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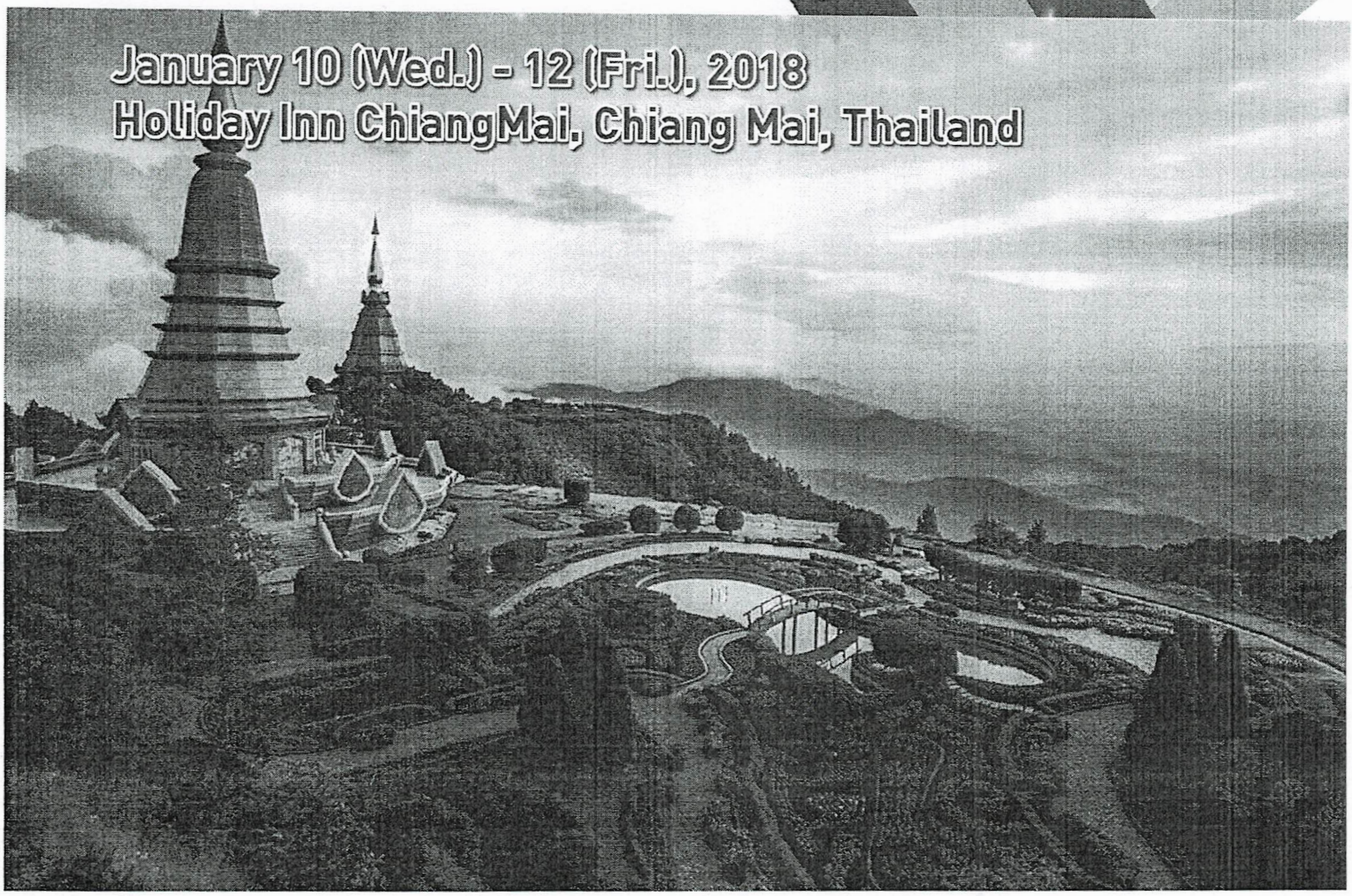

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Poster Sessions
Jan 11, 2018 (Thursday)

P1: Poster

[09:00-10:00] Grand Nanta Ballroom II

Chair: Kashif Naseer Qureshi (Bahria University, Pakistan)

[P1-1] Secure Cloud Computing Algorithm Using Homomorphic Encryption and Multi-Party Computation
Debasis Das (BITS Pilani Goa Campus, India)

[P1-2] The Effect of Datagram Size and Susceptible Population on the Epidemiology of Fast Self-propagating Malware
Luc Tidy and Steve Woodhead (University of Greenwich, United Kingdom (Great Britain))

[P1-3] Identity Based Security for Authentication and Mobility in Future ID Oriented Networks
Rongfei Wan, Bin Da and Richard Li (Beijing Huawei Digital Technologies Co., Ltd., P.R. China); Chuang Wang (Huawei Corporation, P.R. China); Hongpei Li (Huawei Technologies, P.R. China)

[P1-4] Intelligent Sensor Network for Fence Protection
Balazs Voneki (European Organization for Nuclear Research, Switzerland)

[P1-5] Data Trustworthiness in IoT
Sabah Suhail and Choong Seon Hong (Kyung Hee University, Korea); M. Ali Lodhi and Faheem Zafar (COMSATS Institute of Information and Technology, Pakistan); Abid Khan (COMSATS Institute of Information Technology, Pakistan); Faisal Bashir (Bahria University Islamabad Pakistan, Pakistan)

[P1-6] 3TAAV: A Three-Tier Architecture for Pseudonym-Based Anonymous Authentication in VANETs
Ganesh Bellikar (IISc, India); Ashutosh Bhatia (Birla Institute of Technology and Science, Pilani, India); Ramesh C. Hansdah and Sudhanshu Singh (Indian Institute of Science, Bangalore, India)

[P1-7] An Airborne Communication Relay Scheme for IEEE 802.11 WLAN Based Network
Dongjune Lee, Jae Sung Lim and Hoki Baek (Ajou University, Korea)

[P1-8] Cryptanalysis of a Privacy-Preserving and Provable User Authentication Scheme for Wireless Sensor Networks Based on Internet of Things Security
Jongho Moon (Sungkyunkwan University, Korea); Youngsook Lee (Howon University, Korea); Hyungkyu Yang (Kangnam University, Korea); Taeui Song and Dongho Won (Sungkyunkwan University, Korea)

[P1-9] Cryptanalysis of a Chaotic Chebyshev Polynomials Based Remote User Authentication Scheme
Chunyi Quan, Jaewook Jung, Hakjun Lee, Dongwoo Kang and Dongho Won (Sungkyunkwan University, Korea)

[P1-10] Response Driven Efficient Task Load Assignment in Mobile Crowdsourcing
Shashi Pandey and Choong Seon Hong (Kyung Hee University, Korea)

[P1-11] Cloud of Things Based on Linked Data
YunHee Son (Chungnam National University, Korea); Kyu-Chul Lee (Chungnam National University, Korea)

[P1-12] Beam Division Multiple Access (BDMA) and Modulation Formats for 5G: Heir of OFDM?
Pankaj Kumar Dalela, Pramod Bhave, Pushpender Yadav, Anshul Yadav and Vipin Tyagi (C-DOT, India)

[P1-13] Reservation-Based Cooperative Traffic Management at an Intersection of Multi-lane Roads
Myungwhan Choi and Areeya Rubenecia (Sogang University, Korea); Hyo Hyun Choi (Inha Technical College, Korea)

[P1-14] An Efficient Improvement Potential-based Virtual Network Function Selection Scheme for Reliability/Availability Improvement
Dinh Ngoc Thanh and Younghan Kim (Soongsil University, Korea)

[P1-15] Video Streaming Service and CD Sales
Tomonori Manabe and Kenichi Yoshida (University of Tsukuba, Japan)

[P1-16] Broadcast MAC Protocol Using Relative Distance for Periodic Safety Messages in Vehicular Networks
Yafeng Deng and Young-June Choi (Ajou University, Korea)

[P1-17] Blockchain: Challenges and Applications
Pinyaphat Tasatanattakool (Rajamangala University of Technology Suvarnabhumi, Thailand); Chian Techapanupreeda (Thonburi University, Thailand)

[P1-18] Weighted Frequency Hopping Control in TDL for Coexistence of Satellite Spectrum
Seonjoo Choi, Jae Sung Lim and Hoki Baek (Ajou University, Korea)

[P1-19] Mobile Augmented Reality on Web-Based for the Tourism Using HTML5
Piyapong Dangkham (Thepsatri Rajabhat University, Thailand)

P2: Poster

[09:00-10:00] Grand Nanta Ballroom II

Chair: Mrudang Pandya (CSPIT-Changa, India)

[P2-1] An Efficient Rate Adaptation Algorithm for Streaming over HTTP
Waqas Ur Rahman and Kwangsue Chung (Kwangwoon University, Korea)

[P2-2] Design of Marine Environment Monitoring System Based on Open Source Softwares
Sun Park and ByungRae Cha (GIST, Korea); JongWon Kim (GIST(Gwangju Institute of Science & Technology), Korea)

Mobile Augmented Reality on Web-Based for the Tourism Using HTML5

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Abstract—**This research presents the development of the augmented reality (AR) for the tourism in Lopburi ancient city. The main objective is to inform the attraction place's data to the tourist. The interaction with the tourist and the environment is possible in the real time. There are many AR platforms which can be used for the various functions. Each of AR platforms requires specific application. The users need to install the AR application before using. It is not suitable for tourists. The HTML5 application development is allowed in a cross-platform manner. The advantage of HTML5 is that the users can access the application immediately without installation application required. This research uses HTML5 and JavaScript to develop the augmented reality into web-based for support of mobile devices. The attraction place's data will be displayed on the mobile web browser. It is the same as browsing the internet. There are 6 points of interests in this work. The result shows that the augmented reality technology can be used in tourism effectively.**

Keywords—Augmented Reality; HTML5; Mobile Application;

I. INTRODUCTION

Lopburi is located about 150 kilometers north of Bangkok. The Lopburi ancient city is unlike many historical cities. It is mixture of eastern and western building styles. Lopburi, also known as Lawo, was the important city of the Khmer. The Khmer ruins are found around the Lopburi ancient city. During the King Narai the Great's period, Lopburi was established as the second capital. The most of architecture were built with the help of French architects. Now, the ancient city of Lopburi has a potential in physical and facilities that can serve for historical tourism.

The attempt to promote the tourism is providing the creating in the use of technology, such as website and social media. The Augmented Reality (AR) is one technology for making a special experience to tourist. The AR technology allows the user to see the real world with the virtual objects. The paper in [1] studies on the mobile AR for heritage content. The research provides the review analysis to improve the usability of the software product. The AR technology is used in the cultural heritage tourism. The papers in [2] and [3] present the implementation of the AR mobile application for location based service. The three-dimensional information with AR technology is shown in [4] for Islamic cultural heritage. In [5], the research suggests the new system to inform the tourist. The system uses the AR technology with the beacon which can provide the information of the point of interest (POI). The AR technology can also use in the teaching history tourism as shown in [6]. In [7], the mobile AR application is developed for identification the places. The application uses Vuforia SDK for operation on Android. The commercial mobile AR applications already exist (e.g. Layar, Wikitude and Aurasma) but they all require installation on the user's device. It is not suitable for tourist. They have to install the specific application, if they travel to other AR application places.

The HTML5 is a technology which can be allowed in a cross-platform manner. The HTML5 supports the developer to use the mobile device sensors. In [8], the framework for mobile web application using HTML5 is presented. The framework can be used for the implementation of mobile web application. The paper in [9] develops the marker based mobile AR application with HTML5, webRTC and XML3D. The application is a cross-platform supported web browser. The benefit of HTML5 is that users can use the application without installation required.

This paper presents the development of HTML5 in the location based mobile AR application for the tourism of Lopburi ancient city. The AR data consists of 2 parts: annotation part and interaction part. This application is used to promote the tourism.

II. AUGMENTED REALITY ON WEB-BASED

There are 2 methods which bring AR to the web-based application [10]: Server Based Tracking and Local Tracking Services. For the Server Based Tracking, the web browser captures the image and streams to the server. The result is streamed back to the client. In the Local Tracking Services, the application runs on the device. There is no data streamed on the networks. The processes to develop the augmented reality on web-based are enabling access to the device camera, getting GPS data and acquiring sensor data.

A. Enabling Access to the Device Camera

The AR mobile application needs to use the device camera for view the live video of the real world. The HTML5 supports the developer for permission to use the camera. The *getUserMedia* is a method of *Navigation* object which can use the video input device. For using the *getUserMedia*, the developer needs to setup a JavaScript to contain a code to access the camera. The live video is delivered to the specified success callback. The stream working is sent to the *<video>* element in the HTML5 on the webpage.

B. Getting GPS Data

The *Geolocation* API is a specification that provides scripted access to geographical locations of the user device. The method is called when on application requires an updated position (the device changes location). The *Coordinate* object holds the geographic information. There are 2 *Coordinate* object properties to get the geographic coordinate: latitude and longitude. They are measured in the decimal degrees. To calculate distance between two points, the haversine formula [11] is used to find how far it is from the tourist to the attraction place.

C. Acquiring Sensor Data

The mobile device has a built-in accelerometer. The accelerometer is a sensor which can measure tilt and motion. The tilt and motion of the device can be captured with HTML5. The *DeviceOrientation* API provides information from the sensor about how the device is physically oriented in space. There are 3 properties [12]: *alpha*, *beta* and *gamma*. The *alpha* property is a direction of the device according to the compass. The *beta* and *gamma* properties are the angle in degrees of the device which is tilted front-to-back and left-to-right, respectively. The *alpha* property is used to be a direction of the user's viewpoint. The user's viewpoint will be compared to the bearing for checking the same direction. For the bearing, it is the angle between the North and the user's position to the attraction place. It can calculate from GPS data using formula in [11]. Fig.1 shows direction of the bearing and the user's viewpoint to the attraction place

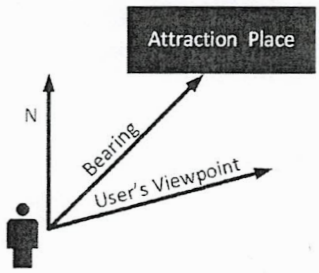

Fig. 1. The bearing and the user's viewpoint.

III. Implementation

The point of interest (POI) is a place which is fixed location and identified by name. In this work, the 6 attraction places are selected to be the POIs. The each POI contains the place information such as name, geographical location (latitude and longitude) and attraction place detail. The information of POIs are used to process for AR. Table I shows the information of 6 POIs. The representation of POI consists of 2 parts: an annotation and an interaction part. The annotation part is a transparent board that displays name and information of POI. The interaction part is a group of buttons for getting more information. There are 2 buttons: phone and website. The user can touch these buttons to take actions, dial phone number and browse the website. The representation of POI is shown in Fig.2.

TABLE I. THE INFORMATION OF POIS.

POI Name	Geographical Location	
	Latitude	*Longitude*
Wat Phra Si Rattana Mahathat	14.798739	100.613898
King Narai's Palace	14.800409	100.611622
Prang Khaek	14.802303	100.611695
Ban Wichayen	14.802981	100.610309
San Phra Kan Shrine	14.802345	100.615002
Phra Prang Sam Yot	14.802980	100.614015

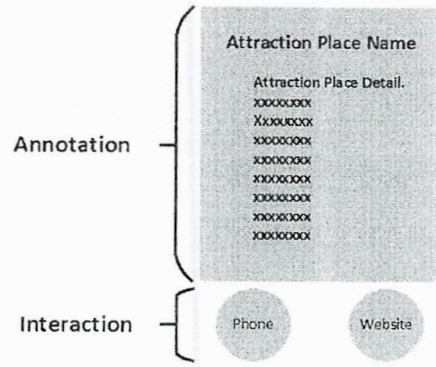

Fig. 2. The representation of POI.

To start AR, the rear camera device is default setting for live video. The camera can be enabled access by using *getUserMedia* API. The live video is used to be a background. Next step, the geographical location user will be read from GPS using *Geolocation* API. The GPS data is used to calculate distance for searching the closest POI. The bearing is calculated from the geographical location of the user and the POI. For comparing the direction, the user's viewpoint is acquired from accelerometer sensor. The tilt and motion of the device can be captured by *DeviceOrientation* API. The *alpha* property is used to be the user's viewpoint. The POI detail will be appeared on mobile screen with 2 criteria. First, the distance from the user to the attraction place is less than 150 meters and, the second, the Δdirection is less than 15 degrees. The Δdirection is the difference between the user's viewpoint and the bearing. In case of the criteria, the POI data is shown on the mobile screen by *Canvas* API. The representation of POI consists of 2 parts: an annotation and an interaction part. The buttons in the interaction part can be touched to take action by using JavaScript (*onClick* event). Fig.3 shows the steps in the mobile AR implementation.

IV. Result

Once user changes viewpoint, by revolving clockwise or counter clockwise, the *deviceOrientation* event will send the data from the sensor. The POI is shown on a screen according to the criteria of user's bearing and the user's viewpoint. The implementation of the AR on web-based is test on the SAMSUNG A7 mobile with Android 6. The application runs

on SAMSUNG internet 5.4 (web browser). In Fig. 4, the user is in front of Phra Prang Sam Yot and the bearing is 356 degrees. The user's viewpoint (direction) is 353 degrees (Δdirection = 3) and the distance between the user and the attraction place is 61 meters. This case is in the criteria (Δdirection < 15 and distance < 150), the POI will be drawn on the screen.

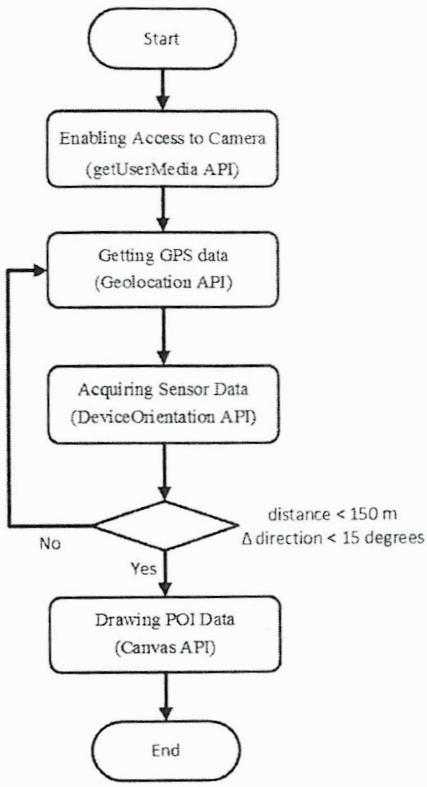

Fig. 3. The steps in the mobile AR implementation.

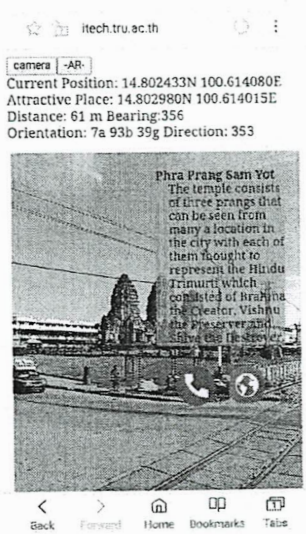

Fig. 4. The POI detail on mobile screen.

There are 2 buttons under the annotation: phone and website. For the phone button, it is used to call to TAT Lopburi. It shows a pop-up menu to take the actions, call or send message. The website button is used to browse the internet for more information. In this case, the TAT Lopburi's website is browsed for tourist getting more detail. Fig.5 and Fig.6 show the interaction with these buttons.

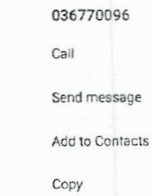

Fig. 5. The action of the phone button.

Fig. 6. The action of the website button.

The user moves viewpoint out of the criteria, the POI will be disappeared. In Fig.7 and Fig.8, at the same location, the user moves the device to left and right. The user's viewpoint (direction) is changed to 321 degrees (Δdirection = 35) and 24 degrees (Δdirection = 28), respectively. So the POI is disappeared. In Fig.9, the user moves location and the distance between the user and the attraction place is 265 meters (distance > 150). So the POI is disappeared.

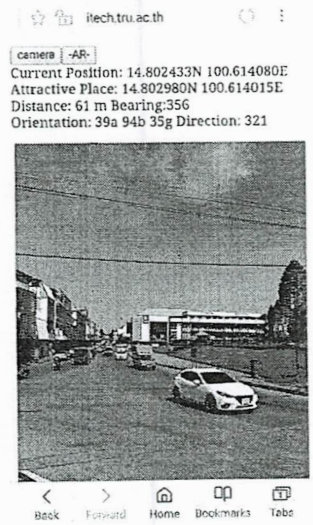

Fig. 7. The user's viewpoint is not in the criteria (left move).

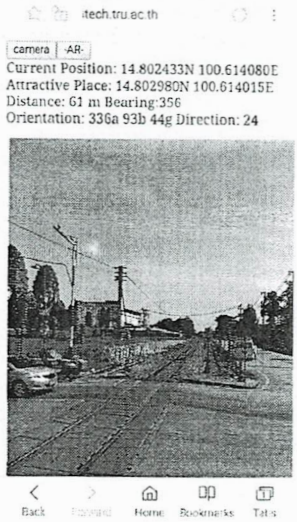

Fig. 8. The user's viewpoint is not in the criteria (right move).

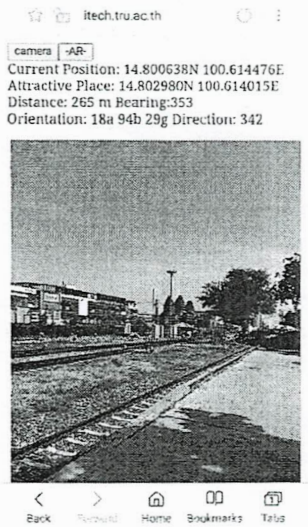

Fig. 9. The distance is not in the criteria.

In order to verify the usefulness of this research, functional evaluation was made by 10 tourists in Lopburi ancient city. The results of the functional evaluation are as follows.

1) Easiness of usage 4.7/5
2) For clearness of display 4.5/5
3) For contents of display 4.2/5
4) Satisfaction as tourist service 4.5/5

For the functional evaluation by tourist's questionnaire, the usefulness of the proposed mobile AR application could be verified.

V. Conclusion

The AR technology on web-based is used to promote the tourism in Lopburi ancient city. This technology can interact between the tourist and the real world. This work uses HTML5 and JavaScript to develop the AR on web-based. It is not installation application require on user's device. The AR solution can be displayed in an internet browser. The 6 attraction places are selected to be the POIs. The POI consists of 2 parts. First, the annotation part is a display of POI's name and information. Second, the interaction part is a group of buttons for dialing the phone number and browsing the website. The results show that the AR can display on the user's mobile screen correctly. The AR technology can be used in tourism effectively.

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