Research into the Personalized Digital Signage Display Contents Information through a Short Distance Indoor Positioning

Sungwook Yoon and Hyenki Kim[*]

[*]*Corresponding Author : HyenKi Kim, hkkim@andong.ac.kr*
Dept. of Multimedia Engineering, Andong National University,
388 Seongcheon-Dong, Andong-City, Gyeongsangbuk-Do, Republic of Korea
uvgotmail@nate.com, hkkim@andong.ac.kr

Abstract

Digital signage has seen its demand increasing with a mergence between ubiquitous computing technologies getting vigorous, in addition to the distribution of mobile devices and the provision of convenience through various application for their users. Furthermore, it has contributed to the expansion of a cultural event area and the raised attention of people. This study researched into the position determination methods which enable a motion scheduling based on the location of people using position determination technology and provide individualized display contents according to the demands for an 'interaction' through bilateral communication, control, responsiveness, personalization and participation. This research outcome is not only expected to enable the utilization and effective delivery of cultural contents beyond the time and space but to elevate a usefulness value of an individual tourism content.

Keywords: iBeacon, Digital Signage, LBS, Scheduling

1. Introduction

When the convenience models using a short distance wireless communication based on a sensor networking system of a smart phone and the Position-based services using a GPS sensor are being vigorously produced, there has been an increasing interest in a model which can make use of a short distance communication system in an outdoor advertising area. This requires a recomposition of display strategies and systems according to the variables that distinguish and segmentalize its vertical sides which offer tailored information for a particular person. There has been no, or least if any, physical limit to the access to information collection thanks to smart phone devices with a unrestricted mobility, which also has expanded an information exchange space.

In particular, the necessity to provide tailored interactive information in a display zone with added interactive factors using statistics on various things like the offline moving line of people and their preferences and habits makes a more efficient provision of information possible. Advertisement mechanism of a low-cost and high efficiency is made as such to expect an active participation of commercials consumers in offline environmental factors and information input, and this brings up a necessity to provide information such as big data analysis factors, event alarms, position base and situational awareness. To achieve this, a digital signage concept can be introduced into the traditional outdoor advertising factors for more participatory advertising effects.

Digital Signage means a multi-media that offers information, entertainment, and advertisement through a digital display installed in public or commercial areas that can be remote controlled[1].

This study designed a position-based digital signage system to provide personalized information for an effective feedback and constructed prototypes accordingly. Particularly, the purpose was to efficiently locate advertisement consumers through a

position technology using BLE, to schedule based on the priorities of consumers' personalized contents, and to make an application to provide contents information for a changeable storytelling by using people's voluntary goals and environmentally adoptable mobility factors.

2. Related Researches

2-1. Digital Signage

Digital Signage is a new media which evolved with a technological development of media convergence between broadcasting and communication, not a changed form of a conventional outdoor advertisement media. Just like technological development and its outcomes affecting various areas, the improvement of digital technology and its outcomes do not just stay in producing new markets but the communication methods under changed media environment are reforming through positive trials.

The change of media environment in a digital advertisement improved the conventional OOH into a new digital advertisement media of digital signage, which has emerged as an attention-getting new media advertisement as with the change in life style.

2.2 Technological Consideration in Previous Studies of Positioning

The researches in the efficiency of space for people pursue an efficient utilization of space through an effective moving line arrangement by taking into account a spacial convenience, practical use and expandability, and suggest solutions to stagnation and congestion in a converging area like entrances and elevators.

There was a study case where a location-based positioning was applied in contents of augmented reality[2] and its deepened case in an in-depth analysis of cognitive science[3], and in another study, ubiquitous technology was applied in a cultural display space and also in educational contents of universities[4]. Generally, a moving line is made from a basic background of a storytelling and composes associated story developments leading to a effective form of display structure. Ubiquitous technology, which helps in display, is becoming a strong supplementary method in enforcing display storytelling factors and getting a meaning as an interactive space[5].

Wireless sensor networking technology that can be utilized in these studies has been used as an amalgamative model in sensor technology which is broadly used in USN in many ways[6]. Recently, in a wireless communication position technology, various position technologies such as ultrasound, RF, UWB and RFID are being used, and there are also others like a FigerPrint positioned with a RF signal using Wi-Fi, an infrared device with an innate ID code, a RF using bluetooth devices, a RFID to exactly recognize a relatively short distance, a UWB which is strong with obstacles and a Colbaborative indoor position using RSSI weighting[7]. The Apple company is pushing ahead with iBeacon which is Bluetooth version 4.0 as a strategic marketing system and The Android side is putting a high evaluation on the BLE system utilization[8].

3. Methods to Provide Information of the Watching in a Display Zone

3.1 Environmental Analysis and Requirements

The scheduling and services for an effective watching in a display zone require an understanding of the precise indoor and outdoor position of people.

The Trigonometry using an existing AP and the Fingerprint using RSSI are good to provide contents using people's in/outdoor positions or position-based services, but it is more realistic only to use them in confirming an entry into a large scale of display zones where an error is not going to be a big deal because services should be provided after the

zone is divided and arranged to map into a RF strength and DB, and the distortions for changed additional obstacles should be taken into account.

In an individual content display zone, it is effective in positioning to assign a matching innate id with each of contents and cognitive devices by using BLE devices. The service environments for people in a display are need to enable to position people through an entry to people's view point and consider obtaining flexibility of scheduling to set up routes like a compulsary course, a recommended course and a user's designated course along the watching courses.

Also, the flexibility in providing contents for each watching area within the flow of storytelling and the indication of personalized information need to be included.

To promote a faithful watching of a certain content, it is more desirable to use assisting devices such as a digital signage, sounds and lights rather than individual devices. To achieve this, the position data needs to be obtained by acquiring sensor network information of smart devices and the meaningful position data has to be operated which can manage a watching scheduling when necessary through an exact indoor position. The watched contents from a current people's location need to have its values adjusted by introducing a weighting value, or the compulsary areas having a long waiting line need to change into a booking status after transferring to another moving line through an estimated waiting time calculated upon its booking. Changing a time for a moving line schedule has to be made at the time of an entry into a zone and setting up a route can be completed by putting a Queue in a booking list for compulsary contents.

3.2 Designing of Routes and Contents Information Provision Scheduling According to Storytelling

When designing a watching zone, a Zone and a content watching region within a zone (Content Service Region) are divided, and a compulsary course for a storytelling (Way Point) is randomly composed for compulsary contents within a zone.

Also, users can re-comprise a compulsary course for a storytelling or a Way Point for a sub-course by differentiating a space organization if necessary.

Through this, when having a long waiting line, the sub-contents can be provided as a personalized form within a flow of storytelling. A watching moving line allows a revisiting and a random movement setting through a user's setting and provides watching information by saving a watching history through positioning. The saved watching postscript is an individualized form which was designed to include performance missions or attainment missions for watchers(Fig. 1).
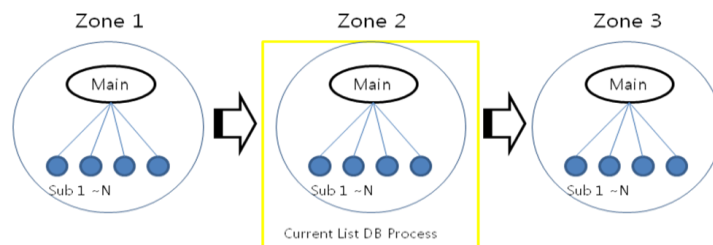
Figure 1. Content Information Scheduling

4. Positioning Display Areas Using Beacon

In order to position a watcher in a display zone, the location information obtained through an indexing of BLE Beacon is mapped and matched with contents. The RF strength of Bluetooth AP or an id verification to locate watchers through Beacon is prompt and relatively economical in terms of installation and maintenance.

The weighting values for basic watching orders and the watching priorities of actually operated display zone can be set up by processing the database position information

compared to Beacon. An example of its application is a display zone of a Korean Culture Theme park development project of Andong-City, and a test simulation was performed in the Confucianism Land. The Korean Culture Theme Park and Confucianism Land include a storytelling-style assignment and a mixed watching order, and the precise division of its zone and each content for a zone makes an application of design easy.

4.1 Individual Positioning for Contents Information Service

People approaching to view contents can be offered additional information about the watching onto a smart device, once position data is exactly recognized. Also, information can be delivered using the installed display instrument, lights or ultrasound audio within a display zone. An effective point facility can be installed on the display using wireless communication modules, and the LED lights to increase attention to the display or the individual sound delivery service using unilateral ultra speaker can be done as well. The Fig. 2 shows a diagram about the possible service arrangements for a watcher of an individual content.
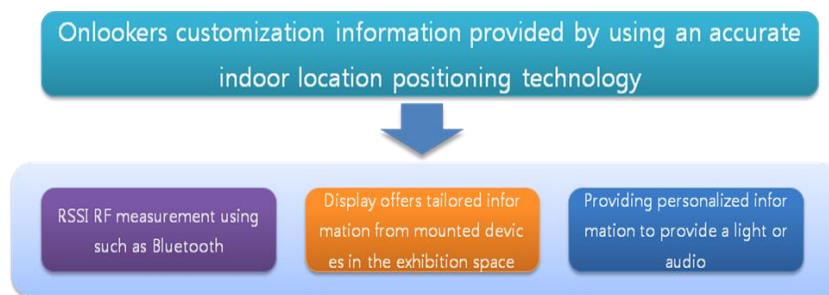

Figure 2. Diagram about the Possible Service Arrangements for a Watcher of an Individual Content

This study designed an evaluation method of a watcher's in/outdoor position which can verify a location from the contents' perspectives as a mixed form of Bluetooth and Wi-Fi AP. Bluetooth is used to catch the three points for a each display zone and recognize a position within a single content through the extraction of a simple id, and Wi-Fi uses data communication to restore information through the position information recognized from Bluetooth AP and its innate Bluetooth id. In addition, position service to see if a watching Zone is operated through the RF strength of Wi-Fi. Verifying a Bluetooth id matched with a display content requires relatively less resources than an existing Radio Map DB positioning of Wi-Fi signal strength in terms of the network overload or the use of DB.

4.2 Designing of a Watching Scheduling

The real-time positioning of database generated from Wi-Fi Open Radio Map which is to identify a position within a storytelling Zone and the creation of database by measuring signals at the continuous ROAD spots through each AP and also measuring Wi-Fi strength at each area and detailed spots in sub-agency facilities need to be done. Each of the indexed content zones is entered using Bluetooth AP or gets the number of waiting people checked at the same time. After creating a certain route link, certain locations within a route are matched with routes in San-Sung town and a queue booking information is created together with database weighting values.

This database is added to a waiting people list field for each region. Database for a waiting people list increases a valid waiting list which directly registers in a queue and reduces a rate of valid waiting for people waiting for a certain time at the main event areas, then restores a database record. It can also be used as a variable that can change a valid moving line by a new scheduling, depending on the level of attention of watchers. With a compulsary moving line necessary for the development of a storytelling put at a

basic moving line and added a weighting value, when there are many waiting people at each block, a booking waiting list can be operated and concurrent events can be recommended by comparing the number of people in a waiting line at main events, how many people can be accommodated for each main event and a running time for a main event for a day after calculating how long it takes to walk the longest distance between zones within the same zone. As an indication of a content positioning outside and within each of the indoor zones of Confucianism land, iBeacon was installed in an individual watching contents zone and the location data was collected using Wi-Fi AP from each zone.

In the Client as a watcher, a log for a schedule is changed and temporarily saved using the sensors of smart devices and the collected data of each zone from the servers at the time when communication was possible is utilized to be available for people by transferring contents services to the application based on indoor position, then the outcomes are posted back to the smart devices or servers.

In each minimum unit of the contents indoor display zone of the Confucianism Land, Bluetooth AP was installed and a valid distance was identified using a RSSI strength that was transferred to a smart device to verify an id of Bluetooth AP. Wi-Fi AP identified any breakaway within a zone by designing RSSI database as a form of Fingerprint to recognize a large Zone and maintained a validity of a queue registration in the compulsary watching zones. It was possible to use this in an outdoor watching zones for an effective use. When installing Bluetooth AP, cognitive distance information and weighting values are saved. Database was created by measuring the RF strength of BLE AP and arranging a Fingerprint list after deciding a signal strength with a decided contents coordinate.

4.3 Application of Provision of Personalized Information

The design of a personalized scheduling was based on the San-Sung town of Korean Culuture Theme Park and it was made to provide an effective scheduling, digital signage contents according to a watchers' moving line, a watching order, and an application of storytelling. The Fig. 3 shows an aerial view and a facility layout of San-Sung town.
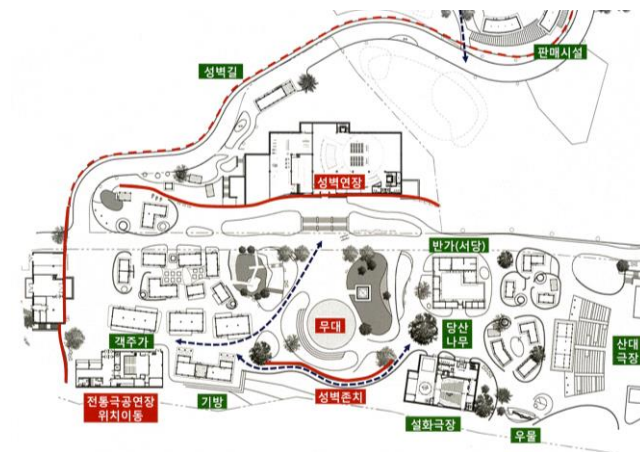
Figure 3. Setting the Viewing Path Point

The Fig. 4 is a diagram showing a distance from a ticket office to the last event place and a watching route in order. The main moving line starts from a main entrance connecting every display zone allowing a free watching of Gaekjoo Madang(peddler's yard), Kwana Madang(yamen's yard) and Banga town. The main moving line goes in an order of the main entrance, a traditional play venue, an army experience centre, a fable theatre, a Sandae theatre, and there are various experiences and events ready in place between the moving lines.

Figure 4. Digital Signage Content Map of the Area-specific Storytelling Progress

The available facilities with the detailed events and decides basic priorities of each facility and event along the main moving line and the sub-moving lines according to the existing storytelling of the Korean Cultural Theme Park. Basically, if a weighting value of a nearby zone is a positive number, it is going to be a recommended moving line for the next watching direction. In a zone with a reset weighting value due to no recommended route that was caused as a result of a completed process by re-visiting a already watched zone, the nearest zone from the main moving line can be recommended for the next moving line. The links to the valid moving lines were created using a MapController and MapView of Android API Location Manager and its location-based services and maps.

5. Conclusion

Provision of contents using BLE Beacon is possible in various fields as a multi- sensor networking system and especially, a provision of position-based information in a place crowded with lots of watchers is necessary. It is possible to design a model applicable to a theme park that enables a scheduling and a position-based service according to a watchers' storytelling. Like this, scheduling a position-based service can apply to theme parks and let watchers make an effective use of a cultural space as well as encourage an efficient operation of a theme park. One of its benefits is providing various contents within the same category while increasing an efficiency of a waiting time by recommending an alternative route in a zone with the calculations of a weighting value for each view point within the route rather than just providing a simple watching route.

Acknowledgements

References

[1] S. H. Chae, "Digital Signage of content-based industry status and outlook", Korea Creative Content Agency, no. 6, **(2012)**, pp. 1-22.
[2] K. G. Han, "A Study on contemporary space in Ubiquitous society - Focusing on Interactive space", Korean institute of interior design journal, vol. 21, no. 3, **(2012)**, pp. 50-57.

[3] K. H. Shim, "Cognitive Science and Cultural Politics of Image -Tasks and Perspectives of Visual Cultural Studies in the Age of Ubiquitous Computing", Korean Association for Studies of Philosophical Thought, vol. 24, no. 2, (2013),pp. 179-231.

[4] Y. J. Won, "A Study on the Exhibition space using storytelling - Focus on the visiting type of circulation path", Korean institute of interior design Conference, (2013).

[5] B. T. Ahn, "A Study of Smart Campus Education Service based on Ubiquitous", Journal of Advanced Information Technology and Convergence (JAITC), vol. 11, no. 5, (2013), pp. 137-146.

[6] Y. Seo and J. Ahn, "Novel Method for Enhancing Contents Recommendation Accuracy Using LBS-based Users Viewing Path Similarity", International Journal of Multimedia and Ubiquitous Engineering, vol. 8, no. 4, (2013), pp. 217-226.

[7] S. K. Kang, H. K. Kang, J. E. Kim, H. Lee and J. B. Lee, "A Study on the Mobile Communication Network with Smart Phone for Building of Location Based Real Time Reservation System", International Journal of Multimedia and Ubiquitous Engineering, vol. 7, no. 2, p(2013), p. 17-36.

[8] J. J. Yang, Z. H. Wang and X. Zhang, "An iBeacon-based Indoor Positioning Systems for Hospitals", International Journal of Smart Home, vol. 9, no. 7, (2015), pp. 161-168.

Authors

Sungwook Yoon, He is studying Doctor course in multimedia engineering from Andong National University, Korea. His research interests include multimedia contents, e-book and Internet of Things.

Hyenki Kim, He received the B.S. and M.S. degree in electronics engineering from Kyungpook National University, Korea, 1986 and 1988 respectively. He received Ph. D. in electronics engineering from Kyungpook National University, Korea, 2000. He joined Andong National University in 2002, where he is currently a professor at Dept. of multimedia engineering in Korea. His research interests include multimedia system, mobile app. and Multimedia communication.