Using Location-Based Social Networks for Emergency Response

Presentation for the United Nations International Meeting on the Applications of Global Navigation Satellite Systems

Tal Dekel  
dekelta@tau.ac.il

Ram Levi  
ramlevi@tau.ac.il
Outline

INTRODUCTION

ASSUMPTIONS

ENABLERS

CASE STUDIES

CHALLENGES

RECOMMENDATIONS

Flickr.com
discovery.com
iphonebuzz.com
standard.net
hackingtricks.blogspot.com
Esa.int


Tal Dekel * Ram Levi

December 30, 2011
Basis for the Research

- 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 how people communicate

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

• S&R efforts recently show increase use in SNA+GNSS (that is likely to increase)

• Why now?

• How could SNA be utilized in crisis management to better respond in future crises?
Mobile Crowdsensing

“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
Trend 1 - GNSS

- GPS IOC in 1993
- Removal of Selective Availability in 2000
- Price, size and power consumption decreasing dramatically
- GNSS infrastructure is provided to everyone for free

"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

Source: isoc.org December 30, 2011
Tal Dekel Ram Levi
Timeline of Major Technology

Social Networks
- Arpanet 1967
- Hotmail 1996
- PayPal 1998
- Google 1997
- Facebook 2003
- Twitter 2006
- Wikipedia 2001
- YouTube 2005

Internet
- Email 1966
- Internet 1995

GNSS
- GPS / GLONASS IOC 1993
- GPS S/A 2000
- GLONASS renewal 2001

Mobile & Cellular
- 1st SMS 1992
- Palm Pilot 1996
- WiFi 1997
- 3G / WiMAX 2001
- iPhone 2007

Other
- Internet 1995
- GSM 2G 1991
- GSM 2G 1993
- December 30, 2011
- Tal Dekel * Ram Levi
Trend 3 – Social Networks

[Image of a world map with social connections]
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 – Cellphones & Smartphones

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

**Cellular Subscriptions**

**Broadband Subscriptions**

Source: ITU
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
Introduction

Earthquake and aftershock map

Tent City in Port-au-Prince area

Source: [http://www.heartlandalliance.org/international/updates.html](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
Success stories

The Israeli hospital – Haiti
Source: [http://www.tampabay.com](http://www.tampabay.com)

Health facilities location

Israeli search and rescue team in action
Source: [http://www.vosizneias.com](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

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

Survivor looking for relative survivors


Google person finder received 7000 request in the first few hours

Source: http://www.kochiservnet.com/
Google Crisis Response Team


Google maps update on locations of impromptu shelters: http://maps.google.co.jp/maps

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

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
  – Act with the mobile network providers to prepare for different crisis scenarios
  – Fast approach to deploy temporary mobile network for the disaster area
  – Examine network redundancy options, including broadband satellite links or microwave
  – Affordable IP relays to create an improvised best-effort mesh network

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

• Application level
  – Survey popular social platforms and add "emergency features"
  – Develop tailor made application for emergency automated GNSS based report
  – 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
  – training
Recommendations

• R&D for knowledge gaps
  – Deepen crowdsensing R&D
  – Research 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
  – International agreement for assisting in restoration of communication after a disaster
  – Network 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 R&D
• Possibilities for International cooperation
• Paper under review and will be available shortly
Using Location-Based Social Networks for Emergency Response

Thank You!

Tal Dekel  
dekelta@tau.ac.il

Ram Levi  
ramlevi@tau.ac.il