Smart Tourism via Smart Phone – An Enhanced Approach

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Abstract— **Tourism is a critical element of economic activity and one of the world's most important sectors. Alongside this, the rapid development of technology and computer science has brought impressive results in the field of smart devices. Technology integration into tourism has brought about a new kind of tourism, that of Smart Tourism. Smart Tourism refers to the growing need to integrate ICT into the tourism industry. This integration aims to improve a place's economic activity and the user's experience during their holidays. This study describes developing an ICT system based on innovative mobile phone technology to create a recommendation system.**

Keywords—Smart tourism, Smartphones, Mobile app, Data collection, Recommendation system

I. INTRODUCTION

Tourism is one of Greece's most important sectors of growth and economic activity as it is estimated to contribute 20% of GDP. However, despite the promising picture, there are issues and challenges that need to be addressed immediately, such as a) how to keep the country at the forefront of tourists' preferences in a sustainable and beneficial way for the economy and its inhabitants, and b) which is the way/means/mechanism should be adopted by professionals in the field for the dissemination of information and the creation of a better understanding of the tourism industry.

These challenges can be faced by using the information and communication technologies that provide powerful new tools and opportunities for business activity. Moreover, the Internet is a 'place' where the tourism industry can flourish. By using online and cloud services, a business has the possibility to offer advanced tourism experience, new products, and services to potential customers around the world in a direct, cost-effective, and fast way. Tourism can be seen as an "information-intensive industry" [1], and the adoption and utilization of new digital technologies have a decisive and crucial role in supporting it.

Increasing interest is observed for mobile technologies and mobile apps as the capability of "ubiquitous connectivity" satisfies a wide range of needs and promises huge potential in the tourism industry [2], [3]. In this context, the development of applications for mobile devices such as smartphones, and tablets is imperative, as the use of these types of devices and their applications are widely used daily [4].

Understanding the current state and the deficiencies in the tourism industry in this domain, we designed and implemented a mobile application aiming to increase traveler satisfaction and improve business benefits. More specifically, we present a mobile application designated in collaboration with a hotel business on Skopelos island. Our goal is twofold: to facilitate the travelers in their selection of tourism products and services by being fully aware of their characteristics and to provide an integrated tool for supporting the hotel management and the effective use of its resources and consumers satisfaction.

The rest of this paper is organized as follows. In the next section, we present the related work. Section III describes the proposed system in detail. Section IV presents the system implementation and the app walkthrough. We conclude this work with final remarks and future work.

II. RELATED WORK

A recent study based on data collected between 2005 and 2017 shows an impact of 86.1% of ICT on international tourism [5]. This arises from the multiple benefits that tourists gain by using ICT and especially mobile applications during their journey [6], [7]. Personalized usage, flexibility, easiness, and ubiquitous are only some benefits for consumers while customer loyalty, enhancement of effectiveness, and direct communication and interaction at any time and anywhere add value and profit to the business [8].

In tourism, smartphones have a dual role for their users: to keep a history (memories) of the users' journey (e.g., pictures, photos of the places the users travel to) and to use relevant applications to help their experience. Smartphones are changing the behavior and emotional state of tourists by meeting the needs for a wide variety of information. Importantly, the direct information support of smartphones allows tourists to solve problems more effectively, share experiences, and 'store' memories. Thus, travelers' needs can be addressed at any time in the travel process, including the predictive, experiential, and reflective phases [2]. For example, in the experiential phase (i.e., during travel), smartphones provide access to location-based services (i.e., "destination guides" apps) that can identify tourist's current location and provide relevant information suggestions based on tourist surveys, such as restaurants, shops, museums, entertainment, navigation, and local activities.

Smirnov et al. [9] distinguish mobile tourism applications into four main categories: online booking (e.g., hotels, flights, cars), information resources (airport, public transport), location-based services, and trip journals. they can provide recommendation, attraction information, tourist context, region context, ridesharing and transport services [10]. Using open-source tools, Afzaal et al. [11] proposed a mobile app that assists travelers to find the appropriate hotel and restaurant for them. It is based on sentiment aspects classification which is identified in implicit, co-referenced, and explicit manner.

In 2016, keeano [12] was created, an app available for Android and iOS that assists travelers in choosing a beach based on their interests, preferences, and mode of transport (by land or sea). In partnership with MarineTraffic, it provides real-time boat information for yachts around the coastline. Also, users of the app can view anchorages, marinas and mooring points for their boats, beaches suitable for their pets or suitable for their interests (e.g., water sports, family-friendly).

III. THE PROPOSED SYSTEM

A. System Description

We proposed and developed an interactive system that engages users and is fed with their feedback, including a mobile phone app. The mobile application is part of an overall business proposal regarding the promotion and presentation of the main functions of the hotel (accommodation, food, and beverage) and possible places to visit (nearby beaches and activities) for the tourists. Using a set of services [13] that cooperate, users are provided with appropriate suggestions for the best restaurants, beaches, and activities. The client application includes, among others, restaurant information service, recommendation services [14], [15], and map-based or three-click rule navigation [4]. The provided services are available on the home application screen accessed by navigation elements or menu. Depending on their choice, the user can receive recommendations for food and drink, beaches or activities accompanied by photos or maps extracted from the internet.

B. System Architecture

The system is based on two main subsystems and three other support components to adequately support the integrated recommendation system. The web platform and mobile application are the main components for content management and data collection respectively. In the Application Programming Interface (API), which allows software components to communicate with each other using a set of tools and protocols [16], the server, and the database have a supporting role and are responsible for the dissemination and storage of information. Fig. 1 shows the system architecture of the specific research.

The architecture model describes the flow of content through requests submitted by both the web platform and the mobile application. A typical system request/response procedure is as follows:

a. The web platform subsystem requests data to the server via internet network.

b. The server receives a request and retrieves data from the database. The server responds back with the requested data over the internet to web platform.
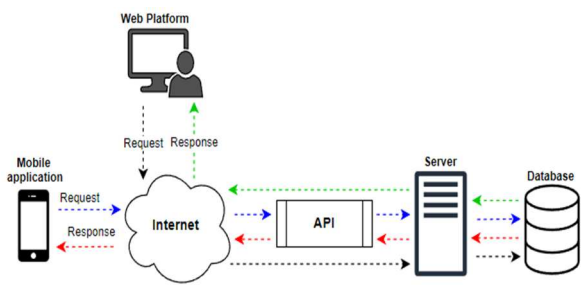

Fig. 1. Overall architecture system.

c. Mobile application user request data to the server via internet network and API.

d. The server receives data request and determines the type of request (GET or POST). Then server retrieves data from the database.

e. The server returns data in JSON format to mobile application via internet and API.

C. The Mobile Application

The main component that we will focus on in this research is the mobile application. The mobile application contains all the content and information the user needs to interact with. The user's interaction with the mobile application is the primary source for data collection which will be used to feed our recommendation system.

At the same time, the mobile application has various features that were designed and developed based on the needs of the hotel unit and its customers. These features include a) no installation required, b) authentication capability, c) fast and easy navigation, d) personalized filtering, e) map-based navigation, and f) 360°-view and augmented reality (AR) experiences. You can find the latest update of the app with all the features [17].

1) Recommendation content

The mobile application will recommend to the hotel guest various foods and beverages, activities, and beaches that they can visit as possible options that fit their profile. The result will be to improve the guest's experience during their holiday period, and at the same time, the services provided by the hotel will be enhanced.

The application will provide the recommendations separately, according to the user's needs. For food and drinks, users can choose the restaurant page that, alongside the recommendation of the application, will receive information about the type of food (e.g., starter, salad) or drink (e.g., red or white wine, sweet or bitter cocktail), where they can get it, the evaluation of other users, and the possibility of a detailed description of their choice.

The other content in which the application provide recommendation are the activities and beaches. The first field focuses on the user's activities and what she or he can do in Skopelos island. Activities such as spa, cycling, scuba diving and more, are provided by various businesses on the island and enable the users to have unforgettable experiences on their vacation. In addition, the application provides for each business open-hour info and different ways of communication such as by call, email, and social media.

Finally, the field of beaches consists of all the beaches on the island of Skopelos. The application provides details about

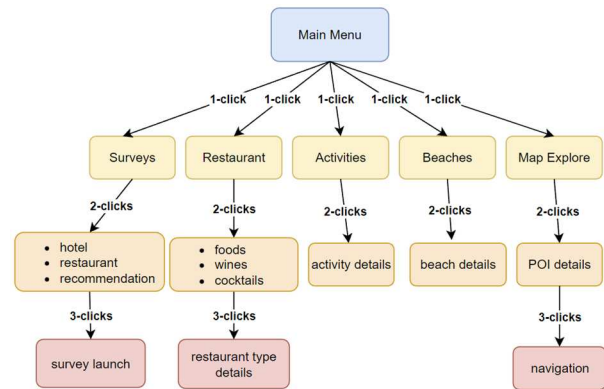Fig. 2. Five basics pages of the mobile application.

Fig. 3. The three-click rule navigation on the mobile application.

the kind of beach (sandy or pebble) and the kilometer distance from the user's location. By clicking on any option, the user can collect further information about the respective beach and see the beach through a 360° view. Fig. 2 illustrates a sample of the lists of foods and beverages, beaches, and activities for which the application provides the chance of recommendations. In addition, it shows the mapping of the recommended content on a map of the island of Skopelos.

2) Hybridity

To improve even more the user experience and to avoid downloading the application from an online store, the mobile application was designed and developed to function as Progressive Web Application (PWA). PWA is a recent approach to developing mobile applications as a combination of web and native applications, capable of working on different devices and any platforms while offering to the user enjoyable interactions [18].

PWAs, in addition to the convenience they give developers in exporting new versions of the application, enable the user to operate the app without an internet connection. Finally, they provide security as they are not required to be installed by an online store.

3) Authentication

Authentication is one of the users' first interactions with a digital product. The main reason is to keep the user's data safe as they interact with an application. However, in many cases, an authentication action causes discomfort to many users as it may not be considered necessary several times.

The application, which was developed in the context of this research, provides the possibility to use both with and without authentication. In the first case, the user's preferences are saved with their Facebook login credentials. Otherwise, where a user continues to interact with the app without logging in, the issue of how to preserve their preferences arises. A random user id (UID) extraction system corresponding to the given mobile device was developed to address this issue. The disadvantage of this is that if the user changes or loses the mobile device, the personalized preferences extracted based on the selections are also lost.

4) Three-click rule navigation

The navigation in the mobile app was developed with the user's convenience in mind to find what they are looking for quickly and easily. For this reason, the design of the app was based on the "three-click rule". Based on this rule, users must find what they are looking for before three clicks to avoid becoming frustrated and leaving the app [19]. The navigation

is carried out through a bottom navigation bar or a side menu. Fig. 3 shows all the possible landing pages of the user in the application.

5) Filtering

Increasingly, people seek individualized experiences tailored to their specific interests, indicating a trend toward personalization [4]. One kind of personalization can be considered the filtering of content. With this option, users can search for the most interesting content. The mobile application offers this possibility both in the content of restaurants and in that of the beaches and the activities.

6) Map-based navigation

Because tourists are generally familiar with GPS navigation on their mobile devices, it is primarily seen as a logical part of any tourist application [4]. Therefore, a map-based navigation function was considered beneficial for tourists to quickly locate or navigate specific POIs (restaurants, activities, and beaches).

7) AR experience

Another feature that offers the mobile application to users is the AR capabilities. In the tourism industry, augmented reality is increasingly used as a marketing, information, and experience channel [20]. Driven by the benefits that AR technology can offer in the tourism sector, the AR experience was integrated into the promotion of the wines provided by the restaurants of the hotel unit, as shown in Fig. 4.

D. The Web Platform

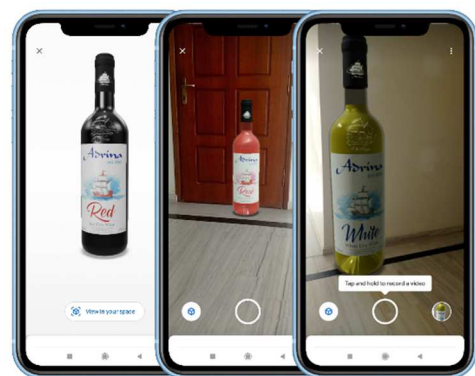A Web Content Management System (WCMS) was developed to support the mobile application. A WCMS is a
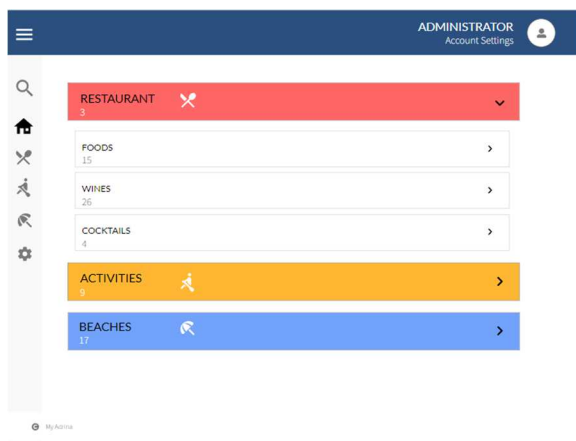

Fig. 4. AR experience with a bottle of wine.

Fig. 3. Administrator dashboard page.

Fig. 4. Data collection using Questionnaires.

software that controls the content, primarily HTML content, that is consumed across multiple digital channels (e.g., mobile apps), with the most popular being WordPress, Joomla, and Drupal [21].

In our case, the developed WCMS has the admin page role and will be visible to the end user through a web platform. The purpose of this platform is to offer administrative capabilities for content handling (insertion/removal/modification) and the possibility to collect appropriate data that could be used in a recommendation system.

The administrator of the web platform prescribed by the hotel unit can handle content about food and beverages, activities, and beaches, as shown in Fig. 5.

IV. IMPLEMENTATION

A. Data Collection

Data can be captured by three different sources:

- User activity (implicit): information is collected about the user's choices and navigation movements.

- Questionnaires (explicit): used for explicit data collection.

- User ratings: used as input reference to the system.

The categories of data, their characteristics and sources are summarised in Table I.

TABLE I.   DATA AND CATEGORIES

Category	Source	Example
User online action	ClickStreams	Location, type of device
Demographics/preferences	Questionnaire	Age, gender/ type of food user feedback of drink/wine, type of cuisine
Reviews	User rating	Comments

Questionnaires: through three different questionnaires users provide feedback on the quality of the services provided and their level of satisfaction with the Hotel, the Restaurant, and their experience in Skopelos (Fig. 6). The use of questionnaire provides several advantages such as
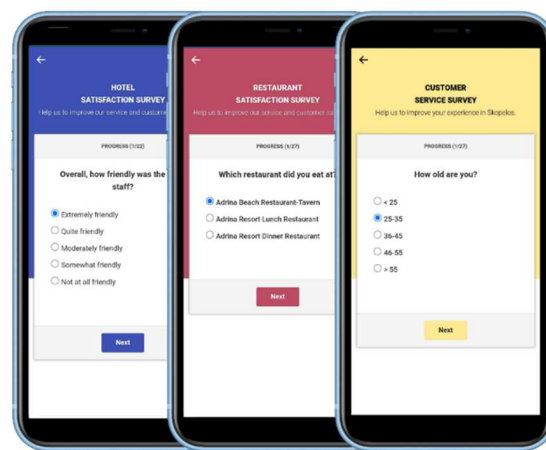
practicality, speed: cost-effectiveness, ease of analysis, comparability, and access to everyone [14].

User action: Clickstreams are aggregated data relative to HTTP requests and responses as the online user explores the application. The process is used to model user's behavior and extract patterns of the browsing path, capturing the sequence of the screen visits, the order of visiting and the actions. Clickstream analysis can be done at two levels [20]: at the server level (traffic analytics) and at the website level (e-commerce analytics) and extracts high-level characteristics of users. In the mobile app the clickstream data is obtained as the users browse the websites or explore the social media of business hotel (e.g., Facebook).

Traveler reviews: Research shows that users' motivation to share their opinions about their travel arises from the willingness to help the travel service provider [23]. Using the communication channels, the users express their experiences and feelings in an informal and interpersonal tone. The aim of reviews is twofold: a) to provide information and b) to influence the other consumers [24].

B. Pilot Testing

For the mobile app's evaluation, a local hotel's assistance was sought. All hotel consumers are eligible to participate if they wish. They are invited to complete the questionnaires or rate the proposed food and drinks. There are two online surveys with a small number of questions focused on user satisfaction with the hotel and restaurant-provided services. Moreover, the clickstream procedure is used to collect data as the consumers explore and interact with the hotel website. The evaluation is currently in the process of data collection, and its completion is expected to produce the first results.

CONCLUTION AND FUTURE WORK

In this work, we propose, design, and develop a mobile application system that will assist travelers in Skopelos. The development of mobile app exploits the possibilities of state-of-the-art technology and tries to face the difficulties coming from the dependence on personal preferences, environmental conditions, user constraints, business logic, and requirements.

In the current state, the application is in the pilot phase, and we suggest future research to enrich it with more capabilities: a) AR functionality, and recommender system AI and data mining techniques to generate the appropriate recommendations.

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