

## Motivation

Due to the emergence of information technology, maps are more useful and essential in our lives. Maps can be regarded as a basic need in this new services-based world of Ubiquitous Environments. The commission on ubiquitous mapping has focused on rethinking the concept of maps, mapping and Cartography from theoretical, pragmatic and technical viewpoints in this changing information environment. Our main achievement will be explained from the following two aspects.

### (A) Constructing the theories on ubiquitous mapping

#### [Original aim]

Place the notion of Ubiquitous Mapping based on real-world map interaction and ICT-based context-aware mapping services in the domain of Theoretical Cartography; examining (1) Primal mapping between geomeia (real, graphic and language spaces) and human (cognitive space), and (2) Secondary or ICT-based mapping between geomeia and geodatabase.

Develop the theory of Map Evolution on ICT enabled socio-cultural environment, by (1) Clarifying similarity and difference in comparing variant systems to establish an evaluation scheme, (2) Revealing significant factors such as ubiquity and egocentrism for Map Evolution on ICT, and (3) Creating map evolutionary tree diagrams representing natural selection of maps in past, current and future according to real ICT-based ubiquitous mapping services and socio-cultural environment of different countries, particularly East Asia.

#### [Achievement]

The commission have held meetings and constructed the theories on ubiquitous mapping. Some of the result are open in public as follows.

[1] Takashi Morita, 2015. Evolution of Cartography in Internet and Ubiquitous Environments. CIU2015, ICA, Tokyo, March 17 to 20. (Open access from <http://ubimap.csis.u-tokyo.ac.jp/ciu2015/>)

[2] Min Lu and Masatoshi Arikawa, 2015. Towards human-centered mobile mappings: Methodologies and implementations. CIU2015, ICA, Tokyo, March 17 to 20. (Open access from <http://ubimap.csis.u-tokyo.ac.jp/ciu2015/>)

[3] Masatoshi Arikawa, 2014. Towards human-centered three-dimensional geospatial information, The Journal of Cartographers Association, Map, 52(3), 5-14 (In Japanese).

[4] Masatoshi Arikawa, 2015. Semantics of Map Evolution – cooperative representation process between human and computer -, Chizu Joho Journal, 31(1), Preface, International cartographic information center (In Japanese).

[Website of the commission on Ubiquitous Mapping:]  
<http://ubimap.csis.u-tokyo.ac.jp/>

#### [Steering members:]

Chair: Masatoshi Arikawa (Center for Spatial Information Science, The Univ. of Tokyo, Japan)

Vice-chair: Yuefeng Liu (Institute of Remote Sensing and GIS, Peking Univ., China)

Secretary: Min Lu (Center for Spatial Information Science, The Univ. of Tokyo, Japan)

Advisor: Takashi Morita (Hosei Univ., the previous chair)

Executive Committee liaison: William Cartwright

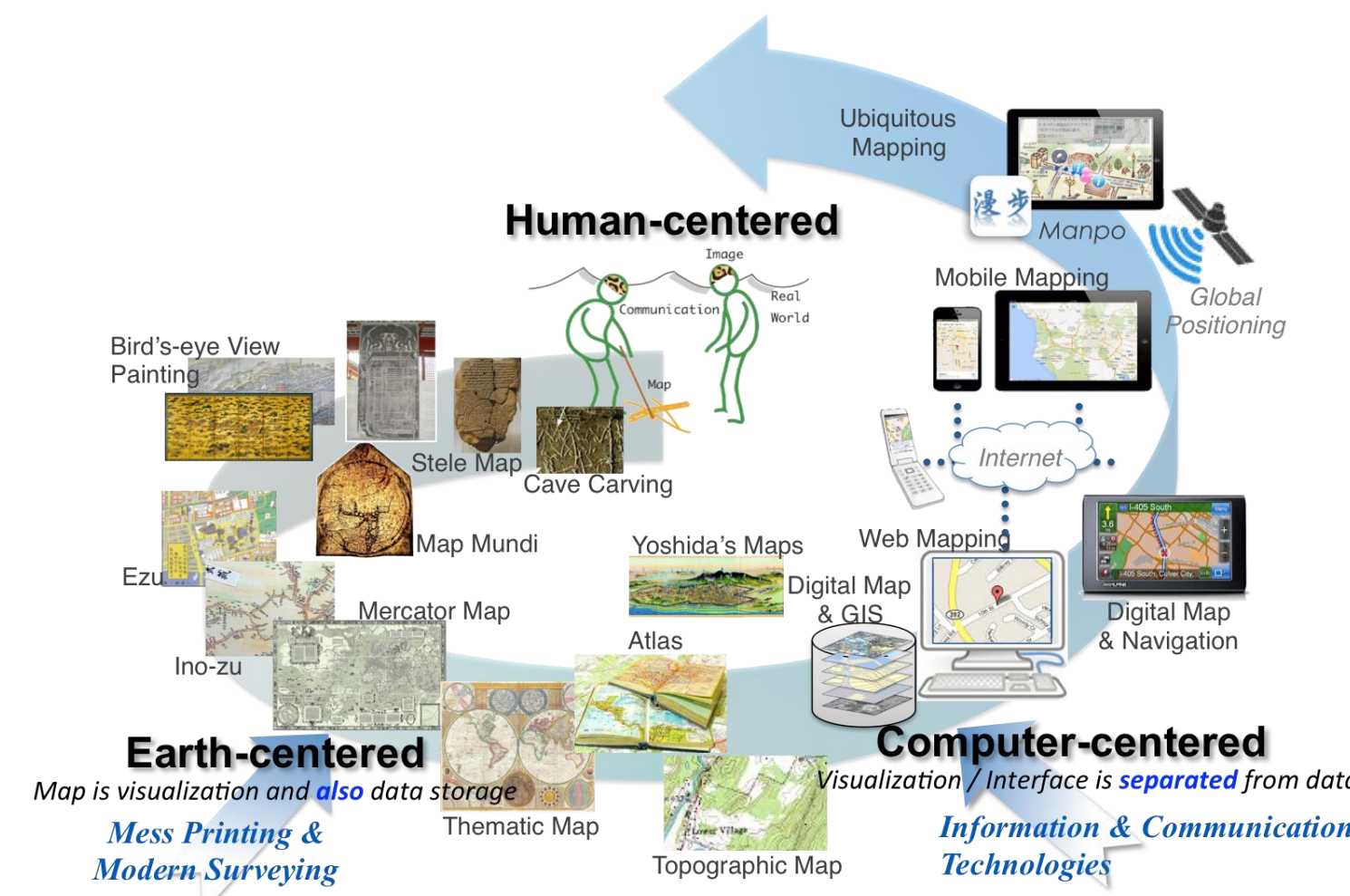


Fig. 1 Diagram of the spiral up evolutions of maps.

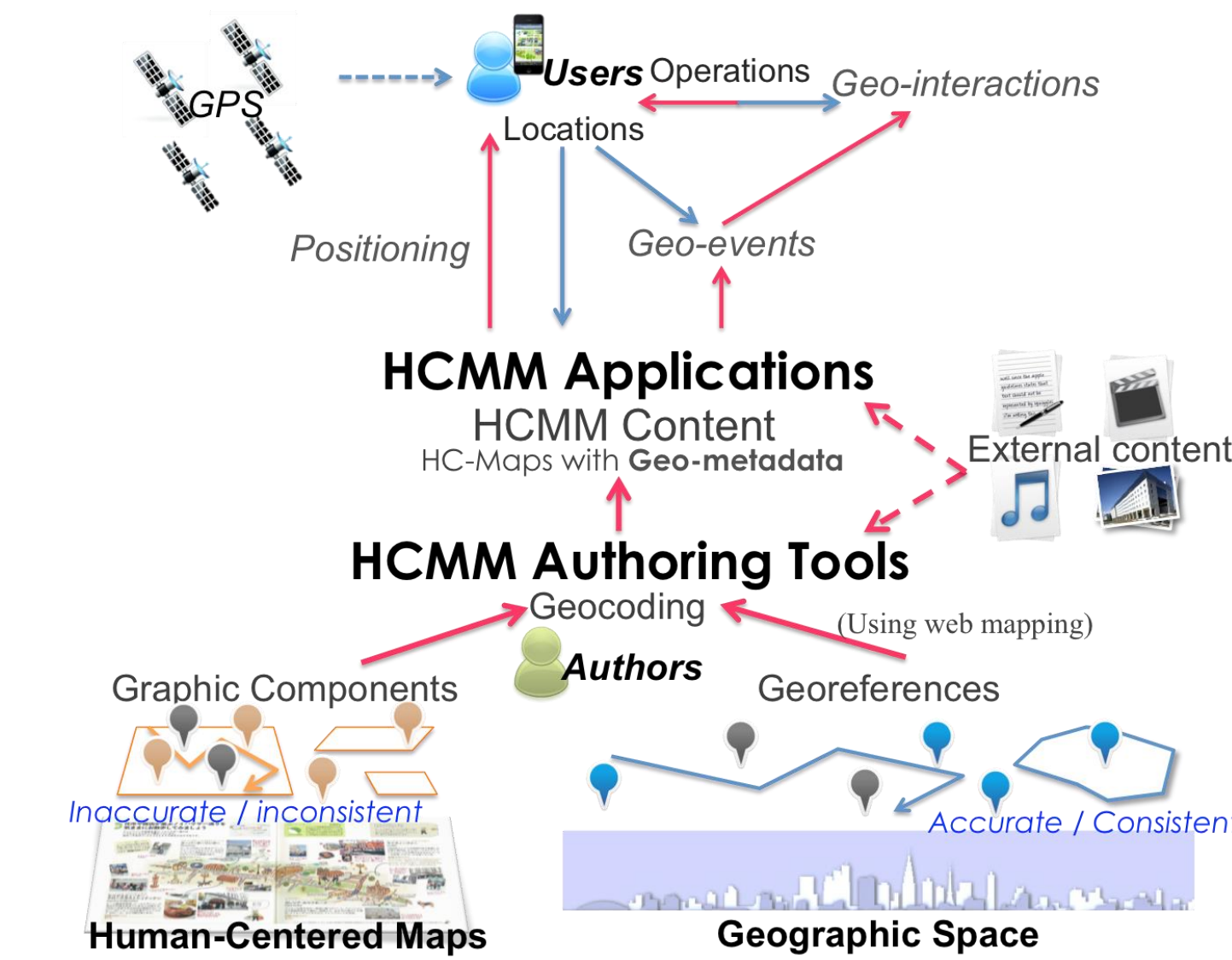


Fig. 3 Examples of (2) Secondary or ICT-based mapping between geomeia (real, graphic and language spaces) and geodatabase. It shows a framework of Human-Centered Mobile Mapping (HCMM) with the idea of importing existing well-designed conventional human-centered maps to the mobile environment, as a practical solution in the current technologies and conditions.



Fig. 5 Symposium on maps of the women, by the women, and for the women in 2012 in Tokyo. The number of the participants of the symposium became more than two hundreds.



Fig. 7 1:1000 Tokyo Model of Roppongi Hills in a Technical Tour of CIU2015 on March 17, 2015,



Fig. 9 Group Photo of CIU2015 at the entrance of Sanjo Conference Hall of the University of Tokyo on March 18, 2015 in Tokyo

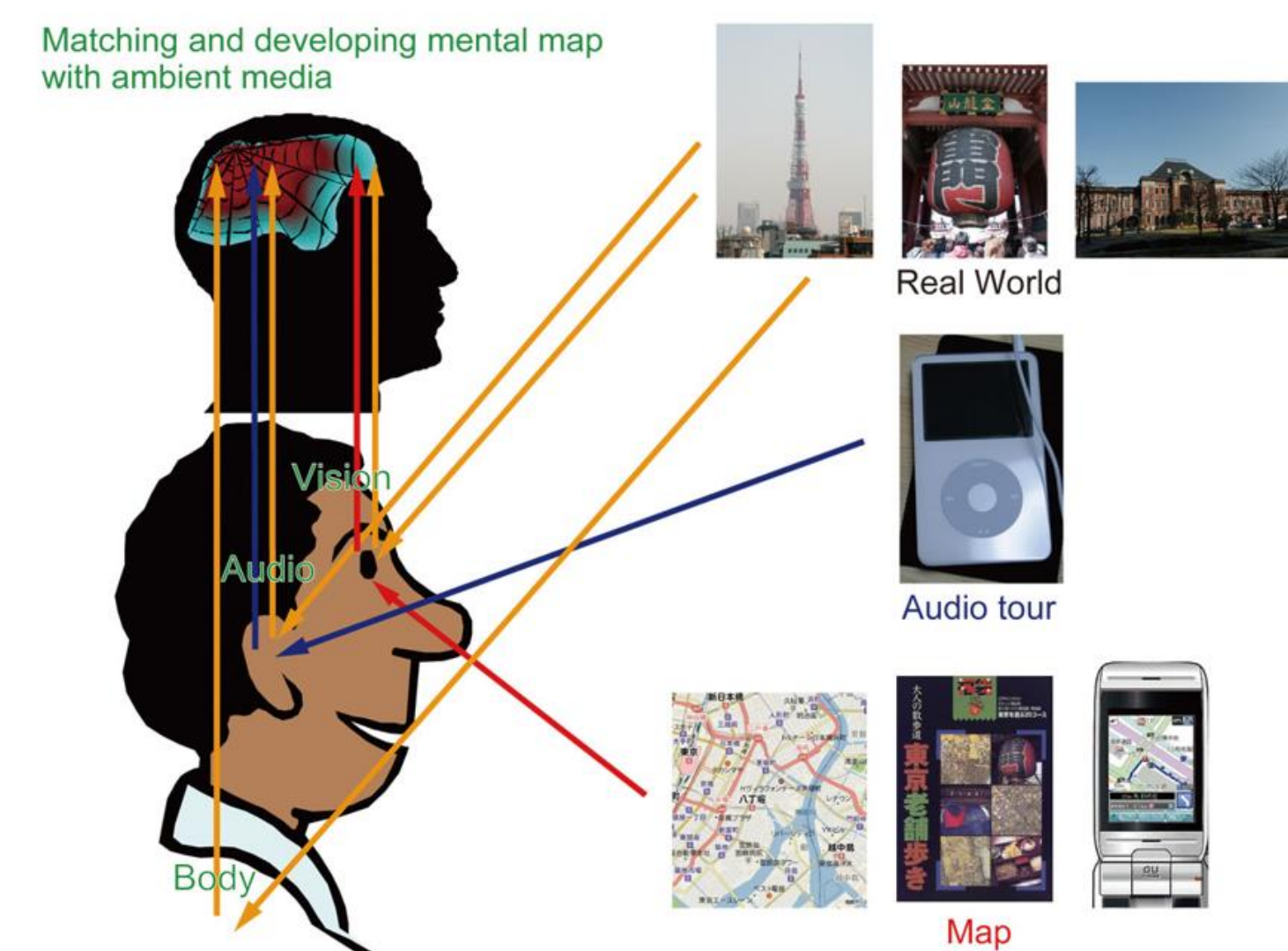


Fig. 2 Examples of (1) Primal mapping between geomeia (real, graphic and language spaces) and human (cognitive space)

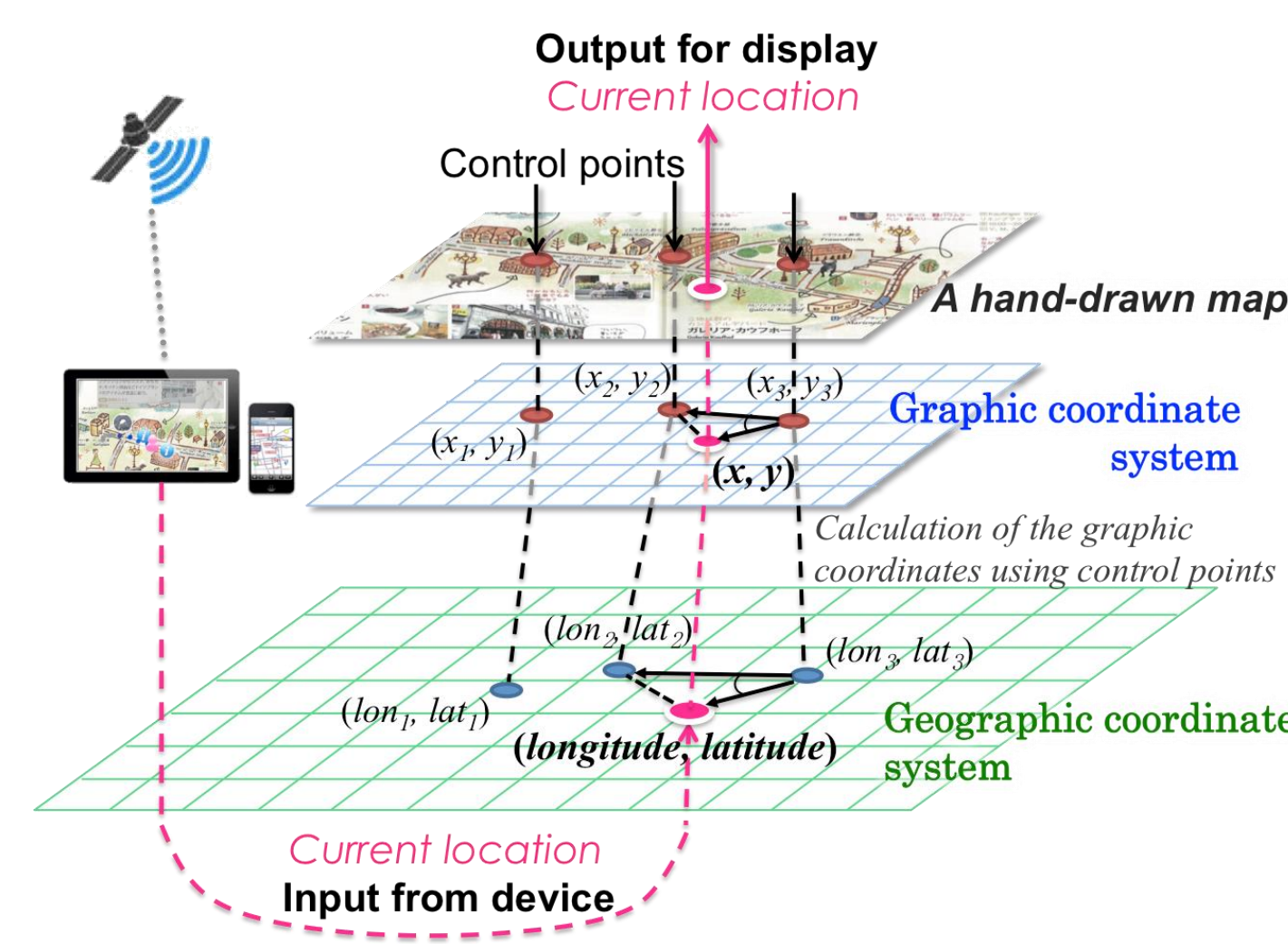


Fig. 4 Mapping processes of positioning on a hand-drawn map: using nearby control points to calculate the graphic position when a geographic location is obtained.

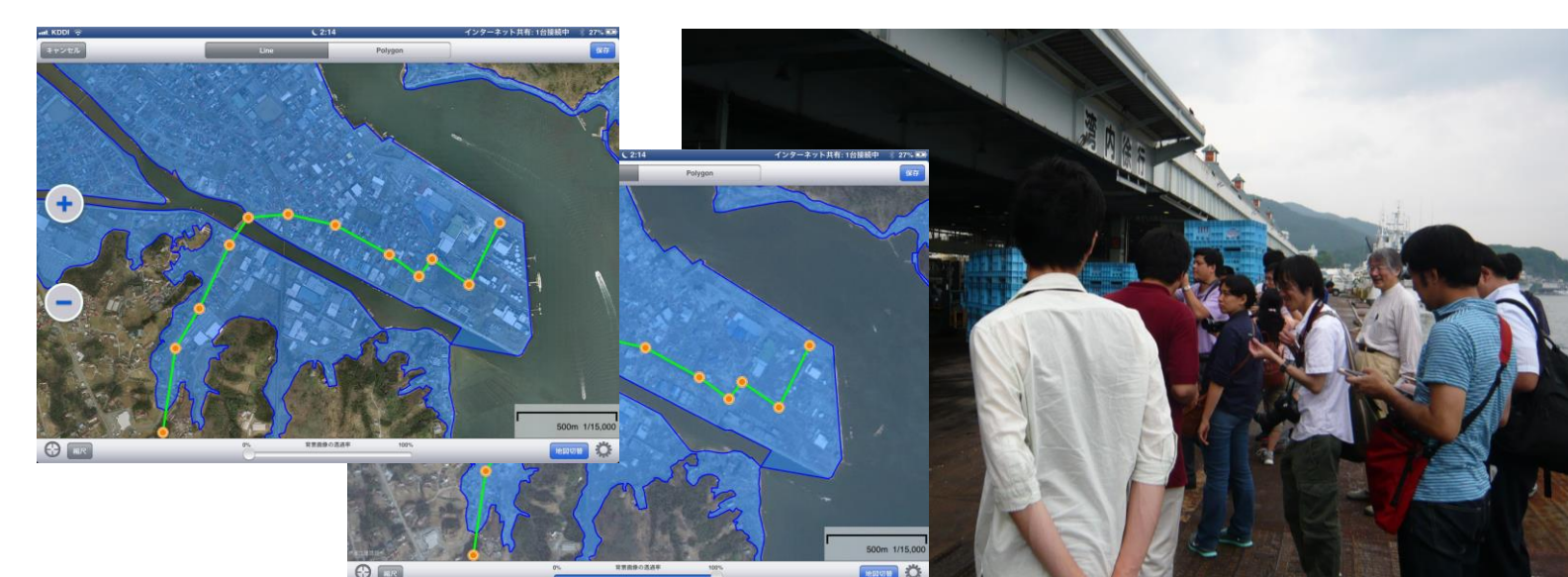


Fig. 6 Workshop on Ubiquitous Mapping in Kesen'numa City in 2012. Our commission had several technical field visits using original location-based applications. The above two screen shots on iPad's are use examples of one of our original location-based applications developed for the technical visits in Tohoku area suffered by Tsunami in 2011. The application helped the participants find easily their location in the real world and imagine what happened.



Fig. 8 Real-Time Monitoring Traffic Information at the Tokyo Metropolitan Police Department in a Technical Tour of CIU2015 on March 17, 2015 in Tokyo



Fig. 10 1:200,000 Globe Model made of ceramic tiles in Geospatial Information Authority of Japan in a Technical Tour of CIU2015 on March 20, 2015 in Tokyo

### (B) Activating and leading a research community on ubiquitous mapping in the world

#### [Original aim]

Organize workshops including site observation to comprehend contemporary situation of ubiquitous mapping.

#### [Achievement]

We have held several international symposiums and workshops on ubiquitous mapping as follows.

[1] ICA Workshop on Ubiquitous Mapping in Tokyo and Kesen'numa, Japan from July 28 to 31, 2012

The workshop was composed of two parts. The first part was held on one day, that is, July 28, 2012 at the University of Tokyo, Kashiwa Campus. The part focused on exchanging ideas through aural presentations of research and planning for activity of the Commission of Ubiquitous Mapping. The number of the participants of the first day is about thirty. The second part was held on three days from July 29 to 31 in Kesen'numa City which is famous as beautiful ria coast and was destroyed in part by Tsunami on March 11th, 2011. The workshop has provided participants with several mobile applications on iPhone's and iPad's which were developed by our local organizing group to efficiently understand on site what happened in the areas damaged by Tsunami on March 11th, 2011 using past aerial photos and the borders Tsunami arrived overlaid on aerial photos and residential maps with GPS positioning.

#### [2] CIU2015

The three commissions, which are Maps and the Internet, Theoretical Cartography, and Ubiquitous Mapping, organized a joint International Symposium on Cartography in Internet and Ubiquitous Environments (CIU2015) in Tokyo, Japan from March 17th to 20th, 2015. It was also sponsored by Center for Spatial Information Science (CSIS) of the University of Tokyo. The first and fourth days were spent for technical tours of visiting Roppongi Hills (one of the largest integrated property development in Japan), Tokyo Traffic Control Center, the Geospatial Information Authority of Japan (GSI), Geological Museum and so on. The participants experienced various kinds of maps and the culture behind them in Japan. The conference was held on the second and third days at Sanjo Conference Hall in Hongo Campus of the University of Tokyo. The number of the participants was about seventy, and they came from China, USA, Taiwan, Philippines, Vietnam, Indonesia, Australia, India, Bangladesh, Iran, Kuwait, Egypt, German and Japan. The proceedings are available from the web (<http://ubimap.csis.u-tokyo.ac.jp/ciu2015/>). Selected papers of the symposium are prepared to be published from Springer.

#### [3] TEC2015

ICA Joint Workshop - Towards Evolutionary Cartography from Global Perspectives - Organized by Commissions of Theoretical Cartography and Ubiquitous Mapping, Windsor Florida Hotel, Rio de Janeiro, Brazil, August 21st, 2015.