Mapping of Risks and Resources in Public Health for Decision Support Clients on Mobile Devices

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Project Objectives

**AIM:** EARLY WARNING: TELE-EPIDEMIOLGY & LOGISTICALLY OPTIMIZED RESPONSE (Spatial Decision Support)

**HOW?** SPATIAL MODELLING OF PUBLIC HEALTH RISK AND EFFICIENT ALLOCATION OF MEDICAL & PUBLIC HEALTH RESOURCES

**WITH:** DELIVERY OF AN ADAPTIVE SPATIAL DECISION SUPPORT SYSTEM (Open Source)

**TO WHOM?** GOVERNMENT, ADMINISTRATION, DOCTORS, PUBLIC HEALTH WORKERS, PEOPLE EXPOSED TO PUBLIC HEALTH RISKS (Decision Makers)
Definition:
Spatial Decision Support System

GIS: Geographical Information System
GIS: Spatial Patterns of Risk & Spatial Distribution of Resources

DSS: Decision Support System
DSS: Medical Environments are Complex Dynamic Systems – Support Decision Makers in complex environments

SDSS: Spatial Decision Support System
SDSS: Spatial Decisions: Risk & Resources
Early Warning & Response Cycle

Diagnosis Support
Generate Early Warning

Risk map

Response Support
Activate Response of Health System

Temporal/spatial risk
- Water Bodies
- Environmental & Socio-economic Conditions

Temporal/spatial outcome
- Outbreak of Disease

Temporal/spatial response
- Vector Control and tailored Allocation of Medical and Public Health Resources,

Robust Data and Voice Communication
Decision support
Resource Allocation

Remote Sensing
Ground data

New outbreak data

Smart Phone

EARLY WARNING & RESPONSE Spatial Decision Support System
Early Warning & Response Cycle

- **Diagnosis Support**: Generate Early Warning
- **Risk map**: EARLY WARNING & RESPONSE Spatial Decision Support System
- **Remote Sensing**
- **GPS Smart Phone**
- **Temporal/spatial risk**: Water Bodies, Environmental & Socio-economic Conditions
- **Detection**: Environmental Conditions for Disease Vectors
- **Replication Zone Mosquito**
- **Risk Zone (Fly Range Mosquito)**

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Early Warning & Response Cycle

EARLY WARNING & RESPONSE
Spatial Decision Support System

Risk map

Response Support
Activate Response of Health System

Decision support
Robust Data and Voice Communication
Allocation of Resources

Temporal/spatial response
Vector Control and tailored Allocation of Medical and Public Health Resources,
Early Warning & Response Cycle

EARLY WARNING & RESPONSE
Spatial Decision Support System

Response Support
Activate Response of (Public) Health System

Risk map

Decision support
Robust Data and Voice Communication
Allocation of Resources

Spatial Support for Vector Control Units
GPS-tailored Application of Larvicides
Checking of previous Public Health Interventions

GPS Smart Phone

Temporal/spatial response

Vector Control and tailored Allocation of Medical and Public Health Resources,
Early Warning & Response Cycle

EARLY WARNING & RESPONSE
Spatial Decision Support System

Diagnosis Support
Generate Early Warning

Risk map

Risk Layers

Risk at Geo Location

Geographic Layer

Geo Location

my Risk

GPS

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Early Warning & Response Cycle

EARLY WARNING & RESPONSE Spatial Decision Support System

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Source: http://www.navit-project.org/
Mobile Devices & Decision Support

Provide tailored Access to Risk Maps and Allocation Maps of Resources

Mobile Devices as a Decision Support Client

Government

Elimination of Virus Hosts

Public Warning

Restriction of Mobility

Quarantine Management

Personal Protection

Medical Staff & Vector Control Units

Administration

People exposed to Public Health Risks

Mobile Devices as a Decision Support Client

DSS-Clients

DSS₁, DSS₂, DSS₃, DSS₄, DSS₅

Mobile Devices & Decision Support

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GPS-Pseudo Measurement is defined as an indirect provision of Sensor Data without a physical Sensor by using the GPS-Location of the Mobile Device.
Types of GPS-Pseudo Measurement

- Contamination of Water, Soil, Air ...
- Contamination of Fruit, Vegetables, Meat, ...
- Radioactive Radiation as Public Health Risk
- Epidemiological Risk at GPS location

Mobile Devices as a Decision Support Client for Public Health Risk
Differences: Crowdsourcing

Crowdsourcing (e.g. NoiseTube, UN-SPIDER Disaster Mgmt)

- Mic records Noise
- Submit e.g. Noise Data
- Public Health Risk at GPS-Location

GPS-Pseudo Measurement

- No real Sensor
- GPS-Location
- Public Health Risk at GPS-Location

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Public Awareness, Crowdsourcing & Public Health Authorities

Submit Snapshot of dead birds at GPS-location

Return Map with other Cases in GPS-Environment

Create Public Awareness

Validation of Risk

No real Sensor

Public Health Disease Warning at GPS-Location

Community Memory

Submit GPS-Location

GIS Risk Map Server

Crowdsourcing Server
Response & Public Health Risks

Mobile Devices as a Decision Support Client
Spatial Application of Agrochemicals

Low Tech Precision Farming

NDVI / EVI Crop Health

Economic Benefits & Public Health Benefits

- OpenSource-Development e.g. Augmented Reality-Toolkit LookAR! for Android Phones
- Smart Phone
- APYLY AGROCHEMICAL x AT RATE y
- Crop Health GIS
Response & Public Health Risks

Mobile Devices as a Decision Support Client

Low Tech Precision Farming

APPLY AGROCHEMICAL \times AT RATE \ y

Public Health Objective

Food Security

Minimize Exposure to Agrochemical for Farm Workers and Environment. Workflow optimization & self protection of Workers

Optimize spatial patterns for Application of Agrochemicals

Economic Benefits: Optimized Farming with Low-Tech IT-environment => Developing Countries
Space Technology & Decision Support

Remote Sensing Data

GIS
Geographic Information System

OpenSource
GRASS
Geographic Resources Analysis Support System

> Free Availability

> Adaption to Early Warning

> Multiplatform [Windows Linux Mac]

Smart Phone

GPS-Pseudo Measurement

Linux-OS on Mobile Device
IT-Infrastructure
Offline Usage – OpenSource & OpenContent

http://maps9.navit-project.org

OpenStreetMap & Risk Layer
Maps can be downloaded used offline e.g. in Navit

(1) Online
Select Map Area & Download

(2) Offline (Navigation)
Use Risk Map & Collect Data
e.g. by Vector Control Unit

(3) Online
Store Collected Data to GIS Server

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Smart Phones Usage
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These Types of Public Health Risks are not DETECTABLE directly for the public.

Crowd Sourcing can be used to detect first indirect signs of Public Health Risks.

Early Warning and Public Health Response can be triggered if and only if Public Health Agencies have approved a Public Health Risk.