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City-Logging System Design for Conversion City Information Service

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Abstract

Background/Objectives: The currently operating system of city information is not working smoothly due to not only the utilizing problem of existing infra but also the irrationality of separated operation for each service, but also the lack of providing service that is integrated with various information. To address these problems, this paper proposes a City-logging system. **Findings:** This study suggests the system of City-logging that is providing a convergence service of city information for the purpose of solving the above mentioned problem. The suggested system is to provide the information such as a traffic census, a police control of illegal parking and stopping, and the monitoring of air pollution. **Improvements/Applications:** After analysis of collected data from the mobile monitoring equipment, as the service is provided, the security network for the purpose of improving accuracy and safety of information is built and data is encrypted to deal with privacy. The proposed system will be realized and the efficient operating method of city information service will be suggested after this.

Keywords: City Information Service, City-Logging System, Data Fusion, GPS, Ubiquitous, U-City

1. Introduction

U-city is established by the concept of the Ubiquitous computing applied to the space of a city[1]. It provides various kinds of convenient functions due to the convergence of city space between the state of the art infra of ICT (Information and Communication Technology) and Ubiquitous computing for the information service. A city information includes the information of commercial and public which is necessary for the urban integrated operation and an urban information which is necessary for the urban integrated operational service. Also there are various information included such as an urban information of producing and managing by a local government, a linked information of related offices which is necessary for local government's work and services, and a sensor information of real time collection .

But the utilization of city information did not proceed very smoothly at the point of an operation status of the present city information. This phenomenon is due to the three kind of factors explained below. Firstly, the operation of Infra installation is difficult. There are a lot of technical problems to solve in case of implement-

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ing maintenance of an existing infra inside city such as roads, facilities, communications, and other service.

Secondly, the operation of each service is separated respectively. In a state of building a task operation system for each related office, an upgrade has not been made efficiently due to the lack of two-way communication as some similar services are managed in redundancy[2].

Thirdly, the supply of various total services is not available. The total service for the portal site operation and the integrated management of various information such as administration, culture, environment, and traffic does not work properly. Complaints about the latest technology and public service have increased because of not satisfying requirements of civic qualities.

This study suggests a city-logging system that provides the service of smart city information in order to solve the above problems. The suggested system provides various services such as a traffic census, a police control of illegal parking and stopping, and the survey service of air pollution to merge and analysis of collected data using potable observation equipment. The converged data is composed of that of CCTV, GPS, temperature and humidity, gyro, illumination, ozone, and air pollution.

2. Relevant Study

2.1 The Elements of City-Logging System

The City-logging system is composed of three steps. Firstly, the potable survey equipment collects data. Secondly, Collected data using City-logging system is stored by the form of metadata and is analyzed by data fusion. Thirdly, the various services such as a traffic census, a police control of illegal parking and stopping, and the survey service of air pollution are provided according to the analyzed information[3].

A data which is collected information such as city imagery, GPS, temperature and humidity, luminous intensity, environmental pollution, and noise through observation equipment is recorded in real-time in City-logging system.

The sequency diagram of City-logging system according to the data flow of each step is shown in Figure 1. The mobile sensor transmits the data to a Collector on a almost real-time basis. A Collector is to verify mobile sensor and is to receive data from sensor that is only finished verification.

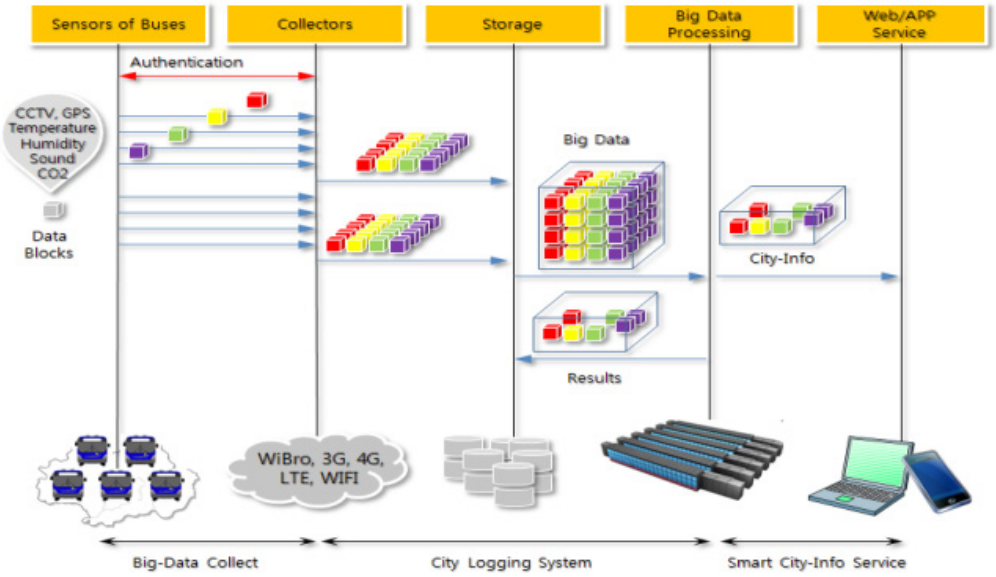

Figure 1. Composition of a city-logging system using mobile observation equipment.

This process is necessary so as not to happen the problems of City-logging system due to the wrong data. These data are accumulated in the storage and are supposed to analyze through Big Data Processing. The result of analysis is stored again in the storage and is to make good use of the service of city information.

2.2 The composition of City-Logging Big Data

There are many vehicles driving on the city street. The created information from various sensors attached in vehicle as well as the ambient images are transmitted on a almost real-time basis. In order to achieve the above it is necessary not only to build the wireless network but also to collect data of streaming and text generated by vehicles operating other areas. In this study these data considered as CLBD (City-logging Big Data)[4]. In order to process and analysis of collected CLBD, it is possible not only to save and manage data efficiently in the large capacity of storage but also to provide quick search by a variety of methods. A scale out technology is used for the efficient management of CLBD. The method of scale out is able to expend linearly an independent system according to the required performance. It is very useful technology to expend linearly when needed performance and capacity. The performance and capacity as well as the amount of process will be able to increase linearly after adding storage without stopping service.

The analysis of streaming media produces various index and information in case of CLBD that is generated in real-time. The primary index and pattern information are produced in the process of data. The primary index is produced by using computer resource of crowd in the streaming media. In addition to index, the pattern information is produced by using the generated additional information and its process is shown in Figure 2.

The primary index information is largely composed of Poster Cut and Partial Story Cut. Partial Story Cut is set up and divided the area of streaming with the image processing and is a process of selecting image which is appropriate for the average of divided streaming. Poster Cut extracts summary information and produces index from streaming media providing a Tilted Display type for the average image of Partial Story Cut. In particular, Power Cut is used key words for searching the encryption system.

2.3 The Composition of Security Network for City-Logging System

A City-logging system provide the function of security in order for not only verification between equipments of image and sensor and their collectors, but also the data encryption against data transmission through a wireless network, but also the privacy of image content including voice. In this study the observation conditions of air pollution for the city street surroundings are to be logging on a almost real-time basis after collecting and analyzing the GPS information, time, and air pollution information. That makes it possible to provide the service of index for city environment that becomes smarter.

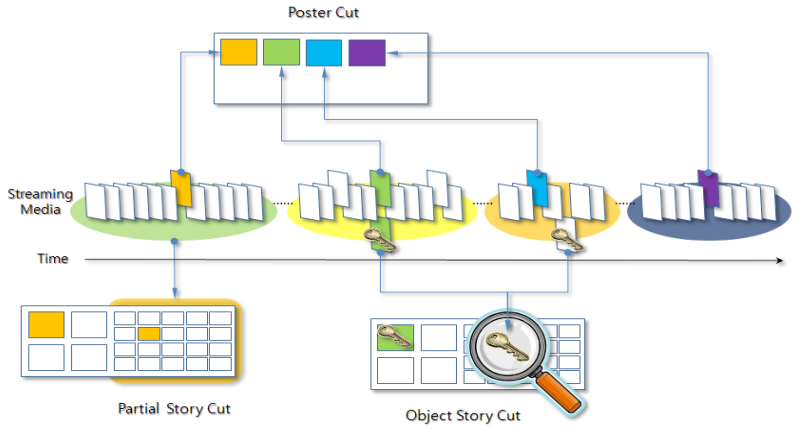

Figure 2. Process for CLBD index.

2.3.1 Certification

The procedure is necessary for mutual identification for the purpose of data transmission between various sensors and data collecting devices, certification, and procedures for the authorization of IA&A (Identification Authentication and Authorization).

2.3.2 Encryption

After finishing IA&A between image and sensor devices and data collecting devices, then the certification procedure for streaming data transmission between transmitter and receiver will be completed. Packaging streaming data performs encryption before packet in order to send a packaging streaming data.

Encrypted packaging streaming data which is collected packet in the receiver side is produced. Decryption is reverse process of encryption as encrypted packaging streaming data is converted in original packaging streaming data.

2.3.3 Privacy

The image and sound of passenger inside vehicle and people around road may infringe on privacy. The raw data saved storage in City-logging system is saved as encrypted. The image processing completed the privacy treatment only is to decrypt and able to use the public purpose.

3. The Convergence Service of City Information

3.1 Recognition of Multiple Vehicle Objects by Multiple Camera

The observation device analyzes road condition. The movable device records image of downtown street surroundings periodically. It needs to recognize images from computer vision technology to do that. It is required objective recognition algorithm by multiple camera to calculate exact number of vehicles within certain range based on recognized image.

There are lots of difficulties to recognize and trace multiple objects in the real world. Some objects are stopping, some are slowly moving and others are moving irregularly. To trace multiple objects, we need to resolve following issues; 1) Problems caused by trace for one object such as change of appearance, irregular moving and lighting change, 2) Overlapping and scrambling caused by objects themselves. Although R&D for moving camera and objects enables us to show the most general natural phenomenon, it is difficult to overcome change of the background since camera also moves with objects. It is required to find moving objects under same background and trace moving objects irrelevant to background.

Figure 3 schematizes a concept about recognition of multiple moving objects. Some conditions are provided

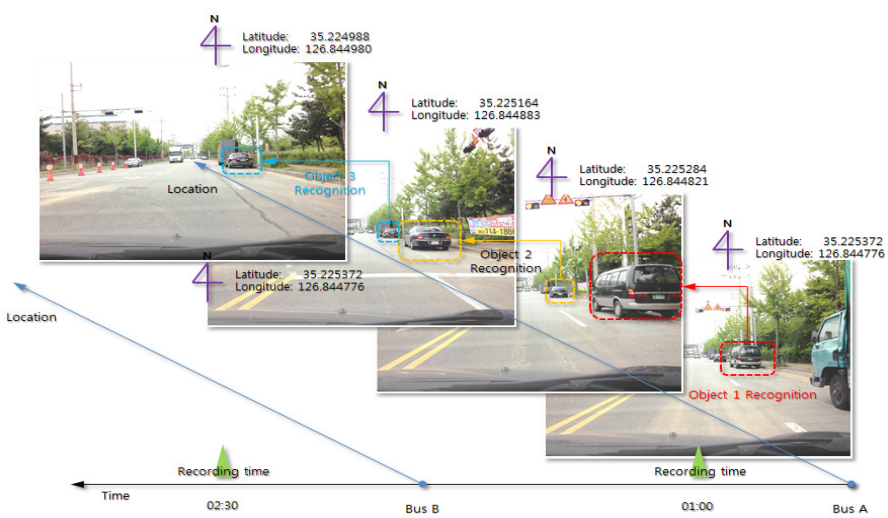

Figure 3. Recognition of real-time multiple moving objects.

to moving objects within certain area among the input images and managed as follows.

The process of condition management algorithm for moving objects secure total process time by handling every 3 frames not by 1 frame in 30 frame images per second under the condition of normal process such as object detection by smoothing and vehicle image measurement. We need sampling and correction of the object area, and separation of multiple objects, sampling of object information and trace stage.

3.2 Parking and Stopping Regulation

Multiple cameras realizes vehicles violating parking and stopping to the side of road by using recognition technology for multiple moving vehicle objects. Figure 4 shows the example.

Assuming Bongo car is recognized as it is parked to the side of road in the images transmitted by bus A at 1 pm, if identified same car is still parking at the same place in the images transmitted by bus B at 2:30 pm, it is certain that the car has been parked over permitted time so that the car violates parking and stopping.

3.3 Traffic Measurement Service

The traffic information on the roads is measured by multiple cameras under the recognition technology for multiple moving vehicle objects and provided to citizen. Algorithm for measuring traffic is needed to do this. The amount of traffic can be measured based on the objective recognition information for multiple vehicles recognized imagery information of multiple cameras. It is necessary to define the size of the statistical traffic in order to measure the amount of traffic. Using a defined a degree of traffic congestion and GPS information, an algorithm to measure the traffic volume which is recognized in the databased major terrain is researched and developed. Figure 5 illustrates an example of a service using the measured traffic volume of data observed.

3.4 Observation Service of Air Pollution

The Korean government established the air pollution measuring spots for building the air quality monitoring network in 1980 to identify the atmospheric contamination and to obtain the basic data necessary for the air quality improving policy. It has developed air quality monitoring network system after adding the network of measuring air pollutants in major atmospheric environmental substances since 2000. The air quality monitoring network of Korea is divided for the installation purpose[4]. One is an air pollution monitoring network to measure air quality reference materials and the other is a special air pollution monitoring network to measure other sub-

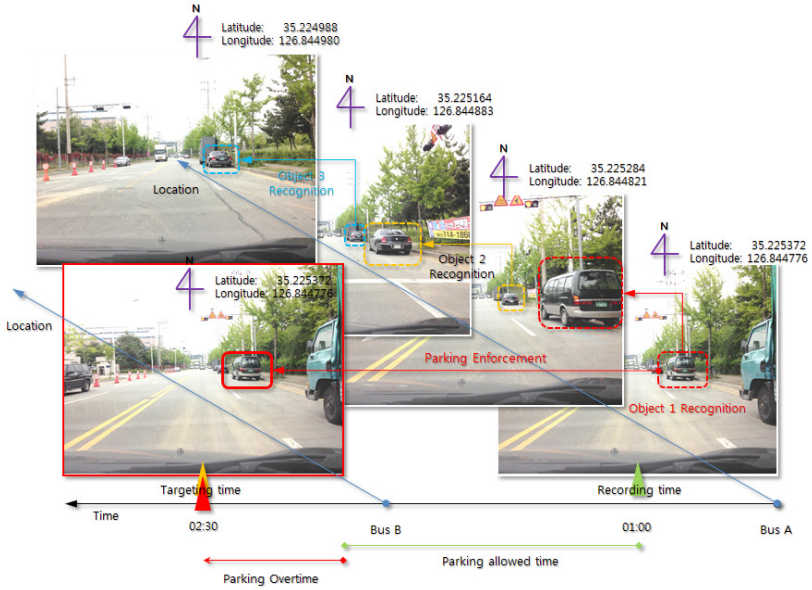

Figure 4. Example for regulation of car parking.

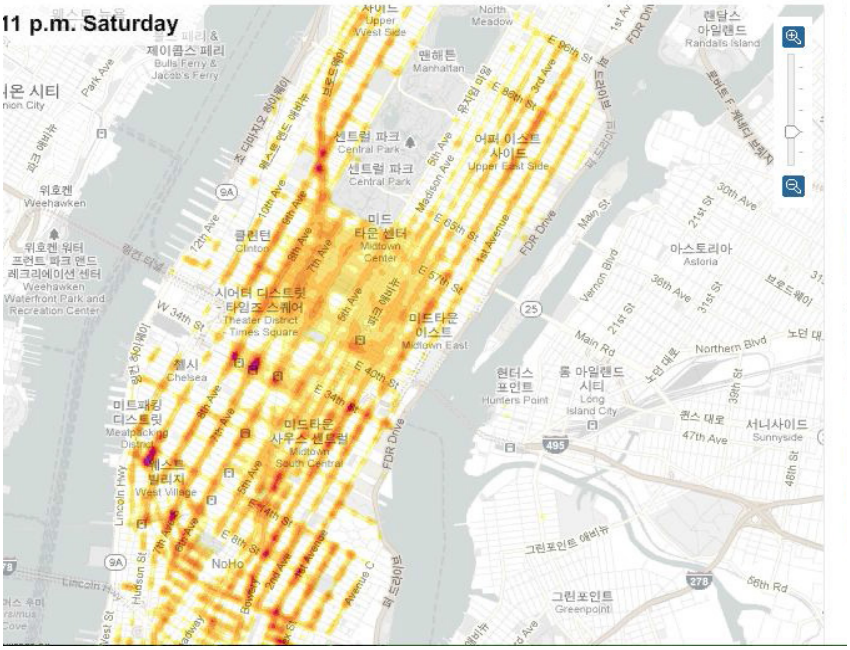

Figure 5. Example of an observation service using traffic volume.

stances in the air. The air quality monitoring network can be operated by single or combined networks according to the situational purpose.

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4. Conclusion

The currently operating system of city information is not working smoothly due to not only the utilizing problem of existing infra but also the irrationality of separated operation for each service, but also the lack of providing service that is integrated with various information. This study suggests the system of City-logging that is providing a convergence service of city information for the purpose of solving the above mentioned problem.

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5. Acknowledgment

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