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An Ontology-Based Booking Application for Personalized Packages in the Health Tourism Industry

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Abstract: Currently, health tourists primarily rely on independent facilitators to manage and book their medical appointments and vacation plans. There is a notable absence of dedicated booking applications for health tourism packages. This paper proposes HealthTourismHub, an application designed to provide personalized packages that include medical appointments, accommodation options and recommended tourism activities. It also serves as a platform for medical experts and accommodation providers, allowing health tourists to discover and connect with them. To incorporate personalization, HealthTourismHub uses an ontology that organizes medical and tourism data, along with a reasoner that generates new knowledge. This approach enables the application to offer customized packages and identify the most suitable providers for each user. Providers are strategically paired and located in close proximity, with the package also including personalized tourism recommendations. A survey was conducted to assess the usability of the application and general perspectives towards health tourism, including motivations, concerns, and preferences. The results revealed an above-average SUS score, indicating that users found the application user-friendly and effective. Some areas for improvement were identified, such as error handling and additional functionalities. Nonetheless, HealthTourismHub shows great potential as a pioneer in the field of health tourism applications.

Keywords: health tourism; medical tourism; semantic web; ontology; software application

1. Introduction

Health Tourism (HT), generally referred to as the phenomenon in which individuals seek quality medical treatments internationally, is said to have experienced significant growth the past decade [1–3]. This type of tourism allows travelers to explore lower-cost medical procedures with shorter waiting times compared to those in their origin country [4]. In addition, access to advanced technologies and modern equipment and the fact that some specialized treatments are not available in their local healthcare system, render HT an attractive option for people seeking affordable, quality medical care [5,6].

One of the main components that make HT a multifaceted experience is the fact that it combines healthcare with the pleasure of vacation. Patients that travel abroad to receive medical services often stay in the country they are visiting before and after the treatment, for the purposes of engaging in travel, leisure and restoration [7]. HT packages that include the arrangement of medical procedures, accommodation, travel logistics, and tourism activities, covering both tourism and healthcare elements, offer a holistic approach. This concept recognizes the importance of mental and physical wellness in the recovery process, making the entire experience more than just a medical procedure.

Research conducted between 2016-2017 indicates that only 10% of health tourists plan their trips independently using the internet and their personal devices [8,9]. In contrast, most of them rely on

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assistance from HT or insurance facilitators [8]. These facilitators act as moderators, playing a crucial role in guiding them to suitable HT arrangements [9,10]. An HT booking application could serve as a facilitator, offering a convenient way for patients to organize their medical and travel arrangements.

At present, there is a number of applications that provide HT services [11–15]. However, their functionality seems limited in terms of comprehensive HT planning. They typically include a range of HT offerings, emphasizing on medical care and providing users with information about healthcare facilities, professionals and treatments. Only some of them assist patients in planning their accommodation and travel logistics [13,15]. This limitation suggests an opportunity for the development of an innovating booking application that facilitates the entire HT experience and offers a diverse range of medical and travel services, bundled into convenient packages.

Simultaneously, there is evidence suggesting that tourists, in general, are moving away from the traditional pre-organized packages and they are now showing preference to more flexible and personalized options [16]. This trend reveals the potential for significant improvement in the HT industry, by implementing an application that could simplify the process of booking all-inclusive HT packages while enhancing the overall experience through personalized planning. Consequently, health tourists could benefit from tailored guidance by saving time and effort and maximizing satisfaction [17,18].

One method to incorporate personalized HT packages within a booking application is by leveraging the capabilities of an ontology. An ontology is described as a shared conceptualization within a particular domain [19]. It provides a structured representation of entities, attributes and relationships and it plays a major role in the context of the Semantic Web. Integrating an ontology into an HT booking application makes it feasible to accurately represent intricate knowledge. Particularly, the construction of an ontology that handles medical and travel information allows better data exchange and management by establishing a common vocabulary, defining terms and specifying relationships. Furthermore, ontological reasoning that employs logical rules and deductions contributes to creating an application with semantic interoperability and intelligent HT relationships.

This manuscript introduces an ontological approach to enhance the user experience in the sector of HT platforms. The application presented, called HealthTourismHub (HTH), focuses on improving the current health tourism market, by providing complete and personalized HT packages. These include medical appointments with professionals, suitable accommodation options, and recommendations for tourism activities. All elements are curated to match the user's specific needs and preferences, allowing them to plan and book their entire HT experience in one place. At the same time, it serves as a platform for healthcare and accommodation providers to advertise their services and derive benefits from this system. Users can book appointments with these providers directly within the application. For ultimate convenience, the application matches accommodation with nearby medical experts, minimizing travel time during the user's stay. On top of that, the platform includes a range of extensive booking options that health tourists can customize, such as dates, desired location, number of travelers and other preferences. Developing a well-designed HT application acts as a gateway for people worldwide to access high-quality healthcare and contributes to making HT more appealing.

2. Related Work

2.1. HT Applications

As stated above, HT is the act of traveling abroad with the purpose of receiving medical treatment or therapy while making use of the destination's attractions and amenities. This trend is experiencing a growing momentum, having significant economic implications [20]. Successful inbound HT practices involve concierge services around the needs and preferences of the people interested, top-notch medical care, and long-term affiliations with the clinics [21]. In the current market, there is a number of web applications that work as HT arrangers and provide the users with medical travel services, reflecting the increasing popularity of this phenomenon. Yet, most of them tend to offer standardized solutions lacking complete HT packages and customization.

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The online platform *health-tourism*[1] provides information on HT services, allowing users to access details about medical specialties, treatments and destinations while facilitating communication with medical centers [11]. Another similar HT website is *MedicalTourism*[2], a cost-free and informational platform designed for people seeking information on HT locales, prices and services, healthcare providers and clinics [12]. The application *Health & Medical Tourism in Italy*[3] includes HT packages tailored for patients looking to combine rehabilitation with a vacation in Italy [13]. The HT packages provided by the online medical travel marketplace *PlacidWay*[4], do not encompass accommodation and tourist activities [14]. Lastly, *Iran Health Tourism Organizer*[5] *(IRHTO)* is a platform where users can apply to book a package, including medical appointment, accommodation and transport [15].

Following the aforementioned applications, the project SocialNTT aims to enrich the user experience in HT by offering a platform that integrates and shares information from social networks, where general tourism and HT data is provided. The primary goal is to inform individuals about relevant information, however, the project does not provide HT packages at all [22].

Within the HT context, AyurTourism is described as a web-based recommendation system that provides personalized recommendations for people seeking Ayurvedic treatments by considering their preferences, feedback, reviews, and user profiles. The system promotes HT in India by allowing users to book appointments at hospitals and providing them with a curated travel plan. The plan focuses on suggesting accommodation facilities, food, and travel options near the hospitals, rather than actually booking them [23].

It is important to note that while there are multiple HT marketplaces online, many lack versatility, with the majority of these platforms mainly addressing basic needs and emphasizing only on medical arrangements. Despite the existence of only a limited number providing HT packages combining medical and accommodation planning, their offerings are often constrained, as they tend to disregard the significance of the touristic dimensions within the realm of HT. Research reveals that that substantial majority of medical tourists prioritize vacation plans as the primary reason for their visit [24], suggesting that these applications do not address a significant aspect of the travelers' needs.

The application described in this manuscript aims to bridge this gap by offering a comprehensive HT experience. Unlike existing solutions focused solely on medical arrangements, this approach focuses on the entire travel experience. This eliminates the need for users to search for these services independently. Furthermore, the platform is the only one that curates personalized HT packages based on the needs of each individual health tourist and their companions. It also offers extensive customization options regarding location, dates, and other details. While many HT applications function primarily as information portals, HTH facilitates the direct booking of HT services. Overall, as the current landscape of HT applications lacks the ability to provide complete HT packages, the proposed HTH application addresses this gap by offering a user-centric solution.

2.2. Ontology Approaches

Several studies have explored ontology oriented techniques for web applications, with a notable prevalence in the bioinformatics community [25]. However, when it comes to the HT market, there remains a noticeable absence of ontological approaches, failing to adequately capture the complexity inherent in this industry.

Turning attention to the tourism sector, semantic technologies can provide effective methods for integrating tourism data and support flexibility and opportunities in delivering information [26]. The Mondeca tourism ontology is founded upon the conceptual framework established by the World Tourism Organization (WTO) [27]. The OnTour ontology was designed for the tourism industry, including components related to geographical location, accommodations and leisure activities

1. health-tourism.com
2. MedicalTourism.com
3. healthmedicaltourismitaly.com
4. placidway.com
5. irhto.com

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[26,28]. Although numerous ontologies have been developed in the field of medicine and biology [29], it seems that an ontology dedicated to medical appointments is absent. There appears to be no ontology that presents structured information about medical services and specialties, relationships between health providers, services and locations.

The study of MTSC (Medical Tourism Supply Chain) aims to develop an ontology specifically made for the supply chain in the HT industry [30]. This ontology is able to describe the roles and activities of stakeholders involved and does not focus on describing HT packages related to medical and tourism services offered by providers.

The creation of the Tunisian Medical Tourism (TMT) Ontology is designed to provide personalized recommendations for HT options in the region. The presented recommendation system operates within a social network environment by analyzing interactions among trusted friends to understand their interests. Once these elements are gathered, the system utilizes them to identify similar objects within the TMT Ontology, enhancing personalization and promoting HT in Tunisia [31].

Chantrapornchai and Choksuchat (2016) conducted a case study focusing on the construction of an ontology specifically tailored to categorize information about HT in the Hua Hin region of Thailand. By integrating this ontology into a web application, an intelligent search function is facilitated, allowing users to explore wellness destinations [32]. The application does not provide HT packages; instead, its primary objective is to provide patients with information regarding health and wellness tourism in Thailand.

The ontology presented in [33] targets HT managers, assisting them in comprehending the potential of their natural resources (e.g., hot springs or hiking trails) and guiding investment decisions. This is a system using the HEALPS2 ontology to model HT destinations, tourist groups and health needs to identify areas for improvement within a destination and does not specifically focuses on representing information about all-inclusive HT packages.

Based on the available information, there is a remarkable gap in ontologies concerning tourism, medical appointments and HT as a whole. The analysis described in this manuscript underscores the oversight of an ontology that integrates medical information on providers, accommodation details and tourism activities for creating all-inclusive HT packages. Addressing this gap through the development of a new, more holistic ontology could significantly enhance the development of personalized HT experiences, a feature currently absent from existing systems.

3. Methods

3.1. HTH Application Description

3.1.1. User Roles

This manuscript aims to present HTH, an application designed to assist both patients and service providers in organizing their planning processes for HT. The application system adopts a multi-tenant platform, offering a range of services such as profile creation, user management, search, booking facilities, user history and calendar functionalities. Therefore, the platform addresses the needs of two different user groups: Health Tourism Patients (HTPs) and the service providers categorized into Medical Experts (MEs) and Accommodation Providers (APs) (**Figure 1**). These three user roles have unique requirements when engaging with the platform.

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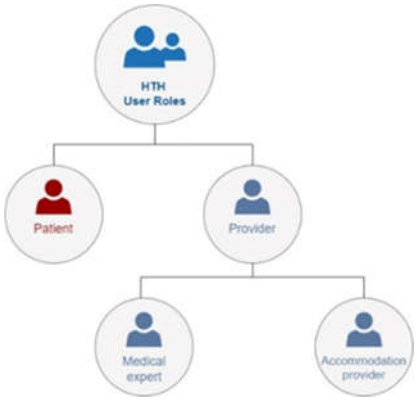

Figure 1. The three user roles of the HTH application.

1. User role: Health Tourism Patients (HTPs).

For HTPs the platform functions as a one-stop shop for planning and booking HT packages. HTH provides them with the necessary tools to build custom packages, which incorporate a scheduled medical appointment, nearby accommodation and recommendations for tourism activities. Notably, the platform stands out due to its personalized approach. Users can create profiles outlining their specific preferences. This includes detailing preferred travelling options, accommodation needs and medical requirements, as illustrated in **Figure 2**.

Patient							
General	Traveling			Accommodation			Medical
Basic	Activities	Eating	Landscape	Amenities	Type	Special choices	Medical info
Full name	Cultural [y/n]	Diabetic diet [y/n]	Beach [y/n]	Accessibility options [1-5]	Apartment [y/n]	Travelling with [Alone, Family, Group]	Booking for children [y/n]
Gender	Family-friendly [y/n]	Gluten free [y/n]	City center area [y/n]	Facilities [1-5]	Bed and breakfast [y/n]	Travelling with pet [y/n]	Accessible entrance [y/n]
Phone number	Food and wine [y/n]	Lactose free [y/n]	Coastal area [y/n]	Food and drink options [1-5]	Hostel [y/n]	Working [y/n]	
Birth date	Fun and games [y/n]	Local cousine [y/n]	Countryside area [y/n]	Services [1-5]	Hotel [y/n]	Accommodation preference [Budget-friendly, Luxury]	
	Historical [y/n]	Organic [y/n]	Historic area [y/n]	Things to do [1-5]	Loft [y/n]		
	Local [y/n]	Street food [y/n]	Inland waters [y/n]		Mansion [y/n]		
	Nature [y/n]	Vegan [y/n]	Island [y/n]		Ski resort [y/n]		
	Nightlife [y/n]	Vegeterian [y/n]	Mountain area [y/n]		Spa-wellness center [y/n]		
	Shopping [y/n]	Fine dining [y/n]	Rural area [y/n]				
	Tour [y/n]		Urban area [y/n]				
	Wellness [y/n]		Village [y/n]				

Figure 2. Profile creation for HTPs.

Basic information such as full name, gender, phone number, and birth date is required for booking, identification, and communication purposes, while the rest is optional and part of the user profile building process. Within the Travelling category, users can specify preferences for activities, dining, and landscapes. Activities include tours, attractions, and experiences users might be interested in, while in the Eating category users indicate dietary needs and preferences, saving them time and effort when seeking suitable dining options during their travel. Moving on, users can express preferences under the Landscape category, enabling the system to recommend HT packages in locations that match their desired scenery. Most of the above options have been sourced from and share similarities with the travel platform *Tripadvisor*[6] which serves as a digital guide utilized by

6. tripadvisor.com

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tourists [34]. In the same manner, HTPs can choose from a broad range of accommodation amenities categorized for their convenience, preferred accommodation type and other special accommodation choices. *Hotels.com*[7] Provider API, accessed through *RapidAPI*[8], served as the primary source of information for these accommodation options and categories [35]. Furthermore, as depicted in **Figure 2**, users can also outline medical information to ensure their travel experience meets their specific healthcare needs. This comprehensive user profile creation process enhances the overall HT experience by considering various aspects of user preferences and requirements.

HTPs can then explore a selection of packages through a booking form that is provided (**Figure 3**). The form includes a search bar with an autocomplete dropdown functionality that allows the users to explore packages near specific destinations like cities, neighborhoods, airports, points of interest and more. Users can also select a medical service from a range of options. The platform employs a two-step filtering process for medical service selection. Users initially indicate a medical specialty from a provided list. Subsequently, the system dynamically updates the available medical service options in a chained dropdown menu to correspond with services offered within the chosen specialty. Finally, selecting preferred travel dates ensures the package aligns with their desired travel schedule.

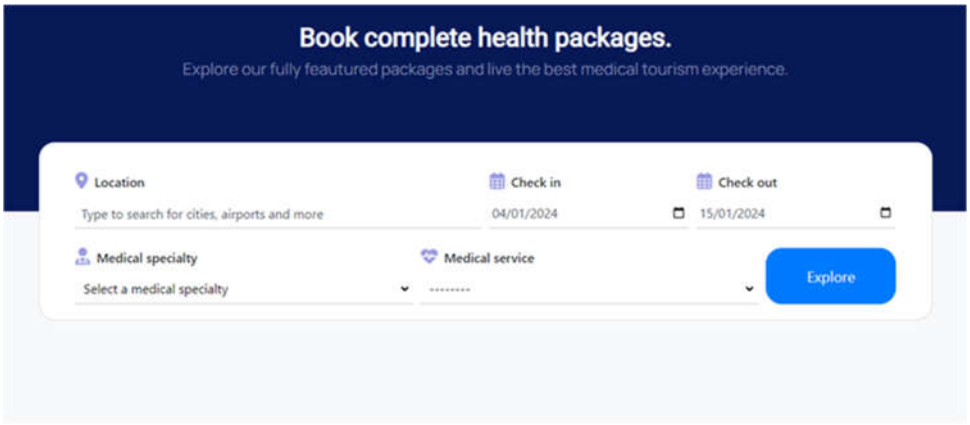

Figure 3. Booking form.

Using this information, the platform's recommendation service generates personalized HT solutions including medical appointments with qualified professionals, suited accommodation, and curated tourist activities, all situated in geographical proximity (**Figure 4**. These personalized recommendations are generated based on the information in each user's profile. HTPs can also select advanced filters like number of travelers, budgetary constraints, and more, enabling precise package customization. Each HT package solution offers HTPs an overview enriched with detailed information. This includes in-depth details about the location, medical information, accommodation features, curated activity suggestions, photographic content, pricing information, and a map (**Figure 5**). After navigating and the ideal package is identified, they continue with the booking process. A convenient history function helps them review and manage past bookings.

7. hotels.com
8. rapidapi.com

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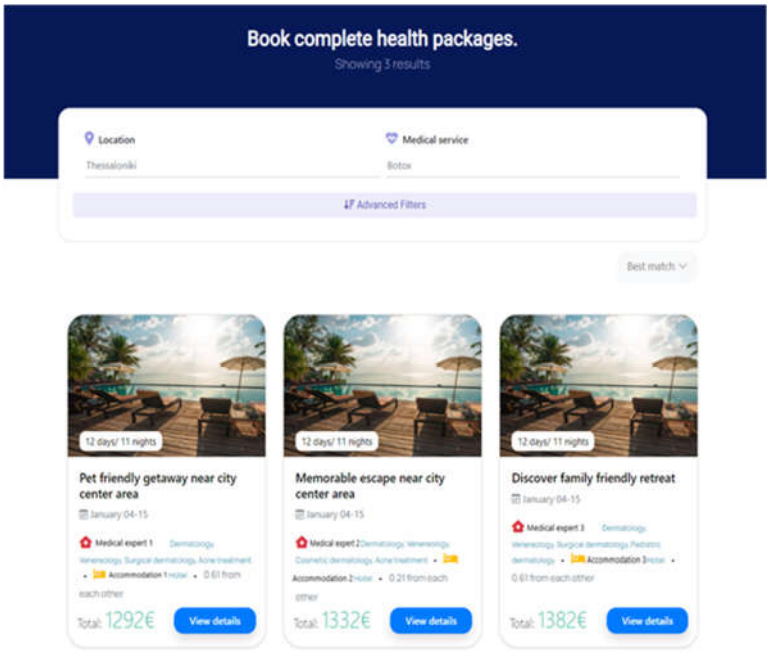

Figure 4. Booking results.

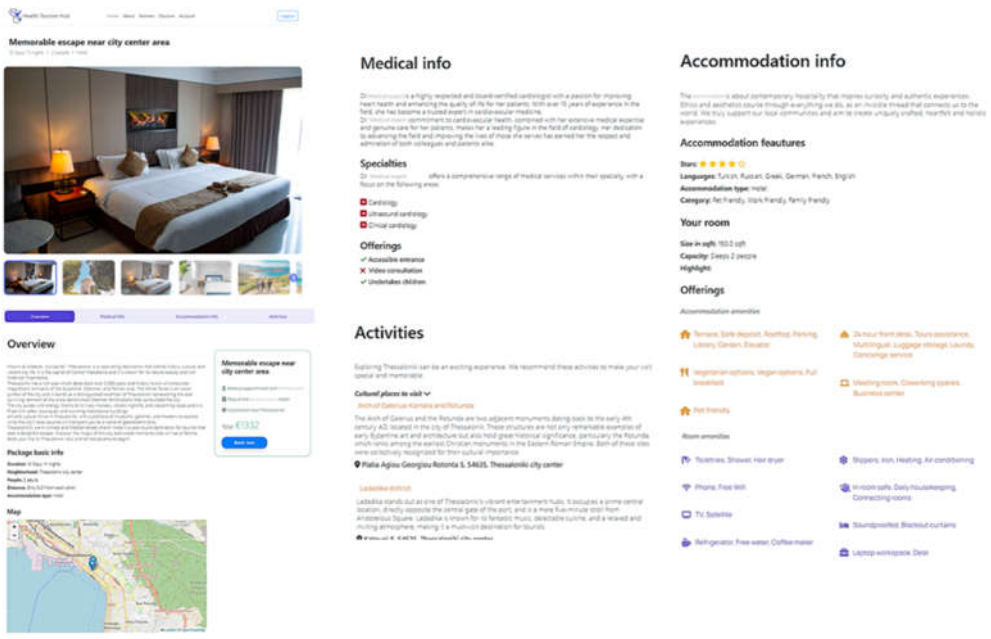

Figure 5. Package details: Overview, Medical info, Accommodation info and Activities.

2. User role: Medical Experts (MEs).

MEs use the platform to showcase and promote their services to HTP seeking personalized healthcare abroad. To ensure clear communication and trust, MEs need to provide information while building their profiles. The information provided by users is divided into three main sections, as detailed in **Figure 6**.

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Medical Expert					
General			Medical offerings		Extra
Basic info	Details	Location	Specialties	Services	Medical info
Full name	Bio	Address	Medical specialties	Medical service	Providing medical care for children [y/n]
Gender	Languages	Postal code		Cost per visit	Accessible entrance [y/n]
Phone number	Insurances	City/town		Expertised [y/n]	Video consultation [y/n]
		Regional unit			Working since [y/n]
		[Pin on map]			

Figure 6. Profile creation for MEs.

Within the General category, MEs input fundamental details including users name, gender, phone number, and professional information such as bio, languages spoken, and the insurance coverage they offer. They are also prompted to input their complete location, which can be confirmed using an embedded map feature (**Figure 7**). OpenStreetMap, an open-source geographic database project, underpins this functionality [36]. Additionally, they are required to highlight their area of medical expertise and list the services they offer to potential tourists. The HTH platform currently covers a range of medical specialties and sub-specialties and over 600 medical services available for selection. These medical services have been mostly sourced by existing platforms in the medical industry. For instance, *Doctoranytime*[9] is a Greek platform that assists users in finding and booking appointments with healthcare professionals and helped with identifying a list of medical services [37]. *MedicalTourism*, a leading platform for HT information, also provided valuable resources for building HTH's medical service directory [12]. For each service offered, users must include cost information and specify whether they are specialized in that service. Finally, MEs are encouraged to provide additional information that potential HTPs might find useful in their decision-making process (see **Figure 6**). This user profile creation process ensures that their profile accurately reflects their skills and offerings. The application also includes a function that provides the users with a calendar that tracks booked appointments, facilitating efficient schedule management.

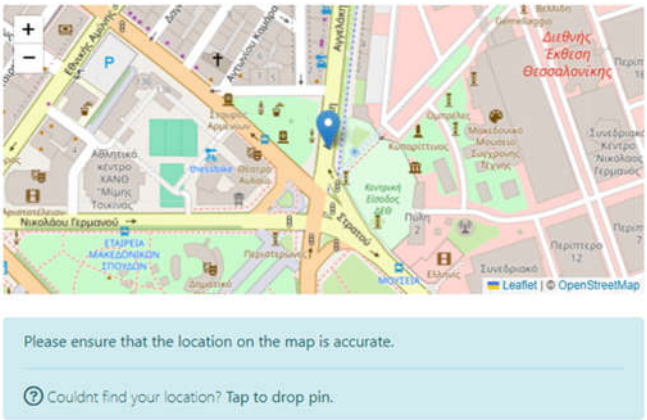

Figure 7. Embedded map feature.

3. User role: Accommodation Providers (APs).

9. doctoranytime.gr

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In a similar manner, APs also utilize the platform to appeal to HTP and increase visibility. As part of the profile-building phase, APs are also required to add essential information about their establishment, as outlined in **Figure 8**.

Accommodation Provider					
General			Accommodation		Rooms
Basic info	Details	Location	Amenities	Type	Room info
Full name	Description	Address	Accessibility options	Star rating [None-5]	Room
Phone number	Languages	Postal code	Facilities	Apartment [y/n]	Price per night
Since		City/town	Food and drink options	Bed and breakfast [y/n]	Size in sqft
		Regional unit	Location highlights	Hostel [y/n]	Sleeps people
		[Pin on map]	Pets options	Hotel [y/n]	Room amenities
			Services	Loft [y/n]	
			Things to do	Mansion [y/n]	
			Working away	Ski resort [y/n]	
				Spa-wellness center [y/n]	

Figure 8. Profile creation for APs.

Similar to how MEs create profiles, APs are likewise obligated to provide details regarding their establishment. This information encompasses the property's name, contact information, and the date they started operating. They also include details of the property such as description and languages spoken by staff, along with its exact location, following the same approach as explained for MEs. Under the Accommodation category, users are tasked with adding amenities offered by the property, specifying the property type, and indicating its star rating. During the research process for potential amenities provided, the same methodology as described above was utilized, with accommodation amenities conveniently categorized, using *Hotels.com*[7] Provider API, accessed via *RapidAPI*[8]. Additionally, APs list accommodation rooms along with their features and amenities. For this user role, as part of the provider group, the platform includes the calendar function where reservations made through the application are displayed and managed.

3.1.2. Usage Workflow

The flowchart shown in **Figure 9**, illustrates the process of how users navigate through the HTH app. When a user access the home page, their next steps depend on whether they're logged in or not. If not, they can either proceed with authentication or initiate the account creation process. Once logged in, users can visit their account and add personal details. In their provider roles, MEs and APs are required to input service-related information. Additionally, they have the option to view their confirmed appointments or bookings via the calendar page. On the other hand, logged-in HTPs can personalize their profiles by incorporating preferences. Through the Discover page, HTPs can explore and reserve HT packages. Furthermore, they have the option to visit the History page, for accessing confirmed bookings.

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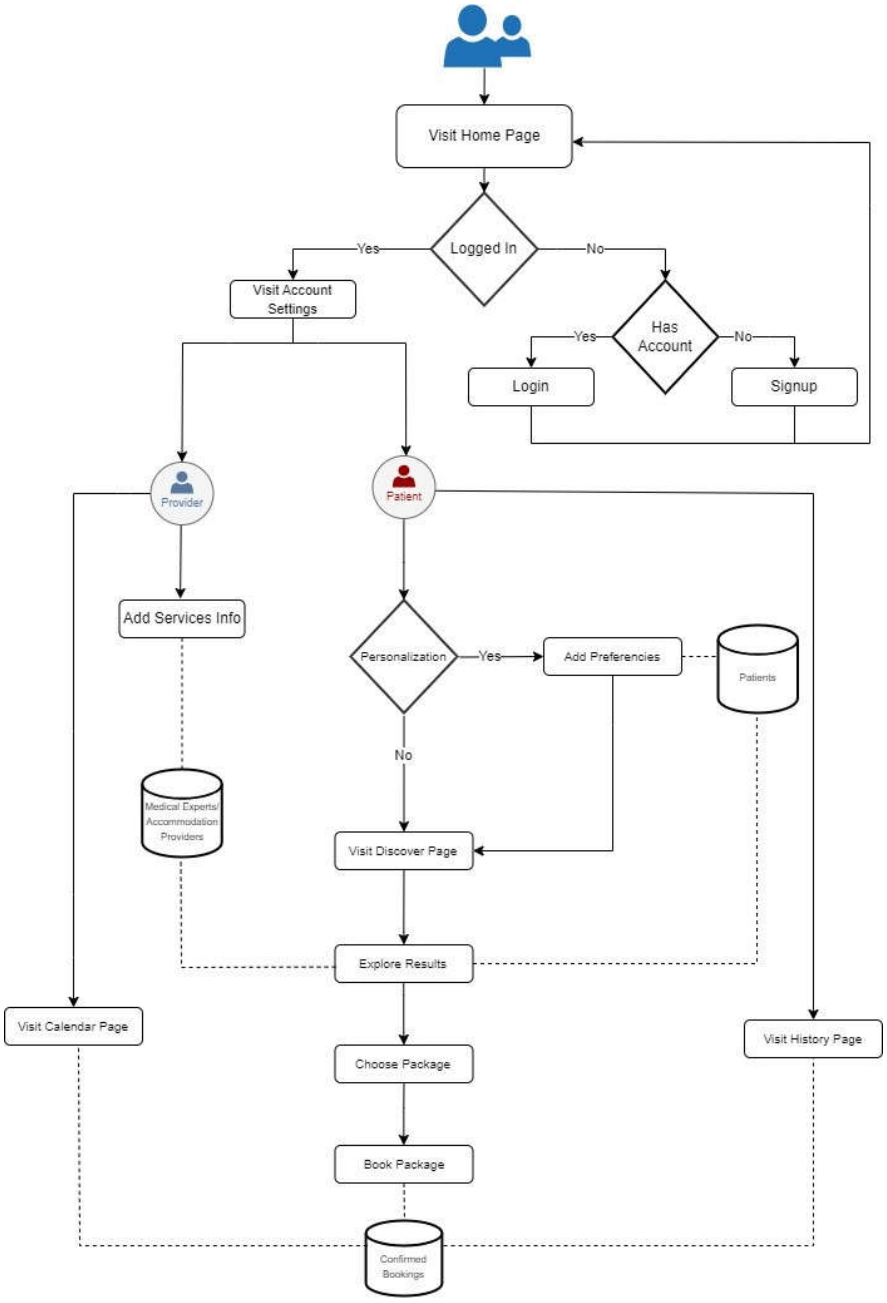

Figure 9. Flowchart of the application.

3.1.3. Technologies

Figure 10 depicts the technology stack used to build the HTH application. As shown, the application is built on the Django framework using Python, offering both web and app versions. Python 3.10 was selected for its ability to offer flexibility, code readability and reuse; it excels in Rapid Application Development (RAD), and enables efficient software creation with a fast edit-test-debug process [38,39]. Django is a Python-based web framework that supports RAD and clean design, while offering security, scalability, and flexibility [40]. Using the MVT (Model-View-Template) architectural pattern, it efficiently manages data and logic, making it an optimal choice for the HTH application. In the front-end development of the project, HTML, CSS, JS along with Django templates were used (see **Figure 10**). HTML provides structure, CSS offers styling, and JavaScript adds interactivity. Django templates facilitate dynamic content rendering within the Django framework [41].

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An ontology was developed to improve package customization and manage complex information efficiently (see **Figure 10**). This ontology structures knowledge through the definition of classes, entities, and relationships. It enables systematic sorting of available providers and personalized tourism recommendations, all based on users' preferences. In addition to the ontology, the backend also incorporates SQLite to store and manage data.

Figure 10. Technology-stack architecture.

In detail, the ontology is represented using OWL (Web Ontology Language), a language used for creating ontologies that allows defining classes, properties and relationships between entities [42]. RDF (Resource Description Framework) is a framework for describing resources and uses subject-predicate-object triples to represent statements, providing a structured format [42]. Notably, OWL is built on top of RDF, adding supplementary expressive power to this framework. The ontology was built using Protégé 5, a widely recognized open-source ontology editor with a user-friendly interface. Its support for OWL and robust reasoning capabilities [43] proved useful in the construction process. In order to effectively store, retrieve and manage the ontology within the Python application, AllegoGraph was selected after considering other triplestore (a database for storing RDF data) solutions. These alternatives included Apache Jena [44] and Eclipse RDF4J [45], Java frameworks for handling RDF data; Virtuoso, a triplestore that offers speed and scalability [46]; and Ontotext GraphDB, which provides high-performance RDF storage with advanced querying capabilities [47]. AllegroGraph stood out as the sole option that offers a Python API, while also supporting SPARQL queries and efficiently handling large datasets [48]. Although AllegroGraph offers built-in semantic reasoning functionality, it was found to be limited. To address this, Owlready2, a Python package, was chosen as a complementary tool due its ability to incorporate the HermiT reasoner [25]. HermiT reasoner is a popular powerful tool for knowledge representation that efficiently classifies complex ontologies [49].

3.2. HTH Ontology

This section introduces the HTH ontology, which serves as the basis for creating the HT packages within the application. The ontology performs the selection of suitable MEs, APs, and recommended tourist activities to be included in a package for the HTPs using the platform. The HTH ontology employs a hierarchical structure that allows for systematic organization of data. This structuring helps with managing information; for instance, medical services can be listed based on the medical specialty they belong to.

The HermiT reasoner analyzes characteristics and relationships between entities and classes within the ontology. Based on this analysis, it automatically creates new, more specific classes (subclasses) to enhance the organization of data. For example, when providers enter their profile details following the process described earlier, the reasoner automatically assigns them to the

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appropriate classes based on this information. This classification allows for personalized recommendations for users with specific needs.

Defining semantic relationships helps to establish new connections between classes and entities. For example, when a provider includes their location, the ontology automatically categorizes them based on that information and other location data stored in the ontology. By defining a common vocabulary and set of rules, the provided information is organized in a standardized manner within the HT domain. This ensures for example that all providers who offer common facilities are in the same class. The reasoner also identifies inconsistencies in a domain, which helps in maintaining data integrity.

The ontology was designed to handle data related to both medical and tourism domains (see **Figure 11**). The medical part of the ontology is related to healthcare aspects of HT. It contains classes representing medical specialties and medical services. Likewise, there are classes associated with tourism activities, accommodation amenities and features. There is also a class designed to consolidate all information concerning places. This includes geolocation data, details about tourist attractions, and destinations that health tourists might visit.

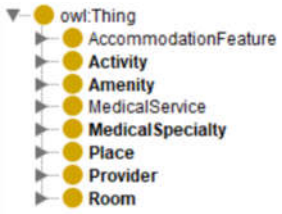

Figure 11. Main classes of the ontology.

The Provider class is used to categorize medical experts and accommodation providers that offer services for health tourists. It essentially represents individuals who fulfill the role of a provider within the HTH application. The main sub-classes of the Provider class are AccommodationProvider and MedicalExpert (**Figure 12**).

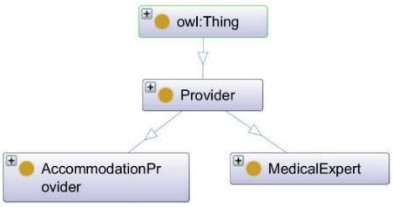

Figure 12. The provider class.

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

The AccommodationProvider class is defined to represent the providers that use the application to offer accommodation services and connect with potential guests. When an HTP searches for HT packages, the system identifies the ideal APs using this class. This class can relate to other classes within the ontology (**Figure 14**). In depth: 1. Amenity → AccommodationAmenity: This class, as shown in the **Figure 13**a, is dedicated to organize information about accommodation amenities. 2. Feature: A class that is designed to structure information about accommodation features with subclasses AccommodationType and Stars rating (**Figure 13**b). 3. Room: This is the class where every instance is connected through the relationship providesRoom. The Room class has its own relationships of room amenities (Amenity → RoomAmenity) alongside some data properties that are associated with characteristics such as size and price. The Accommodation Provider class acts as a foundation for a hierarchy of more specific subclasses. These subclasses are defined within the

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ontology and allow for the creation of new knowledge through reasoning. This process uses rules to infer additional information. These subclasses categorize the APs based on their characteristics, such as adventure, family-friendly, private, accessible, luxury, nature, and others. To give an example, if a user expresses an interest for pet-friendly accommodation during an HT trip, the system identifies instances that belong to the Pet-friendlyAccommodationProvider subclass.

(**a**) (**b**)

Figure 13. Classes associated with the AP class (**a**) AccommodationAmenity subclasses; (**b**) AccommodationFeature subclasses.

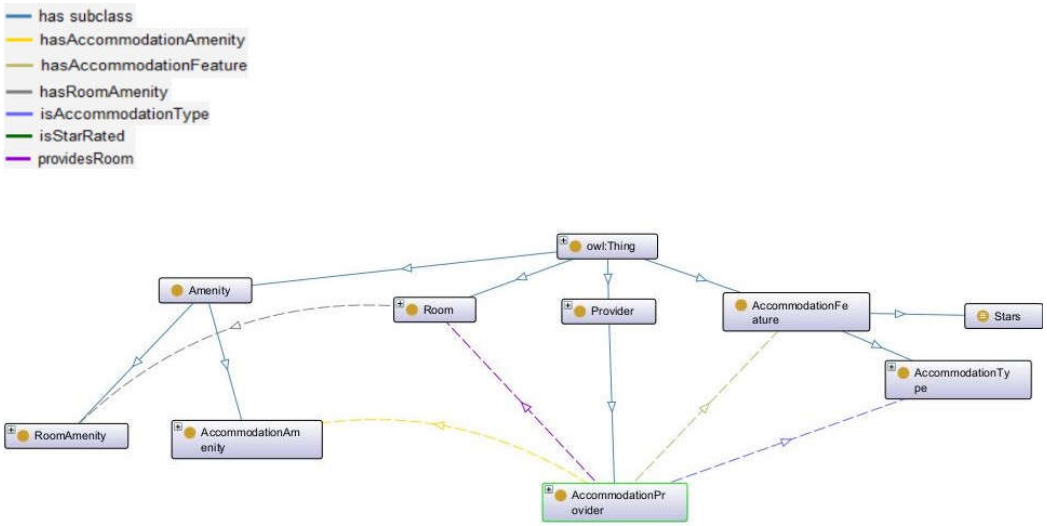

Figure 14. Graphical representation of the main AP relationships.

The MedicalExpert class in the ontology represents healthcare professionals who are interested in offering their services to health tourists through the application. It is primarily associated with two other defined classes (**Figure 16**): 1. MedicalSpecialty: This class serves the purpose of categorizing the range of medical specialties within the healthcare system (see **Figure 15**a). Each MedicalExpert is connected to their specific area of expertise with the relationship specializedIn 2. MedicalService: MedicalExpert individuals are connected to instances of the MedicalService class (see **Figure 15**b) through a relationship called offersMedicalService. For example, a cardiologist would be a MedicalExpert instance that is linked to the Cardiology subclass of MedicalSpecialty. He also may be offering services such as Electrocardiogram or AorticAneurysmTreatment. These associated services would be instances of their respective subclasses under CardiologyService, itself a subclass of MedicalService (**Figure 15**b). Through the reasoning process, the MedicalExpert class can be used as a foundation for creating more specific subclasses. This hierarchical structure allows for detailed categorization of healthcare providers and supports personalization within the application. Examples of these subclasses encompass factors such as accessibility, experience levels, and pediatric care. Consequently, when HTPs search for HT packages, the ontology will return the most suitable MEs taking into account the information provided in the booking form as well as their profile preferences.

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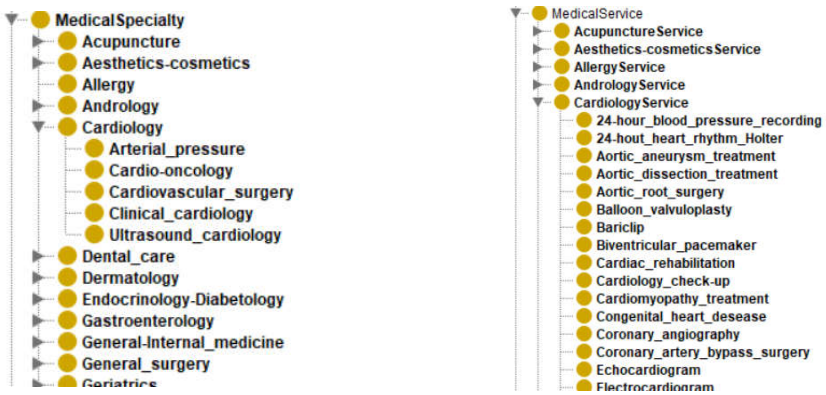

(**a**) (**b**)

Figure 15. Classes associated with the ME class (**a**) MedicalSpecialty subclasses; (**b**) MedicalService subclasses.

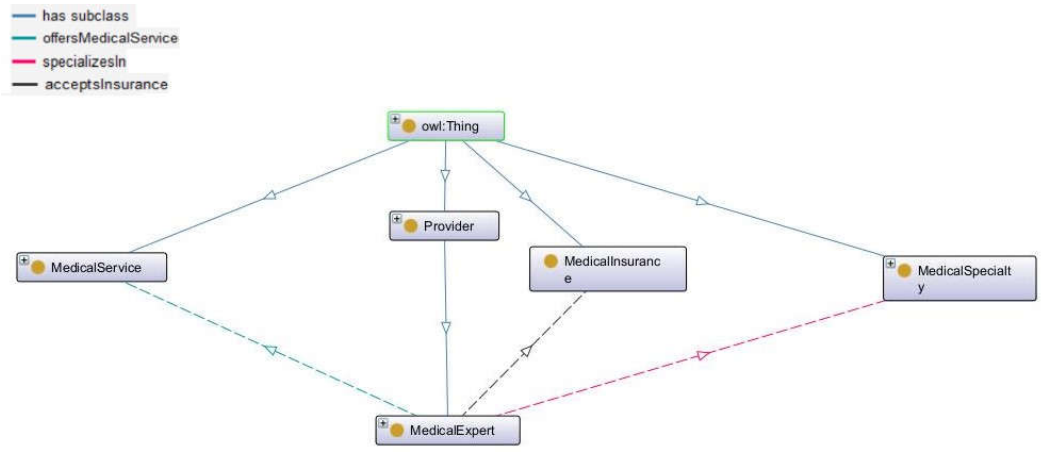

Figure 16. Graphical representation of the main ME relationships.

The Place class acts as a root for all place-related classifications and holds significant importance within the ontology. The Location subclass focuses on pinpointing the geographical position of a provider or any other building or facility through the isLocatedIn relationship. Accurate representation of these details allows for effective geolocation, mapping, distance calculation, and navigation. Furthermore, the Landscape subclass categorizes various natural and urban environments. This class is connected with the PostalCode subclass of Location (**Figure 17**). For example, when an instance of Landscape → CityCenterArea is known, it can be implied that other entities with the same postal code are likely near the city center. This allows for categorizing providers and places based on their proximity to specific landscapes. All provider instances are classified according to their location, meaning that when HTPs wish to book an HT package, the ontology provides MEs and APs based on the landscape preferences outlined in their profile as well as the destination field specified in the booking form (see **Figure 3**). Finally, as pictured in the **Figure 17**, the PhysicalPlace subclass categorizes real-world buildings and structures relevant to health tourists, including points of interest or facilities contributing to their trip. The application uses the PhysicalPlace class to provide recommendations to HTPs.

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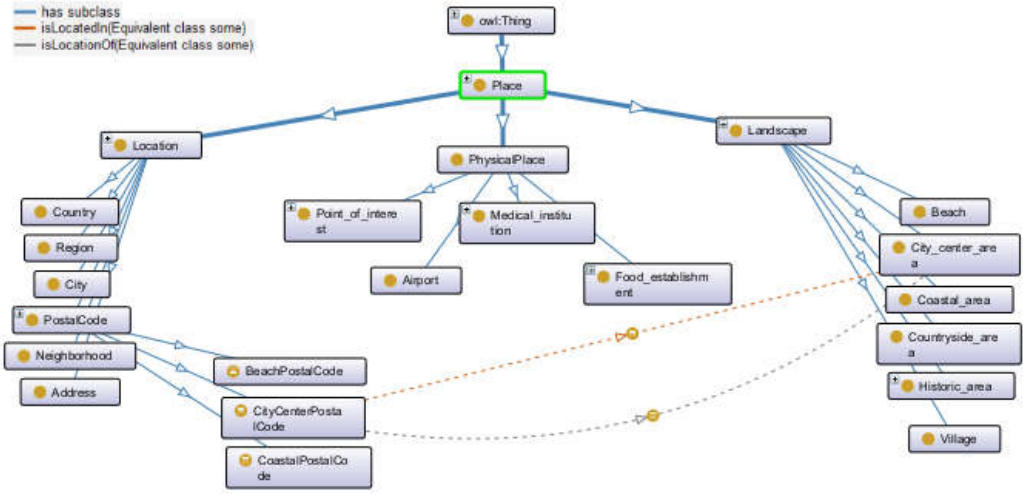

Figure 17. Graphical representation of the Place class.

The Activity class relates to the various activities that HTPs can participate in during their health journey. By organizing activities within this class, the system ensures a more structured way to manage and recommend them. This class consists of two other subclasses (**Figure 18**). The Eating subclass classifies different dining options based on dietary restrictions and preferences. The LifeActivity subclass focuses on activities that health tourists and their companions might enjoy. This class interacts with the previously discussed PhysicalPlace → PointOfInterest class through the includesActivity relationship. For example, if a user seeks recommendations for historical activities, the system utilizes the ontology and the includesActivity relationship to find instances of the HistoricSite, Monument, and Museum subclasses within the desired area and recommend them to the user.

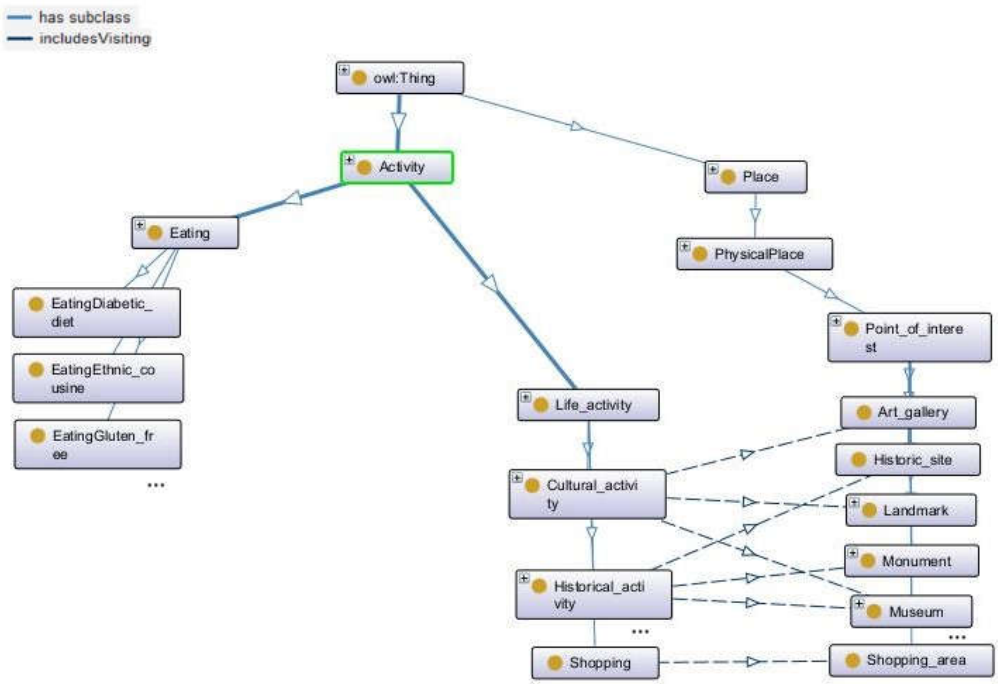

Figure 18. Graphical representation of the Activity class.

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

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3.3. HTH Packages

This section explores how the HTH application builds customized HT packages for its users as. Each HT package offered on the platform incorporates three elements: an available ME, an available AP, and tourism recommendations (**Figure 19**). To achieve this personalization, the system leverages the ontology. After the potential options are found, the system refines the results by finding the optimal pairings between providers. This ensures users receive HT packages that combine conveniently located medical care and accommodation, along with relevant tourism recommendations.

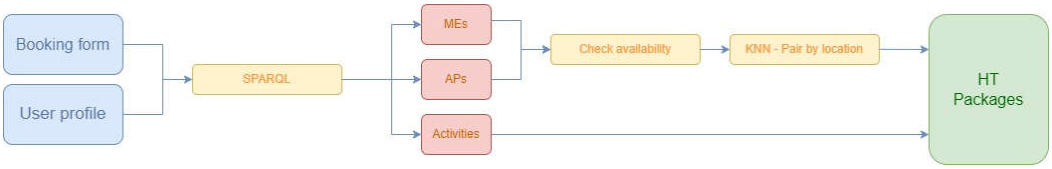

Figure 19. Building the HTH packages.

3.3.1. SPARQL

The classes and relationships described above collectively contribute to the development of a system capable of offering HT packages. The identification of the elements the package consists of (medical care, accommodation, and tourism) for individual HT packages is facilitated by the ontology. Using SPARQL, a query language designed to manage data stored in RDF [50], the system identifies suitable solutions.

Information from the user profile (**Figure 2**) and both the booking form (**Figures 1** and **3**) is used to build SPARQL queries. For instance, when identifying MEs suitable for the HTP's needs, SPARQL considers factors such as medical service and destination preferences from the booking form, and specific medical choices from the user profile. By querying this data, SPARQL generates a list of MEs along with their coordinates. In a similar way, SPARQL enhances the customization process by assigning weights to various travel and accommodation preferences outlined in the user's profile, such as preferred amenities, accommodation types, and other relevant factors, ranking available APs accordingly. A query searches the database (ontology) for tourist activities near the chosen destination, while also considering the user's travel preferences stored in their profile. Overall, SPARQL queries act as a powerful search engine within the system, allowing it to find combinations of medical care, accommodation, and activities to create a customized HT package for each individual.

3.3.2. Pairing

The SPARQL queries generate lists of providers along with their locations (coordinates). To optimize the user experience, the system further refines these matches by prioritizing providers in close proximity. This additional step ensures the closest possible pairing between medical and accommodation options.

This pairing is facilitated by the utilization of the NN (Nearest Neighbor) algorithm [51], which ensures optimal matches between providers based on geolocation criteria. This algorithm employs ranking methods to data, sorting them according to their similarity. In this context, the coordinates of providers serve as the input data for the algorithm, allowing it to efficiently assess the geographical proximity of different service providers. As a result, HTPs are presented with HT packages that include booking appointments and arranging accommodation by providers located close to each other for convenience. As shown in **Figure 20**, an HT package includes the distance between the recommended providers, confirming their close proximity.

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Figure 20. HT package presentation.

For instance, a user might wish to explore HT packages that include accessible providers in the city center area and historical recommendations. Utilizing SPARQL queries and the HermiT reasoner, the system retrieves providers who belong to relevant subclasses such as AccessibleProvider, CityCenterProvider and HistoricalActivities that are associated with HistoricSite, Monument, and Museum classes, simultaneously matching the user's specific healthcare and accommodation needs (e.g., Cardiology, Electrocardiogram, Hotel). This demonstrates the system's ability to generate personalized and comprehensive recommendations and deliver a user friendly experience. For the returned providers, the system must identify whether they have availability or if they are booked. It then employs the NN algorithm to pair these suitable providers, prioritizing the closest options.

4. Evaluation

4.1. User Survey

To gain a better understanding of HT and elucidate the perceptions of HTPs towards this phenomenon, a questionnaire was conducted. The survey aims to gather information regarding the concept of HT and the HTH platform. The participants were given access to interact with the platform individually and also received a user scenario guide of the application to ensure effective navigation and maximize their experience. The guide provided relevant information specific to their role and the application's functionalities.

HTPs were asked to respond to a series of questions, assessing their level of agreement with various statements. These questions/statements were divided into different groups, each focusing on specific aspects relevant to HT (see **Table 1**).

Table 1. Groups of questions/statements HTPs responded to.

Questions/Statements	Purpose
Demographics	Segmentation
HT	General perceptions, motivations, concerns
HT packages	Preferences and needs
HT applications	Willingness to use such applications

As seen on the **Table 1**, HTPs initially respond to demographic questions, for a better understanding of how different demographic groups perceive and engage with HT. These questions incorporate variables such as age, gender, income, employment status, marital status. The next group of questions/statements aims to understand HTPs' basic thoughts about HT. The purpose is to explore what might encourage or concern them, as well as which medical treatments or destinations they prefer. Following, respondents provide input on what they consider an all-inclusive HT package, specifying their preferences and needs. They also respond to a set of questions regarding the use of HT applications and indicate their willingness to use similar applications in the future.

For the above sets of questions, the primary goal was to discern the motivations, preferences and general opinions of individuals towards HT. Additionally, HTPs were asked to provide feedback on

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the application itself, with questions regarding to their experience while exploring its features and functionalities (see **Table 2**).

Table 2. Groups of questions/statements HTPs responded to provide feedback on the application.

Questions/Statements	Purpose
Experience	Feedback on the application experience
System Usability Score	Measure the usability

This part of the questionnaire includes suggestions, comments and feedback on the application experience, with the aim to enhance the application's effectiveness. Standard research tools like the System Usability Scale (SUS) were utilized. The SUS is a widely used questionnaire consisting of a series of statements designed to evaluate the usability of a system or application [52].

4.2. Results

This section presents the aggregated statistics of the data collected from the user survey. A total of 30 people filled out the survey, with nearly equal gender distribution (16 male, 14 female) and the majority falling within the 25-34 years old (average: 29.5).

1. HT.

One-third (10 out of 30) of participants were unfamiliar with the term HT, revealing a knowledge gap concerning the phenomenon. Additionally, only 2 out of 30 participants reported having traveled abroad to receive a medical treatment. However, despite this lack of familiarity with HT, a majority of respondents (21 out of 30) expressed interest in exploring this option and agreed to the possibility of traveling abroad for medical purposes.

In evaluating motivations and concerns for HT, the survey included sections where HTPs responded to general statements about medical procedures. Medical quality was a top priority for them, with 26 out of 30 strongly agreeing and 4 agreeing that the quality/technology of a treatment impacts their decision. Cost was another major consideration for most respondents when it comes to a medical service, with 29 out of 30 agreeing or strongly agreeing that it matters to them. Medical privacy is also a significant concern for HTPs, with 25 out of 30 stating its importance. Finally, the reputation of medical institutions in a potential HT destination is important to most participants (28 out of 30).

Figure 21 depicts a bar graph illustrating the motivations for HTPs to consider HT. The highest response (83.33%) indicates access to advanced medical treatments as the leading motivator. Similarly, high quality/new technologies remains a top priority for HTPs, with a significant 76.67% indicating it's an important factor. Cost savings emerges as another important motivator (73.33%), suggesting that HTPs are mindful of staying within budget while seeking HT. A smaller subset of HTPs (40.00%) may explore HT to access prohibited/not available medical treatments in their home country. Interestingly, tourism itself garnered a lower response with only 30.00% of the total participants including it.

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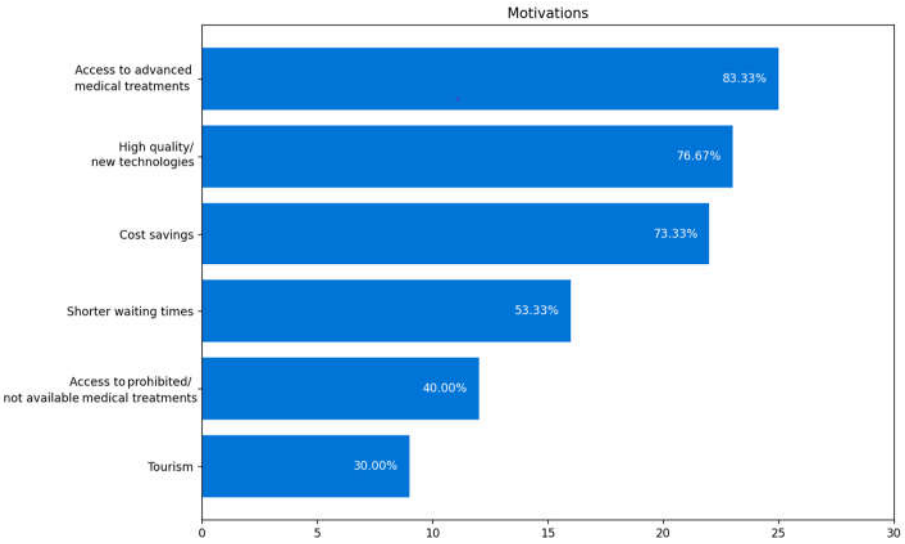

Figure 21. What would motivate the HTPs to consider HT.

As seen on the bar graph below, lack of information (60.00%) and limited post-treatment care (60.00%) are the two most prominent concerns about HT. Close to half of the participants shared concerns about the quality of potential medical treatments, a factor previously identified as top priority for all of them. Safety and security (50.00%) and potential language barriers (50.00%) were additional concerns for HTPs. Cultural considerations (16.67%) appear as the least worrisome factor, suggesting that many participants are open to HT regardless of cultural differences. Overall, **Figure 22** reveals that HTPs prioritize well-researched and well-supported HT experiences with the importance of planning for and understanding post-treatment care.

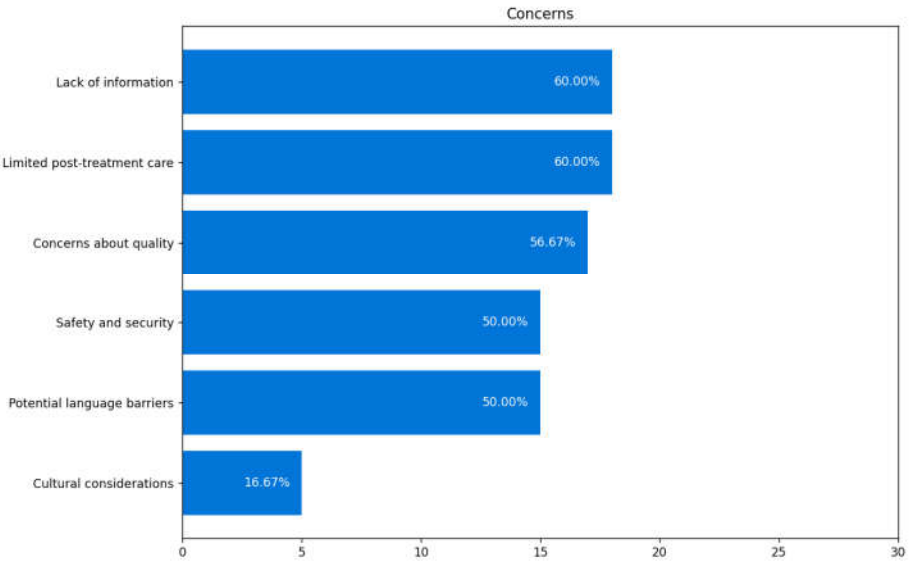

Figure 22. Main reasons HTPs would avoid HT.

HTPs also had the chance to answer open-ended questions. The analysis revealed that most of them (83.3%) would explore HT with family, followed by friends (40 %). Some HTPs commented that they would also visit a country for health reasons with their partner. Notably, none chose large groups. Participants were also given the opportunity to comment freely regarding the medical services they would prefer. People are most likely to consider surgery and cosmetics for HT, followed by dental care. Other answers include cardiology, oncology, orthopedics, physiotherapy, and even psychiatric services. Generally, people commented that they are willing to travel if the treatment is

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complex, unavailable locally, or offers higher quality than what is available in their region. When asked about the country or region they would consider, almost all pointed to Europe and European countries. None of the participants shown interest in Asian countries that are increasingly popular destinations [53].

2. HT packages.

Among the 30 participants, 16 agreed and 3 strongly agreed (63.3%) that they would consider purchasing an HT package. 6 participants were not interested and the remaining 5 were neutral. Examining the results, it was found that nearly 90% (17 out of 19) of those interested in HT packages also agreed they had general interest in HT, suggesting a positive perception of HT translates to a higher likelihood of purchasing related services.

When participants were asked whether they are interested in all-inclusive packages specifically, their interest level did not show a significant increase and only one additional participant expressed interest (20 out of 30 total), while 'Agree' remained the most frequent response (16). All participants initially open to a regular HT package (those who agreed) also expressed interest in the all-inclusive option, except for one who remained neutral. Correspondingly, those who disagreed with a regular HT package in the first instance also declined the all-inclusive option. This pattern suggests a limited overall preference for comprehensive solutions.

As to what they consider a complete HT package (illustrated in **Figure 23**), all respondents (100%) felt that medical appointments and accommodation were the most important and should definitely be included. Transportation services (80%) and paid travel expenses (73.3%) were also highly valued. Additional services, such as eating, translation, and customer support are also seen as important by a majority of respondents. Lower than the half (40%) believes that recommended activities must be a part of a package As mentioned, the platform HTH focuses on appointments, accommodation, and recommended touristic activities, but does not currently cover other travel expenses, transportation, translation services, or wellness programs, factors that many HTPs might consider. Despite receiving a relatively low rating as a package component (40% interested), a significant number of participants (21 out of 30) acknowledged the value of organized activities in supporting post-treatment care. Nearly all participants (29 out of 30) agreed on the convenience of having accommodation close to medical facilities, a factor HTH prioritizes.

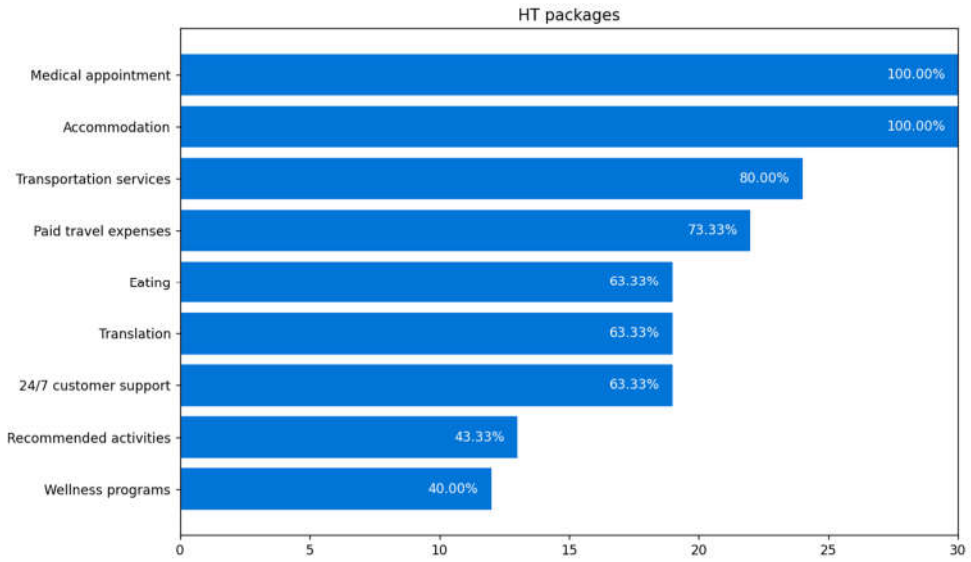

Figure 23. What HTPs would consider an all-inclusive HT package.

To delve deeper into decision-making factors, the survey also explored the types of tourism activities HTPs would consider if traveling for HT. As shown on **Figure 24**a, the results show that food-related activities were the most popular choice, with 24 out of 30 participants expressing interest. Cultural activities (21) and local experiences (20) followed behind, while historical

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attractions were of interest to 17 participants. Shopping, sports, and nightlife were considered less essential options. Respondents showed a preference for urban city centers as their potential HT landscape (76.7%), followed by beaches, inland waters, coastal areas and islands (**Figure 24**b. Historic areas and mountains were also of interest, with some participants additionally considering countryside areas and villages. When considering locations for their HT experience (see **Figure 24**c), HTPs prioritized local attractions and landmarks (90%) and nature/national parks (80%). While some expressed interest in spa and wellness centers, shopping districts and entertainment venues were less popular choices. These findings provide valuable insights for HT operators like HTH, suggesting that HTPs are more likely interested in local exploration and cultural immersion in the city center, access to nature aligns and food-related experiences.

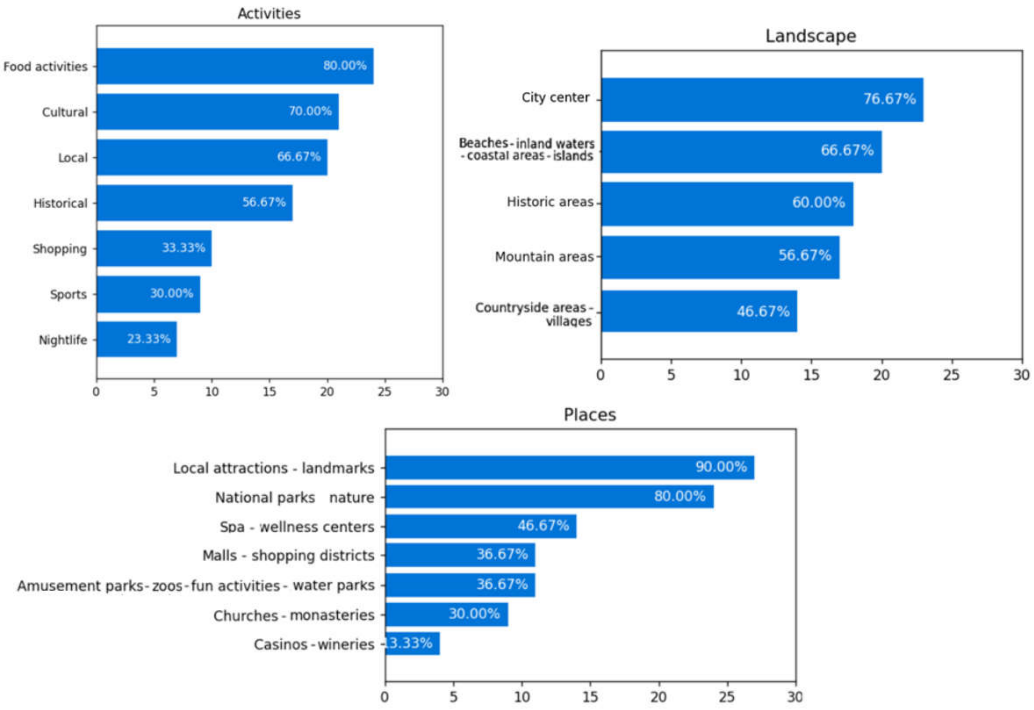

Figure 24. Tourism options HTPs would consider if traveling for HT: (**a**) Activities; (**b**) Landscape; (**b**) Places they would visit.

3. HT applications.

This study explored participant preferences for HT-related applications. In detail, nearly all participants (all agreed/strongly agreed, except one neutral) endorsed the use of an online medical appointment application. The survey showed a positive outlook for all-including booking applications with 24 out of 30 considering using one for their travel. When it comes to HT applications, 20 people would consider using one to explore HT. Examining the data further, over two-thirds (71.43%) of participants willing to try HT were also interested in using an HT application. Additionally, a remarkable 90% overlap existed between responders interested in all-inclusive HT packages and those who would use an application to book them.

Booking medical appointments via online applications was seen as convenient and effective (27 agreed/strongly agreed). In addition, a large majority (23 out of 30) believed HT applications could improve communication with medical providers. Transparency was also key, with nearly all (90%) believing HT platforms could clarify HT costs. Most participants perceived HT applications as a secure way to book HT packages. These findings suggest a well-designed HT platform could bridge communication gaps and promote security.

The graph in **Figure 25** reveals that users prioritize informative content and reviews when evaluating HT applications. Detailed provider profiles and access to customer support are also seen as important factors. HTH currently focuses on providing information and comprehensive details

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about the HT packages, but does not offer customer support or user reviews yet. While personalization features received a lower rating (60%), it still indicates some user interest.

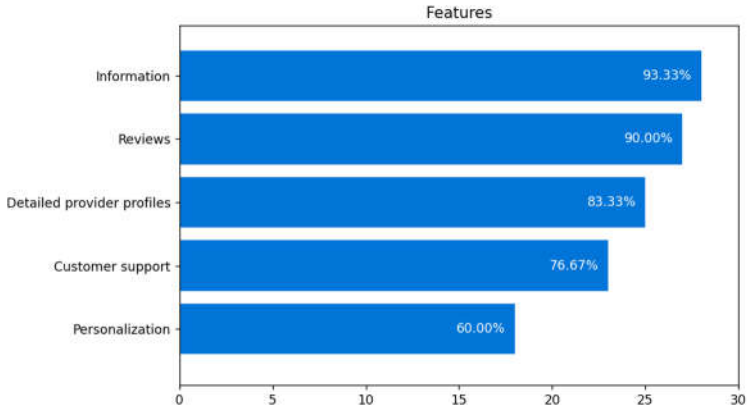

Figure 25. Most important features in an HT application.

4. Application experience.

The survey results revealed generally positive user experience with the application. A 90% of respondents found the information on the homepage helpful, and the same high percentage indicated they understood how to use the application effectively. No participants expressed any disagreement with these findings. While the vast majority (29 out of 30) found the account page user-friendly, one participant disagreed. Similarly, only one participant encountered difficulty filling out their personal information, while everyone else agreed it was a straightforward process.

The majority found the package results accurate (20 out of 30), with informative descriptions (24 out of 30). The review and payment process, along with the history page, were also considered easy to use by a significant portion of users with no users expressing disagreement. While a third of respondents (10 out of 30) experienced some technical issues, half reported minimal limitations and 9 remained neutral. Encouragingly, a large majority (25 out of 30) expressed satisfaction with the overall experience, and none disagreed with recommending the application to others.

While a small minority (1) disagreed, most participants (24 out of 30) expressed interest in using the application for its purpose. Looking closer at the data, a strong user preference for using the HTH application for different HT-related needs was found. Firstly, 85.71% of participants willing to travel abroad for medical treatment also expressed interest in using the HTH application. Similarly, 18 out of the 20 participants interested in purchasing complete HT packages agreed on using the application. For users open to booking complete HT packages via an application, a high number (20 out of 22) indicated a preference for using HTH. Notably, one participant who strongly agreed on the above statements, disagreed on using the application.

5. Usability evaluation.

The SUS questionnaire was utilized to capture HTPs' feedback during the evaluation process, as it offers a straightforward and reliable way to assess how usable a system is. The SUS study score was 77.08 with standard deviation 16.92. The score translates to good acceptability for the usability of the system and is considered above average with a grade B.

In depth, 18 users indicated an intention to use the system frequently while 10 remained neutral. Only two people found the system complex or difficult to use. Integration of various functions received strong agreement for being well-done, and the majority (25 out of 30) felt the system was easy to learn without extensive prior knowledge. While a small number (4) found it cumbersome, the overall feedback suggests an overall user-friendly application.

Figure 26 presents the normalized question scores from the SUS study. Most participants felt confident using the system without technical support, and found the system to be free of inconsistencies. Those who expressed an intention for frequent use had slightly lower scores on the SUS.

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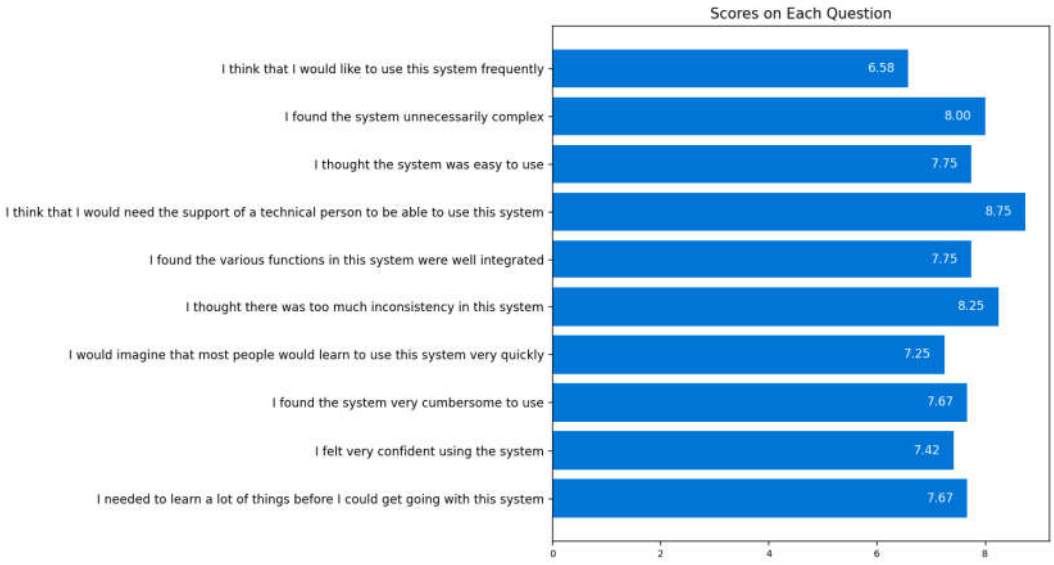

Figure 26. SUS scores on each question.

6. Qualitative analysis.

Participants also provided valuable insights through open-ended questions about their overall experience. When asked about errors, bugs, or limitations, nearly half reported encountering none. Some mentioned known limitations implemented specifically for the demo, such as the ability to register without agreeing to the privacy policy and functionalities that were not yet fully functional. However, a few participants identified areas for improvement. One user found the profile building process cumbersome, and three others struggled to find available packages, likely due to the limited medical services offered in the current demo version. Additionally, two participants encountered browser errors. Overall, while a significant portion of users experienced a smooth experience, the feedback highlights opportunities for improvement regarding error handling and functionalities.

Probing deeper, the survey also asked HTPs to identify any missing functionalities within the application. Some HTPs commented that their lack of experience with HT applications prevented them from identifying missing functionalities. Some valuable suggestions for improvement emerged. For improved search efficiency, one user proposed the ability to change location and medical service filters directly on the results page. Additionally, two participants suggested a “next button” or similar feature within the profile creation process to simplify navigation. Understandably, some participants highlighted the limited locations and services available in the current demo version. User suggestions also included functionalities like favorite packages and accessing reviews, which could be valuable for users comparing different HT options.

To conclude the survey, participants were asked to share their positive experiences. Most participants described the application as user-friendly. They found the application easy to understand and navigate. The package description page was particularly well-received, with users appreciating the clarity and usefulness of the information provided. Furthermore, participants expressed satisfaction with the accuracy and personalization of search results, along with the ability to successfully book a package through the application. Finally, the design and use of familiar booking application patterns were appreciated for their ease of use.

5. Discussion

The research unveils user perceptions and experiences regarding HT and the HTH platform. The findings reveal valuable insights for platform development, showcasing promising opportunities to advance the field of HT. The study identified a knowledge gap regarding HT, with some participants unfamiliar with the term. This highlights the need for raising awareness about HT as a potential medical care option. However, a majority of respondents expressed interest in exploring HT,

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suggesting growth potential for the industry. Encouragingly, those interested in HT also showed a preference for HT packages and using an application to access these services. This indicates that offering HT packages through a user-friendly application could be a successful strategy.

The survey resulted in several important insights into why patients would choose to seek medical care abroad. HTPs would mostly pursue HT for procedures unavailable locally or to experience superior medical technology. This aligns with qualitative data, where participants expressed a willingness to travel for complex, unavailable, or higher-quality treatments. Cost savings also emerged as a significant factor, consistent with existing literature. These findings underscore the importance for ME to prioritize accreditation, leverage advanced technologies, and maintain transparent pricing structures to attract HTPs that utilize the application.

Limited post-treatment care options and a lack of information about potential HT destinations were major concerns for HTPs. The HTH platform addresses these by offering comprehensive information about destinations, ensuring transparency regarding the qualifications of healthcare providers, and providing detailed package information. However, there might be a need for further improvement in providing specifics about the procedures and post-treatment care. In addition, HTH can also offer valuable assistance by providing translation services in the future, to address potential language barriers.

The survey finding that none of the participants expressed interest in traveling for HT with large groups suggests that HTH can focus less on large group options and prioritize catering to families and smaller travel parties. Based on the findings, it is evident that a complete all-inclusive HT package should prioritize core elements such as accommodation and medical appointment booking. The survey suggests that recommended activities aren't the top priority for most participants. Many found them valuable for post-treatment but overall less than half considered them essential. It's noted that the current offering of HTH does not cover other important factors such as travel expenses, transportation, translation services, or 24/7 customer support, which many participants might consider essential. This highlights an opportunity for expansion or adaptation to better meet customer needs. Despite these limitations, HTH does offer convenience by providing close proximity to medical experts and accommodation providers, which is a positive aspect of the platform.

This study explores participant preferences regarding HT applications, aiming to identify the features that users value most. Generally, participants viewed online booking of medical appointments as convenient and effective. Many also believe that HT applications could enhance communication with providers, clarify costs, and provide secure booking of packages. HTH emphasizes detailed profiles and information provision, which are deemed very important by users. Personalization, the key feature that makes HTH unique, is still significant but not as highly prioritized. Customer support and reviews are definitely some additions that would increase user satisfaction.

The HTH application received positive feedback regarding usability and user experience. Participants found the application informative, easy to navigate, and helpful for exploring HT options. The user friendly interface was important factor. The SUS score of 77.08 further supports this positive evaluation. This suggests HTH's potential to become a valuable tool for users booking HT packages. By addressing the identified areas for improvement, HTH can position itself as a valuable application for HTPs, MEs and APs.

5. Conclusions

HT is experiencing growth, yet there's a lack of in-depth research that explores its full potential and applications. The creation of innovative applications within the HT domain, offering unique features or solutions not found in existing platforms, could attract a broader audience. A notable aspect in the discussion of HT applications is the limited availability of all-included HT packages in the current market landscape. This paper proposes an ontology-based HT booking application called HealthTourismHub (HTH) that offers complete and personalized HT packages, including medical appointments, accommodation, and tourism activities, all customized to user needs and preferences.

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HTH also benefits MEs and APs by allowing them to advertise their services and connect with potential clients.

The platform offers a range of services such as profile creation, search and booking facilities, history and calendar functionalities. HTPs can create profiles outlining their specific preferences and book HT packages that include a scheduled medical appointment, nearby accommodation and recommendations for tourism activities. MEs can showcase and promote their services to HTPs seeking personalized healthcare abroad. APs can use the platform to appeal to HTPs and increase visibility of their establishment.

The ontology organizes data for HT packages in the HTH application. It uses a hierarchical structure to categorize providers, medical specialties, services, accommodation types, amenities, tourist activities, places and others. HermiT reasoner automatically creates subclasses and ensures data consistency. SPARQL queries allow the application to recommend suitable medical experts, accommodation, and activities for health tourists based on their preferences and booking information. The system also prioritizes providers located close to each other by utilizing the NN algorithm, ensuring convenient travel and accommodation for users.

A survey was conducted to understand user experiences with the HTH platform, letting participants explore the application with a user guide. In conclusion, key motivations for seeking care abroad include access to unavailable procedures, superior medical technology, and cost savings, suggesting that HTH should emphasize accreditation, advanced technologies, and transparent pricing. Concerns about limited post-treatment care and information scarcity indicate a need for comprehensive procedural details and translation services. Essential package elements include accommodation and medical appointment booking, while adding travel expenses, transportation, translation services, and 24/7 support could meet user needs better. Survey's findings suggest that a smaller proportion of health tourists is interested in personalization and most of them are interested in important arrangements concerning the necessary information. The application received a generally positive feedback. Overall, improvements can position HTH a valuable application for enhancing HT.

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Abbreviations

The following abbreviations are used in this manuscript:

HT	Health Tourism
HTH	Health Tourism Hub
HTP	Health Tourism Patient
ME	Medical Expert
AP	Accommodation Provider
OWL	Web Ontology Language
RDF	Resource Description Framework

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SPARQL	SPARQL Protocol and RDF Query Language
NN	Nearest Neighbor
RAD	Rapid Application Development
JS	JavaScript
CSS	Cascading Style Sheets
HTML	HyperText Markup Language
MVT	Model-View-Template
SUS	System Usability Scale

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