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A proposed Smart Archaeological Tourism Walk Plan: A Case Study on The Holy Family Journey in Sharkia Governorate

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Abstract: The diffusion of digital technologies offers great creativity and innovation potential in all aspects of the tourism industry. Integrating advanced ICT technology with the tourism industry plays a vital role in enhancing tourism services and experiences, particularly in the archeological tourism context. This study suggests a smart walk plan that offers tourists location destination and experiences according to their preferences. In particular, tourists can express different preferences regard to the type of tourist site, the level of contention to avoid crowded sites, the accessibility and convenience of different sections of a site and the distance and congestion of the trails. From this perspective, in this paper, tourist Contention, Convenience and Accessibility-based Smart Tourism-destination Approach (footstep) is introduced to deliver visitors to the Holy places at delta Egypt using online services, believing they are always linked and do not have specialized IT skills. A tourist just needs to deploy footstep at his smart hand-held. A control unit residing on the cloud analyzes tourist current location and then recommends a tour based on tourist interests to certain places and their parts. Tourism site information and its sections. Results from footstep simulated experiments have shown that it outperforms the shortest approach to the path which suggests a tour based solely on the distance to those destinations. In addition, footstep shortest path approach to outperformance takes the consistency of network connections available over the paths chosen.

Keywords: ICT; archeological; shortest route; IoT

1. Introduction

It is apparent that the development of information and communication technologies (ICTs) has transformed the tourism industry from the point of views of both the industry structure and business strategies, and practices (Al-Hasan et al., 2011). Following this, it is acknowledged that the considerable development of information technology, particularly, the applications of the internet has radically changed the tourism industry (Almobaideen et al., 2015). Smart tourism can be defined as integration between ICT and urban tourism platform in order to offer services and related information to tourists pre and during their travels. Such integration is based on recent development in mobile computing and advanced technologies such as cloud computing, artificial intelligence, and Internet of things (Almobaideen et al., 2016). Whereas, Batty Ouzounis (2012) indicated that a smart city can be determined as "a city in which ICT is merged with traditional infrastructures, Coordinated and integrated using new digital technologies".

Based on cloud computing and the Internet of Things (IOT), smart tourism aims to use intelligence perception of all types of tourism information to acquire and adjust real time tourism information via mobile internet or internet terminal devices. Recently, considerable literature interest has grown up around the theme of ICTs applications in different contexts of life. Despite the breadth of such studies, little attention has been paid to smart cities and its tools in the context of IoT and smart tourism. Thus, the main purpose of this study is to propose a model that fits in these complementary contexts in order to serve e-Tourism in general and archaeological tourism in particular. The most notable contributions made in this paper could be summarized as follows:

a. General smart tourism architecture was proposed with the defined function of its different components. As a cloud-centric IoT-based architecture, this architecture assumes the existence of sensors in sections of tourist sites and road segments, cellular. As a cloud-centric IoT connection for an always connected tourist, and smart phone or other hand held device is available for each tourist.

b. The details of a Control Unit (CU) that exists on the Cloud and that receives, analyzes, and generates the required information for a tourist will been presented and explained.
c. An analytical description of a model that cloud be used to differentiate and compare between various tourism sites, their constituting sections, and the paths that lead to these sites should be illustrated and used in the program that simulates the proposed environment.
d. Accessibility, convenience, and contention of tourism sites' sections, in addition to road paths congestion, and distance have been combined and used for the first time, up to our knowledge, in an evaluation and differentiation between various tourism attractions according to a tourist preferences.

The rest of this paper is as follows. Section 2 presents a literature review, background and related works that are of important interest relative to the work done in this paper.at section3, state The Holy Family Journey in north Egypt, In section 4, the assumed network model, footstep general architecture, footstep phases and analytical model, and the simulation environment have been illustrated in details. The results of several simulated experiments are discussed in section 4. Finally, we conclude with section 5.

2. Literature Review

In recent years, the scientific debate on smart cities and smart tourism destinations has been growing rapidly Komninos et al. (2013) postulate that the essential elements of smartness for any targeted city are human capital, infrastructure, and information. Mingjun et al. (2012) argue that tourism informatization and intellectualization would represent the future tendency of the integration of the internet of things (IoT) technology into the tourism industrial upgrading. Accordingly, Nam & Pardo (2011) explain that the major priorities for any smart tourism destinations can be depicted by undertaking a demand-side or a supply-side perspective. Consequently, enhancing different tourist experience and offering intelligent platforms to collect and distribute information within local Stakeholders.

Elsewhere, Wang et al. (2013) propose the embedding convergence of smart cities and tourism IOT in China. They further indicate that the emerging smart tourism matches China economic growth and industrial transformation. Poslad et al. (2015) indicates that the development of the Tripzoom systemhas been introduced. This mobile sensor-based system aims to achieve sustainability goals by promoting mobility shifts. This is done by observation of common multiple urban transportation means, and the generation of individual and group mobility profiles that is coupled with the use of a targeted incentivized marketplace. After testing the system in three European country cities for six months the main findings were that the system has achieved a level of behavioral shifts in travelling manner. Cultural Heritage Areas together Context-Aware Systems present a great opportunity where the Ambient Intelligence (AmI) paradigm can be successfully applied. However, the need to design web applications by considering rich internet interfaces requires often a careful study before to include sensor data from the ambient context (e.g. coordinate for position or environmental data). Whereas, Almobaideen et al. (2016) proposed a tool which is MVC-based JavaScript and dynamically connected with sensor data has been proposed to service a cultural site be developing a map area using image gallery. To test this smart image gallery system, called SMART VILLA, an ancient Renaissance Villa, called Villa Mondragone, has been selected as a context of mobile and safe cultural access. NFC proximity smart devices were used to locate each point of interest inside ancient rooms.

Similarly, Palumbo (2015) has suggested the Smart Tourist App (STAPP) which assists mobile tourists via the integration between traditional city card and the mobile devices specifications. This integration is based on qualitative data collected through questionnaires conducted to a panel of Italian tourists visiting Palermo and Rome over a three months period of time. An evaluation of the impact of mobile technology in augmenting and streamlining the tourist experience represented, via STAPP, has been conducted. STAPP integrates Kano Model (KM) and the Analytic Hierarchy Process (AHP) Methodologies. These methodologies allow categorization and ordering of service attributes based on how they are perceived by traveler tourists. Almobaideen et al. (2015) has proposed a new approach using combined criteria to provide a service that suggests geographical routes based on user preferences in terms of public transportation and Service. Public transport mean preferences could include bus, train, metro, and walking. Service related preferences include the best wireless network connection such as GPRS, 3G, and 4G, along the available paths. The combination of these two preferences is highly desirable since a continuous and good internet connection is crucial while tourists moving to sites. Such approach has been modeled and simulated via android java program and then compared with other approaches, one of them is the shortest route selection approach. Results have shown that the combined criteria outperform others in selecting Geographical routes while considering the preferred public transport means as well as staying connected with higher quality network connections.

This paper focusing on last approach for enhancing tourist experience and facilitate their trip in convenient way with good impact in raising tourist attention towards ARCHAEOLOGICAL TOURISM in Egypt, open the door to other historical sites to keep track and adopt ICT towards fulfilling and satisfying tourist needs

2.1 The Holy Family Journey in North Egypt

The Holy Family marched from Bethlehem to Gaza to the Zaraneeq (Filousia) Reserve, 37 km west of Al-Arish, and entered Egypt through the Sinai desert from the northern side, on the one hand of the Farama (Plosium) located in Benin, the cities of El-Arish and Port Said.

a. The Holy Family entered the city of Tel Basta (Basta) near the city of Zagazig in the Sharkia governorate and about 100 km from the city of Cairo in the north-east, in which the spring of Christ was springed with water. The city was full of idols. The Holy Family that city and headed south.
b. The family left Tal Basta (Basta), heading south, until it reached the town of Mostorod - Al-Mahma, about 10 km from Cairo.
c. The word “court” means its place of bathing and it is called so because the Virgin Mary protected the Christ there, washed clothes, and in the return of the Holy Family it also passed on Mostorod and Jesus Christ emanated for him the glory of a source of water still present today.
d. From Mostorod, moving to north of Belbeis (Philips), Belbeis Center, located in Sharkia Governorate, approximately 55 km from Cairo.
e. The Holy Family remained at a tree known as the Virgin Mary's Tree, and Bilbeis also passed by Belbis as he returned.
f. From Bilbeis, the family traveled north to west to the town of Minya Samanoud - Minya Jinnah from Minya Samanoud. The holy family crossed the Nile River to the city of Samanoud (janmooti - prose fly) inside the delta and their people received them a good reception, so Christ blessed them for him with glory The Virgin Mary kneaded him while she was there, and there is also a water well blessed by the master himself and from the city of Samanoud, the holy family traveled north to west to the Burullus region until the city of (Sakha - Khast - Beikha Issus) has now arrived in Kafr El Sheikh Governorate.
g. The feet of Jesus appeared on a stone, and from it the city took its name in Coptic. This stone has hidden a long time for fear of being stolen in some ages and discovered this stone again from about 13 years ago only.
h. And if the Holy Family had taken the natural road while walking from Samanoud side to the city of Sakha, then it must have passed through many of the countries affiliated to Gharbia Governorate and Kafr El-Sheikh and some say that it crossed its way in the wilds of Belqas.
i. From the city of Sakha, they crossed the Nile (Rashid branch) to the west of the delta and moved south to the Natrun valley (al-Asqit). Christ and his virgin mother blessed this place.
j. From Wadi Al-Natrun, he traveled south towards Cairo

3. General Architecture Footstep

The architecture of the proposed protocol is illustrated in Figure 1. As the figure shows, the most important and main components in the architecture are as follows: The tourist hand-held device which is assumed to be GPS enabled and allows the tourist to send a preferences message and get back the required feedback.

3.1 Footstep Components

The first hypothesis stated that “There is a statistically significant difference at (0.01) level between the mean scores of the control group and that of the experimental one on the post administration of the EFL listening test in favor of the experimental group." Each tourism site is assumed to be equipped with small wireless sensors that should be placed in various sections, rooms, squares and others of that site, these sensors collect various information that could be of interest to tourists such as the temperature, humidity, air quality, and location. Location information is sent to the GateWay (GW) node which is a more computation and communication capable device connected to a permanent power source. The GW collects and possibly aggregates this information and sends it to the CU to be placed in the Tourism locations DB. The control Unit (CU) is a major component which resides on the cloud and performs necessary computation based on information that exists in various databases. A detailed description of the CU and the components it contains and interacts with is shown in Figure 2.

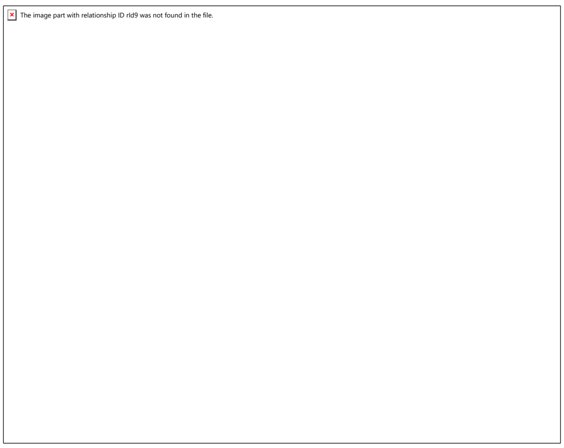

Figure 1. General Architecture of footstep

The Following details are the description of the components presented in Figure. 2. Message Preferences: Sent to the control unit from the user's smartphone and contain the following fields:

a. Time: when the message is created.
b. Location: User location when GPS device creates a message or reads it.
c. Destination: destination intended for the User.
d. Type of tourist sites: A visitor defines the type of tourist sites he wishes to visit, at our research archeological is our aim.

Control Unit (CU): a cloud-centered IoT controller for the processing and analysis of user data. It is related to the DB regional maps, DB network coverage, and DB tourism locations. The CU is composed of the following modules:

1) Reception: This module receives notification of user preferences and inspects the fields thereof.
2) Analysis: This module analyzes the information obtained from the message and requests paths information available between the current tourist location and the suggested tourist destination sites that can be found in the database of the tourist locations. The analytics module selects the best one after consulting the network coverage database for the corresponding network connection quality available over these different paths, among the paths that have been found to lead to a destination.
3) Generation of routes: This module produces the best route based on the information analyzed and using A* algorithm for finding the shortest path and alternates routes in real time and which is known as Google map routing algorithm.
4) Visualization of the route: This module sends back the information to the user and shows it on the smartphone. These systems are linked to the CU. There are three types of databases:
    a) Database of geography and transportation: Contains all road maps and records of transportation types including the services provided on board the means of transportation such as Wi-Fi if available.
    b) Network coverage database: contains information on all geographical areas with their respective cellular network coverage quality.
    c) Database of the tourism venue: Store information on the area, description and current level of the different attractions on each site

Figure 2. Details of CU Unit

3.2 Footstep Phases and Analytical Description

The suggested protocol consists of three phases: transformation of message preferences, analysis of user preferences and selection of geographical paths based on the preferences analysis in the first step, user preferences are transmitted from the user smartphone to the control unit in a message of preferences. The message of preferences includes the location of the user, the type of tourist sites that they want, Whether or not there is a limit on accessibility, and time limits for visiting a tourist site, if any. You can relay this message over Wi-Fi or cellular networks. During the second phase the control unit uses the reception module to access the field of the preferences post. therefore, using the analysis module, it analyses the data that was obtained.

Where α is a weight factor which could be used to give more importance to a certain term in Equation (1) over the other. In our experiments, we have set α to 0.7 so that the contention level of a site (Cont.Sitei) participates more, in the whole weight calculation (W.Sitei) of a site (i), than the distance to that site (Dist.Sitei). Each one of the suggested sites could contain multiple sections. One tourist with special needs could not access some of these sections. If the preference message indicates that the tourist has restrictions on accessibility, then footprint excludes those inaccessible sites from the list of suggested surrounded sites. For each of the remaining sites, and after checking the DB tourism locations, footprint calculates a weight that differentiates as in equation (2) between different sections of that site.

$$w.segs=\delta.segs+ \mu\times dist.segs +cong.segs=1 \qquad (2)$$

For the three above listed weighting parameters, the values 0.2, 0.4., and 0.4 were used to perform the experiments described in section 4.

The next step is to find ways that fulfill three characteristics towards the suggested sites; namely less congested and better coverage by wireless network connections, distance to segment, Wireless network might be a cellular network or a WiFi hotspot, accessible in the vicinity or over the bus. The analysis module retrieves all road segments information from the transportation DB and the network coverage DB in order to calculate the weight for each road segment using equation (2) which illustrates the way of giving weight to each road segment from which different paths constitute. In the third phase, the route generation module in the CU uses the analysis module information (each section of the road and its corresponding weight) to measure and select the best geographical routes to the destination.

A set of potential best paths are then sent back by the route visualization module to be viewed on the mobile user's smart phone. The consumer smartphone information shown should include a route map, transport information and a time schedule to be followed during the journey.

3.3 Footstep Simulation Environment

The proposed approach was implemented on the basis of the simulator adaptation which was introduced in (Almobaideen et al., 2015). This simulator is an android program which was adapted through three phases for this study purpose. In the first step, topology of the transport network, as mentioned in subsection 3.1 The part of the software was introduced during the second step, simulating the architecture described above. This part of the simulator was then used to simulate a tourist preference message which was received, analyzed and based on the calculations provided by the sites, parts and weights of the paths are implemented as defined in subsection 3.3. The third and final step is to use the A* google map algorithm, to find the way to the suggested tourism sites with the best weights [13].

4. Results and Discussion

In this section, we present the results of evaluating the footprint approach through a set of experiments. A tourist travels between six different locations in the next figures, in an order that starts with the first and finishes with the sixth among sharkia journey stations. We believe the tourist wants to visit only six different locations or sites out of the 8 governate available.[14] The selection of these six locations is based on either the shortest distance between these places, as the shortest route approaches, Or on the basis of combined road congestion criteria, the level and convenience of intra-site contention and the quality of the road available through the routes to those destinations, as is the case with footprint, Shortest-with- congestion consistency to the shortest path approach selection criteria. Results shown in those figures represent an average of 36 different random scenarios for all approaches. And for all places that have been visited. This is because footprint chooses the least six crowded places to be visited

On the other hand, the shortest path method relays only on the distance between locations of difference to choose six locations from all available locations. Shortest-with-congestion gives rating 0.8 weight, and the contention 0.2. This inevitably results in the discovery of which results in footprint modest dominance over this metric's shortest path method. In comparison, and since the shortest time possible, the consistency of the network connection is taken into account footprint couldn't be better than shortest, but on two of five routes.

a. very busy places, which by the shortest route to the road are fare beyond the limits of the contention. In Figure 3 the distance between a tourist current location or site and the next site of a total of six is shown as the tourist is moving around.
b. In the Figure. 4 the distance between the current tourist location or site and the next of a total of six sites is shown as the tourist moves around.

Zakazig >telbasta =2.1km
Telbasta>belbes =20km (27 min)
Telbasta>samnoud=61 km(1.20hr)
Telbasta>mustarad=63 km(1.19hr)
Belbes>mustard=44km(59 min)

Figure 3. The distance between the current tourist location or site and the next of a total of six sites

The fact that the shortest route to the path is focused solely on choosing less distant paths enables a tourist to travel along the shortest available paths. Footprint, on the other hand, chooses the less six crowded, least congested, and stronger wireless network served sites to be visited during tourism. This multi-dimensional footprint selection criteria leads to a penalty for traveling along longer paths, which does not necessarily result in longer trip time due to the congestion factor along those paths.

Figure 4 shows the level of congestion over the selected routes between tour sites as tourist movements from the first site to the sixth. Except to move from sites four to fifth footprint can route the tourist through less congested or nearly as congested paths as the paths chosen by the nearest path approach. Apart from moving from the second to the third sites. Footstep could have chosen even less congested routes, but it wasn't because it also looks for paths with better network connectivity to the less crowded, i.e. less contention level and so on. The selection criteria give less weight to the network connection quality which is equal to 0.2 compared to the weight assigned to the congestion level as 0.4. Footprint could have chosen even less congested routes, but it wasn't because it also looks for paths with better network connectivity to the less crowded, i.e. less contention level and so on.

c. Compared footstept, with others in literature.
For example, moving to the first section(zakazig for example) suggested by the shortest path leads to a section with a contention level of 70 percent, whereas moving to the first position suggested by footprint Which could be different from the one indicated by the shortest path, results in visiting a contention level segment of less than 10 per cent.

Figure 4. Footprint level of congestion over the selected routes

This is because footstep proposed an order of sections based on a different element, i.e. the degree of contention, than the distance at which only the shortest path approach relays or the combination of distance and quality of network connection. The more the parts crowded the more time it takes to complete a tour. By taking into account these two considerations, footstep evidently outperforms the shortest way of selecting parts within a site as in figure5.

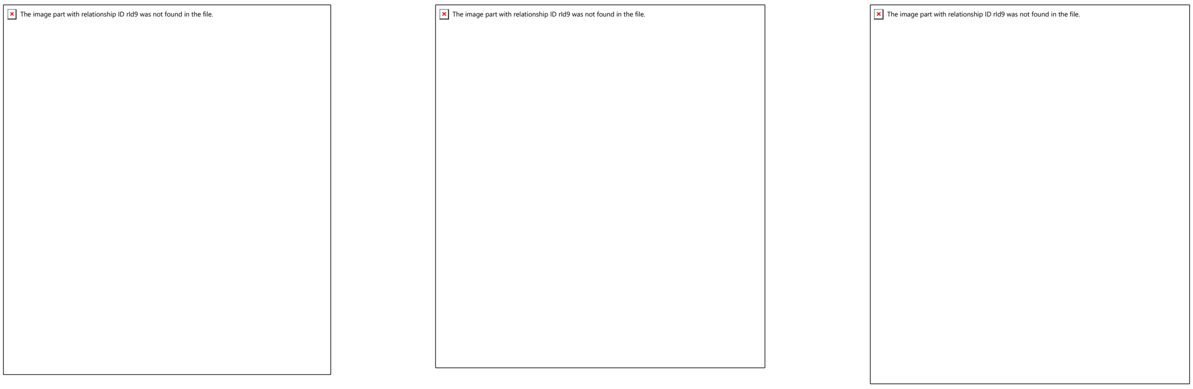

Figure 5. Footprint simulation best destination

5. Conclusion

The application of IOT tools would improve tourist experiences, especially in the context of archaeological tourism. It will also facilitate and support efforts to safeguard and sustain the archeological heritage. Therefore, the purpose of this study was to propose and evaluate the impact of a new approach, footprint, to recommend mobile tourist destinations based on their own preferences in term of location, expressed in a message sent to the control unit (CU). The CU exists within a cloud-centered IoT and has access to various databases fed by information via smart city sensors that capture the relevant information. Results of simulated experiments conducted to evaluate footprint were presented and discussed.

Footstep has been found to recommend more suitable sites in terms of a lower level of intra-site contention and inter-site track congestion, although it may be more distant than others because the paths to those sites are protected by reliable wireless network connections.

However, since footprint selects a set of less crowded, more convenient and open sections within each venue, it enables a tourist to have a much quicker tour with a lot of leisure, By calculating weights with different routes ,footprint found best route to be Zakazig>telbasta>belbes>mustarad

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Conflict of Interest

The authors declare no conflicts of interest

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