PROJECT SUMMARY

Overview:

Emergency communications networks are crucial for monitoring and providing assistance to affected people during long-persisting disasters such as Tohoku earthquake in Japan or Hurricane Katrina in the US. Given substantial and increasing penetration of smart-phones throughout the world, we envision future emergency networks to consist of adhoc links between mutually reachable smart phones in the disaster area, unfailed portions of the cellular network, and the communication capabilities provided by the specially deployed emergency equipment (e.g., fixed and mobile wireless access points deployed on the ground or in air via helicopters, satellite radio interfaces, etc.) All these components vary in their ability to provide necessary communications as the disaster unfolds. It is therefore essential to continuously monitor and ‘‘tune’’ the network to provide the best possible coverage and communications capability. We envision the network evolution to be based on both automated data collection from the smart phones via specially designed emergency apps (e.g., sounds, pictures, weather conditions, vibrations, etc. in the area), and human directed communication such as phone calls and social media. In this proposal we consider integration of
only the twitter based information regarding the local situation
because of its simplicity and popularity

Intellectual Merit :

This proposal examines how a emergency network can be built using smart-phone based ad hoc networks as underlying technology and then evolved dynamically as the disaster unfolds. The explored approach includes (a) a WiFi tethering based ad hoc smart phone network that uses a distributed scheme with minimal coordination to cope with the mobility, (b) an intelligent and adaptive deployment of movable access points/communications centers to connect disconnected network components, (c) dynamically forming coalitions among the smart phones in a vicinity in order to exploit the overlap/redundancy in the sensed data for conserving smart-phone battery and other resources, and (d) examine how the data obtained from twitter during the disaster can be exploited for obtaining a global view of the situation and thus help network evolution. The analysis of twitter data itself involves several bigdata challenges including the fact that many tweets may not be relevant, may not carry accurate location and time information, and the content could be fuzzy or mutually conflicting. Because of the difficulty of handling these issues in an automated fashion we focus on devising effective mechanisms for classification, prioritization, and ordering of tweets so the interpretation and decision making is simplified for the human operators in the loop. However, the project is not about the effectiveness of human-in-the-loop control, and will only examine issues of effective implementation of the network evolution goals that are provided by the human analysis.

Broader Impacts :

The increasing frequency and impact of disaster events coupled with well established or rapidly increasing penetration of smart phones in all countries of the world makes smart phone based disaster relief networks both practical and ideal means to both communicate with affected people and also collect crucial data such as sound, pictures, vibrations, temperature, etc. using an increasing array of sensors already available on the smartphones. In addition, owing to the modest technological requirements and ease of use, twitter has established itself as the premier human communication mechanism during disasters. This project takes these two phenomenon and stitches them together to create an agile disaster communications network that is expected to provide significant additional value in future disasters.

Keywords: Disaster Recovery, Ad hoc communications, Twitter, Network Evolution, situational awareness.