# AUTOMATIC IDENTIFICATION OF ROAD SIGN IN MOBILE MAPPING SYSTEM

Jae Seung Jeong [a], Jae Min Park [a], Byung Guk Kim [a], Dong Hoon Jeong [b]

[a] Department of Geoinformatic Engineering, Inha University
253 Yonghyun-dong, Nam-gu, Incheon 402-751, Korea
kompsat@inhaian.net, jeje21pjm@naver.com, byungkim@inha.ac.kr
[b] Korea Cadastral Survey Corporation Cadastral Research Institute
45 Yeouido-dong, Yeongdeungpo-gu, Seoul 150-911, Korea
gisjeong@hanmail.net

**ABSTRACT:**

MMS(Mobile Mapping System) generates a efficient image data for mapping and facility management. However, this image data of MMS has many difficulties in a practical use because of huge data volume. Therefore the important information likes road sign post must be extracted from huge MMS image data. In Korea, there is the HMS(Highway Management System) to manage a national road that acquire the line and condition of road from the MMS images. In the HMS each road sign information is manually inputted by the keyboard from moving MMS. This manually passive input way generate the error like inaccurate position, mistaking input. In this research we developed the automatic road sign identifying technique using the image processing and the direct geo-referencing by GPS/INS data. This development brings not only good flexibility for field operations, also efficient data processing in HMS.

## 1. INTRODUCTION

We need position indication method that different position indication method of Korean road connection systems is new to development of HMS (Highway Management System). Therefore, distance post management system has developed in road management unify system. In develop the distance post management system, make unify distance post management system that could mark position by using distance post, constructed whole general national road every 1km. in addition, whole system data about road could express same position information thus, make the common use the data. Figure 1 is example of position marking by use distance post.
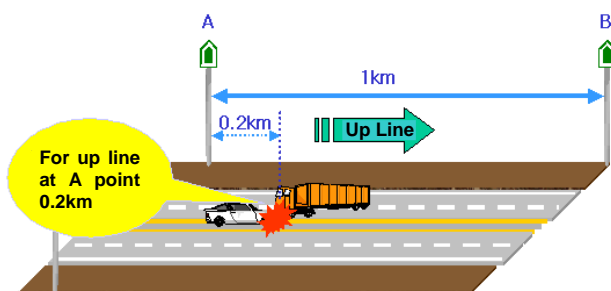


Figure 1. Position indication method to use distance post

Distance post, core of Distance post management system and key of reference, is road equipment that established every 1km in general national road. Current using method for obtain distance post coordinate is passively input the coordinate by using keypad when user pass the distance post during drive Road safety survey and analysis vehicle(RoSSAV) or Road imagery acquisition vehicle. Above passive input method could increase user's tiredness and make problem about position accurate according to user's skill. So, purpose of this paper is automatically obtain 3D position information of distance post

by use image that obtained by RoSSAV application for image processing method and calculate distance post image center point, needed for acquire distance post 3D position information.

## 2. MOBILE MAPPING SYSTEM

There is operating and developing mobile mapping system in KICT(Korea institude of construction technology), Road safety survey and analysis vehicle(RoSSAV) and Road imagery acquisition vehicle <Fig 2>. Road safety survey and analysis vehicle(RoSSAV) is system that test road safety and raise driving safety. Road Safety Survey and Analysis Vehicle is developed system for mapping about road facilities and road by use moving Vehicle that loading various equipment of CCD Camera, GPS• IMU, Laser scanner and so on.



Figure 2. Road imagery acquisition vehicle(Left),
Road safety survey and analysis vehicle(Right)

So this paper will get a image center coordinate of distance post, one of the most important equipment of road management system, by using road image that taken by RoSSAV's front camera.
Table 1 is specification of CCD camera(CV-M7+) that using this paper to acquire image.

| Items | Contents |
|---|---|
| Camera | Color CCD |
| Image size | 1380 × 1030 |
| Cell size | 6.45 × 6.45 |
| Validity chip size | 8.90mm × 8.90mm |
| Lens | 12mm one focus lens |
| Horizontal angle | 40.7° |
| Vertical angle | 30.9° |

Table 1. CCD camera(CV-M7+)



Figure 3. CCD camera(CV-M7+)

## 3.  DISTANCE POST EXTRACTION

Purpose of this study is that we will be automatically getting a 3D position information of distance post by using integrated GPS, IMU data. Figure 4 is process of getting 3D positioning information of distance post, current process is obtain a image center point of distance post, use image that taken by RoSSAV's front camera, by using image process method. Purpose of this paper is automatically acquire center coordinate of distance post by utilize image that acquired by RoSSAV's front camera.
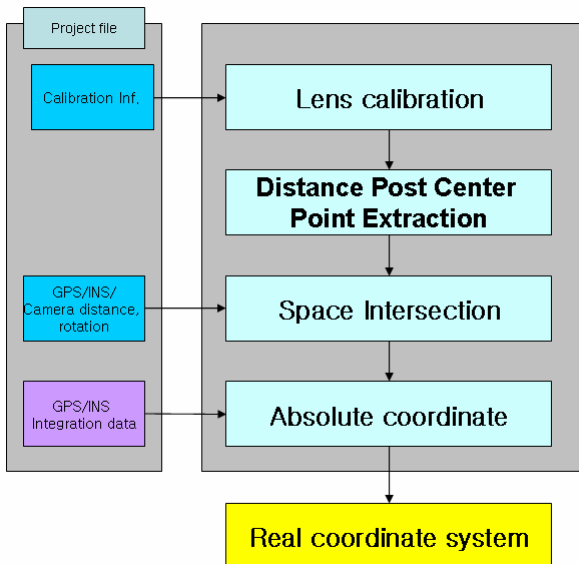


Figure 4. Distance post third dimension position extraction process

### 3.1  Distance Post

It is distance post that become target of our automatic extraction. We can see that most of distance post are green with figure 4.

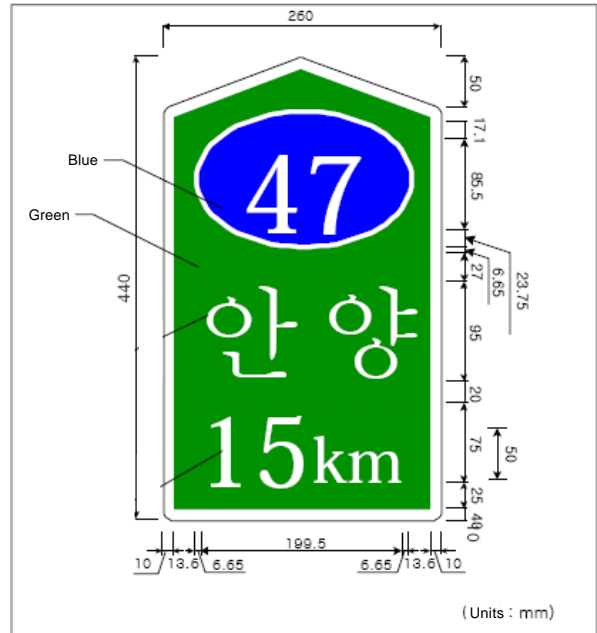Size is 26    by 44    . Main color of distance post is green and blue color.



Figure 5. Distance Post

### 3.2  Distance Post Extraction Processing

Achieve process such as figure 6 to acquire distance post center image coordinate. We can see that most of distance post are green with figure 5. We are going to give threshold and search distance post center sacred ground by shape using green color.
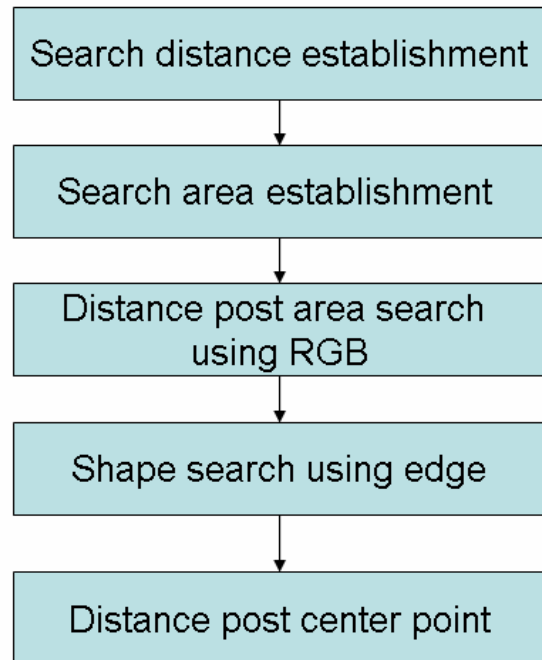


Figure 6. Distance post automatic extraction process

### 3.2.1 Image characteristic

Distance post to extract that is green post that occupy about 5% in whole image in this paper. Image special quality is exist various road-facilities and tree, buildings.



Figure 7. Acquisition image

### 3.2.2 Search distance establishment

Distance post is road-facilities that is established in 1km to general national road. We chose anticipation area that distance post is established using distance(To fore and the back at distance post establishment point 300m) (Figure 8). We conduced in speed elevation in image settlement searching image electively.
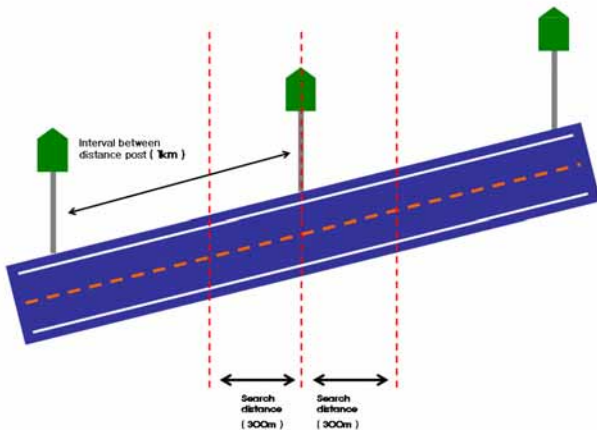


Figure 8. Search distance

### 3.2.3 Search area establishment

Distance post is established to right side of road. When show distance post at the same time in image of RoSSAV' right and left of front camera, can get third dimension coordinate of object by space intersection. We established right side to search area of image central point like figure 9.



Figure 9. Search area

### 3.2.4 Distance post area search using RGB

RGB area of distance post appears about 21, 68, 79 by RoSSAV' front camera. These color area receives effect according to lighting or photographing environment. When saw as underground result, big difference did not look. Therefore, we give threshold by ± 20 degrees in RGB color sacred ground through an experiment and choose candidate group. This time, distance post's color is similar pixels of part grouping. We used more pixels at candidate choice enlarging size of candidate pixel.
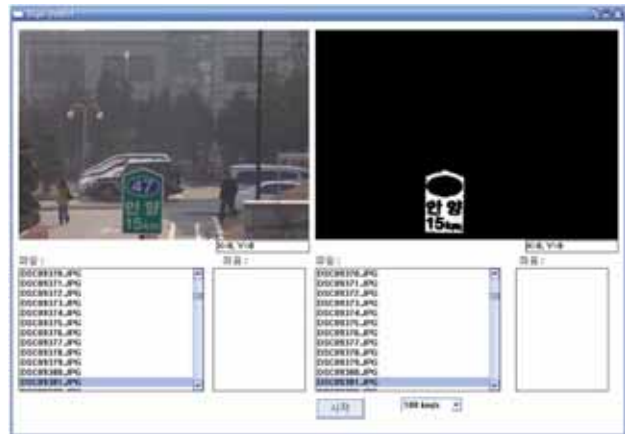


Figure 10. Distance post area search using RGB
(Image by Sony digital camera)



Figure 11. Distance post area search using RGB
(Image by Road imagery acquisition vehicle)

### 3.2.5 Shape search using edge

After select candidate, extract pentagon form of distance post using edge area. We search final distance post's position by this method. This time, we use gouge extraction operator Canny operator. Finally, distance post central point in searched distance post's image used best center image point.

## 4. TEST

We stood distance post specially. And we tried extraction test.



Figure 12. Distance post extraction(KICT parking zone)

We experimented distance post extraction using distance post automatic extraction program in this paper. Testing area is General National Road No.38 Anseong-si Gyeonggi-do in Korea image. Distance post's number is up line 7, down line 7 <Figure 13>. Image's photographing distance is 10m, and distance of target area is about 21.8km, and image's number is 4,376 in right and left camera. Test area distance post became all extractions using distance post automatic extraction program. We are going to calculate third dimension coordinate of distance post in RoSSAV using GPS∙ IMU data.



Figure 13. Test Field(Anseong-si Gyeonggi-do)



Figure 14. Distance post extraction(Test field)

## 5. CONCLUSIONS

Distance post's image-point extract automatically in this paper using image. This image is acquired by front camera by RoSSAV. We can get 3 dimensions coordinate of distance post in this study using distance's center image point and GPS•IMU integration data. Therefore, this study can expect in automatic cartography technology development using MMS.

## ACKNOWLEDGEMENTS

## 6. REFERENCES

C. Vlncent Tao 2000, *Semi-Automated Object Measurement Using Multiple-Image Matching from Mobile Mapping Image Sequences*, Photogrmmetric Engineering & Remote Sensing, pp1477-1485

C.Y. Fang 2004, *An automatic road sign recognition system based on a computational model of human recognition processing*, Computer Vision and Image Understanding 96, pp237–268

Jeong Dong Hoon 2004, *A study on camera calibration and 3D positioning for land-based mobile mapping system*

KICT(Korea Institute of Construction Technology) 2004, *Development of Road Safty Survey and Analysis Vehicle : RoSSAV*

KICT(Korea Institute of Construction Technology) 2006, *Development of Road Safty Survey and Analysis Vehicle : RoSSAV*

MOCT(Ministry of Construction & Transportation) 2005, *Production kilometer post of General National Road production, construction and management guide*

Xiaoyangv CHEN 2001, *Automatic Recognition And Location Of Road Signs From Terrestrial Color Imagery*, Geoinformatics & DMGIS'2001, Bangkok, pp238–247