APPLICATION OF MONITORING TECHNIQUES FOR THE TEMPORAL VARIATION OF BEACH LITTER

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KEY WORDS: Beach Litter, Monitoring Techniques, Network Camera

Abstract: This study was attempted to know the temporal change of beach litter on the Heungnam beach, Geoje Islands, Korea by using network camera. First, it was carried out calibration and geometric correction for distortion correction of the camera. Next, It was measured the gross area of sandy coast in shooting range using surveying instrument for the temporal change analysis and estimate the total beach litter mass. Beach litter fluctuates mainly on a monthly time scale or less with wind and tidal. Therefore, it should be expected that the results are provided as scientific data to prepare for the remedy of beach litter.

1. INTRODUCTION

The main cause for the marine debris can be divided into following two types; land-based sources from the land and ocean-based sources from marine accident, marine work or fishing. It is estimated that the amount of debris from land-based debris is around 75～85% (Ministry of Maritime Affairs and Fisheries, 2005). Generally, marine debris can be divided into 3 categories of beach litter, floating debris and submerged marine debris(Koo *et al*., 2000). Marine debris can be defined as visible objects that are floating or flowed from the ocean or coast(Park and Kang, 2005). To monitor to reduce the damages from beach litter can be very important data for identifying the condition and to improve the practicality of related policy. For domestic monitoring, however, complete enumeration is almost impossible due to time, money and manpower. Thus, only some part of coast is designated as target area and being monitored. If the amount of beach litter for whole coast are estimated based on this limited monitoring data, there will be huge error factors(Park and Kang, 2005).

So, Jang *et al*. (2012) performed a study on the detection of beach litters using image processing method and images taken from IP camera. However, there is difficult to obtain accurate results, due to lens distorted and non-warping images. Therefore, it is necessary to lens distortion correction and geometric correction from the viewpoint of photogrammetry. This study is preliminary case study of applying monitoring techniques for the temporal variation of beach litter.

2. DATA AND METHODS

2.1. Study Area

The target area for the present study has been selected as the Heungnem beach in northeast side of Geoje island because a lot of both land-based and fishery-based debris flow into the area through river since the area is adjacent to the mouth of Nakdong River. The target area is relatively simple sandy coast. It's width is maximum 30m and the length is around 300m along the coast and it allows easy access for tourists(Figure 1). In the present study, 2 network cameras have performed 24 hour non-stop recording to identify the creation and change of debris in target area coast(Figure 2).

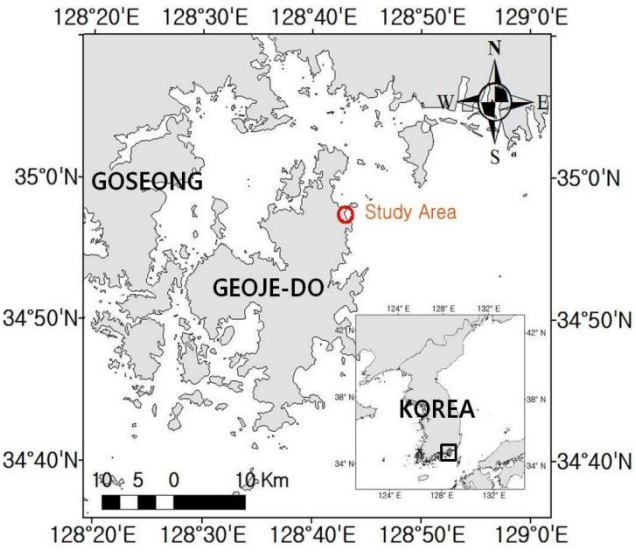

Figure 1: Location of the study area.

Figure 2: Network Camera for beach litter monitoring.

2.2. Camera Calibration and Ground Control Points Measurement

Normally, images captures by camera contain distortion and it can be vary by different lenses. To obtain correct and secure data from captured images, correction of distortion based on camera features is necessary. In the present study, 2 network cameras with CMOS sensor 2 Mega pixel and IR LED 24PCS are used. In this study, features and interior orientation parameters of camera lens, which are needed to revise the captured images, were identified by calibration using calibration targets. At the same time, ground control points(GCPs) measuring with RTK-GPS

were performed for geometric correction for captured images. 30 GCPs were installed in target area coast, than location grid was obtained through observation(Figure 3).

(a) (b)

Figure 3: Ground Control Points surveying using a GPS receiver, (a) a sample of GCP target on the beach and (b) Ground Control Points on the beach(Image from Google, 2012).

2.3 Field Monitoring

Beach litter collecting for the whole target area was initiated on June 15, 2012 and it was assumed as a starting point of monitoring where the amount of beach litter are 'zero'(Figure 4a). Later, to identify the amount and inflow of beach litter, images that captured in real-time for 10 days were transformed into 1 hour-based still-image and then compared and analyzed(Figure 4b). Also, beach litters were collected through site monitoring on June 26, 2012 and its quantity, weight and volume were measured(Figure 5).

(a) (b)

Figure 4: Captured images from two network cameras, (a) CAM1 (June 15, 2012) and (b) CAM1 (June 26, 2012).

(a) Litters on the beach.

(b) Litters categorization.

Figure 5: Field monitoring for beach litter.

3. RESULTS

Interior orientation parameters of camera 1 obtained from camera lens calibration is shown in table 1. Lens calibration results by Kim *et al.* (2012) are -0.1883 and 0.2595 mm for Rollei d7metric camera, 0.8149 and 0.2749 mm for Rollei d30metric camera, -0.0005 and -0.1036 mm for smartphone type A, and -0.1057 and 0.0164 for smartphone type B, in principal point xH and yH, respectively. On the other hand, the principal point results of interior orientation parameters in this study were shifted farther than previous study.

With the help of real-time monitoring using network cameras, it was possible to identify actual status and time series changes of beach litter that flowed into coast. As a result of site monitoring that was performed 10 days after the beach was completely cleaned, the total amount of beach litter except naturally-created ones like seaweeds, straws or woods was as follow: total quantity-1571 pieces, weight-289.9kg, and volume-3553.2 ℓ.

Table 1: Interior orientation parameters obtained from camera lens calibration

		Interior orientation parameters	
Camera 1	**Focal length**	4.358512mm	
	Principal point	**xH**	3.078840 mm
		yH	1.703464 mm
	Radial distortions	**K1**	2.298e-002
		K2	1.709e-003
	Decentering distortions	**P1**	1.994e-004
		P2	-8.916e-005

4. DISCUSSIONS AND REMARKINGS

The present study is to suggest a new monitoring method that can overcome time and money limitation and identify the actual status of beach litter by expanding the target area for monitoring. The research area was selected as the Heungnem beach in northeast side of Geoje island since there have been repetitive damages caused by both debris from fishery and land-based debris that are flowed from Nakdong River. Actual status of inflow and temporal change of beach litter were identified through image data from network cameras that were installed in the target area. However, wide angle which was adjusted to observe floating debris flowing into coast and distortion of camera lens acted as error factors in correction of images. Therefore, it is estimated that the further study on this limitation should be necessary. If it is possible to identify the amount of beach litter through monitoring the images after some improvement of the present study, it can be expected that it will significantly contribute to calculate the exact amount of beach litter scientifically and even to decide when to collect those beach litter effectively.

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ACKNOWLEDGEMENTS

This research was a part of the project titled Yeongnam Seagrant funded by the Ministry of Land, Transport and Maritime Affairs, Korea. Also, this research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education, Science and Technology(2012R1A1A2002761).