Where2: Exploring prior visitor journeys to enrich upcoming visitor's experience

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ABSTRACT

In recent years, the growth of the travel industry has been astounding. Yet, it is still not easy for an individual to have a meaningful travel experience even, so vast amounts of information are available on the web. As an attempt to support travel decision-making and improve visitor's experience, we designed *Where2*. *Where2* is a location-based mobile app that highlights Points of Interest (POI) customized to tourist's travel-related attributes (e.g. the length of their stay). POIs are in-*situ* recommendations proposed as *"Ghost Paths"* journeys - the idea that you can follow a prior tourist shoes to explore the city. We generate *"Ghost Paths"* journeys by using a non-intrusive positioning system that captures prior tourists' Wi-Fi signal and detect their journeys across the city. With this system our goal is to support visitors with their travel decisions and nudge them towards optimal journey choices that maximize their utilities.

CCS CONCEPTS

• **Human-center computing** → *Ubiquitous and mobile computing*; *Human Computer Interaction; Interaction Design.*

KEYWORDS

Travel; Volunteer Geographic Information; Tourism; Location-Based; Recommender system; Nudging; Behavioral Economics.

1 INTRODUCTION

Travel and tourism tendencies are changing fast. While decades ago, travelers were constrained to pre-defined travel plans [8], the advancement of technology has change how travel information is delivered from sources to tourists, leading to a substantial growth of tourist information systems [14, 17]. Nowadays, travelers rely on search and social engines to obtain information about travel-related attributes (e.g. points of interest and travel expenses) and determine and maximize the utility of every choice alternative [1]. One limitation of travel guides or blogs is that, they do not make inferences about user's preferences and merely focus on delivering as much information possible to satisfy the interests of the majority [4]. They rely on people's will to engage in seeking information and reflect on options available to find the "best-fit". However, one might notice that providing information might not lead to better judgments and decisions [7, 16]. The existence of many choices for a specific decision makes it difficult to weigh and choose and engaging with data is a laborious process that often leads to disengagement [7]. In a nutshell, bounded rationality prevents people to maximize their utilities in every given choice and poor choices can lead to a poor experience that can push visitors to move elsewhere.

In recent years, a variety of technologies have been developed in academia [11,15] as well as in industry to help individuals to find travel information [21, 22, 23]. *Google Maps*, for instance, revolutionized online mapping service applications with real-time position information and detailed information of locations, including photos, reviews and comments [3]. Crowdsourcing applications like *Tripadvisor* [18] or *Yelp* [19] are often used for travel inspiration before planning. They offer the possibility to effectively plan trips by discovering activities deduced from user generated content (UGC) such as comments, ratings, photos and videos. These sources enable travelers to combine knowledge and experiences from previous visitors to their own preferences, leading to an increased satisfaction and confidence in their travel decisions [4]. Yet despite the potential, research has recently questioned the credibility of UGC systems. A case study on *Tripadvisor* has demonstrated that UGC content is repeatedly compromised to enhance the business reputation (e.g. restaurants) or damage competitors' status [10]. A recent study classified it as *non-fully- tourist-oriented* since only a small number of travelers engage in content contribution [13]. And further research, highlighted the challenge of assessing contributor's evaluations, since review's content might merely reflect the overall experience and fail to denote different service' features [12]. Moreover, biases as the halo effect (e.g. overly positive view of a particular situation or person), the recency bias (i.e. rating based on the most recent performance) or the peak-end rule (i.e. relying on the most extreme point and the end of the episode to evaluate the overall experience) [37], significantly bias the overall assessment of the

experience, specially when combined with the reliance on users' memory of the experience [12, 13].

In response, research has been making great strides facing the challenges of *unreliable subjective reviews* and *information overload*. For instance, COMPASS [15] and GUIDE [11], two context-aware tourist guides, offer a service to travelers centered into four requirements: flexibility (i.e. enabling visitors to explore different options), context-aware information (i.e. providing custom-fit options, suited to their location), support for dynamic information (i.e. providing daily specials attractions) and support for interactive services. In line with this research, we also envision a more dynamic travel interaction through a system able to understand tourist's needs, offer services that suit their preferences and facilitating decision without involving a lot of effort. Our focus is to help travelers to be more spontaneous when they arrive at their destination, while providing information that match to their preferences. We propose a different approach to existing travel guides. We take advantage of a non-positioning system to capture prior tourists' journeys and collect travel related attributes (e.g. points of interest visited during their length of the stay). We analyze footprints of prior visitors to understand how travel behavior changes based on the value of it attributes (e.g. which locations travelers tend to visit based on the length of their stay, companionship or travel expenses) and create custom travel profiles accordingly. We use those footprints to generate *"Ghost Paths"* journeys - *in situ* and *objective* recommendations from prior visitors that provide guidance on how people can visit the city to attain the full potential of their travel.

2 *WHERE2*

We propose *Where2* as a mobile app (i.e. a smartphone with GPS and Wi-Fi capabilities) able to infer user's location and changes in their journey to alert our visitors to POIs nearby (see Fig 2 – Left Side). The framework of this research it is based on two main novel components: a non-positioning system that collects data from prior traveler's visits, and the "ghost paths" mechanism that generates footprint journeys as travel guide recommendations.

2.1 Non-positioning system

Non-position systems can avoid issues of subjective reviews by providing accurate information from performance (i.e. observable and objective behaviors), which can considerably improve travel decision-making [9]. The exploration of non-positioning systems is not novel. Previous research has explored technologies such as Bluetooth, RFIDs [39], GSM [40] and Wi-Fi technology to capture and observe spatio-temporal mobility data, such as daily commutes, flock detection, route planning or analyzing waiting times [24, 25, 26, 27, 38]. An example of a review that could be provided by a non-intrusive system, might be "78% percent of tourists take 10 minutes from the cable car station to the market", which is clearer and more objective than a simple "a short walk".

In this work, we use *Beanstalk* [27], a non-intrusive positioning system that obtains non-volunteered geographic information by taking advantage of the signal emitted by people's Wi-Fi devices (e.g. mobile phone). Individuals are tracked based on passive WI-FI signals sent to one of the 80 WI-FI scanners (routers) scattered in POIs throughout the island. By assessing and mapping individual's passerby in specific stopovers (e.g. the harbor or a famous market), *Beanstalk* is able to track individual journeys and the flow of people across the city (see Fig 1, Fig. 2 right side). Visitors are identified by the device's mac addresses (which is unique and stored anonymously for privacy concerns). Travelers' visits are stored as *individuals travel journeys*. To comprise rich, journey-oriented travel information, we merely focused on tourist journeys data, distinguished by the signal sent by their device.

To address ethical and privacy issues in the design and use of non-positioning, we priory assured that Beanstalk encrypts users' personal data. Moreover, one prerequisite of our system involve an informed consent, which describe the data collected and it purpose [35, 36].

Figure 1 - Non-positioning system components [2].

2.2 Ghost Paths" Journey

We designated as "*Seasonal Ghost Paths*" the journeys from prior tourists that are automatically generated by the non-intrusive positioning system (see Fig 2). To customize the journeys provided, we request our users to fill out a visit form, prior to their trips with the goal of generating a *travel profile* and rate the *Points of Interest* (POI) in the end of their visit. The profile form comprises information about the length of the stay, estimated budget, companionship (i.e. family or friends), transportation mode and season. The application uses this information to filter prior tourist journeys data and select services that could fill the requirements for different types of travelers, by using a weight combination approach of it values. The rating form, aims to assess how satisfied the tourist visiting a specific stopover and understand it experience after their visit (in order to exclude poor experiences form the *"Ghost Paths"* journeys).

We categorize *travel journeys* base in different travel attributes: length of the stay, travel expenses, companion, season, requirements (e.g. cultural experience, adventure, etc.) and location. Currently, we explore a weighted hybridization approach to generate *travel profiles*: at first the system provides equal weights to all the attributes and then adjust it values as the predictions are met [6]. Our goal is to combine two different types of knowledge: content-based (e.g. what users like) and knowledge-based (e.g. what better suits their needs).

Following Kandampully [8] suggestion on "service packaging", we incorporated both service quality and demand by selecting a custom-made journey, from *one specific past traveler* stops elected from our database. For example, a tourist visiting the city during Carnival will be suggested to watch the Carnival parade, besides others tourist attractions in a specific day. This recommendation is grounded on a journey of a prior tourist that visited the island a year before, who also filled out the travel

profile with similar attributes (e.g. length of the stay, season of the visit and travel expenses) and rate the parade as a good attraction. In case that the system is unable to find a similar profile, the system ask to the user if he wants to adapt the travel profile in terms of budget, or if he prefer to take a more generalized "go with the flow" journey. To provide a general journey, the system collects the most visited venues in the same time interval and generates a journey that is conceivable for new visitors in terms of time, transportation mode and companion.

Path Presentation: To present the *"Seasonal Ghost Path"*, the system infers the user's current location, and presents the activity or venue that can be initiated or reached from the current position (see Fig 2- Left Side). To facilitate decision-making and make the experience more enjoyable, the complete path is hidden from the user and it is only shown gradually as the tourist reaches a new POI, similar to a location triggered *scavenger hunt* (see Fig 2- Left Side). These decisions occur when tourists are selecting tour journeys or making a real-time decision (e.g. modifying the initial plan on the basis of interactions with the destination's environment, people, or post-tour extensions [28].

Path Selection: When facing a *hunt clue*, if the user can *accept* the suggestion, *Where2* will show the new route using *Google Maps*. If the user *denies* it, the system will redirect him to a journey from other traveler (instigated from the current location or its surrounding), allowing him to explore other options. We follow Paay's et. al. [11] idea of transitory search - *"the ability to start with a vague idea, view and compare intermediate results and then reformulate preferences and criteria until you find an activity that sufficiently suits the situation"*. As a deviation from a pre-meditated path can impact the POIs visited (e.g. one POI could take longer time to explore and prevent another POIs from being visited given the visiting hours), when the user explore other POIs, we frame the information in terms of *gain and loses* [5, 16] to emphasizes choice outcomes and trigger user's reflection (e.g. "*Deciding to explore the natural pools now could limit your visiting time in the whale museum (closes at 5pm)"* or *"visiting the theater today will reduce potential waits (15 minutes) than tomorrow (week day"*). Moreover, as people are influenced by *default choices* [16], the most suitable option is always *pre-selected*. Lastly, *Where2* includes the ability to adopt food detours into the journey paths, to allow users to be flexible about their food choices and places (see Fig 2 - Right Side).

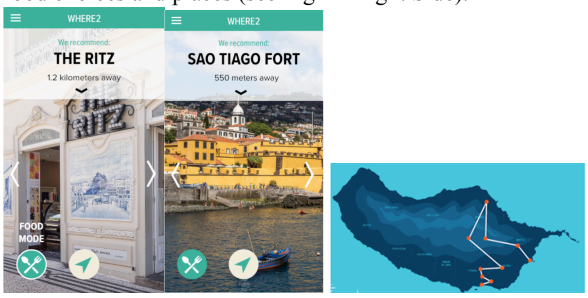

Figure 2 – Left and middle image represent the suggestion of the "Ghost Path" and the Food detour option, while the image on the right displays an example of a "Ghost Path".

3 Study

To gain an initial understanding of users expectations towards the app and understand how they would interact with the system, we conducted a questionnaire-based survey with 20 participants. All participants were habitual travellers or travelled to a different country at least once. Participants were not compensated by their participation. The questionnaire comprised 16 questions and aimed to understand what do travellers look for in a travel app, how do they search for activities in a new location (before and during the trip), what kind of traveller type they are (i.e. adventurous or cautions) and what did they perceived as positive and negative features of *Where2*.

3.1 Results

The majority of participants considered themselves as cautious travelers (65%, N=13) and reported seeking information about activities to perform in a new location before the trip (65%, N=13). As expected the main purpose was to maximize the number of activities performed/places visited, to draft a travel path and to find the best activities available. In turn 30% participants (N=5) search for information before and during the trip in order to explore the surroundings, reorganize the route (for instance, when coping with a setback such as a delay, bad weather), to gain a better insights of what to do nearby or to explore an alternative that was not considered before the trip. One user (5%) reported seeking information during the visit for the same reasons.

Participants' search was made mostly using *Tripadvisor* (45%, N=9), *Google* (Maps combined with Google Trips) (35%, N=7), travel blogs (15%, N=3) and Lonely Planet (10%, N=2), among others. Regarding *Where2*, participants reported being likely to use and rely on *Where2* on a future trip (averaging score 3.6 on a 5 point scale). When asked about the strong points of the application, participants mentioned: simplicity (regarding usability and mental effort demanded), flexibility, the surprise effect and the ability to visit a new place having an itinerary that was not priory planed (i.e. saving time). In turn, the weak points were the lack of users' reviews, the inability to share a route, the lack of flexibility to personalize a route, the size of the screen and the burden caused by swiping repeatedly (P[7] *"The process of looking for a restaurant would take too long if it's being shown one by one"*). Yet, all in all, participants revealed great interest in the use of the app.

4 Conclusions and Future Work

While the growth of the travel industry has been astounding, it is still not easy for an individual to have a meaningful travel experience by analyzing vast amounts of information are available on the web. In our understanding, current travel systems rely too much on user's motivation to inspect information to make decisions or are biased by subjective reviews. With research showing that 85% of travelers seek for travel insights during their trip and decide on activities after having arrived at the destination [20], we designed *Where2* - a mobile app that maps user-

generated travel journeys from prior visitors, offering a unique travel experience that fits to their travel-utilities during their visit. For this purpose, *Where2* provides *"Seasonal Ghost Paths"*, POIs recommendations that allow fresh visitors to explore places guided by the journeys of previous travelers. *Where2* provides two novel perspectives for the design of travel recommender systems. The first contribution is the ability of keeping and weighing more strongly updated journeys of recent travelers *"Ghost Paths",* helping to provide efficient and customized journeys. And the second contribution is it ability to evade subjective reviews, one of the main problems from other well-known travel sources [9].

To understand users' expectations towards Where2, we conducted a preliminary study that allowed us to identify users' needs, preferences and content requirements before it development in the wild. Our future work has two main objectives. The first one is conducting user experience interviews to evaluate prior traveler's experiences at each point of interest, enhancing the value of the path that might be suggested in the future. For this purpose, our aim is to reach tourists in exit points of the city (i.e. airports and ports) and collect quantitative data (by asking visitors to rank of venues visited) and qualitative data (inquiring users about their experiences and additional insights). Our second main goal is to deploy *Where2* in the wild. Currently we are assuming that the data collected during the last 17 months is a good starting point to generate a vast catalog of journeys from all types of travelers. Yet, our goal is to collect more data from the non-intrusive positioning system during the next 8 months before releasing and testing our app.

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