Engaging Citizens – Participatory Sensing

Environmental data for applications – MMEA WP1 final seminar, 23 Sep 2015

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Agenda

- Participatory sensing
- Our activities in the field
- Challenges and approaches
Participatory Sensing
People with their devices as sensors

- Measuring enables meaningful actions.
- Are people good as sensors?
  - We are everywhere, carrying powerful mobile devices.
What is participatory sensing?

- Citizens providing environmental observations with the help of mobile technology
- New, emerging paradigm in environmental monitoring
- Crowdsourcing
  - Spectrum: experts / trained volunteers / ordinary citizens

- Related: Citizen Science
  - “Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions” (Oxford English Dictionary)
Citizen Science: A few examples

SatCam

GALAXY ZOO

tomnod

Air quality

iNaturalist.org
Benefits of participatory sensing

- Cost-efficient extension of spatial and temporal data coverage
- Near real-time situation awareness for improved decision making
- Combining with other sources, finding correlations (validation)

**Example:**
- Remote sensing techniques have already proven their efficiency in forest monitoring.
- However, they lack adequate ground reference data, because of the high costs of the required field work, the lack of field personnel and legislative restrictions relating to data privacy.
- Moreover, data is often obsolete since acquisition of frequent observations is not realistic for economic and practical reasons.
VTT activities in the field
Water quality monitoring

Remote sensing products provided by the Finnish Environment Institute
- MODIS, 500 m resolution
- Meris (2011), 300 m resolution
Weekly Average Summer 2011


Correlation average 2011: 0.72
Relasphone Concept

- Acquiring forest inventory (e.g. biomass) data with mobile phone
- Reference for satellite image interpretation
- Outputs thematic forest maps
- Complete information provision chain for preparing forest management plans
- Basic version of Relasphone available from Google Play store for free

In-situ forest inventory data

Satellite data

Growing stock volume by tree species

VTT Probability Chain
From ground photographs to image analysis to forest plan
Forest Biomass Analysis Pilot

- 55 plots visited over 10 sites in November–December 2014
  - Basal area measured with Relasphone
- The collected data was compared to reference forest inventory data for accuracy assessment
  - Comparison of Relasphone measurements to reference data over 55 plots showed a good agreement ($R^2 = 0.94$)
Forest Biomass Analysis Pilot

\[ y = 0.8952x + 37.485 \]

\[ R^2 = 0.9394 \]
VTT research on participatory sensing

- Participatory Sensing in Environmental Monitoring – Experiences (2012, doi: 10.1109/IMIS.2012.70)
- Participatory surface algal bloom monitoring in Finland in 2011–2013 (journal, Environmental Systems Research, 2014)
- Citizen Science For Earth Observation: Applications In Environmental Monitoring And Disaster Response (2015, doi: 10.5194/isprsarchives-XL-7-W3-1221-2015)
- Participative Forest In-Situ Measurements For Biomass Mapping In Satellite Images Over Durango State, Mexico (oral, IGARSS 2015)
VTT research on participatory sensing

- **Citizen Science for Earth Observation**
  - Invited session, IGARSS 2015

- **Topical projects:**
  - **MMEA**: Levävahti (WP1), China Testbed / Shenzor (WP5)
  - **EducEO**, for European Space Agency
  - Proposed: **CitizenForest** – Citizen Observatory for Forest Monitoring, Horizon 2020, VTT coordinator, 15 partners, 5 M€

- **EnviObserver**: platform/solution for participatory sensing
Shenzor (in MMEA WP5, China Testbed)
EducEO – Education for Earth Observation capitalizing on a Citizen Science approach

- Project for the European Space Agency (ESA)
- VTT, Pajat Solutions, Plan Finland
- http://educeo.info

1. State-of-the-art, networks, opportunities
2. Demonstration through three pilot projects:
   - Forest Biomass Analysis
   - Emergency Data Management
   - Water Quality Monitoring
3. Roadmap
Participatory sensing, an operational scheme

- Define data need (parameters, quality, method, location)
- Engage citizens
- Motivate citizens to participate
- Provide proper tools
- Provide data and analysis tasks
- Quality control

End-users
- Local and global
- Forest owners
- Forest managers
- Forest industry
- Environmental institutes

Public authority databases
- Copernicus
- GEOSS
- Research

Citizen Forest Observatory

Citizens

Observe

- Observations
- Social media images
- Observations based on social media image analysis

Analyse

- Citizen observations
- Observations based on social media image analysis
EnviObserver – participatory sensing solution

- Configurable platform for participatory sensing
- Interfaces, data storing, quality control
- Visualization, data access, alert services

- Tailored mobile applications for multiple mobile platforms
- Utilization of camera, GPS and other integrated sensors
Challenges and approaches
Primary Challenges

- **Citizen Engagement**: Generating and sustaining citizen engagement and motivation.

- **Upscaling**: Responding to the requirement for sufficient data volumes with adequate geospatial and temporal distribution, and supporting also dynamic needs for observation data from specific area and time, for example aligning with satellite overpasses.

- **Data Quality**: Ensuring data accuracy and reliability; Learning about the actual data quality, reaching the desired data quality level, and proving and showing the achieved data quality.

- **Commercial Sustainability**: Achieving commercial sustainability for the Citizen Observatory activity, through the capability to provide end-users benefit and added value.

- **Legal Framework**: Ensuring compliance with legislation, regulations and other boundary conditions. Managing issues of observer privacy, data ownership and forest owner’s data privacy.
Citizen engagement

- **Sustained motivation**: incentive for the observation work
  - **reward**: recognition, status, contribution visibility, information, service value, money etc.
  - **socializing**: involve people, let people connect
  - **participation**: let users feel part of a big common effort, offer background info and motivation
  - **reminders**: ask people for certain types of observations in limited areas; offer motivation

- **GAMIFICATION**!

- Reporting observations needs to be **simple, easy and fast**
  - Minimize startup effort, offer easy setup. Do not require registration for basic features. Provide smooth mobile user interface.
Onwards

- Participatory Sensing: Vision for 2020?
  - Citizen Science is a widely accepted method for collecting in-situ data with good quality as a supplementary data source for multiple purposes.

- Leap towards professional and economically sustainable operations.

- Thank you!
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