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Salvage System Using Location Based Services

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ABSTRACT

In the salvage area, the location of the incident vessel and diver to rescue the victim are very important. But there are no ways but to rely on the GPS satellites to obtain the location in the salvage sites. Because the positioning using GPS satellites has a measurement error of up to 50 meters caused by the status of the atmosphere, a new positioning method with more accuracy should be devised. So if studies on measuring the position of the ships and divers accurately in the sea are performed, it will be helpful in the field of the salvage positioning. In this paper, a high precision positioning system in salvage using DGPS signal through mobile broadcasting is proposed with positioning error of up to 1 meter.

Key words: Differential GPS, Salvage, DMB, Location Based Service

1. INTRODUCTION

MLIT (Ministry of Land, Infrastructure and Transport) of Korea government has built the reference and monitoring stations of NDGPS (Nationwide Differential Global Positioning System) for the safety of the ship sailing the coast and has provided DGPS services so that a positioning in the nation anywhere including marine and inland becomes possible. However, because an additional calibration information of GPS [1], called DGPS, will be usually transmitted by a beacon, there are a lot of problems in that the expensive beacon receiver should be needed and positioning accuracy will not be guaranteed in the shaded area. To overcome these limitations of general DGPS services [2], MLIT had started to provide the NTRIP (Network Transport of RTCM via Internet Protocol) through the general internet.

Although DGPS services have been expanded due to internet, there are also limitations that communication environment connecting the wire and wireless network should be maintained. Due to these constraints for transmission methods of calibration information, DGPS services had not activated greatly compared to the investment of infrastructure. So the most efficient way to commercialize the DGPS services may be referred a DPGS based on TDMB (Terrestrial Digital Multimedia Broadcasting) [3]. There is an advantage that does not require an extra facilities investment because TDMB system has a nationwide network infrastructure in Korea and the TDMB receiver module already has been included in the smart phone mounting GPS function [4]. In the salvage fields requiring high precision positioning, DGPS services based on the TDMB can be used as one of the powerful technologies in positioning so we proposed the high precision positioning system in salvage using DGPS signal through mobile broadcasting.

The organization of our paper is as follows: In

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Section II, we introduce mobile multimedia broadcasting system and the international trends in the fields of DGPS services. In Section III, we explain our scheme high precision positioning system in salvage using DGPS Signal through mobile broadcasting. The results of experimental tests are discussed and compared to previous work in Section IV. Finally, we conclude our paper and make mention of future work in Section V.

2. DMB SYSTEM AND INTERNATIONAL TRENDS OF DGPS SERVICES

TDMB is made for terrestrial transmissions on band III (VHF) and L (UHF) frequencies so that TDMB is unavailable in the United States because those frequencies are allocated for television broadcasting (VHF channels 7 to 13) and military applications. USA has adopted ATSC-M/H for free broadcasts to mobiles. In Japan, 1seg is the standard, using ISDB.

T-DMB uses MPEG-4 Part 10 (H.264) for the video and MPEG-4 Part 3 BSAC or HE-AAC v2 for the audio. The audio and video is encapsulated in an MPEG transport stream (MPEG-TS). The stream is forward error corrected by Reed Solomon encoding and the parity word is 16 bytes long. There is convolutional interleaving made on this stream, then the stream is broadcast in data stream mode on DAB.

In order to diminish the channel effects such as fading and shadowing, the DMB modem uses OFDM-DQPSK modulation. A single-chip TDMB receiver is also provided by an MPEG transport stream demultiplexer. DMB has several applicable devices such as mobile phone, portable TV, PDA and telematics devices for automobiles. As of December 14, 2007, ITU formally approved T-DMB as the global standard, along with three other standards, like DVB-H, OneSeg, and MediaFLO. The conceptual transmission architecture for the TDMB video services is shown as Fig. 1.

In 2005, South Korea became the world's first country to start TDMB service on Dec. 1. As of Dec. 2006, T-DMB service in South Korea consists of, 7 TV channels, 12 radio channels, and 8 data

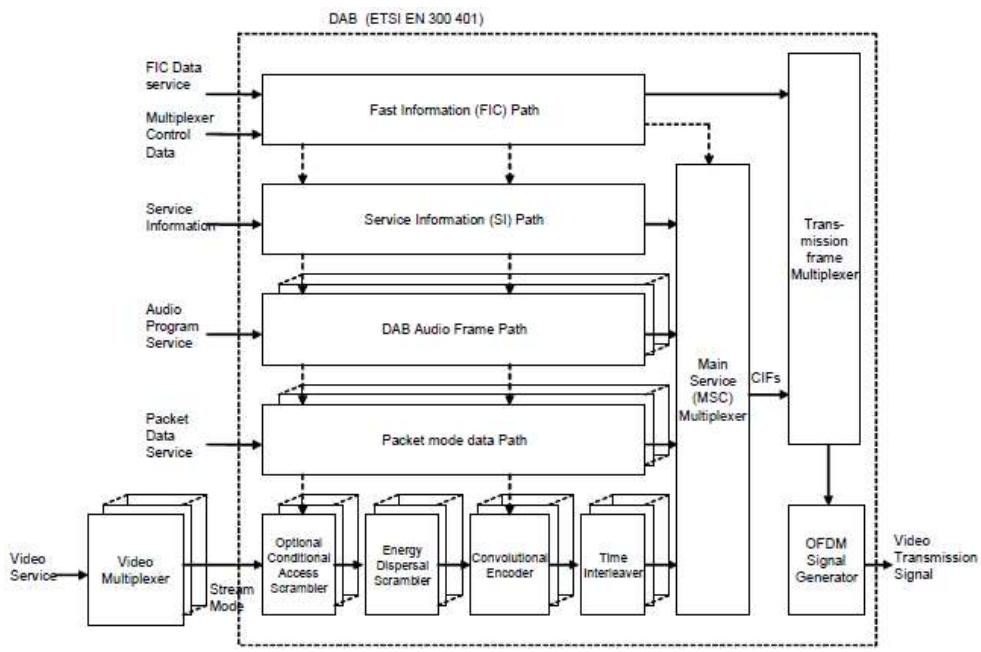

Fig. 1. Conceptual transmission architecture for the TDMB video services.

channels. These are broadcast on six multiplexes in the VHF band on TV channels 8 and 12 (6 MHz raster).

Receivers are integrated in car navigation systems, mobile phones, portable media players, laptop computers and digital cameras. Since the advent of smartphones. DMBs have been made available on phones with receivers through smartphone applications, most of which come pre-installed in phones made and sold in Korea.

In this chapter, with the introduction of TDMB, global trends of DGPS services are reviewed in the viewpoint of transmission medium. DGPS services through beacon are being serviced in U.S.A., Canada, India, and Japan. In the case of Japan, FM DARC (data radio channel) is also used with the beacon, GSM (Global System for Mobile Communication) and NTRIP in Germany, CSD (Circuit Switched Data) and GPRS (General Packet Radio Service) in Swiss, RDS (Radio Data System) and FM DARC in Sweden. Transmission medium of DGPS calibration information in the countries including inland and coastal area are shown in the Table 1.

Table 1. Transmission medium of DGPS according to country

Region	Country	Transmission Medium
Including Coastal	Korea	Beacon, NTRIP
	Japan	Beacon, FM DARC
	India	Beacon
	U.S.A.	Beacon
	Canada	Beacon
Inland Only	Swiss	CSD, GPRS
	Germany	GSM, NTRIP
	Sweden	RDS, FM DARC

3. PROPOSED SERVICE SCENARIO OF DGPS

High precision positioning in the salvage fields such as sinking of ships is very important in the view of identifying the exact position of the site for accident and diver went into the sea to rescue

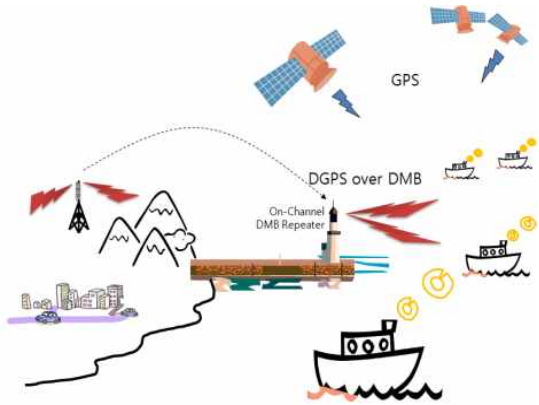

Fig. 2. Concept of the proposed LBS Services.

the victim. To identify the exact point of the accident and diver, high precision positioning algorithm using DGPS through TDMB is proposed in this paper and the concept of the proposed algorithm is shown as in Fig. 2. Ships on the coast receives both the location information from GPS satellites and DGPS calibration information from TDMB repeater installed on the lighthouse.

Positioning calibration information obtained from the DGPS reference stations will be converted into the format of TDMB broadcasting as shown in Fig. 3. The calibration information, RTCM (Radio Technical Commission for Maritime Services), obtained from the DGPS reference stations will be transferred to RAAS (Regional Area Augmentation System) server through NTRIP and converted into the TDMB data format in RAAS server. Lastly, DGPS calibration information are

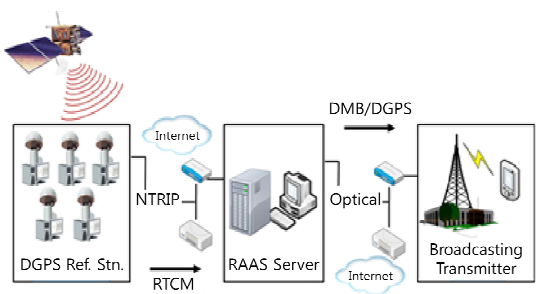

Fig. 3. Extracting and transferring DGPS calibration information.

delivered to TDMB transmitter so that vessel in the sea can receive the both location and calibration information from GPS satellites and TDMB broadcasting networks respectively [5-7]. In result, high precision positioning with positioning error of 1 meter can be realized by utilizing DGPS calibration over TDMB networks.

4. SIMULATION RESULTS

In this chapter, the experiment of the proposed high precision position system was performed by the respective methods of GPS alone, NTRIP DGPS, and DGPS over TDMB. In this experiment, EVK-6 of U-Blox and AKN-1MBT of ASCEN devices were used for GPS alone NTRIP DGPS and experimental. Because the positioning correction information are needed to perform NTRIP DGPS, the real position correction information provided by MLIT were utilized in this experiments

The simulation results for each methods of GPS alone, NTRIP DGPS, and DGPS over TDMB are shown in Fig. 4 and Fig. 5. From these results, the facts that DGPS positioning is more accurate than GPS alone and has a positioning error of 1 meter can be derived [8].

5. CONCLUSIONS

Korea government has provided DGPS services so that a positioning in the nation anywhere including marine and inland becomes possible. In this paper, we suggested the most efficient medium to deliver the DGPS calibration information to the

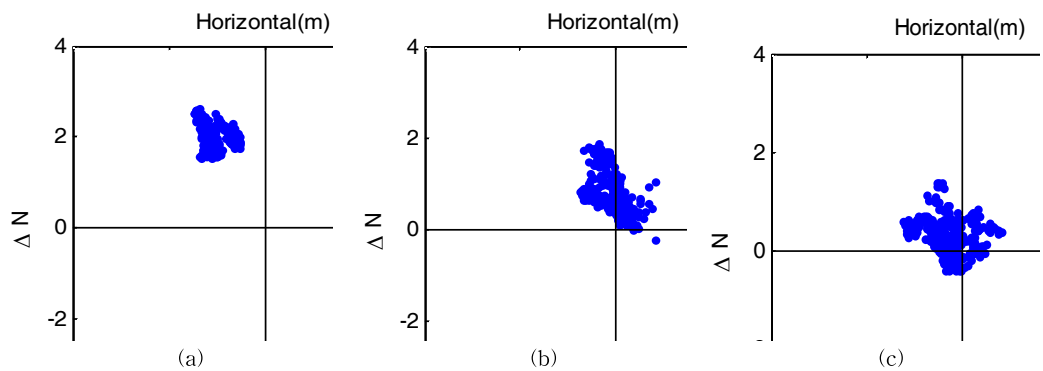

Fig. 4. The results of horizontal positioning error by (a) GPS alone, (b) NTRIP DGPS, and (c) DGPS over DMB according to DMB delivery period of 3s.

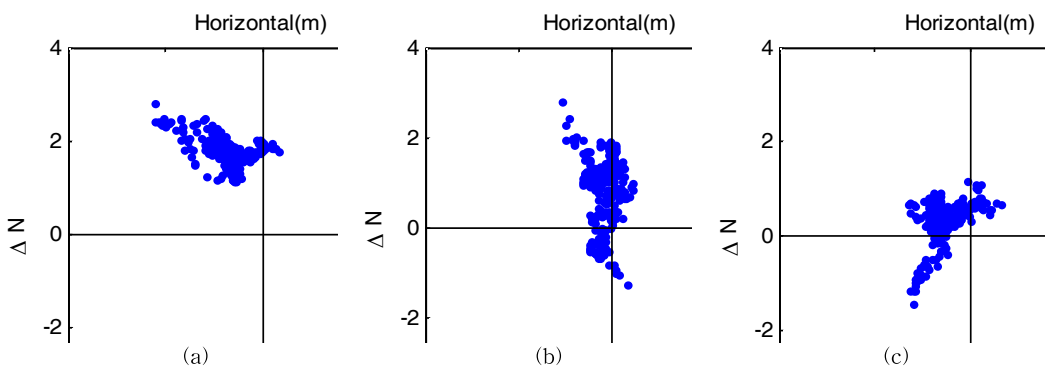

Fig. 5. The results of horizontal positioning error by (a) GPS alone, (b) NTRIP DGPS, and (c) DGPS over DMB according to DMB delivery period of 6s.

terminal and the high precision positioning method. In Korea, TDMB system has a nationwide network infrastructure and the TDMB receiver module already has been included in the smart phone so that TDMB will be thought as the most efficient medium to deliver DGPS calibration information. In the salvage field requiring high precision positioning, DGPS services based on the TDMB can be used as one of the powerful positioning technologies with positioning error of 1 meter.

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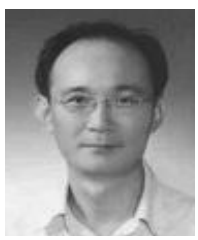

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