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DETECTING SIGNBOARD INFORMATION OF SHOPS FOR REVISING CAR NAVIGATION DATABASE USING VLMS (VEHICLE-BORNE LASER MAPPING SYSTEM)

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ABSTRACT:

Map database for car navigation systems accommodates a variety of urban information such as gas stations and convenience stores to satisfy growing users need. Though map databases are revised once or twice a year, it may not be very satisfactory not only for car navigation services but also for future passenger navigation services, because many new shops are constantly emerging while many of the others disappearing through severe competition for survival. Nevertheless, actual map manufacturing work still depends on labor-intensive methods. Field survey is carried out based on the claims from customers. There's a real need of improving efficiency to serve "fresh" data. VLMS (vehicle-borne laser mapping system) is developed to acquire three dimension data in urban area reliably, quickly and at high resolution for 3-D urban GIS database. It consists of three laser scanners, six line cameras, INS and GPS. The platform vehicle can be operated at 40km/hr. In addition, the high-resolution imagery and spatial data can be applied to acquire sign-board information of urban facilities, for example, convenience stores and gas stations and so on. Since signboards of certain types of shops, such as convenience shops have "standardized" color, shape and logo, and are mounted on wall at specific height to attract someone's notice, it's possible to automatically identify them with image-processing methods. This paper describes methodologies and the results of applying VLMS imagery for the automated revision of signboard information.

1. INTRODUCTION

Many new shops are constantly emerging while some of the existing ones disappearing through severe competition for survival in urban area. Map databases for car navigation systems are revised once or twice a year. It may not be very satisfactory for various navigation services and future passenger ones. Nevertheless, actual map manufacturing work still depends on labor-intensive methods. It's quite necessary to improve a method to keep feature attribute information current. We can acquire 3-D data in urban area reliably, quickly and at high resolution for 3-D urban GIS database using VLMS (vehicle-borne laser mapping system). The high-resolution imagery and 3-D data of VLMS can be applied to extract signboard of franchise shops and to revise urban GIS database.

2. VLMS

VLMS consists of three laser scanners, six line cameras and the combination of GPS / INS. Three laser sensors acquire 3-D Data, while six line cameras acquire three direction texture data on both roadside. The platform vehicle can be operated normally at 40km/hr. The resolution of line camera is quite good with 2048pixels. The CCD camera, equipped with catadioptric lens system gives omni view (Table1, Figure 1, Figure 2,).

The integration of multiple sensors is to extract features which hide behind from one direction. The Features scanned by laser or camera in their own local coordinate systems can be integrated into a single map coordinate system. Because VLMS uses a combination of multiple sensors and positioning devices.

Table1: System Specification of VLMS

CCD	Number of pixel/line	2048 pixels/line
	Number of CCD	1(RGB)
Lens	Fish Eye	F4, 8mm
	Effective Field of View	140deg
Laser	Range Accuracy	3cm
	Scanning Range	300deg
	Frequency	20Hz
	Scanning Resolution	600point / 300deg
	Maximum Distance	70m

Figure 1: VLMS Platform Vehicle

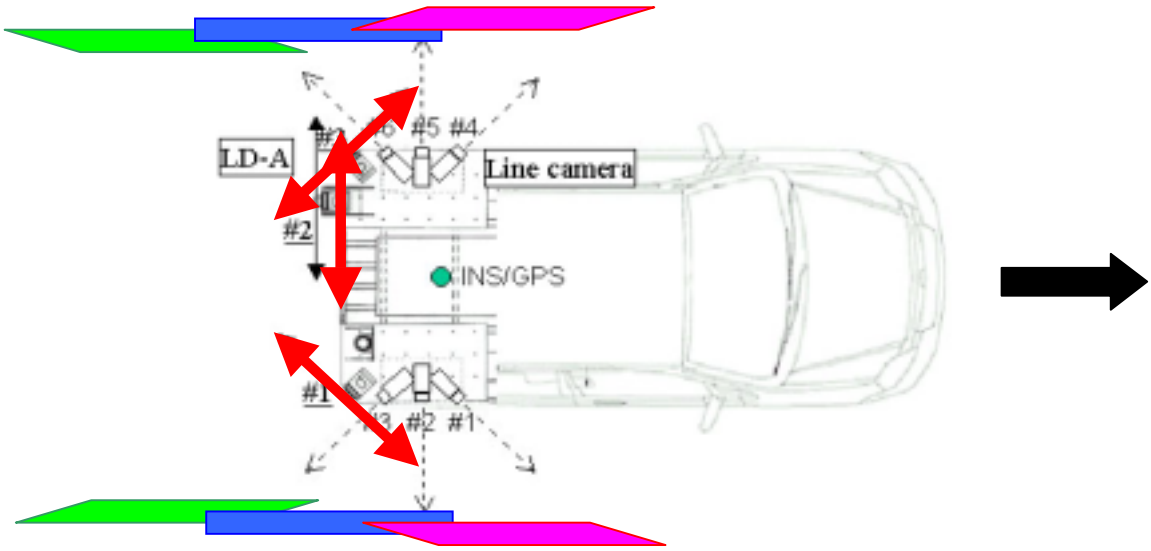

Figure 2: VLMS Principle

3. METHODOLOGY (SIGNBOARD EXTRACTION METHOD)

The high-resolution imagery and spatial data from VLMS can be applied to acquire signboard information of urban facilities. For example, signboards of certain types of shops, such as convenience stores have "standardized" color, shape and logo, and are mounted on wall at specific height to attract people's notice, it's possible to automatically identify them with image-processing methods.

We acquired data at a back street at Roppongi area in the center of Tokyo using VLMS. Referring to land use classification, we set up standardized templates. In this narrow back street case, some typical convenience store logo-mark templates were chosen as shown in Figure 3. We generated surfaces from the laser range data and its texture data with an in-house software developed for 3-D VLMS data. Referring to distance between the platform and the surface, we set template size. Because the signboards of convenience stores are usually mounted on wall at specific height to attract someone's notice, we can limit a search area in apply a template matching for the signboard. In this case, height is 2.5 to 4.0m. We successfully extracted signboards by the template matching method (Figure 4). This result suggested that we could detect or revise signboard data automatically from VLMS data (Figure 5)

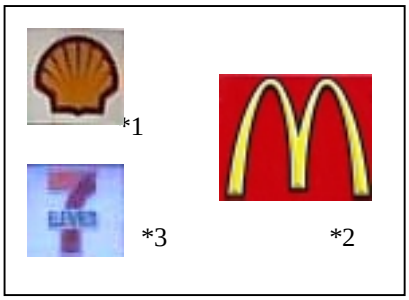

Figure 3: List of Templates

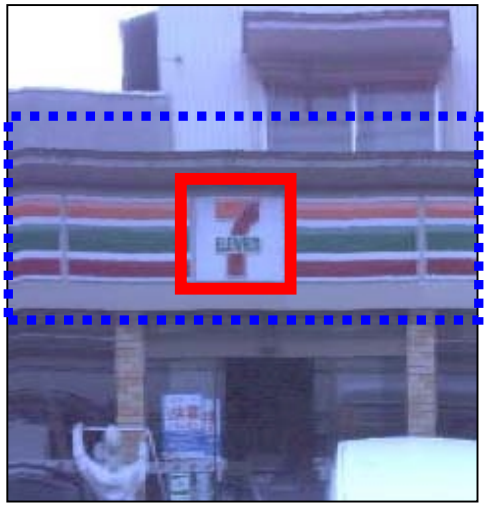

Figure 4: Detected Signboard by template matching

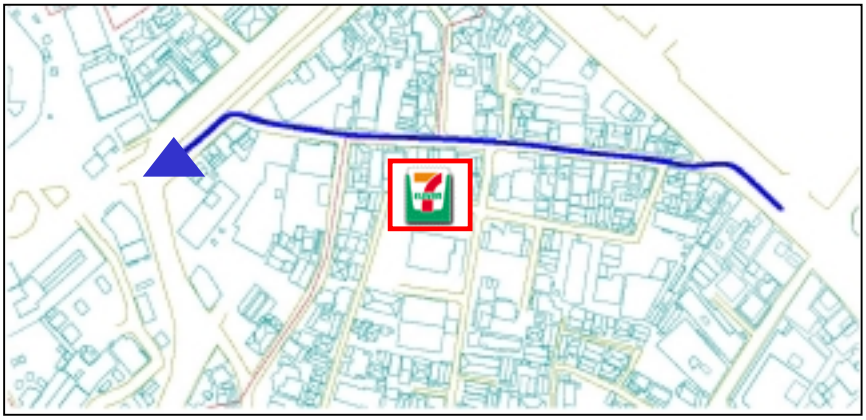

Figure 5: Display of the feature on revised digital map

4. CONCLUSIONS AND FUTURE WORK

The results of this experiment suggested that it is possible to automatically extract signboard of shops and to acquire feature attribute using VLMS data if the signboard images are given as a template in advance.

In this experiment, we generated 27 surfaces of many sizes along the back street whose length is about 300 meters. It took 65 seconds to detect a signboard in one of them by template matching (SSDA method) and about one hour to operate all of them. Improvement of image resolution makes template size larger and processing time gets longer. There is room for considering method of selecting surfaces which are likely to include feature imagery and improvement of matching method to reduce operating time.

We would like to upgrade template variation and try main street area since there are many kinds of shops. And we will consider extracting character on signboard in the future.

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