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# Maintaining telecommunication reachability while in disasters

HIEHATA, Yasuhiko*, KOTO, Hideyuki and NAKAMURA, Hajime

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**SUMMARY**

High expectations have prevailed in recent years that systems would be developed to provide individuals with proper communication in disasters, using mobile terminals such as digital cellular phones. However, the base transceiver stations (BTSs) and infrastructure that mobile terminals require may break down in a disaster. As a result, the users cannot communicate their urgent needs. In the recent Mid Niigata Prefecture Earthquake (Oct., 2004, Shinetsu area in Japan), 135 BTSs of cellular phones were simultaneously disabled and the number reached 189 in total. Consequently, a lot of people could not contact their families because of the power failure and infrastructure breakdown.

To solve these problems, ad-hoc network systems have been proposed, specialized for disasters. A proposal secures emergency communication for users by constructing a sky-mesh network with balloons as ad hoc network nodes in earthquakes. Fujiwara et al. proposed a routing method that discovers an efficient route in disasters, for instance by minimizing the number of hops.

BTSs are generally crowded in overpopulated areas such as Tokyo. Therefore, we expect that users needing to communicate can move to nearby areas covered by other BTSs, and this well serve users' communication needs even in a disaster.

In this paper, we propose a communication support system that provides emergency communication capability for users in disaster areas by leading them to available BTSs or infrastructure with digital TV broadcasts. In addition, we propose a relay application between a terminal that cannot connect to any nearby BTS and a terminal that can connect to an available BTS by using common near field communication such as IrDA or Bluetooth. The Proposed application improves the connectivity of users who cannot directly communicate with any BTSs due to incompatible specification of communication. Distributing this application to users in advance will enable them to send emergency messages even if they are guided to a BTS that uses a different communication method from theirs. With this application in place, the system can guide users to a BTS that they otherwise could not use due to the different specification.

In this paper, we describe the concept of our proposed system. This navigation system can use various navigation algorithms. For example, we can design algorithms that take into account any or all of the following: the distance from each terminal to an available BTS, the remaining battery life of available BTSs or terminals, and network traffic congestion at any available BTSs. We also demonstrate a navigation algorithm for network traffic control that alters according to capacity and congestion of BTSs. We then evaluate its validity with numerical simulation, and show a sample implementation of the proposed system.