Using Location-Based Social Networks for Disaster Management

Presentation for the United Nations/Latvia workshop on the Applications of Global Navigation Satellite Systems

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Outline

**MOTIVATION**

Flickr.com

**ENABLERS**

iphonebuzz.com

**ASSUMPTIONS**

discovery.com

**CASE STUDIES**

standard.net

**CHALLENGES**

hackingtricks.blogspot.com

**RECOMMENDATIONS**

Esa.int
Motivation

• Based insights from a research for Israel Emergency Authority
• Using infrastructure grids as sensors for situational awareness in crisis
• Analysis of most deployed infrastructure grids (electricity, gas, water, ICT, alarms etc.)
• Key finding: new sensors are needed
• Mobile Crowdsensing for Emergency
Current Research

• Social Networks Applications (SNA) are a new phenomenon that changes the way people communicate

• GNSS based SNA applications are used for various applications: social navigation, geo-social consuming, etc.

• Search and rescue efforts recently show increase use in SNA+GNSS that is likely to increase

• How could SNA be utilized in crisis management to better respond in future crises?
“Mobile crowdsensing applications leverage consumer mobile devices (e.g., smart phones, GPS gadgets, and cars) to collect and share information about the user or the environment, either interactively or autonomously, towards a common goal.”

Source: IBM
“If I have seen further it is by standing on the shoulders of giants”

-Sir Isaac Newton

William Blake, Newton, 1795
Source: http://blog.julianlass.com

Augmented Reality in NYC, 2011
Source: http://www.gizchina.com
Trend 1 - GNSS

- GLONASS announced IOC on GNSS meeting December 2011
- Areas covered with up to 4 systems
- Price, size and **power consumption** decreasing dramatically

"Global shipments of GNSS-enabled mobile phones are expected to reach 1 billion in 2020. This is driven by increasing attractiveness and affordability of devices ...”

(The Space Report 2011)
Trend 2 – Internet

• Began in 1960s but rapid commercial acceleration in 1990s
• Services less than “15 years old”: Email, search wikipedia, social networks, e-payments, blogging and more
• Recent development of cloud services as part of BCP.

Source: isoc.org
Trend 3 – Social Networks
Trend 3 – Social Networks

• Increase the speed at which a community can better communicate, coordinate, mobilize and use resources

• User spending more time on social networks

Community resilience and the ability to adapt to change is related to the strength of its social networks

(source: National Research Council)
Benefits of Social Networks

- **Interactivity** – Users can interact and disseminate information in one-to-many and many-to-many forms.
- **Virallity** - messages can be exponentially spread using online services.
- **Measurability** – online actions of users can be measured.
- **Documented history** – actions online can be stored for past analysis.
- **In sociological terms, ongoing contact with people can improve resilience.**
- **Information intelligence gathering** to improve situational awareness in crisis.
Trend 4 – Smartphones and applications

- **Global increase in mobile-cellular subscription**
- **Mobile Apps**
- **Integrated MULTI GNSS GPS and GLONASS (iPhone 4s)**
- **High relevance to emergency response**

Source: ITU
Timeline of Major Technology

**Social Networks**
- Facebook 2003
- Twitter 2006
- YouTube 2005

**Internet**
- Arpanet 1967
- Internet 1995
- Google 1997
- Hotmail 1996
- PayPal 1998
- Wikipedia 2001
- YouTube 2005

**Mobile & Cellular**
- Email 1966
- Arpanet 1967
- 3G / WiMAX 2001
- iPhone 2011
- Quad Core Galaxy S III 2012

**GNSS**
- GPS / GLONASS IOC 1993
- GPS s/a 2000
- GLONASS renewal 2001
- GLONASS IOC 2011

**Satellite Triangulation**
- 1960
- 1990
- 2000
- 2011

- Satellite Triangulation 1970
- GSM 2G 1991
- 1st SMS 1992
- Palm Pilot 1996
- Wi-Fi 1997
- 3G / WiMAX 2001
- iPhone 2007
- Dual GNSS iPhone 4S 2011
- Quad Core Galaxy S III 2012

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Assumptions

• Tools that will be used in the early stages of a crisis are the ones used before the crisis.

• Communication is essential and thus be restored.

• Changing communication ways are forcing governments to integrate solutions in working platforms instead of developing new ones.
Case Study -1

2010 Haiti earthquake

UN Mission Building Port Au Prance

Source: [http://news.bbc.co.uk/2/hi/americas/8458690.stm](http://news.bbc.co.uk/2/hi/americas/8458690.stm)
Introduction

Earthquake and aftershock map

Tent City in Port-au-Prince area

Source: http://www.heartlandalliance.org/international/updates.html
Communication infrastructure

Haiti Earthquake damage map
Source: OpenStreetMap

Damaged communication infrastructures

All Partners Access Network (APAN)

APAN mobile app screen shots

Source: APAN.org
Mission 4636

Mission 4636 architecture

Source: http://www.search-internetmarketing.com/tag/mobile-services/
Disaster management systems

Ushaidi Report Map
Source: http://haiti.ushahidi.com/
Google Crisis Response Team

Google earth images before and after the earthquake

Source: http://www.pcworld.com/article/186897/google_earth_reveals_the_devastation_in_haiti.html
OpenStreetMap Response team
Success stories

The Israeli hospital – Haiti
Source: http://www.tampabay.com

Health facilities location

Israeli search and rescue team in action
Source: http://www.vosizneias.com
Case Study -2

2011 Japan earthquake and tsunami

People wait to be rescued in Kesennuma, Miyagi Prefecture March 12

Introduction

The U.S. Indian Ocean Tsunami Warning System (IOTWS)
Source: http://www.boston.com/
Communication infrastructure

NTTDoCoMo disaster recovery scheme
source: http://www.nttdocomo.com/disaster/index.html

Earthquake’s Impact on Japanese International Bandwidth
Introduction

"While there are so many technologies at this time that isolate us ... social networking tools have shown their ability once again to unify us as human beings”

Tweet from US state department
source: http://idisaster.wordpress.com/
Online search and rescue efforts

**Person Finder: 2011 Japan Earthquake**

Survivor looking for relative survivors


Google person finder received 7000 request in the first few hours


What is your situation?

- **I'm looking for someone**
- **I have information about someone**

Currently tracking about 37400 records.

PLEASE NOTE: All data entered will be available to the public and viewable and usable by anyone. Google does not review or verify the accuracy of this data.

Embed this tool on your site - Developers - Terms of Service
Google Crisis Response Team


Earthquakes in the last week map: source: http://googlemapsmania.blogspot.com/2011/03/japanese-earthquake-maps.html
http://earthquakes.tafoni.net/?lat=37.23032838760387&lon=146.22802734375&type=map&zoom=6
Youtube Person Finder

Source: http://www.nitro-digital.co.uk/blog/2011/04/12/natural-disasters/
Disaster management systems

Source: http://www.ushahidi.com/
Observations & Conclusions

• In crises people use the same communication methods they use in everyday life with higher intensity
• Unmanaged peak of traffic can cause collapses of the network
• Social networks are lifelines for survivors in the disaster areas
• Translation and location were major efforts for Search and rescue teams in the presented test case
• Social networks served mainly S&R teams in Haiti while in Japan both population and S&R teams used the network
Challenges

• Rapid restoration of communications
• Gapping the digital divide
  – Developed and developing countries
  – Young and elderly
  – Government entities and the public
  – Men and women
  – Urban and rural areas
• Avoid overwhelming of the network
• Avoid spread of misinformation and Dishonesty
• Understanding of the Social Network Applications by local emergency authorities
Recommendations

• Infrastructure Level
  – Prepare relevant regulation and guidelines for cellular providers preparation to different crisis scenarios
  – Examine network redundancy options, including broadband satellite links or microwave

• Traffic Level
  – Prioritize data over traditional telephony
  – Prepare filtering systems for congestion control
Recommendations

• Application level
  – Survey popular social platforms and add "emergency features"
  – Prepare “social channels” in popular social networks
  – Develop Data mining tools to increase crisis situational awareness

• Increase Awareness Programs
  – Communicate with citizens regularly through social networks
  – Train government authorities and decision makers
Recommendations

• R&D for knowledge gaps
  – Deepen crowdsensing R&D
  – Promote local research on Information flow during crisis

• Government Initiatives and International Agreements
  – Constructive and proactive dialog with major social network operators and online services such as Google, Facebook and NGO developing search and rescue software
  – Prepare network cloud based command and control centers (local, regional, international)
  – Encourage innovation through international organizations
Summary

• Social networks GNSS based applications used in emergency and crisis
• GNSS, mobile networks and the internet are critical enablers
• Governments need to integrate in a changing communication environment
• Encourage innovation and invest in R&D
• New possibilities for International cooperation
Using Location-Based Social Networks for Emergency Response

Thank You!

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