Participatory Wireless Sensor Network System for Effective Disaster Management

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Presentation Agenda

- ✓ *Introduction*
- ✓ *Objectives*
- ✓ *Technical Approach*
- ✓ *Innovation*
- ✓ *Expected Results*

Introduction/ Background:

- Every year world is hit by large scale disasters

Aftermath of an earthquake in Japan, 2004
Photograph by Kimimasa Mayama/Reuters
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Introduction/ Background:

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- 2013 floods in Uttarakhand – 5700 were dead

- Lacks of effective disaster management solution

- Destruction of communication system after disaster
  - increases the complicacy of disaster management due to the non-availability of real-time sensor data
  - ineffective management of emergency services such as police, fire, food supplies, medical aids

Objectives:

- To develop
  - A participatory wireless sensor network for real-time monitoring, detection, and early warning of disasters such as flood, drought, landslides etc.
  - An easily deployable context-aware wireless heterogeneous overlay network to provide an effective communication network for disaster management.

Technical Approach:

- For pre & post disaster management
  - Need a functioning infrastructure with
- sensors to collect the information, and a communication network to transfer the information
- Pre-disaster warning
  - to reduce the risk due to disasters.
  - requires appropriate sensing technologies and networking technologies that will provide real-time warning of disasters.
- Real-time data can be collected and analyzed
  - Deployment of a variety of sensors
  - Wireless sensor network
  - Video cameras
  - Existing sensors in the smart phones
  - Weather stations
- To detect the anomalies and issue early warning to save life.

Ubiquitious Mult-Context Model
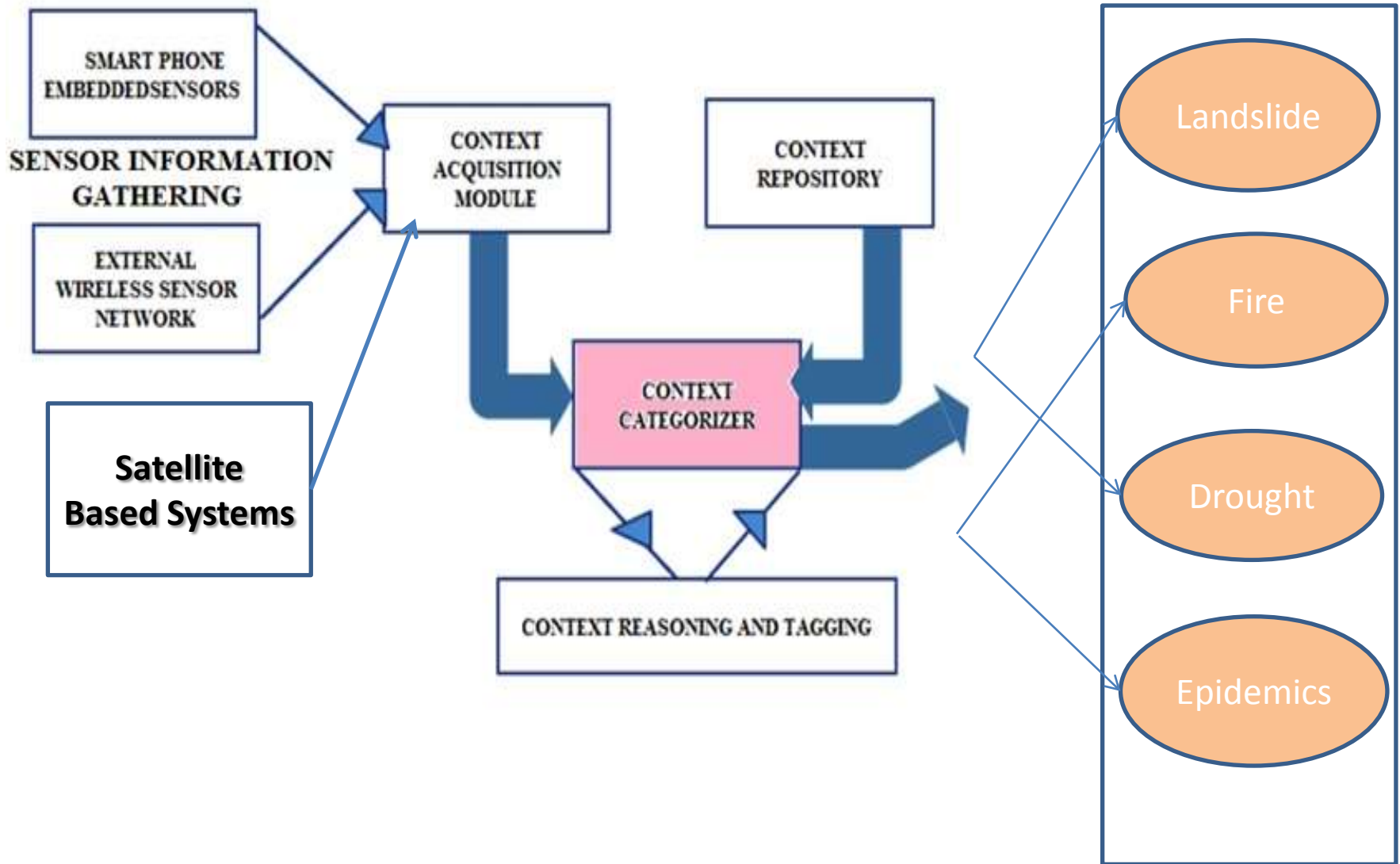
Technical Approach:

- Post Disaster scenario
  - Communication Infrastructure destroyed
  - Re-allocated for prioritized use by first responders only
- This lead to
  - Sporadic loss of connectivity until backup systems can be collected and deployed in the disaster zone (DZ).

Adhoc communication
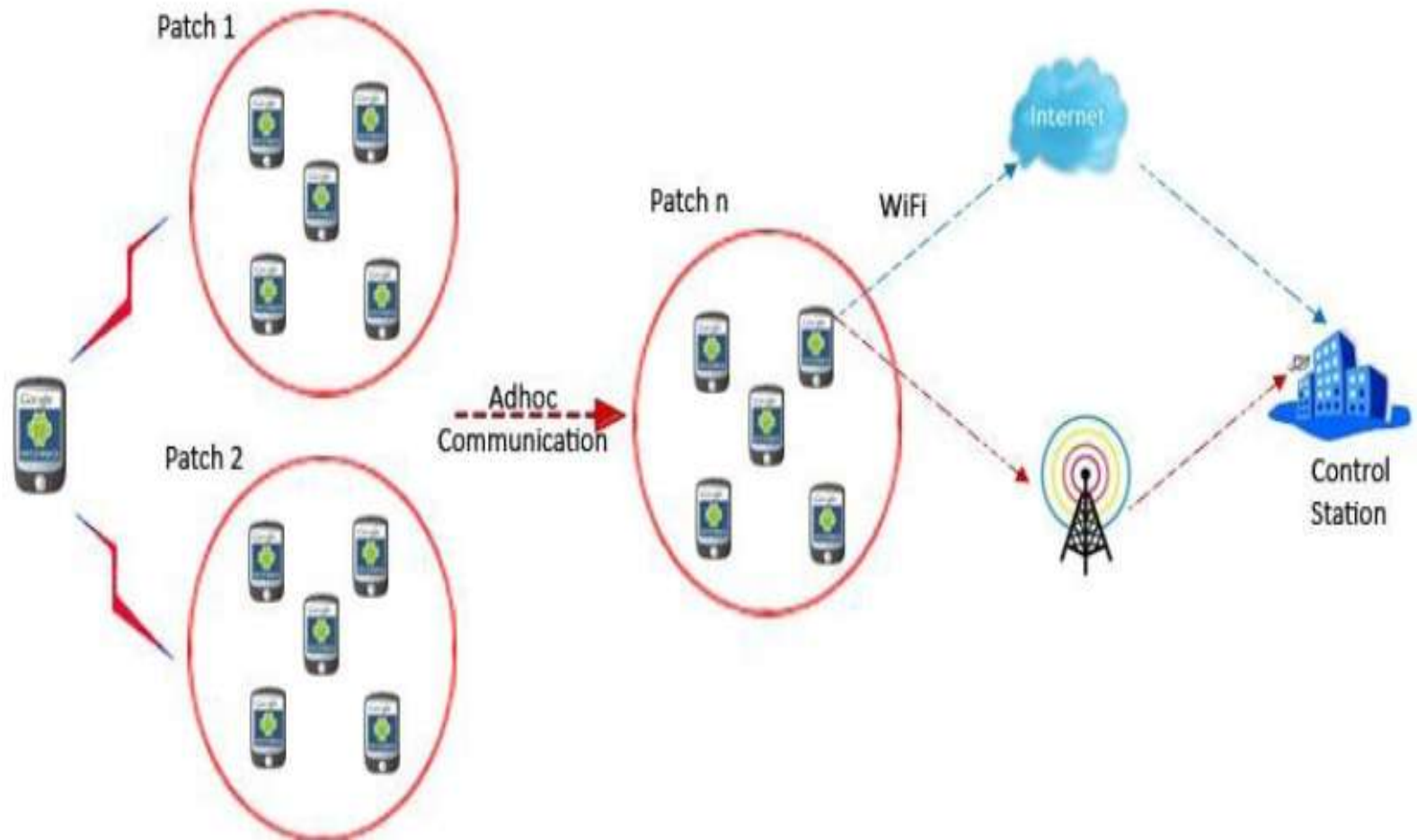
Objectives:

Technical Approach:

- Required to devise an effective end-to-end communication fabric with seamless connectivity

- Require the development of an overlay communication network with
  - Wireless LAN
  - Wireless Sensor Networks
  - Wireless Mesh Network
  - Wireless Flying Robots Network
  - Delay Tolerant Networking
  - Cellular Network

Technical Approach:

- Switching devices to "Disaster Mode"
- Allows devices to communicate using any existing communication means
  - WiFi
  - Bluetooth
  - ZigBee
    - In an ad hoc networking mode
- Incorporating adhoc networking protocols to Smartphone devices
  - To update valuable information regarding disconnected DZ
- Uses multi-hop communication and networking protocols

Innovation:

- A comprehensive system catering to pre and post disaster management scenarios
- Doesn't require additional infrastructure
- Uses available resources of the participants to collect the data from heterogeneous sources
  - Sensor data from smart phones
  - Wireless sensor networks
  - Weather forecasts etc
- Use innovative data mining and aggregation techniques for decision making

Expected Results:

- Context aware system for early warning disasters

- Effective communication infrastructure in a post disaster scenario

- Methods to track the victims in a disaster hit area

- An android application that supports all smart phones without any extra hardware requirements to be deployed in the disaster-scenario.