THE INTEGRATION OF LOCATION-BASED SERVICE AND AUGMENTED REALITY TECHNIQUES TO A ROAD MANAGEMENT SYSTEM

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ABSTRACT: It is almost impossible for road engineers to monitor every road and to successfully and promptly maintain and rehabilitate any defects that have been identified. Therefore, the monitoring and reporting of defects in road systems contributed from the public are indispensable. Location-based service (LBS) has been applied to mobile devices with mobile positioning functions to provide users with location-specific services. Augmented reality (AR) is a technology which can support users in manipulating virtual objects in real environments, and thus can be used for road management with far less time and costs. This study developed a mobile road management system (RMS) on a mobile phone under the Android platform by integrating LBS and AR technologies using Java programming language. Both the public and road engineers are able to download the mobile RMS for free, for anytime and anywhere monitoring and reporting of in-situ defects in road systems. The reported information will be uploaded and saved in the server and then automatically updated to the mobile RMS on road engineers' mobile phones. By using LBS and AR technologies, the time and costs of maintenance activities can be significantly decreased since routes of maintenance activities can be planned in advance and the neighboring defects can be instantly identified and processed, which conforms exactly to the current policies of the "The Public Oversight of Public Works Projects" and "Smooth Roads Project" in Taiwan.

***Keywords**: Road Management System (RMS), Location-Based Services (LBS), Augmented Reality (AR), Maintenance Activity, Mobile Phone*

1. INTRODUCTION

Defect recognitions and immediate reporting assist road authorities in assessing the condition of a road system and then implement maintenance activities [1]. However, it is almost impossible for road authorities to monitor all roads simultaneously, merely based on road engineers. Therefore, the monitoring and reporting of defects contributed by the public are indispensable. In view of the maturity of mobile telecommunications technology, this study presents the development and implementation of a road management system (RMS) which includes a mobile RMS on mobile phone and a web-based RMS based on location-based services (LBS) and augmented reality (AR) technologies.

2. MONITORING AND REPORTING MECHANISM OF A ROAD SYSTEM

It can be commonly observed that different parts of a road system are in various stages of disrepair. Effective monitoring and reporting of conditions ensure that improvements are prioritized in an efficient and organized manner to deal with defects in a road system and for efficient coordination of maintenance activities. A visual "windshield" type survey is the primary inspection method to monitor and report current conditions, and identify the defects in a road system [2, 3]. Then, reporting is undertaken to request contracted maintenance agencies for immediate or planned maintenance activities.

3. DEVELOPMENT AND IMPLEMENTATION OF THE MOBILE RMS AND WEB-BASED RMS

This study developed a mobile RMS on a mobile phone and a web-based RMS embedding the LBS and AR

technologies (Fig. 1). LBS [4, 5] are able to instantly transmit information on defects from the public or road engineers' mobile phones to the web-based RMS and from the web-based RMS to field road engineers' mobile phones. AR [6, 7] provides the function of superimposing virtual objects (defect icons of pavement and traffic facility) upon the actual scene for display on the screen of field road engineers' mobile phone. The mobile RMS and web-based RMS are shown in Fig. 2 and Fig. 3.

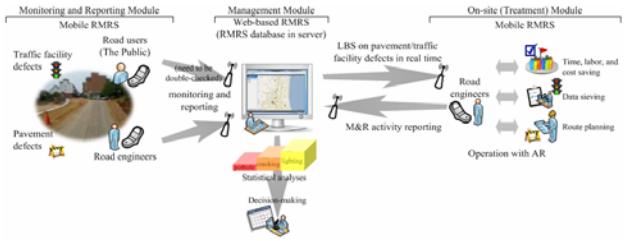

Fig. 1 System architecture.

Fig. 2 The mobile RMS.

Fig. 3 The web-based RMS.

5. CONCLUSIONS

In this study, we developed a RMS system by using Java programming language based on the LBS concept, including a mobile RMS on smart phones and a web-based RMS. Road users and road engineers can use mobile RMS to report defects. The reports are uploaded to the web-based RMS and displayed to the field road engineers for maintenance activities. We also develop the AR technology in the mobile RMS, so that field road engineers can obtain real-time reports on-site, and plan the route and resources for neighboring defects when conducting maintenance activities. Thus, the entire system not only improves the existing web-based RMSs, reduces the reporting and response time, but also lowers the risks to lives and property due to late response.

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