New Navigation System Combining QR-Code and Augmented Reality

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Abstract

Cloud computing system owns a good environment of growth by the fast expand of Internet. The most important key is that Internet has been conducted to everyday basic life. It could be easily access and save from places and items, which letting now the smart mobile cellular phone device growing vigorously, and develop countless of applications along with it. The research combines augmented reality, QR code with cloud computing to establish a cloud navigation system. Throughout the ability of camera from the cellular phone device and apps of QR code, transmits to the operating system by the local wireless networking. After it sends back to the user along with information such as video motion clip and music. Mean while augmented reality uses Park Navigation to identify immediately live scene, letting what is filming through digit information translating telling the user its location, no longer need old style map that costs confusion from the inconvenience of immediate display of information. In addition, augmented reality can also be uses to introduce details to what is need Park Navigation, along with QR code to interact on each other to be more pluralism and letting cloud system to be more perfect.

Keywords: QR code, Augmented reality, Navigation system, Cloud computing

1 Introduction

The diversification of mobile device's application program, many-sided hardware integration and the development of wireless Internet bring application program a developing environment. We can use wireless Internet by utilizing sample base stations instead of being restricted to the inconvenience of the wire. This is a gospel in a lot of industry and business, and the information share also becomes a part of people's lives. Using various functions of application program makes people be able to utilize lots of computer's functions on one's person and makes our lives more convenient. The immediateness of information is also a big point. People always hope to know the information well any time and any place; for example, today' weather and sending out and receiving mails, both of them are parts of our lives. In the environment, the word "Cloud computing" is produced. The Cloud service which is offered by cloud computing [1-2] is that we do not have to use carrying device, send data to cloud server and compute and resend the result to carrying device. Nowadays, every technology draws close to the Cloud because it has the characteristic which can save the cost, and it doesn't confine too much carrying device's efficiency; as a result, it becomes the target that the business aim at.

Augmented reality has become one of the application smart automatic devices combine. Combining real environmental image with fictitious one, users are able to operate things in the environment they can see with their own eyes. It adds fictitious information to the monitor which users see, making them interact with the environment on the screen. The interaction is immediate and can generate 3D effects.

Conventional guiding ways are mainly pictures and words explanations or tour guide. They are really manpower-consuming. Besides, along with the increasing amount of new pictures and words, the printing cost has become more and more. From the view of environmental protection, using smart mobile guidance can not only prevent much unnecessary waste but also renew at any time.

In view of existing internal navigation system situation, there're a few questions can be discussed in the aspects of multi-media application and equipment limit.

(1) Although internal navigation systems are diverse, people seldom use smart mobile devices. It is mainly based on pictures and words explanations. Printing guiding documents to users produces too much uncalled-for waste. In addition, related documents are often out of value and be discarded after used. Moreover, when the information renews, we're not able to control how many copies we have to prepare.

(2) The navigation system can't be cancelled thoroughly. How to control resources effectively and custom service are main points. Rigid explanations without vivid images or real articles can't arouse users'

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emotion effectively.

(3) If users want to obtain information, they have to gain it through counters or guides. If in a too broad environment or the turnover rate of exhibits is high, it will cause users much inconvenience. Altering guiding routes will waste even more resources. Relocating everything's place is very inconvenient for administrators and users. How to know the stream of people on the guiding routes in time and in what direction the thing we want to observe in order to make it convenient for users to navigate timely are final objectives.

In order to bring more convenience to the society, the research builds a bridge between users and administrators via the transmission between smart mobile devices and wireless Internet. Through QR code and augmented reality, the guiding process can be smoother. This research hopes to achieve the goals listed below.

(1) Break the limitation that navigation systems have now. For example, GPS isn't appropriate for indoor environment. This research will break the limitation, optimizing the wireless environment, which magnifies the functions of navigation systems. Besides, it will diversify guiding ways and reduce the large waste of human resources cost.

(2) Save resources cost. Most navigation systems aren't digitized now; this leads to the difficulty of mobile guidance. Old-typed guiding ways make use of considerate papers; they're both rigid and environment-unfriendly. The recycling benefits are limited after papers are used.

(3) Lower human resources needed and make users and administrators obtain information convenient and fast through the management of cloud. In this generation, the park's information renews all the time. How to utilize cloud management to do better management, plan a navigation system and it is convenient for users to use and for administrators to change immediate information.

2 Related Works

Navigation systems in existence are mainly divided into some categories. Conventional guiding ways, making use of papers and human resources, put the park's contents on papers. If we have some questions, we can ask guides. This undoubtedly represents that navigation systems need large quantities of cost and human resources. Used hard copies can't be recycled to use; used papers are thrown away everywhere and then cause environmental pollution. These are the problems worth discussing. In recent years, web navigation system is the burgeoning one. It advocates a digitized environment. In consideration of environmental protection, administrators only need to renew servers' contents periodically, and they can manage the system easily. However, the disadvantage is that administrators have to build machines used to question; keeping them in good repair and managing them in a long term cause new problems. As a result, people develop the mobile guidance technique finally. It has one more character than web navigation system, which is mobility. Every field also weeds through the old to bring forth the new. For example, personal guide, electronic business applications and routes planning, and so on.

2.1 QR code Navigation System

QR code navigation system is composed of four elements, which are websites, download ways, smart mobile devices and the main part of navigation system. The function of websites is to offer elementary information sources. Introducing things in the park briefly through websites can make users know them initially, and the websites can introduce the navigation system at the same time [3-5].

Part of QR code navigation system must be combined with smart mobile devices. The operation roughly divided into four parts, decoding QR code, comparing files, broadcasting speech sound and downloading files. When users use the camera in smart mobile devices to take a picture of QR code tags, the application program belonged to the cell phone will interpret them and then open simple download functions for users.

2.2 Augmented Reality Navigation System

Augmented reality navigation systems divide into tagged one and non-tagged one. Tagged one is used more often on smart mobile devices. First, administrators have to find out what contents they want to navigate, making them fictitious and becoming 3D, and then store them in servers, providing them for users to download before using guidance. This is the images showing up when users read tags of augmented reality. Through smart mobile devices, administrators can add scenes to lives, which can let users see the information hiding in them [5-7].

2.3 RFID Navigation System

RFID also known as radio frequency identification, which is improved from some contact identification systems in common use. Tags of identification don't have to contact with readers and the system can read the information because RF signals send the information wirelessly. Because of the property, it's suit to enter navigation systems [8-11].

Most museums lend users readers because the operation of readers is simple. The storage capacity of RFID system is larger than other tags which need to be read and it's also larger than tags of QR code, so it can store considerable information in it. RFID can give the information to users directly, without being managed by servers.

Another way is often practiced in campus. It can

build regional strongholds through these devices by putting active RFID readers in the park. When readers receive tags, it means that users are in this region now. When we use smart mobile devices to seek it, we'll first search for the newest site of this tag in the database. If users accidentally enter regions banned to get in, the system will remind them timely. It's better application to management and we only have to renew servers when renewing information.

2.4 Navigation System Combines GPS with RFID

The navigation system which combines GPS with RFID is divided into several parts, smart mobile devices, access network, multimedia servers and message servers. Through GPS location, smart mobile devices can display the park map and guide information, and users can know where they are at that time. If users read tags via RFID readers in buildings, the system will send the identification numbers on tags to multimedia servers through wireless Internet and make servers transmit the information to smart mobile devices [12].

Via satellites, GPS can transmit longitude and latitude to systems which serve as map guide service. However, GPS isn't appropriate to be used indoors. Stick RFID tags on corners or intersections which have directions. When users need to know their current places or the guide information, they only have to aim readers to tags to read them, and then the system will send the guide information which is needed according to smart mobile devices that are identified at the beginning.

2.5 Navigation System Combines GPS with Augmented Reality

The navigation system which combines GPS with augmented reality is often outdoors. Users can carry smart mobile devices that have functions of wireless transmission and camera. When users move in the park, the screen will add the information that real space adds. There are two ways to use it. One is to add the information needed to the screen after check the scenes by GPS location. The other is to inlay tags augmented reality use in the scenes and read the information directly. Location adopts GPS and electronic gyroscopes because GPS can only be used properly outdoors. However, in point of current techniques, the system can't do location very accurately, so it is the one developing harder [13].

3 Integrated Navigation Systems

When users enter the park, the situation happening most often is that they don't know the internal arrangement so they have no idea where they can visit first. This system combines augmented reality with wireless LAN location, and it can recognize where users are accurately. Moreover, it can narrow the identification range and decrease the time, and servers can also lower the burden. The navigation system builds mainly integrates QR code and augmented reality with cloud. It gives users pictures, speech sounds and 3D explanation. The system doesn't need guides which waste large human resources, and users can obtain the guide information made for customers.

3.1 Cloud Navigation System that Integrates Augmented Reality and QR Code

The main frame is to use the camera function that smart mobile devices have, combing with augmented reality and QR code to navigate users. When an application program takes tags these two systems set, the tags will be transmitted to managing servers through regional wireless Internet and be classified. The system will determine the information that is used to represent the tag in cloud. QR code mainly uses word information and linkages. When users receive instructions received from smart mobile devices they read sound messages from QR code through linkages, and the system will start voice guidance. Augmented reality sends scenes that camera photographs or tags back, and then transmits them to cloud after they're classified by servers. Next, cloud asks for information from augmented reality servers, judge images the smart mobile devices send back, and proceed with the operation of augmented reality system. Without operating in smart mobile devices, the hardware need of them has decreased a lot. Operating in augmented reality needs a processor which is good enough. The results of operating may be a picture or a film that can be transmitted. This doesn't cause regional wireless Internet too much burden. When the results are sent back to smart mobile devices, users can get the service they ask for. The process is showed as Figure 1 and described as follows.

Step 1. Users use the camera function of smart mobile devices to identify tags of QR code or augmented reality. Guide mode is to pick environmental images to let the cloud servers of this system compare.

Step 2. Send the information which is interpreted in tags back to servers through regional wireless Internet, judge that whether it is a legal request, and record the MAC addresses of smart mobile devices which send out requests so that when the information is sent back, the system can make sure that whether the user is the same and within the service region.

Step 3. Judge that whether they're demands of QR code tags or augmented reality tags through the managing servers. If yes, send out messages to ask cloud servers to supply corresponding service.

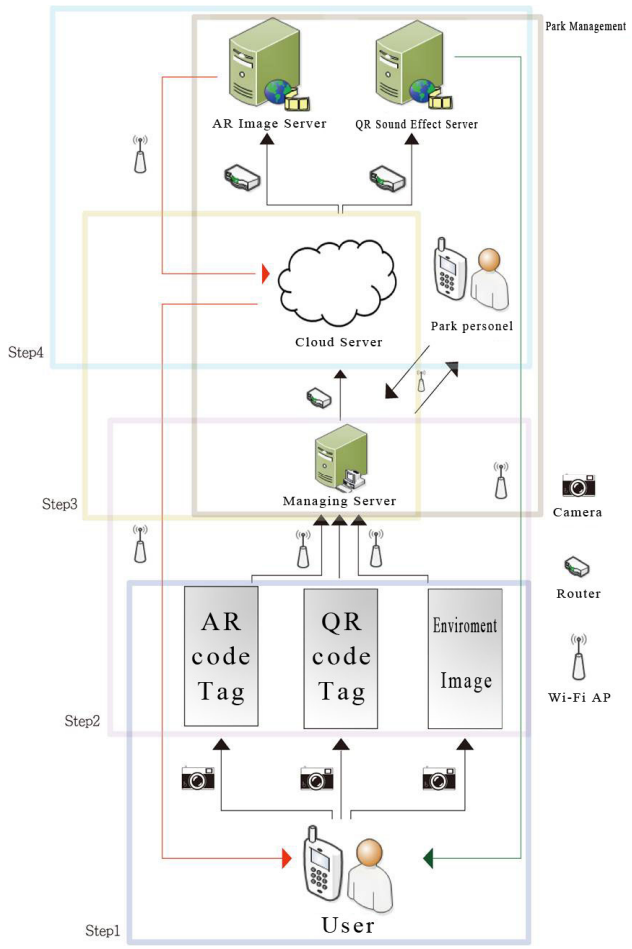

Figure 1. Cloud navigation system

Step 4. After cloud servers receive demands, they only have to check demands sent out from managing servers and locate the region where users are, and the system can start operating. Cloud servers judge linkages of QR code and ask sound effect servers in certain region to send the video guidance to users. Augmented reality is to ask video servers in certain region to send images back to cloud servers and transmit computed 3D picture files according to the flow loading extent at that time. As for navigation systems, cloud servers in them ask video servers for the environmental images, compare them, label destinations that users want to navigate in the images they pick, and send the operation results back to them.

In the aspect of the park management, members in the park can inform users within the range of the newest information through wireless Internet and manage the guide contents. They put the guide information in sound effect servers and augmented reality video servers of QR code through managing servers and set a data base in managing servers. When users send out their requests, managing servers can make sure whether there's the file. If the file loses its linkage, managing servers can tell members in the park to handle it. In this way, it can decrease the time repairing the system.

3.2 Integrate the QR Code System of Cloud

QR code systems are composed of smart mobile devices, sound effect servers of QR code, managing servers and cloud servers. There's a function of sound effects because users need sound effect guidance. After users read QR code, they get word explanation first, and there isn't sound explanation at that time. When users click sound explanation, the system will transmit linkages which are interpreted by regional wireless Internet back to managing servers. After linkages are checked by managing servers, they'll be given to cloud servers, and cloud servers will determine what sound effects they should send out. Next, they'll send messages to ask audio servers to transmit stream audio files to smart mobile devices, which can make users enjoy the sound guidance. The steps are showed as Figure 2 and described as follows.

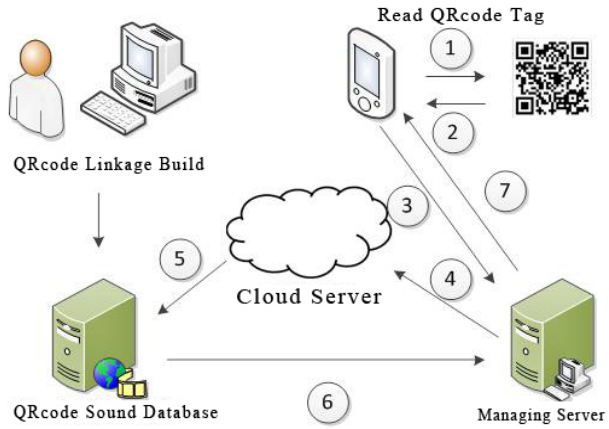

Figure 2. The flowchart of QR-Code System

(1) Users have to own smart mobile devices which have the camera function and choose to install the application program this system supply. They aim at tags of QR code with the camera.

(2) Users utilize their computers and identify the tags through the camera in smart mobile devices. There are two tags. One is simple guide messages that are pictures and word contents, and the other is website linkages.

(3) After tags are identified by the application software of the system installed in smart mobile devices, the system will send out requests to managing servers via wireless LAN. Besides, the system will add the IP address of wireless base station used when being transmitted to the information that is requested to identify from what region messages are sent out in order to let cloud servers differentiate.

(4) After users send linkages that are identified by QR code to managing servers with wireless LAN, managing servers check the MAC addresses of smart mobile devices, remember them, add the IP information of the wireless base station which sends out messages to the information, and transmit it to cloud servers.

(5) After cloud servers receive the request, they check what region is it sent out from first, and then send out demands to sound effect servers of the region, check the linkages are correct, and prepare sending out sound files.

(6) Sound effect servers check prepared file lists and linkages which managing servers get from users again. If they're correct, the sound effect files will be handled by managing servers; if the identification fails the request of cloud servers will be turned down.

(7) After managing servers receive the files then check whether users are still in the range where the wireless LAN gives service. Next, the system check the MAC address and sends sound effect files to smart mobile devices to let users start guiding.

3.3 Integrate Augmented Reality System of Cloud

The main outfits of augmented reality system are smart mobile devices, managing servers and cloud servers. Augmented reality produces feelings that reality and illusion exist at the same time. It adds fictitious information to monitors people see to identify special pictures or scenes around. Besides, it piles images or information drawn by computers with the world users see precisely and the image will show on monitors. After users build 3D images and surrounded maps offer identification, the system will supply cloud servers to let they check. The steps are showed as Figure 3 and described as follows.

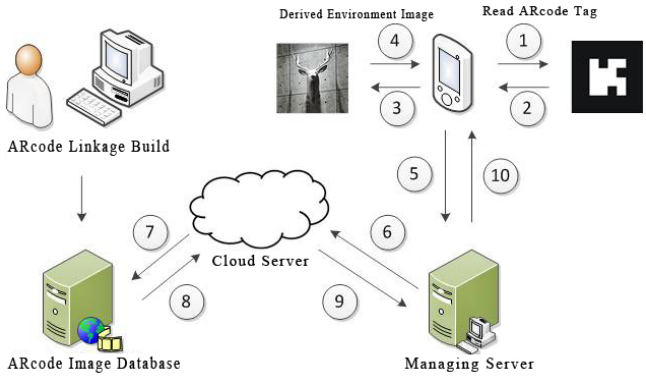

Figure 3. The flowchart of augmented reality system

(1) Users have to possess smart mobile devices having the camera function and choose to install the application program this system supply. When users choose augmented reality guidance, there're two types. The application program will check whether there are tags in the range of identification. If there are correct tags the system approves, they'll be read immediately.

(2) Use the application program to take a picture of tags of augmented reality which are generated when users utilize their computers and identify the tags through the camera in smart mobile devices. The contents of tags are all 3D image linkages.

(3) Suppose that there're no tags of augmented reality within the range, ask users whether they would like to use environmental guidance function. If they agree, they can find out the objective they want to navigate from the lists. After the target is identified, the system will use the camera function of the application program and choose symbolic scenes to take a picture of them.

(4) After smart mobile devices retrieve scenes, the system will consider whether the pictures should be taken again according to their definition. Sometimes light, shake and many factors can affect the location judge.

(5) After the application software of the system installed in smart mobile devices recognizes, if the contents are correct images or linkages interpreted by tags of augmented reality, the system will send out requests to managing servers via wireless LAN. Besides, the system will add the IP address of wireless base station used when being transmitted to the information that is requested to identify from what region messages are sent out in order to let cloud servers differentiate.

(6) After users send augmented linkages that are identified by smart mobile devices to managing servers with wireless LAN, managing servers check the MAC addresses of smart mobile devices, remember them, add the IP information of the wireless base station which sends out messages to the information, and transmit it to cloud servers.

(7) After cloud servers receive the request, they check what region is it sent out from first, and then send out demands to 3D image servers of the region, check the linkages are correct, and prepare sending out 3D image files. If they're environmental images, they'll be identified in cloud servers. It's easier to find out the places and decrease the probability of identifying wrongly.

(8) After cloud servers send out requests to video servers, video servers will transmit images in the region to let cloud servers to compare them so that they can find out where users are and then add guide information to images. 3D images given from linkages of augmented reality need to be compressed according to the crowded level of wireless Internet at that time.

(9) Cloud servers send 3D image files or images which are added space guide information back to managing servers and check whether the requests are correct with them. The system checks the requests first because the flow of images is large. If the identification fails, transmission of images will be turned down. Users can break off the transmission during the process in order to decrease unnecessary waste of flow.

(10) Managing servers transmit files which are already operated to smart mobile devices, and make 3D images interact with users. If users choose environmental guidance, they can get extra information of space from images that they photo early and the

system will show the direction of objectives on images. If users doubt the results of identification, they can compare them with maps the application programs supply. If there're mistakes, users can use the system to identify images again.

4 System Analysis

Compared with the existing navigation system, there are some advantages shown as follows:

(1) Compared to the original navigation system which doesn't integrate the QR code of cloud, its application is more diverse. It can give more multimedia information, and the information is no longer only descriptions of words or pictures. Besides, it saves much room of tags. The contents were stored in papers before; however, this system uses linkages, so it only needs to renew the servers and it can be utilized continuously.

(2) Compared to the original navigation system which doesn't integrate augmented reality of cloud, it has higher-speed judgment ability because the speed of operation will rise when combining with the cloud system. The system uses wireless base stations to be the standard of location. This way can promote the identification ability of augmented reality. Moreover, it can narrow down searching range because regional differentiation, and lower the operation ability that carriers need.

(3) Compared to the navigation system using GPS location, because the location skill isn't impeccable today, it has to collocate several kinds of skills to make it locate more precisely and to make the error smaller. In this system, it only has to locate through wireless base stations can it make cloud servers judge more precisely and do more diverse application.

(4) Compared to RFID audio navigation system, it has absolute predominance of cost because readers cost a lot. Users have to learn how to operate them from the beginning. Whether tags that are carried or readers, both of them are not what users own originally. Therefore, it's easily damaged or lost, and this leads to some problems that the navigation system has to renew its tags or equipments frequently.

(5) Compared to the navigation system which combines GPS with augmented reality, it can be applied more effectively. In general, it's unfavorable to large-scale judgment by using augmented reality system; however, it's appropriate for the recognition under mid-range. It's much burden of servers by searching for large amount of information. After adding cloud servers to the system, it can operate more effectively and also make users whose carriers don't have enough efficiency to operate augmented reality enjoy the service of using augmented reality guidance. GPS has to locate for a long period; therefore, it lacks immediate information. Especially when users are in where are too many shelters, it's easy for GPS to lose locations or misjudge. As a result, it can't offer users right information and this problem will lead to the inconvenience of guidance.

5 Conclusion

How to build a set of navigation system, save abundant human resources and make guidance no longer paper information which lacks of interaction. These are all main points the research works on hard. The research can make smart mobile devices lower large amount of operation and save the electricity, which can maintain long-time online and obtain better benefits. Using Wi-Fi to locate the position can control the stream of people in effect, and the system can offer proper routes, which makes guiding not a system that can only indicate the direction. The establishment of regional wireless Internet creates wireless environment, makes routes smoother and maintain stable transmission speed between users and systems. It will be in favor of the information that augmented reality shows or the information transmission QR-code links, and it can reduce considerable time, creating a navigation system with which users can really interact.

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Biographies

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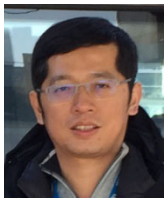

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