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A study of the classification of crowd types to build crowd-sourcing-based GIS

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Abstract. The Smart City concept is a city model that aims to solve city's problems and improve the life qualities by combining new advanced technologies such as ICT and big data. The Smart City concept concentrates on humanity, where complexed technologies are applied in a city, and makes a community of collaborating human life and technologies. In this concept, there are continuous efforts to solve many social problems such as safety and welfare for people. Therefore, it is imperative to improve the method for people to participate in solving social problems; the crowd sourcing technology, which uses crowd mapping and community mapping, is a noticeably improving method. In this study, we review the theoretical background of crowd mapping through the foundation study to make a crowd mapping model and classify several crowd types in the case of disabled welfare systems.

1. Introduction

The Smart City concept is a city model that aims to solve city problems and improve the life qualities by combining new advanced technologies such as ICT and big data. This concept implements 4th modern technologies such as Artificial Intelligence (AI), Internet of Things (IoT) and Cloud Computing. This concept also gains attention as the core power of innovated developments and a space where various technologies are combined.

South Korea has been proceeding the U-City industrial project from 2005. The concept of the U-City focused on technology in South Korea. However, a Smart City concentrates on humanity, where complexed technologies are applied in a city, and makes a community of collaborating human life and technologies. In this concept, there are continuous efforts to solve many social problems such as safety and welfare for people. Therefore, it is imperative to improve the method for people to participate in solving city problems; the crowd sourcing technology, which uses crowd mapping and community mapping, is a noticeably improving method.

Crowd mapping is the combination of PPGIS (Public Participation GIS) and crowd sourcing. The PPGIS defines the people who use the internet, and the GIS defines the process of people's participation. People can attend the spatial decision-making process by making a map, which is analysed like normal maps and GIS. Crowd sourcing is a compounded term of "crowd" and "out-sourcing". In short, people can easily access to the entire process to make a map and participate in the spatial decision-making process; hence, it is "community (crowd) participatory mapping".

To advance information and communication technologies, the implementation of the E-government is the main objective, and the opinions to let people have a chance to participate in the social and spatial



decision-making process are strengthening. In this situation, crowd mapping, which has been guiding people's participation in, can be applied as a solution to several social problems about the decision making of spatial policies and maximize the effectiveness of the GIS.

Thus, in this dissertation, we review the theoretical background of crowd mapping through a foundation study to make a crowd mapping model and classify several crowd types in the case of disabled welfare systems.

2. Participatory GIS and the Concept of Crowd Mapping

2.1. Concept of crowd mapping

Crowd mapping originates from the concept of crowd sourcing, which is a foundation of the internet cloud circumstance. Crowd sourcing is a compounded term of "crowd" and "out-sourcing", which means the solution is obtained from people's participation to solve their social problems. The crowd sourcing concept is based on the analysis and sharing of information, which is naturally formed from big data.

Through crowd mapping, people can learn about interesting local places near them and participate in various processes and communications from the planning stage to the decision-making stage.

Crowd mapping is related to big data and cloud system from the ICT viewpoint. Big data, formal or informal, are obtained from methodologies, tools, saved files, search results, analyses, and visualizations. With increasing usage of smartphones and navigation systems, the Location-Based Service (LBS) is remarkable nowadays, and geographical information is separated from the existing big-data concept and classified as Big Geo Data. Big Geo Data have a limitation because they are provided by the existing big-data technology. To efficiently handle big geo data, cloud technology has emerged as an alternative. In cloud computing technology, the combined internet service can access to portable devices with no telecommunication barriers.

2.2. Classification of Crowd Types in Crowd Mapping

Heipke (2010) divided the people's level of the proportion of geographic information by crowd sourcing (table 1).

Table 1. Crowd types (Source: Heipke, 2009 / Anne-Marthe Ruitton-Allinieue, 2011)

Crowd type	Example	Motivation	Contribution	Data	How to get them involved
Groupies	Retired GIS experts	Map lovers Public/Community acknowledgement	Continuous	Trustable & very valuable Little effort, large value	Community forums
Casual users	Hikers, bikers, mountaineers, etc.	For personal use	Occasional	Little effort, little value	Moderated community platforms

Experts	Active and leading map experts in organizations (mountain rescue, fire brigades, civil protection, etc.)	For personal use To simplify their work	Continuous	Very valuable and trustable	Financial agreements
Media mappers	Once-off mappers activated by media campaigns	Through fun activities (competitions, mapping parties, etc.)	Limited in time and extent. Depends on the frequency of the campaigns	Large effort	Try to turn them into casual users
Open mappers	Users of OpenStreetMap, Google MapMaker, etc.	Public recognition Using good public data		Very valuable and large	Develop open-source mapping tool
Passive mappers	GPS-enabled mobile phones' owners	Money		Unsure about how to use it	Still restricted by law
Mechanical Turks		Money		Must be carefully checked	Publishing HITs

3. Classification of Crowd Types in Korea

It is imperative that the users can conveniently access the information. The users can be sorted into several levels based on the geographical information. It is essential to crowd map according to the user's level.

Crowd mapping can be classified as follows:

- Administrator of public geographical information: The Administrators, who are experts of geographic information and producers of the original information source who perform maintenance and management tasks. Because South Korea has begun to construct GIS following domestic policies, GIS has a public feature. Thus, the administrator's role occupies large proportions of GIS management. According to the area of disabled welfare, social workers and governors of the social department are considered administrators.
- Supplier of commercial geographic information: The suppliers who work with commercial geographic information related to the market of crowd mapping.
- User of geographical information: The user uses this information for smartphone maps, map service on internet and navigation information. In terms of disabled welfare, the disabled who need help and volunteers are considered the user group.

- Positive participants of geographical information: These people are active users, provide current information and revise the errors. Presently, the number of crowd mapping participants has been increasing with the use of smartphones. For disabled welfare, the coordinators who organize volunteering programs are considered positive participants.
- Participants of potential usage: These people unintentionally use and produce geographical information. The advert's information is notably important in space information big data. The normal users unintentionally use social media such as Twitter and search keywords; this information can be meaningful if the geographical features are linked with geographical information. These people appear to be the basic source of geographical information.

4. Discussion

In this study, we reviewed the theoretical background of crowd mapping through the foundation study to make a crowd mapping model and classified several crowd types in the case of disabled welfare systems. The results of this study will be used as a basis to create a crowd-sourcing-based smart map for the disabled to advance smart city services in Korea.

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