Next Generation of Disaster Management and Public Safety—Delivering a Resilient Future

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Supporting Public Safety
by spatial information

Enabling disaster management & evidence-based
decision making
MESSAGE

To create a richer and smarter platform to support timely and effective decision making for disaster management

...a platform for ALL hazards, ALL agencies, and the community
A Worldwide Problem

Disaster events are increasing in frequency and severity

Images: www.bigstockphoto.com; twitter
Disaster management is **evolving and expanding**

driven by **policy changes** and the implementation of **strategic frameworks**

to address the **vulnerability, exposure and resilience** of communities.
The HFA is a 10-year plan to make the world safer from natural hazards.
Australian State Policy Frameworks

Over 20 plans and strategies identified for review.
Percentage of Urban Population and Agglomeration by Size Class 2025-2050

70% urban
30% rural

2050 (9.3 billion)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2011): World Urbanization Prospects, the 2011 Revision
Urbanisation Trend will Continue
Complex Structures
These predictions of increased global population and urbanisation...

...along with increased extreme weather events

is prompting response from researchers around the world to tackle:

Next-Generation Disaster Management
An Integrated Approach
Governance
Multi-sourced data
Open Standards
Collaboration
Effective Communication
Interoperability

A culture change in disaster management;
"Asking and Listening" vs. "Telling and Talking"
Good Information is Needed

Informing decision about “Where and When”;

• In order to decide which **risk** management choice is appropriate, stakeholders require **good information**.

• Without **good information** these decisions are difficult.
Volunteered Geographic Information & Crowdsourcing

User-generated content that contains either implicit or explicit locational

Collaborative mapping activities of users and contribution of geographic data

Source of collective intelligence and relying on the idea that a group can solve a problem more effectively than an expert, even though the group has a lack of relevant expertise

Opportunities of accessing and exploring the vast repository of potentially useful, cost-effective and spatio-temporal data

A natural fit for use in a variety of applications, especially for time-sensitive contexts like emergency response that real-time geospatial data can be of great value

Issues and challenges in the quality and credibility of crowdsourced data, cited by a number of studies.
Geotagged vs. Non-geotagged Tweets

Geotagged vs. Non-geotagged Feeds in General

- 95~99%
- 1~5%

(Birregah et al, 2012)

Practical Study Conducted in CSDILA in Jan 2014

- 97%
- 3%
Methodology and Architecture of the crowdsourced Platform

Data Collection
From the Twitter Streaming API

Keyword Filtering
Earthquake, Storm and Flood

Duplicate Elimination
Eliminating Multiple & Identical Entries

Geotagging Analysis
Filtering the Non-geotagged Tweets

Storing and Structuring Data
Storing in PostgreSQL and making it GIS-ready

Mapping, Analysis and Visualisation
Using ArcGIS

(Laylavi, Rajabifard 2014)
Statistical overview of the disaster-related tweeter data Effective

Keywords
- Earthquake 65%
- Storm 29%
- Flood 6%

Geotagging
- 3% Geotagged
- 97% Non-Geotagged

Tweets (per country)
- USA 50%
- Japan 20%
- Philippines 4%
- Others 26%

Users (per country)
- 65% USA
- 9% Philippines
- 5% England
- 21% Others

Language
- English 57%
- 37% Japanese
- 6% Others

(Laylavi, Rajabifard 2014)
Overarching challenges for an effective Disaster Management:
Connecting and building relationships; establishing principles for sharing; reliability and performance; and legislation.

Proposing a Framework comprises a foundation and four pillars:
Governance and Leadership, Capability, Assurance and Community.
Challenges for Effective Disaster Management

Better Networks
- Robust, secure, more extensive.

Better Information Sharing
- Shared, accurate, timely, relevant, available.

Better Shared Understanding
- Shared, joint, inter-government, coalition and multinational.

Better Decisions
- Superiority, better informed.

Better Actions
- Agile, improved tempo.

Better Effects
- Synchronised, proportionate, appropriate.

Benefits Chain

(MoD, 2005)
Challenges for Effective Disaster Management

3. Reliability and performance
   Ensuring what’s in place actually perform effectively in managing the disaster

4. Legislative support for the developed strategies and activities.
Framework for effective disaster management

Effective Disaster Management

- Governance and Leadership
- Capacity
- Assurance
- Community

Foundation

- Spatial Data Infrastructures
- Research
- Past Reviews

Research Priorities

Priority 1: Understanding natural disasters
Priority 2: Enhanced Decision Making
Priority 3: Technology
Priority 4: Strengthening community resilience
Priority 5: Mission critical communications
Priority 6: Policy
Centre Focus

- Multi-disciplinary
- All hazard and all phases of disaster management
- Global themes and engagement
Research Priorities

- **Priority Area 1:** Understanding Natural Disasters
- **Priority Area 2:** Enhanced Decision Making
- **Priority Area 3:** Technology
- **Priority Area 4:** Strengthening Community Resilience
- **Priority Area 5:** Mission Critical Communications
- **Priority Area 6:** Policy

Training

- **Community Education**
- **Intensive Training**
- **Executive Training**
- **Short Courses**
- **Online Training**
- **Formal Training: Masters level**
External Interest

Over 20 countries and 40 organisations and 15 universities have expressed their interest in being involved.
WITHIN THE UNIVERSITY OF MELBOURNE

• Over 50 researcher from:

Melbourne School of Engineering
- Infrastructure Engineering
- Computer Science and Software Engineering
- Mechanical Engineering
- Electrical and Electronic Engineering

Faculty of Science
- Department of Mathematics and Statistics
- Department of Information Systems
- School of Earth Sciences

Faculty of Medicine, Dentistry and Health Sciences
- School of Population and Global Health
- Social Work

Faculty of Architecture, Building and Planning

School of Government

Melbourne School of Land and Environment
- Forest and Ecosystem Science
- Resource Management and Geography

Melbourne Law School

Faculty of Education
INTELLIGENT DISASTER DECISION SUPPORT SYSTEM
The technical aspects of the system include:

- Webmapping component
- Crowd sourcing component
- Modelling component
- Optimisation component
- Access to authoritative information
The system is current and interactive:

- Live emergency feeds **aggregated from official sources** and the crowd
- “Smart Safe City” mobile app will enable the **two-way communication** between the community and decision makers in a disaster context.
To assist in your evaluation, you can:

- **Load** and **visualize** infrastructure **layers** in IDDSS
- **Query** attribute **data** on map
The system has a number of analysis options:

- **Flood simulation** and **water depth** calculations
- **Property damage assessments** using various damage curves
- Total damage **cost statistics** of flood affected area
The system allows you to:

- Conduct a **bushfire propagation simulation**
- Carry out a **risk area analysis** using buffer rings and statistics
- Determine most the effective **resource assignment** through analysis
- Generate routing over **damaged road network**
Through integration with the Eva Planner:

- Animate **fire spread** and regional **evacuation** sequence
- Egress **time comparison** among 3 different scenarios (blue, red, green)
- **Generate statistics** (exposure population, affected vehicles) on both local and global levels
A tool to bridge disaster management research gaps:

**DISASTER MANAGEMENT RESEARCH REGISTER (DMRR)**

Welcome to the Disaster Management Research Register

This website is a repository of disaster management research worldwide. Within the website is a map of disaster management research worldwide, details relating to specific projects, and resources for finding relevant disaster management projects for you.

Find related disaster management research – worldwide!
Welcome to the Disaster Management Research Register (DMRR). The Register is a repository of disaster management related research worldwide. The Disaster Management Research Register (DMRR) provides a forum for researchers to share and become aware of different disaster related research taking place – no matter the hazard, the disaster phase under focus, or the country being studied. Researchers from ALL countries and ALL organizations can list information about their research projects and view information about other research projects taking place. To view the current disaster management research listed, view the map below.
Lessons Learnt

We are facing unprecedented challenges…

**Fundamental requirement:** COLLABORATION.

Interoperability at the data level in an unrestricted manner;

**Seamless integration** and free flow of data and information exchange.
Thank You
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