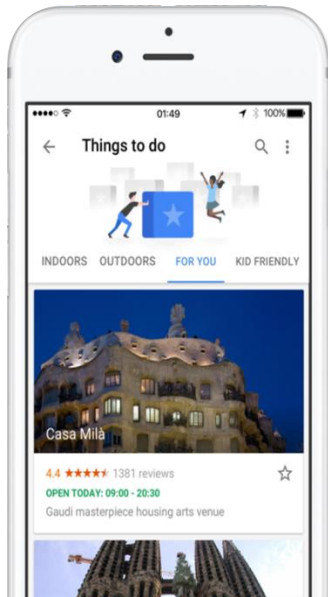


Fig. 9 Things to do interface

Need to Know and to get Around sections are not provided to all cities. It is only for popular ones. Users can download cities to make it available offline, and the application has a beautiful GUI with well-organized information.

C. Tourist Eye application

It is a website (also have an application) that help travellers to prepare their trip schedule, get needed information, discover new places, see others’ trip plans and so on. This website uses Google Maps to represent the places and guide users to the desired destination. In addition, it has a large database to store different places with different categories (such as restaurants and transport) around the world to enable users to make a trip to any country he/she planning to go to. Thus, TouristEye provides several functions that meet their mission “Our mission is to make each trip a unique experience for each traveller, helping you to decide your destination, prepare everything necessary for your journey and give ubiquitous access to the trip information while adapting it to your location and preferences” [5].

The following list describes the most important function the website/app provides:

a) My Trip

The main and basic function of the website enables the user to construct a list that contains all the places he/she want to visit while exploring a city. This is done by representing a list of places found in this city, and the user selects the preferred places. They will automatically be transferred to the My Trip list of the user. However, it is a good feature, but, not include any investigating or considering to traveller needs or constraints such as budget, time and other requirements.

b) Find a friend

The website enables users to create an account and a profile for each user, like in Fig. 10, which represents users’ information such as My trip lists, wish lists, following, and followers. As well as, the users are able to find and add friends like what is represented in Fig. 11. It’s a great feature because the website concentrates on the functionalities which help interaction between travellers, and it considers a competitive advantage since it’s a strong way to attract travellers to the website. Thus, the team decides to enhance the participation of travellers a sharing the good trip schedule they have.

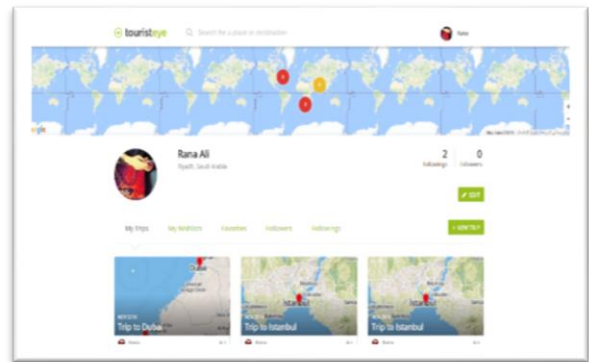


Fig. 10 User profile

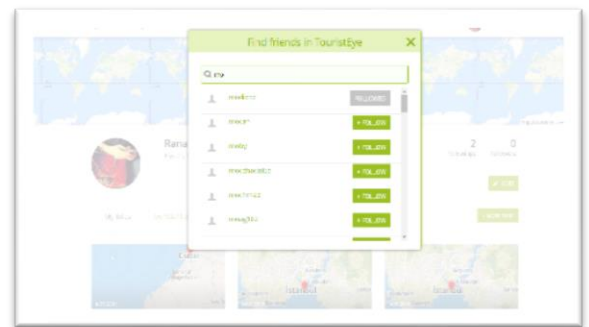


Fig. 11 Find and add friends

c) List of the popular cities/places on the home page

Like what is represented on Fig. 12. It is a good feature to implement because it's one of the ways to attract travellers to the website and make the home page more excited and interesting. Consequently, Ibn Battuta will have a similar feature on its home page.

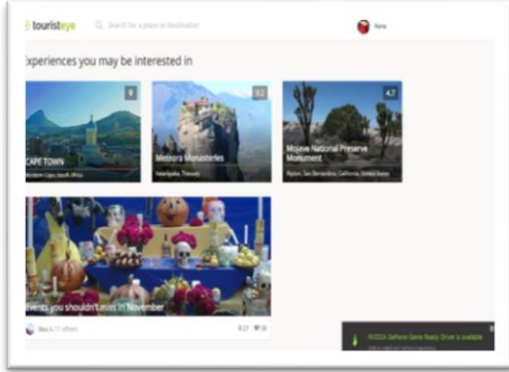


Fig. 2. Popular cities/places

However, the system provides strong features but does not consider with My Trip futures any investigating or considering to traveller needs or constraints such as budget, time and other requirements.

A comparison between the functionalities of the “Ibn Battuta” system and other similar systems is shown in the following table:

III. METHODOLOGY

The proposed application is subject to Iterative and Incremental development methodology. The application is designed, implemented and tested incrementally. All the foreseen objectives of the application were accomplished. The reasons that led the team to choose this model is represented as follows:

- Gives an excellent short time schedule.
- Suitable for complex and reliable systems.
- The excellent cost limitation and documentation.
- It is good for skill limitation.

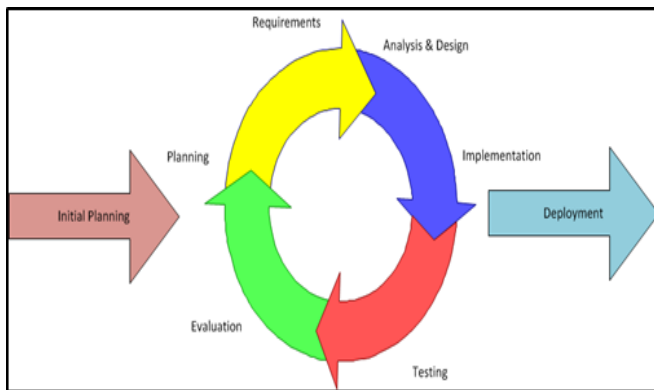


Fig. 3. Iterative and incremental methodology

IV. DISCUSSION

Ibn Battuta is an intelligent system where it considers all travellers types with their different circumstances and the effort and time taken during the arrangement of their travels by several provided features that facilitate all work needed to prepare for the travel.

Furthermore, the main reason behind the appearance of Ibn Battuta is to overcome the storage or problems within functionalities of most of the currently existing tourist systems, exploited, and benefited from their existing features in an aim to achieve users travel requirements.

Therefore, if we make some comparisons between Ibn Battuta and another international tourist system (either applications or websites) such as Road Trippers, Trip Advisor, Tourist Eye application and Google Trip, we will find distinguished competitive features within Ibn Battuta. For example, “daily schedule feature” when compared with other systems. Such as Tourist Eye application, we find that it only enables the user to manually construct a list that contains the selected places without any understanding of the traveller’s needs or constraints, such as budget as well as Google Trip, which only saving a popular day touring schedules and suggest it if the user searches for it. In addition, if we compare the “Geofence feature” with the other systems’ features, we will find that the “Near Me Now feature” from Trip Advisor only allow travellers to search places near them manually. Therefore, the Ibn Battuta application will improve this feature by informing the users of the nearest recommended places automatically. In addition, having accurate, creditable, and complete tourism information such as the places, cities or others in one place will be a competitive advantage in the system. This has been accomplished by the several unique features provided, such as the involving of owners and the abilities of travellers’ participation and modification (such as editing or deleting the comments).

Furthermore, Ibn Battuta benefited from the other international tourist system since they provide great features and professional interested GUI as the representation of cities pages in Google Trip and the type of information provided about each city was gorging since it allows users to navigate easily and reach the needed immediately. Moreover, the ways of travellers participation (e.g. adding comments, posting photos and others) was simulated from these systems since they follow one professional standard.

However, even Ibn Battuta has been trying to overcome the limitations of other systems and get benefited. It’s still faced some storage and limitation with the provided functionalities compared with the other systems, such as a “Booking Hotels” feature and other related features provided by RoadTripper, TripAdvisor and Google Trip. ”My Saved Section” feature which gathered all searching results in one

place by TripAdvisor”.But certainly, all these features and others will enhance the future work of Ibn Battuta.

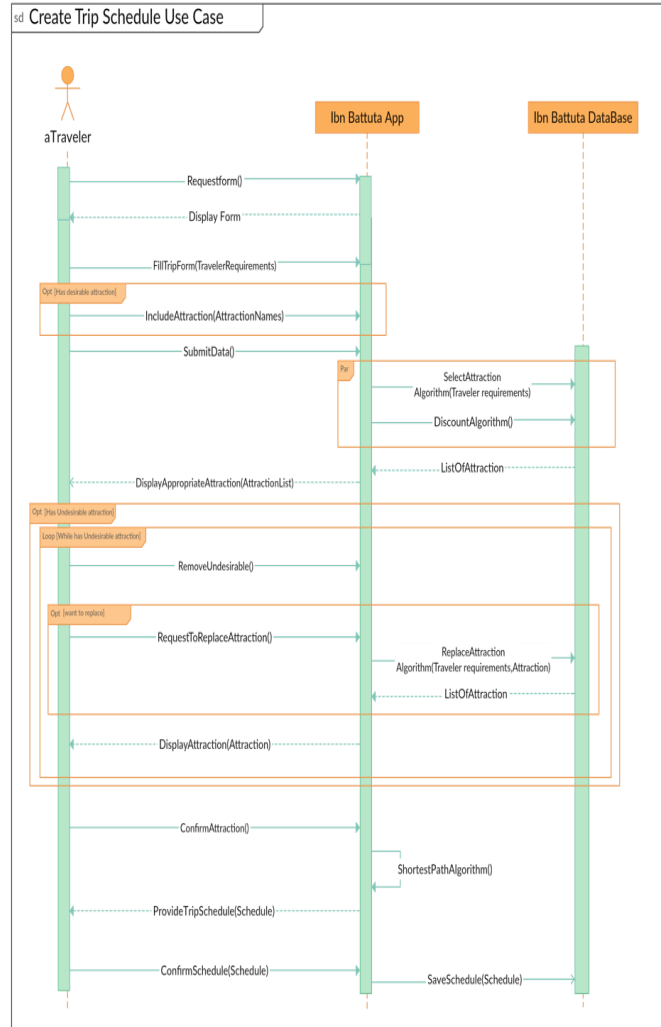
In the end, from our point of view, we think there is a general problem that faces most of the tourism systems, which is the tourism information. The nature of tourism information is difficult! This means it's huge, changeable, adjustable and updatable permanently and to make sure it's correct and up-to-date, it will require a very big effort. Accordingly, having assistance from government agencies responsible for tourism fields to provide the beneficiaries with up-to-date tourism information reports periodically will make a breakthrough in the tourism world!

V. RESULTS

The main purpose of this research is to help and guide the travellers and make their trip more enjoyable by providing a detailed, customized, and day-by-day touring schedule that meets travellers’ needs with comprehensive information about the restaurants and tourist attractions.

To achieve this requirement, the team has built up an intelligent system in the form of a mobile application that helps travellers to customize their trip schedule to match their needs as well as gets involved with them during their journey. The outstanding feature provided by Ibn Battuta, which addresses the gap in current systems, is the ability to construct a customized trip schedule for each day of the travel journey in a short time. This has been achieved by developing an intelligent, creative and unique algorithm that matches travellers’ needs and preferences. There are many factors considered during the construction of the trip schedule to make it as efficient and effective as possible. Saving a traveller’s time is the first important aspect to be considered in the plan. The application takes advantage of building the daily schedule for the traveller based on the shortest distance between tourist attractions. It uses Mashup technology to integrate some of Google Maps’ features in order to measure the shortest distance between attractions and display the trip on the map for easy user tracking. Budget is another important aspect taken into account when building the trip program. In order to have a cost-effective plan, attractions with discounted offers have the highest priority in inserting attractions in the schedule during the discount period. Moreover, the type of attractions preferred by travellers (e.g. museums, shopping, seaside and city centres), time dedicated for each type are deemed in the building process. The most recommended places and landmarks are given high priority as well. A traveller can exclude some previously visited places from the trip schedule. Number of travellers, including kids and adults,

budget available, activities preferred (nature, shopping etc.), number of hours spent in touring are included while constructing the trip schedule. The following figures show how the traveller create a trip schedule and how the system construct it:



The application takes the trip’s info and traveller preferences and requirements through a form, as Fig. 15 shows. This form asks about the date of check-in and checks out, budget for the total trip, how many hours they stay outside per day, the number of adults and kids, priority (from 0 to 5) for each category(natural, museum, entertainment, shopping, etc.). In addition, this form enables a traveller to include places that he/she wants to visit. Then the application will include these places in their schedule.

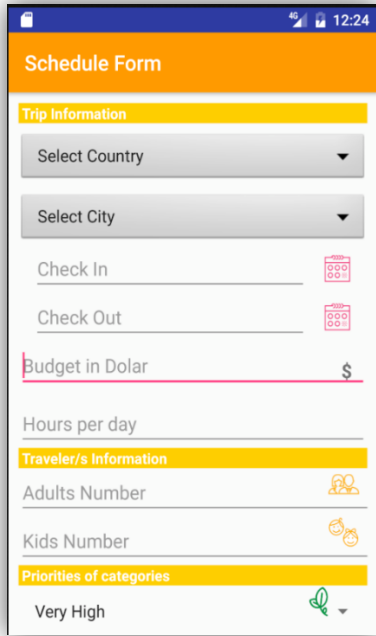


Fig. 4 Schedule form

After the user submits the form, the application will start making a trip schedule that matches user requirements based on three stages: Select Places Algorithm, Discount Algorithm and Sort Algorithm. Here are the details for each one of them.

The first algorithm is the Select Places Algorithm, which is responsible for places selection those matching user requirements. First, it calculates a rate for each category. Then divide hours of trip and budget for each category. After that, collect all places that have high ratings, then sort it descending by ticket cost. Check the first one of them is matching user's hours and budget if hours conflict checks next place. If budget conflict transfer to next rating of places. If matching inserts it in a list and updates the budget and hours of the user, and if the place has a discount, the Discount Algorithm is going to run. The Discount Algorithm is responsible for scheduling the places that with discount offers in the discount period. The money saved from the discount offers will save in a wallet, and the Select Places Algorithm will use it if the user has a low budget and need to insert more places in her schedule or insert places that have a high rate with ticket price higher than user budget. Re-operation for all categories. In the end, a list of suggested places that match the user's requirements is shown in Fig. 16. Travellers can confirm the list, remove places, or request to replace some places with others.

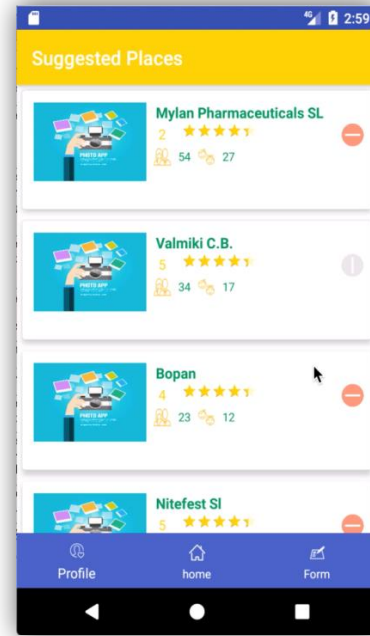


Fig. 5 Suggested places

After the traveller confirms the suggested places, the Sort Algorithm will start, which is responsible for scheduling the places. The sort algorithm work as follows:

- 1) First, the sort function will receive the places that were confirmed by the user.
- 2) Then select a place that has the highest stay need among other places.
- 3) Generate all the possible time that the traveller can go to that place
- 4) Calculate destines between the selected place and the other places using Google Maps API.
- 5) Select a place that has the shortest destines and schedule it with the generated possible time.
- 6) Repeat step 4 and 5 until the hours of the day is equal to zero.
- 7) Now select one day from the generated days based on the lowest total of destines and high day hours. Repeat from step 2 until the traveller days or places are finished.

In the end, a detailed day-by-day schedule shown in Fig. 17 is shown. Traveller can view more information about the place by clicking on the place that is on her schedule, then the place's page will be displayed.

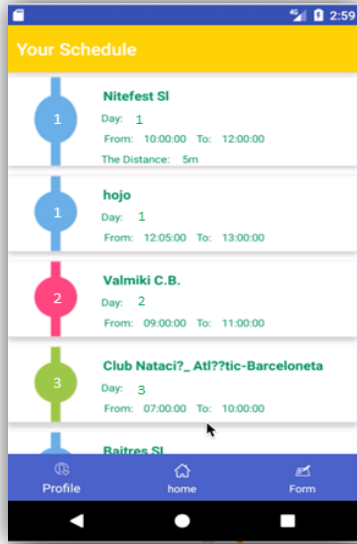


Fig. 6 Day-by-day schedule



Fig. 7 Notify of places interface

Another interesting feature that is available in this application to make it more interactive and intelligent is its ubiquity. Ibn Battuta is ubiquitous with the traveller; it applies the idea of ubiquitous computing by tracking traveller's location and informing him/her when they are nearby recommended and popular attractions, landmarks or highly recommended restaurants with the use of the "Geofences" feature on Android studio. The following interface shows the recommended places that notified to the traveller when he/she becomes nearest to it:

Ibn Battuta offers an additional feature that enables travellers to communicate, ask questions, get answers, and search for up-to-date information. It also saves travellers time and effort when searching for specific information. These requirements are addressed by designing a customized page for a number of famous cities in each country. This

page encompasses the most famous attraction in each city, all necessary information about a given place (e.g. contact information and location), and the highly recommended restaurants. The following interfaces are basic interfaces in the application:

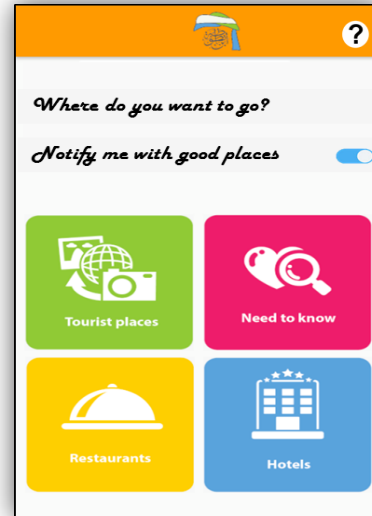


Fig. 8 Home page

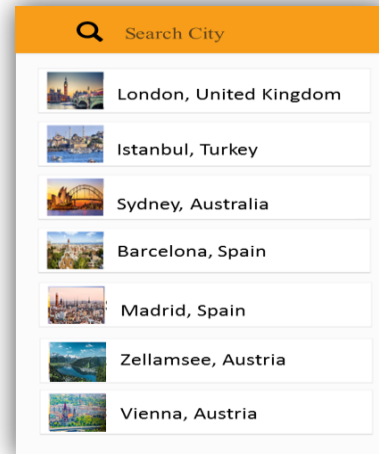


Fig. 9 Search for city

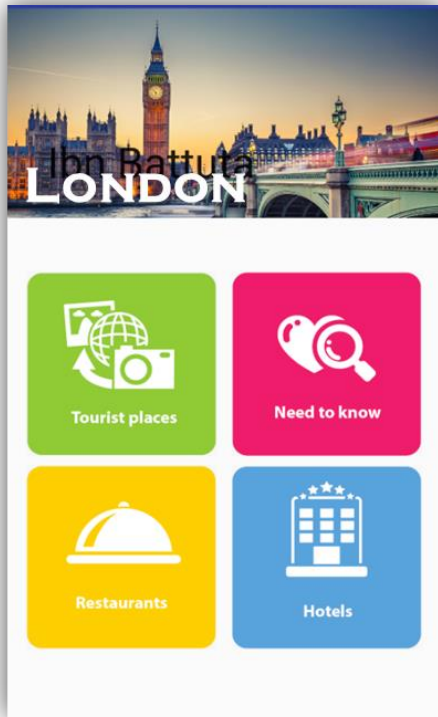


Fig. 10 City page

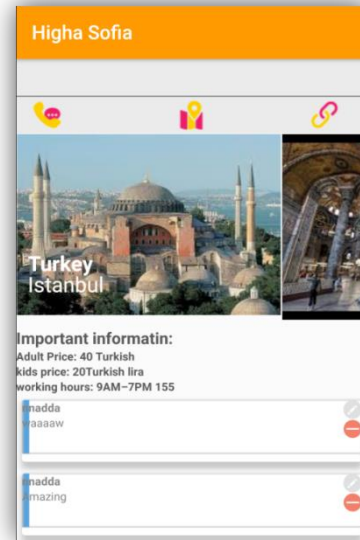


Fig. 12 Place page

All information provided within the page in the Ibn Battuta is authentic and creditable. It is important for the application to encompass realistic and reliable information and recommendation for all the sightseeing places. Therefore, the application allows travellers to interact and give their own feedback about the attractions upon the completion of each day activities. Moreover, owners of the attractions, such as restaurants, shopping centres, and other attractions, can modify the page and respond to visitors' concerns. Fig. 24 represents the owner home page that enables him to view the places that he/she own in the application, add a new place, edit place info or delete a place.

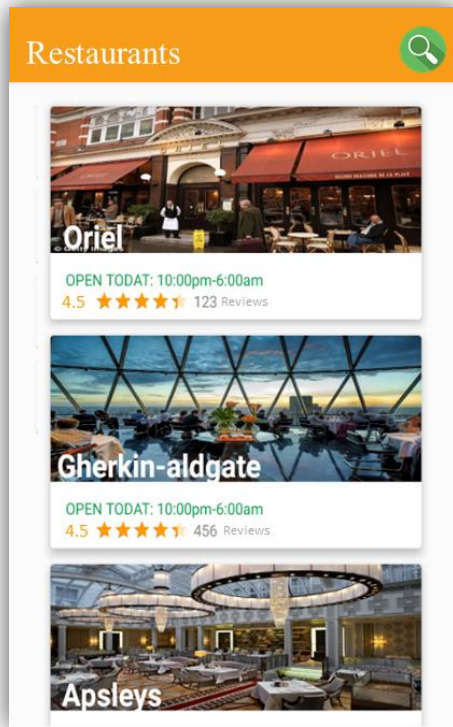


Fig. 11 Restaurants list

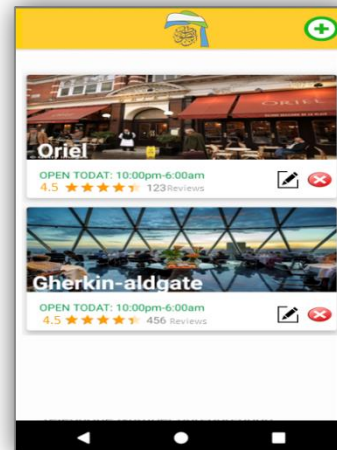


Fig. 13 Owner home page

The below interface is used by travellers and owners to login into the application. It distinguishes whether a user is a traveller or owner, and accordingly it will transfer each one to the appropriate interface.

After the user clicks on the Traveler button in Fig. 26, this interface will be displayed.

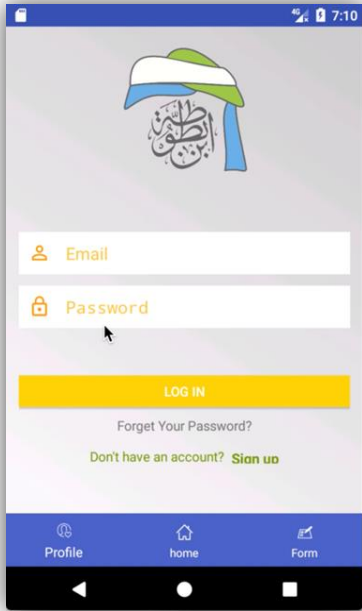


Fig. 14 Login page

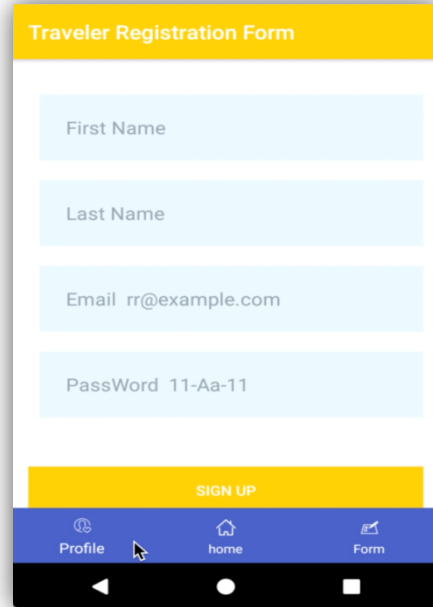


Fig. 16 Traveler registration form

After the user selects the option of sign-up on Fig. 25, this interface will appear to make the user choose whether his/her owner or traveller because each one has a different interface.

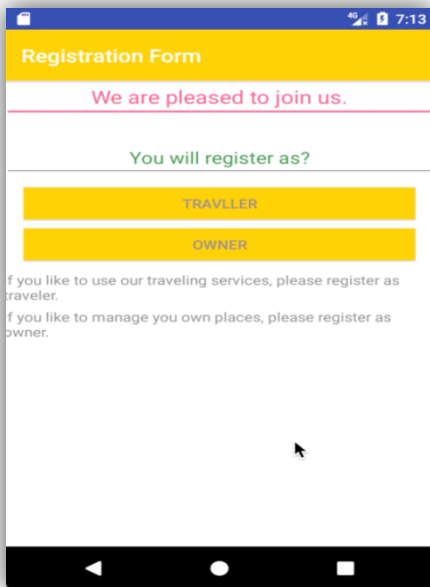


Fig. 15 Sign-up option interface

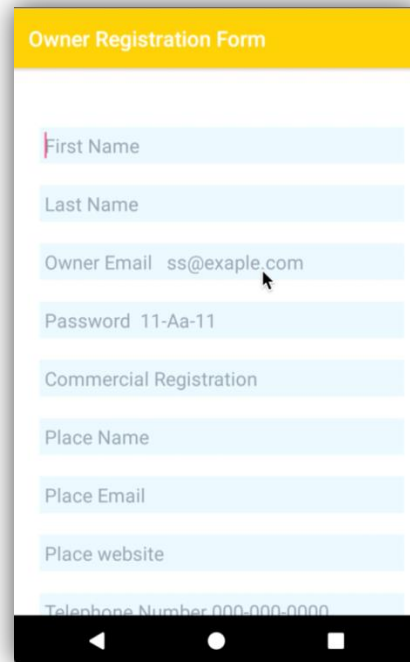


Fig. 17 Owner registration form

VI. FUTURE WORK

Travelling is one of the trend topics nowadays. In addition, using technology is being necessary. Therefore, we need to merge them.

This research should not stop here. For future work, more functions can add them to the application. For example:

- Involve additional intelligent functionalities to enhance decisions for travellers, such as; what is the best country or residence matching the requirements.
- Using artificial intelligence to match places with users' requirements.
- Make schedule up-to-date based on a daily rating of places.

VII. CONCLUSION

In conclusion, the results of this study provide some fascinating insights into the need of the traveller. As we expected, a lot of time is lost to make trip schedule. In addition, in many situations, the schedule is contrary to what the user predicted.

The aim of the application is to solve the existing problems that face any traveller while preparing and during their trips, which no system or travel agencies tried to match traveller needs on the personalized form until now. It is an intelligent, creative, dynamic, and decision support system that support the decision and needs of any traveller by constructing an

intelligent travelling schedule that matches precisely traveller needs from all aspects and being as well as the travelling guidance that guides travellers during their trips and these been done through strong provided capabilities on the system.

The application uses three algorithms as basic. First, to select places, second to sort them, which include discounts.

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Table 1. Similar system comparison

Systems Functions	Ibn Battuta	Road Trippes	Touristeye	Google Trip	Trip Adviser
The system provides a day-by-day touring schedule	✓	✗	✗	✗	✗
The system provide a touring schedule based on traveler requirements	✓	✗	✗	✗	✗
System considered and saved traveler's budget while Scheduling	✓	✗	✗	✗	✗
System suggest popular daily touring schedules and allows user to customize them	✓	✗	✗	✓	✗
User organize daily touring schedule manually	✗	✓	✓	✓	✗
Search for tourism attraction	✓	✓	✓	✓	✓
Search for restaurants	✓	✓	✓	✓	✓
Save places under wish list	✗	✓	✓	✓	✓
Book a Hotel	✗	✓	✓	✗	✓
Compare hotel prices among booking hotels websites	✗	✗	✗	✗	✓
Write a Blog	✗	✓	✓	✗	✗
User share touring schedule with another user	✗	✓	✓	✗	✗
Use maps to represent locations	✓	✓	✓	✓	✓
System gather and organize user's travel reservations into individual page	✗	✗	✗	✓	✗
Reviews, ratings and information for each place	✓	✓	✓	✓	✓
User add photos of places	✓	✗	✗	✗	✓
Get answers to any specific travel questions	✗	✓	✓	✗	✓
Traveler timeline	✓	✗	✗	✗	✓
Receive notification of popular nearest places	✓	✗	✗	✗	✗