Crowdsourcing with mobile techniques for crisis support

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ABSTRACT

Within natural processes responsibilities from central authorities to local levels as first actors of civil protection is a changing pattern. Prevention and preparedness are long-term goals in natural hazards, based on capacities of professional volunteers, and awareness of the citizens as local inhabitants. MAppERS is based on human role as "crowd-sourced mappers" through mobiles application. The feedback from testing and the training courses aim to raising participation in a networked disaster response. The aim is designing and testing an app for mobile with a real-time dashboard platform for public citizens and volunteers of civil protection. Two pilot sites, including trainings on modules fixing, control usability and quality of the product. The synchronized platform offers the activity of cloud data collection with a central data dashboard. A first context of floods processes gathers data in simulations, with crowdsourcing achievement from local population, for proper awareness and long-term preparedness. A second context tests pre-emergency actions on field with rescue team, collecting state-of-art and condition of hazards.

INTRODUCTION

A collective effort of users as "crowd" for problem solving is innovative sustained contribution (Nguyen et al., 2016), like for rescues services and governments authorities (Pedersen et al., 2013, Sievers J.A., 2015). The crowdsourcing-inspired method assumes network of public users for update on content. A pattern in governance gradually spreads the responsibilities from central to local authorities and the interaction with public is an opportunity to lower the costs for data acquisition, as example of crowdsourcing of citizens-scientist (Fienen and Lowry, 2012). MAppERS project (Mobile Application for Emergency Response and Support) deals with human sensors towards mobile application (SA) within crisis support for natural hazards, and prevention of exposed people. Citizens and volunteers enhance efficacy of crowdsourcing as first actors within strategies of surveillance. The SA splits into module MAppERS-V (MP-V) for volunteers and module MAppERS-C (MP-C) for citizens, re-designed according to methodological and logical testing gained during pilot study (Frigerio, 2015). Training and piloting fulfil a long-term objective of participation and crowdsourcing as actors of prevention of hazards, according to the priorities set by the Hyogo Framework. The empowerment of the population reduce costs of emergency management and the training curricula promote awareness with specialized jargon toward SA. The Graphical User Interface (GUI) implemented within SA offers a communication scheme for MAppERS frame. The usability of SA integrates efficiency, effectiveness, accuracy, easiness and error tolerance (Quesenbery 2003). Furthermore, criteria for layout, navigation, accessibility, icon setup and text guidelines design complete the review (Graham, 2011, Wong, 2011).

MAPPERS APPROACH

The modules MP-V and MP-C empower "crowd-sourced mappers" with geo-located information and field survey tested with real case studies. The crowdsource provides support for rescue services, crossing a continuous training as a form of organizational learning and data entry during crisis. Citizens and volunteers promote self-awareness and contribute hazard-relevant information toward mobile. Frederikssund-Halsnæs Fire & Rescue Service manages 372 km² in Denmark, with powerful storms occurred in last years, underlining requisites of accurate vigilance. MP-C offers a *Citizens Kit* available for citizens voluntary registered,

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maintaining proper training for safety measures, and providing geo-located data required by rescue service. Consequently, MP-C improves people's awareness as long-term aim and offers the capacity of real-time information within crisis. Helsinki City Rescue Department coordinates a complex multi-risk reality of the entire capitol city in Finland. The strategy for sheltering population considers people as primarily target focus on safety of life. MP-V aims to simplify the management of resources and roles of volunteers, growing quality of on-field reports and set quickly a local-based prioritization or personnel. MP-V is a *Volunteers Kit* for rescue crew, to organize real-time and standard information for damages during crisis. Crowdsourcing offers decentralization of skills and rapid data gathering without be invasive for emergency procedure.

ARCHITECTURE AND SERVICES

MAppERS includes services for data transfer, modules and dashboard. During piloting, a participants-empowered feedback was essential for both modules, while the test provided criteria of content completing, bug-fixing and optimization in Android environment. Within screens on mobile phone, any kind of measurement is in real time toward an easy-to-use kit. The service links a number and a photo, with control on image size. In Figure 1 as example, the water level gages is marked with height (centimeters) linked with date time. Sending button updates the tables in MySQL DB within dashboard by PHP Webserver. Within water level chart, an image URL shows the photos and a slide bar controls visibility by date range. Cascade menu and tools of updates arrange long lists of text. Inputs by users are observable towards dashboard. Text is abundant for each dropdown menus, maintaining usability of the screen and updatable by users. Within "protection measures" as example, users can enlarge menu and check text in own profile as a sort of guidelines. The personal kit offers capacity to update profile, automatically saved after editing. A geo-located upload by users combines real time mapping with spatial data, as example of involvement and data arising from public (See et al., 2016). In Figure 2 a family team can upload the details required by rescues service for safety in case of crisis. The jQuery autocomplete service wraps the geo-located database by public registry office. The data appears visible in the dashboard and linked to external QGIS project. The access multi-users by GPS with classified dots can be active simultaneously. Clusters of visibility is customized to the kits. As example in Figure 3 the threat of live is required to volunteers as geo-located info, while status for single user appears with GPS recognition. The presence of not on-going life threat as green dot or the real life threat with red dot is represented by easy-to-use buttons and customizable by targets. The location and tracking of each mobile are visible and classified by life threat for volunteers on field. Volunteers are visible simply with ID code internally all squads, while all details of contacts are visible in the dashboard. A free text upload appears as active tool in dropdown lists and a pop-up display emerges for update. The kit is able for single users, while the author and the text appear in the dashboard. In a list "Type of Event" as example, a new text enriches a menu if confirm by user. The update of list is not automatic, while rescue managers evaluates content and feasibility. A geo-located service for emergency message fixes a text, previously prepared and request for safety. The text can be modify and saved within profiles, while coordinates depends on user location. Retrieving phonebook contacts loads a list by mobile and not by profile. Multiple contacts, previously add and customizable, are able for direct send by mobile. The dashboard allows data management in real time toward PHP Web Server and MySQL DB (Figure 4), essential for bug-fixing of during piloting and data control for evaluation. Users have access to proper module (MP-C or MP-V) or both (Administrator). Dataset has same graphic criteria and order as the app, while tables cope with full dataset in real-time. The field "Damage" or multiple sorting are criteria for order and filtering data. The database allow visualization of a real-time crowd-data and furthermore analysis.

RESULTS AND FOLLOW UP

MAppERS works with mobile technology and a dashboard for a demo to support rescue services. Data transfer is available and bi-directional between users and rescue teams, while contents and guidelines increased essential and active updates during piloting. The mobile phone assumes local languages after installing. The

wireframe includes a large research for those parameters crossed on existing examples at world level, identifying best examples as guideline. Users accede both modules with a common screen for registering and sign-in. The Citizens Kit includes a crowdsourcing reporting tool for personnel preparedness and reporting. Each citizen volunteers participates with personal information of family, including vulnerable people present to the geo-located address and setting the age range. People with limited mobility and elderly people in need of assistance can be add for special safety request. The idea of crowdsourcing was a direct test for study areas, involved for data gathering and self-preparedness. Future aims should involve the customization of the platform for adapted task involved to natural hazards, especially linked to new technology of sensors, as new advantage and low cost solutions for data collection by crowd, in contest of human sensors.

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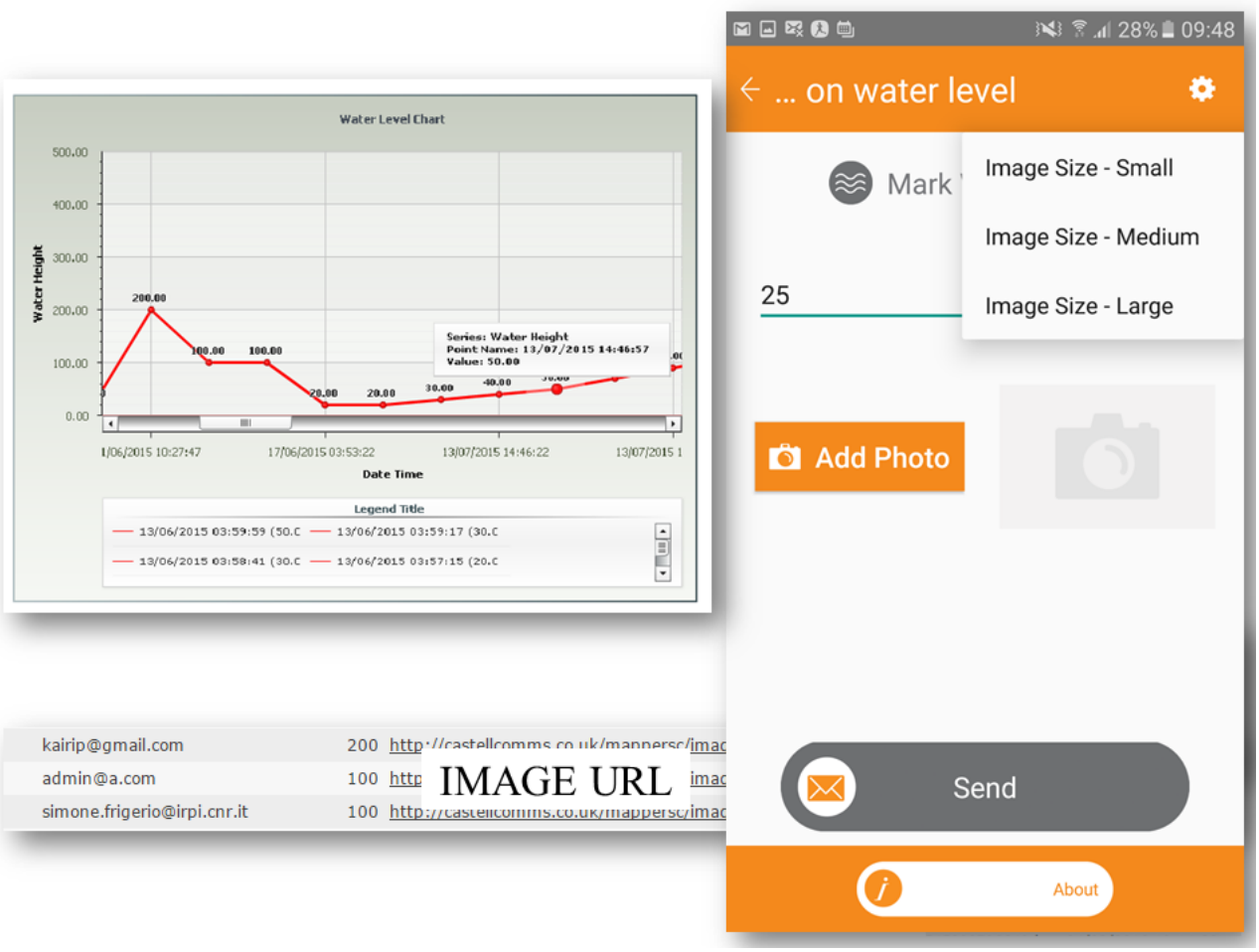

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137 Figure 1. Screen for water level chart. Tool and dashboard graph

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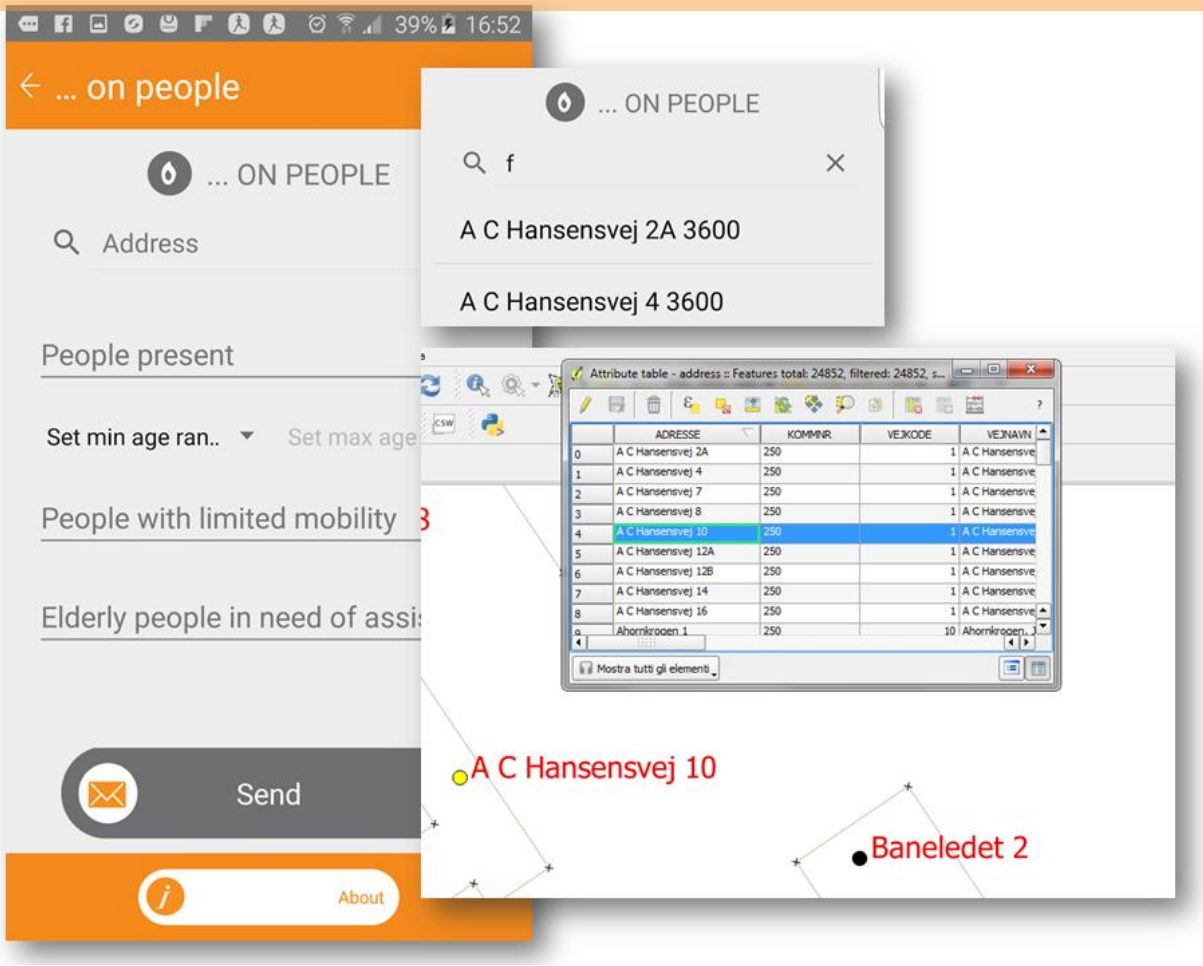
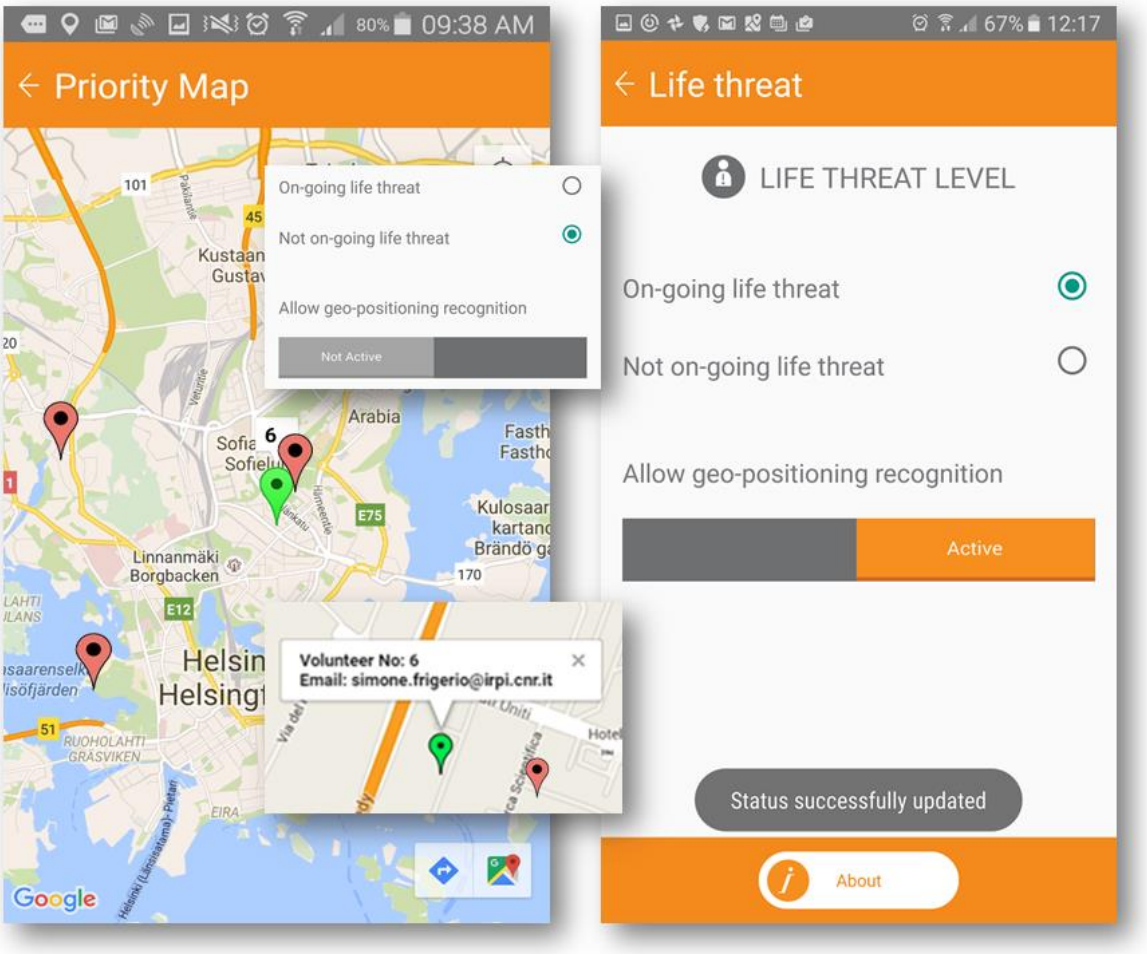


Figure 2. Upload details required with geo-location



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142 Figure 3. Level of threat of life located by GPS and classified on screen

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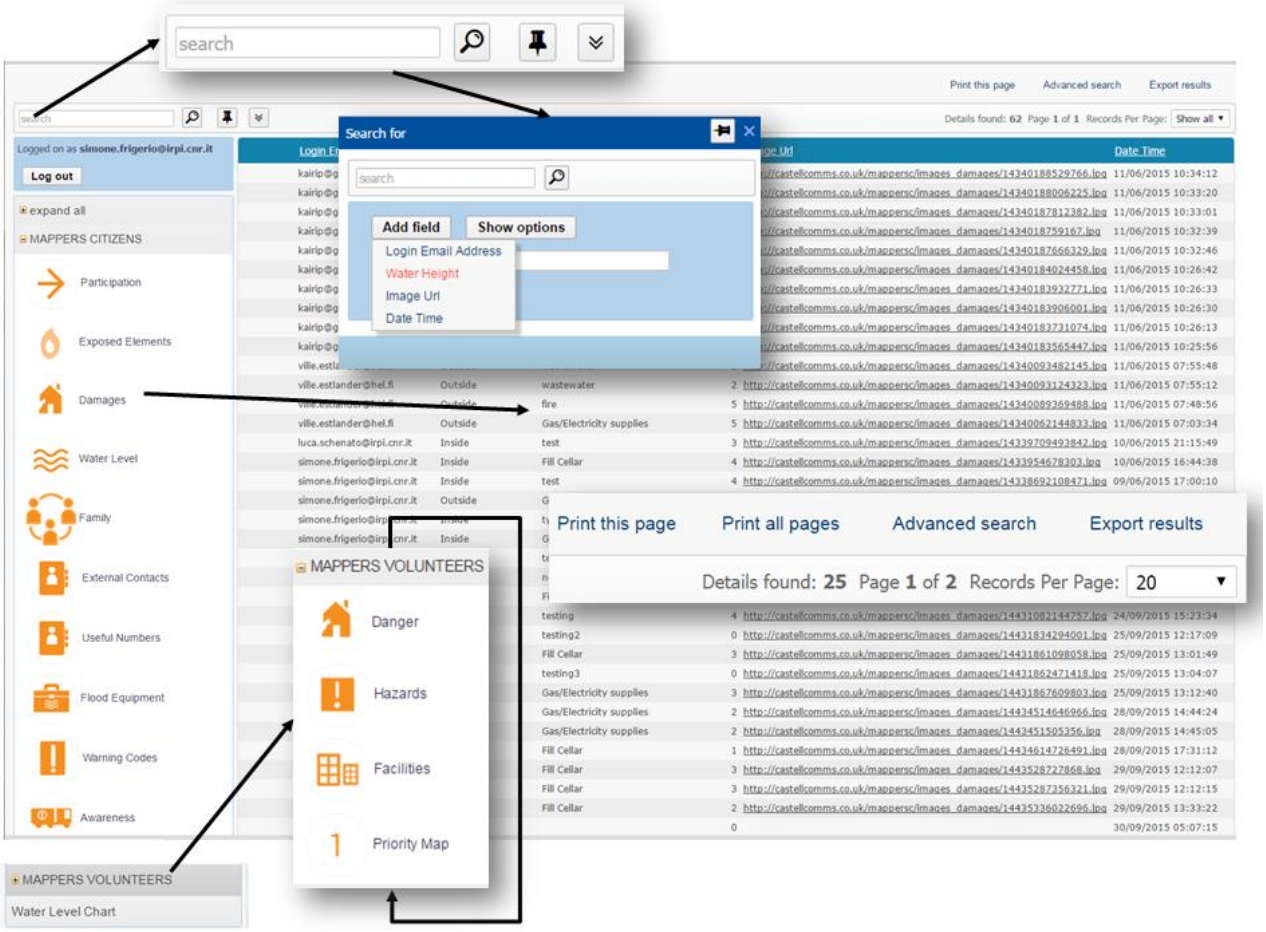

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145 Figure 4. Dashboard architecture with services and dropdown menu