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VR-based Location Aware System Modeling: Providing Location Information for Urgent Requests

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Abstract
Today, LBS(Location-based service) is widely used for various internet services such as traffic information, tracking delivery of shopping goods, and entertainment. For example, many people use map applications of smart phones when they go to a place for the first time. It is, however, difficult for them to receive appropriate information when they are not familiar with smart phones or have difficulties in using smart phones due to surroundings problems. The information system is designed to provide users with real-time traffic information and to help them travel safer and faster.

Keyword: location aware system, smart phone, supporting system

INTRODUCTION

The number of systems using LBS(Location-based service) technology is increasing as smart phones and mobile communications have been widely used. Representative examples of the LBS-used systems are navigation systems for automobiles and map applications such as the google map[1]. The LBS technology uses different systems such as D-GPS, A-GPS, TOA, IRDA, and computer vision according to kinds of services.

Many portal services provide users with information of affiliated companies using map applications. Also, there are a lot of LBS-used systems such as giving users with shipping location of Internet shopping mall orders and with location information of public transportation including buses and taxies. When a user is inside a building, the user can receive location information through the trilateration method from mobile networks like Wibro using information between APs. Especially, the coverage of LAS(Location Aware System) based on smart phones is divided into three categories: macro, micro, and ad-hoc. It has the widest location recognition when using GPS and mobile Communications. It is easy for users, who are familiar with smart phones, to find their first trip ways to travel using location information from various sources.

However, this method may not be easy for users when they are not familiar with using smart phones or when they have difficulties in recognizing surroundings according to weather conditions or night time. Considering every means, including systematic supervision, the simplest and most effective way is a direct instruction by a human who exactly knows the nearby geographic information.

VR(Virtual Reality) has been widely studied in a variety of fields such as sailing vessels, checking pedestrians, and assistive technology. Furthermore, it is able to be applied in real time through expanding computer vision[2-4]. This thesis studies developing technology which allows right beside guidance in reality, adopting VR system to ordinary navigations. In addition, the thesis aims at proposing developmental direction of lbs services through practical experiments.

METHODOLOGY

Characteristics of users and situations are considered in phases of system analysis and design. The system is based on the MVC model and elements of devices are web-server, smart phones, and VR devices as the figure 1 shows.

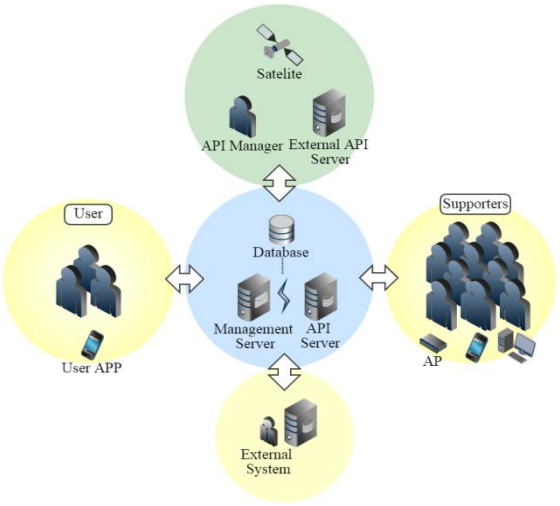

Figure 1: Organization of System

For convenience, the system senses information through GPS sensors and 360 degree cameras of smart phones, not through the usual RTLS(Real Time Location System) Tag. The web-server communicates with users and supporters using external api. When a user clicks the send-button after shooting VR images using a 360 degree camera, the server sends the real time streaming to a supporter through HTTP(Hypertext Transfer Protocol) communication[5].

System Usage

- Situations: urgent requests for location information, requests for rescue
- Users: those who are not familiar with using smart phones
- Surroundings: bad weather, night time
- Road conditions: narrow and complicated alleys or mountain areas, which are both difficult to find ways through navigations

System Architecture

The server system is composed of the apache-tomcat, an open-source, from the perspective of infra-structure[6]. The master table of database is divided into three tables: users, supporters, and history. Each table has a user sequence as a private key, as the figure 2 shows. And Entire Architecture is shown figure 3. In order to improve the system performance, update query and insert query in the same flow are combined into one transaction. The function of the system can be divided into two: functional modules and security modules according to a detailed specification of system. Functional modules include deploy and monitoring of an operation aspect and those of a maintenance aspect.

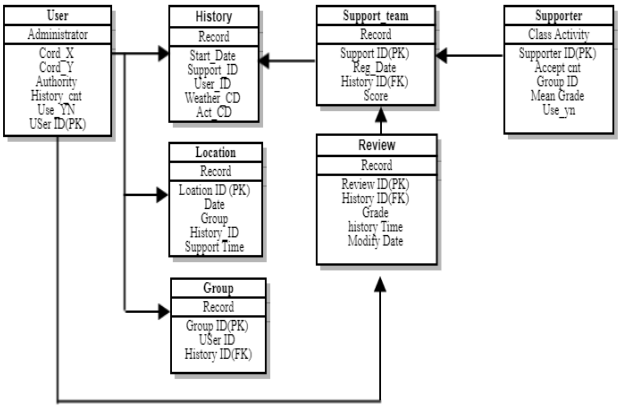

Figure 2: Database Table Schema

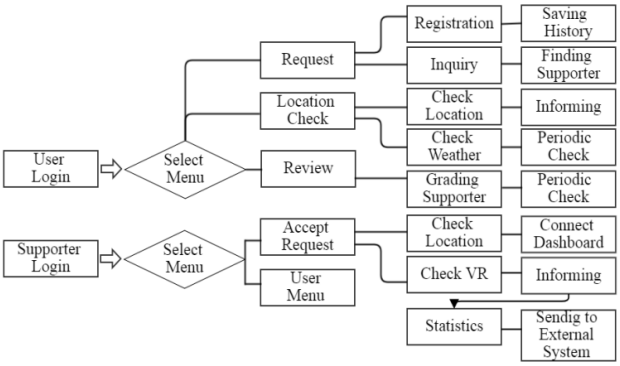

Figure 3: Process Flow

Functional Modules

- Sending users' requests

When a user requests location information through a smart phone on android platform, the system sends a SMS to a supporter registered in the database[7]. When the supporter clicks the confirm-button, the system starts connection with the user.

- Sending VR information

: As shown by fig5, images shot through a smart phone are sent to a supporter. The supporter is able to check the VR images and a map by the dash-board. The INSTA 360 air camera is used to shoot VR images[8] It is able to attached to a smart phone because it is small enough by 26.5g Weight and 37.6 mm diameter. Users can send photos as well as VR image. The dash-board provides users with VR images and map by T-MAP API[9], as the figure 4 shows.

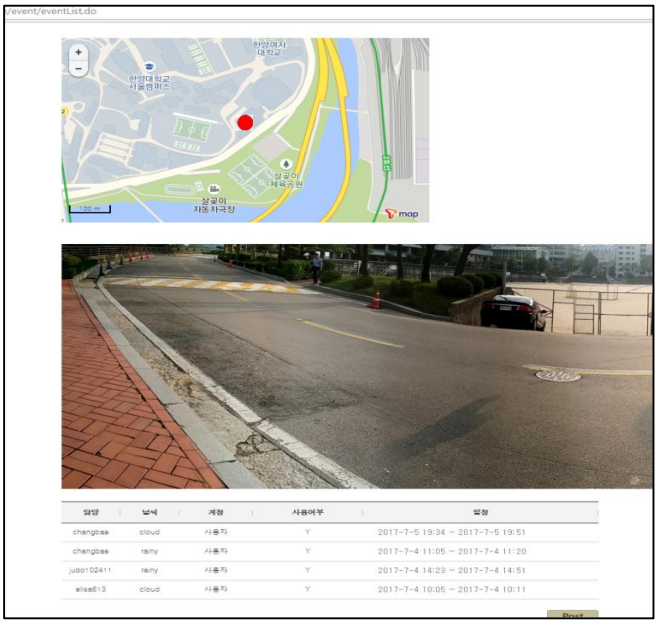

Figure 4: Dashboard of Supporters

- The external interface of information history

: As shown by fig6, when the external interface is needed to expand the system, the system processes interface, giving information of debug log and history log in the SAM (Seauential Access Method File) file through daily batch job as the figure 5 shows.

- System monitoring

: The system gives the system administrator an alarm message when there happen situations like database lock, connection pool of middle ware, or CPU issue of system Daemon.

Functional Modules

The system certifies user authentication through Q&A with non-face-to-face identification method, which is widely used in the Internet Primary Bank[10]. In order to prevent system server-side hacking, secure coding is developed, adopting Cross-Site Scripting(XSS) and SQL injection[11]. The maintenance issue is solved by processing secure method into common server package.

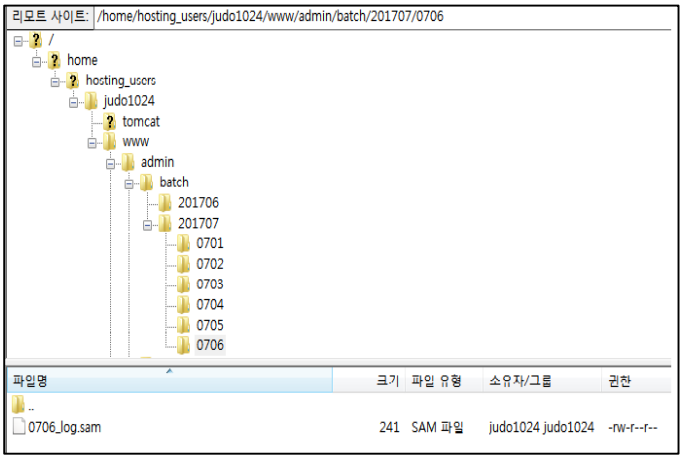

Figure 5: Results of Batch Job

EXPERIMENT

The performance test is conducted for six times during three days from 2017.6.19. to 2017.6.21. The test is designed to process ten client requests simultaneously for six functional categories, and the items needed to improve are deducted as shown by table 1. The highest error rate was shown when a number of users try to approach to the external API at the same time. In that case, the error was caused by interference between each process and by java script errors. Therefore, all communications of each device are modified to use asynchronous communication.

Table 1: Error rate of Performance Test

Module	Error rate	Cause of error
Sending requests	2%	JAVA Servlet exception
Sending VR information	6%	Database connection error
System monitoring	8%	Middleware Thread Pool
External interface	14%	XML Parsing error
System Batch job	6%	JAVA Servlet exception

CONCLUSION

This thesis proposes a direct supporting prototype using VR. VR is adopted in order to overcome one-dimensional limits that present mobile navigations have. Users will be able to use the system conveniently because the system provides stable streaming with users in video-sharing platform just like YOUTUBE, only under conditions of stable wireless communication of users and stable LAN.

These days, there are a wide variety of organizations which need to check location information, including public institutions such as police stations as well as LBS-based business men. In addition, more customized functions, which match characteristics of each organization, need to be studied in order to satisfy personal needs.

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