Title of Project : Large-Scale, Tempo-Spatial Information Gathering Mechanism over DTN-enabled Distributed Micro-modules

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【Purpose and Background of the Research】

Earthquakes and disasters are unavoidable in Japan. Therefore, the information infrastructure should be robust to such emergency cases, and innovative technologies for constructing alternative infrastructure have been required. In this research project, we consider emergency situations with limited availability of cellular networks and Internet connections in urban areas, and develop a methodology to autonomously organize survived communicating nodes to realize a large-scale, tempo-spatial information gathering. One of the significant research goals is to support rescue teams' critical missions and disaster victims' evacuation planning. The mechanism employs ad-hoc collaboration between the survived infrastructure and a number of mobile nodes involving mobile base station, on-board units of vehicles and disaster victims' smartphones.

【Research Methods】

We design the following functions. (1) micro-sensing functions by available mobile nodes and stations (called micro-modules) for sensing and situation awareness, (2) DTN-based communication facilities over micro-modules (Figure 1), (3) micro-processing functions for smart understanding of situations on micro-modules and (4) autonomous tempo-spatial information gathering among micro-modules. Finally, we will prototype a platform that involves these functions (Figure 2).
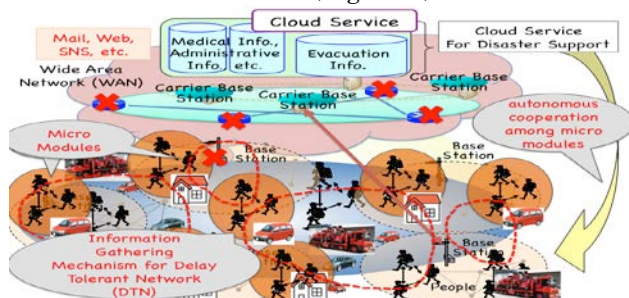

Figure 1 Information Gathering Mechanism over DTN

【Expected Research Achievements and Scientific Significance】

It is very necessary in well-populated urban areas to deploy resistant cellular network infrastructure with uninterruptible power supply (UPS). However, installation of such infrastructure is not often reasonable in rural areas. Meanwhile, recent smartphones and car navigation systems have sufficient capabilities to communicate and co-operate toward information gathering and sharing in disaster areas, but these mobile nodes are not always connected and designing self-organized computation mechanism is a primary research challenge. This motives us to realize information sharing over delay tolerant networks (DTNs).
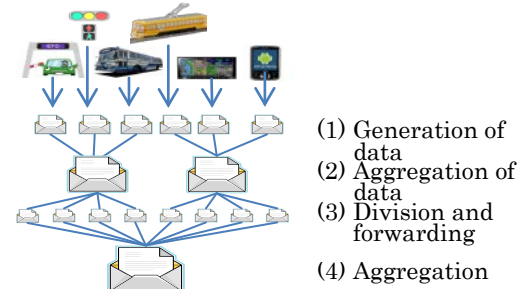

(1) Generation of data
(2) Aggregation of data
(3) Division and forwarding
(4) Aggregation

Figure 2 Tempo−Spatial Info. Gathering Mechanism

【Publications Relevant to the Project】

T. Higashino and A. Uchiyama: "A Study for Human Centric Cyber Physical System Based Sensing -Toward Safe and Secure Urban Life-", *Communications in Computer and Information Science*, vol.146, pp.61-70 (2013).

H. Yamaguchi, A. Hiromori, T. Higashino, et al.: "A Novel Scheduling Algorithm for Densely- Deployed Wireless Stations in Urban Areas", *Proc. of 16th ACM Int. Conf. on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM 2013)*, pp.317-326 (2013).

【Term of Project】 FY2014-2018

【Budget Allocation】 140,000 Thousand Yen

【Homepage Address and Other Contact Information】

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