TRACKING MULTIPLE PEOPLE WITH MULTIPLE GPS DATA LOGGERS

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1. INTRODUCTION

GPS data logger is a very useful tool for tracking object movement. Previous research on GPS data loggers has shown the applications for birds and mammals (Steiner, 2000). The aim of the previous research was that a detailed analysis of homing in pigeons and small mammals has remained difficult because the paths of the animals could not be reconstructed precisely. Just like, it is difficult to track multiple people by simultaneous monitoring. However, few studies have examined methodologies on tracking people with GPS data loggers. The purpose of this study is to examine methodologies on tracking multiple people with multiple GPS data loggers. This paper describes processing for multiple GPS logging data and tracking results for a tsunami evacuation drill.

2. METHODOLOGY

GPS logging data for multiple people was collected in a tsunami evacuation drill for Tsunamis at Utsumi Beach, Minamichita-Cho, Aichi Prefecture on July 25, 2013. About 350 beachgoers took part in the drill. **Photo 1** shows plans and locations on the evacuation drill. The beach is divided into 18 sections. One person with GPS data logger went to the evacuation assembly area through three evacuation routes from each section. **Table 1** shows the specifications of three GPS data loggers used in this study. **Photo 2(a)(b)(c)** show the appearances of the GPS data loggers. M-241 and M-1200E were made by Holux Technology Inc. and TripMate852 was made by Transystem Inc.. **Figure 1** shows a basic structure of GPS logging dataset merged from 18 GPS logging data. Positioning data was recorded as longitude and latitude units. The positioning data was converted to Japanese Plane Rectangular CS Ⅶ using GSI web application service. Furthermore, the data was converted to image coordinate using equation as shown below for matching digital aerial photograph with 1m of pixel resolution.

$$X=(y+x_o)\text{-}1 \quad (1)$$

$$Y=(y_o\text{-}x)\text{-}1 \quad (2)$$

where, X and Y are image coordinates, x and y are Japanese Plane Rectangular CS Ⅶ coordinate, and x_o and y_o are image coordinates of the upper left corner. **Figure 2** shows a flowchart of making a movie for tracking multiple people with multiple GPS data loggers. **Figure 3** shows an example of image coordinate for GPS logging data. **Figure 4** shows an example of color information assigned for tracking multiple people.

Photo1 A location and routes on the evacuation drill

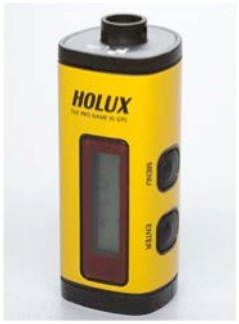

Photo2(a) M-241

Photo2(b) M-1200E

Photo2(c) TripMate852

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Table 1 The specifications of three GPS data loggers

Product	M-241	M-1200E	TripMate852
Receiver	L1, 1575.42MHz	L1, 1575.42MHz	L1, 1575.42MHz
Dimension(mm)	74.5(W)x32.1(H)x30(D)	68.5(W)x22.8(H)x15.5(D)	72(W)x27(H)x25(D)
Position Accuracy	3.0m	3.0m	3.0m

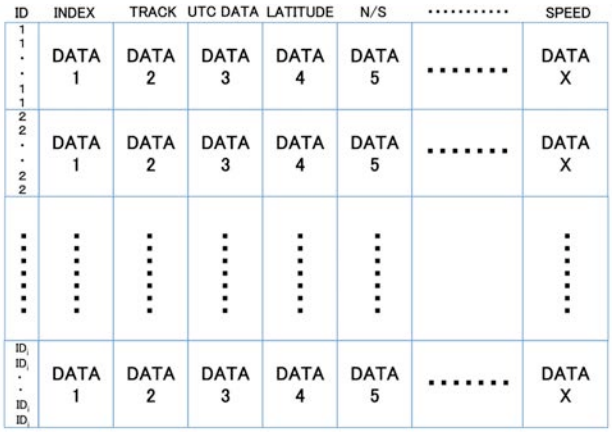

Figure 1 The dataset of GPS logging data

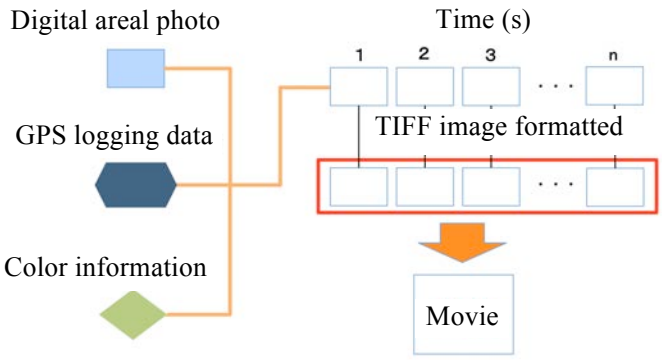

Figure 2 The flow of making movie on tracking people from GPS logging data

GPS ID	TIME	X	Y
1	0	674	593
1	1	674	593
1	2	674	593
1	3	674	593
1	4	674	593
1	5	674	593
1	6	674	593
1	7	674	593

Figure 3 Image coordinate for GPS logging data

R	G	B
204	000	000
229	000	134
229	000	011
239	143	015
168	000	047
142	000	204
113	026	083

Figure 4 Color information assigned for tracking multiple people

Photo 3 The result of tracking multiple people from multiple GPS logging data

3. RESULTS

Photo3 shows the results of tracking multiple people with GPS data loggers. This represents the summary of evacuation drill clearly and comprehensively.

4. DISCUSSION & CONCLUSION

This paper examined a methodology on tracking multiple people with multiple GPS data loggers for evacuation drill. This result could confirm the summary of how movement of multiple people in the evacuation drill.

REFERENCES

Steiner, I., Bürgi, C., Werffeli, J., Dell'Omo, G., Valenti, P., Troster, G., Wolfer, DP., and Lipp, HP.: A GPS logger and software for analysis of homing in pigeons and small mammals, Physiology & Behavior, 71(5), 2000, pp. 589-96.

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