Technical Presentation of A Concept Paper

on

A UAV based Autonomous System for surveillance and proclamation of warning during disaster

PI

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Team of Students

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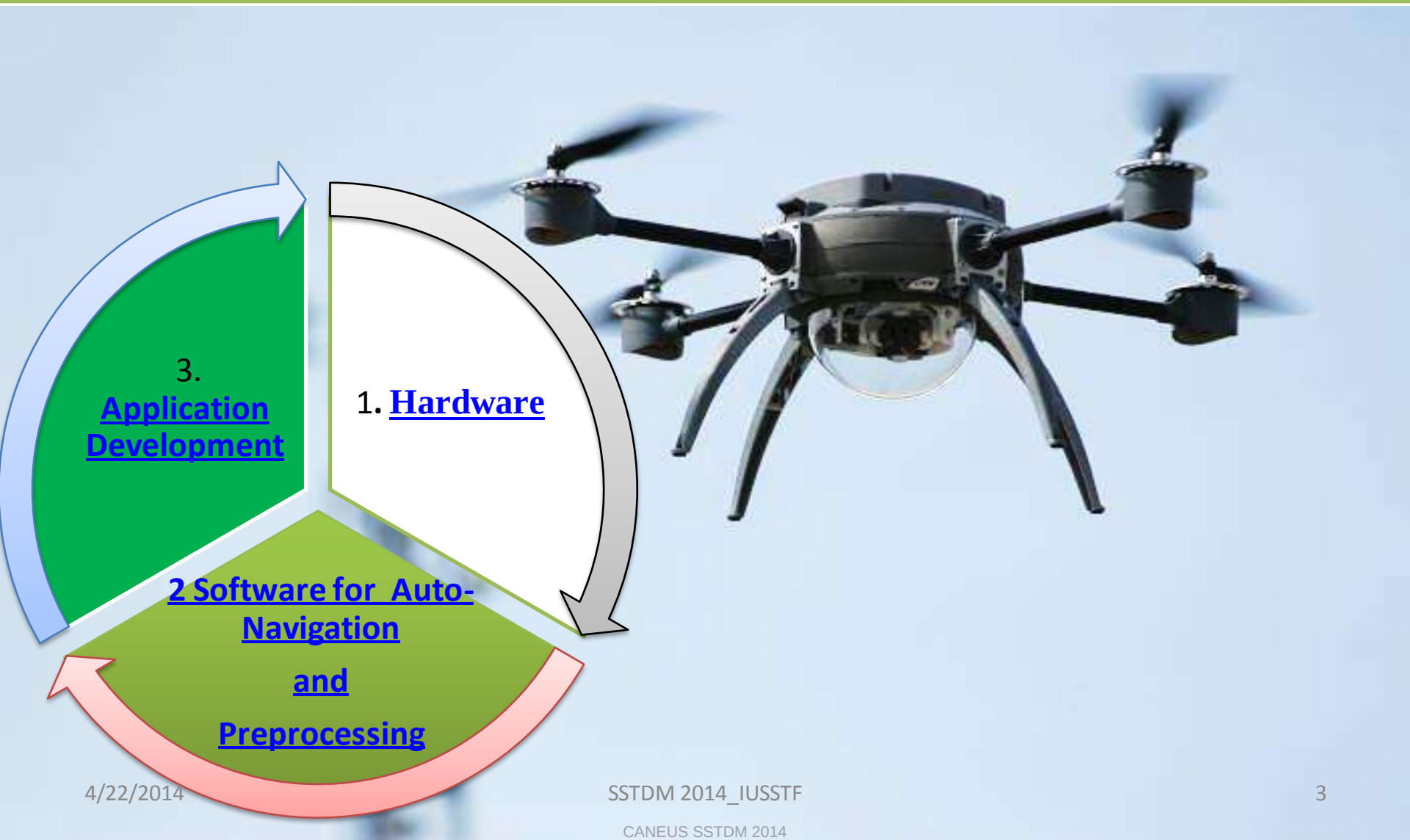
Introduction

Technical community concerned to disaster preparedness face strong challenges in collection of real time (RT) data during disaster, arriving at appropriate decisions based on domain expertise and RT and/or near RT geo-spatial data.

Objective

Development of an Autonomous System based on UAV for surveillance of disaster and proclamation of warning, if required.

An Autonomous UAV System for surveillance and proclamation of warning during disaster



1. Hardware - **Proposed System**

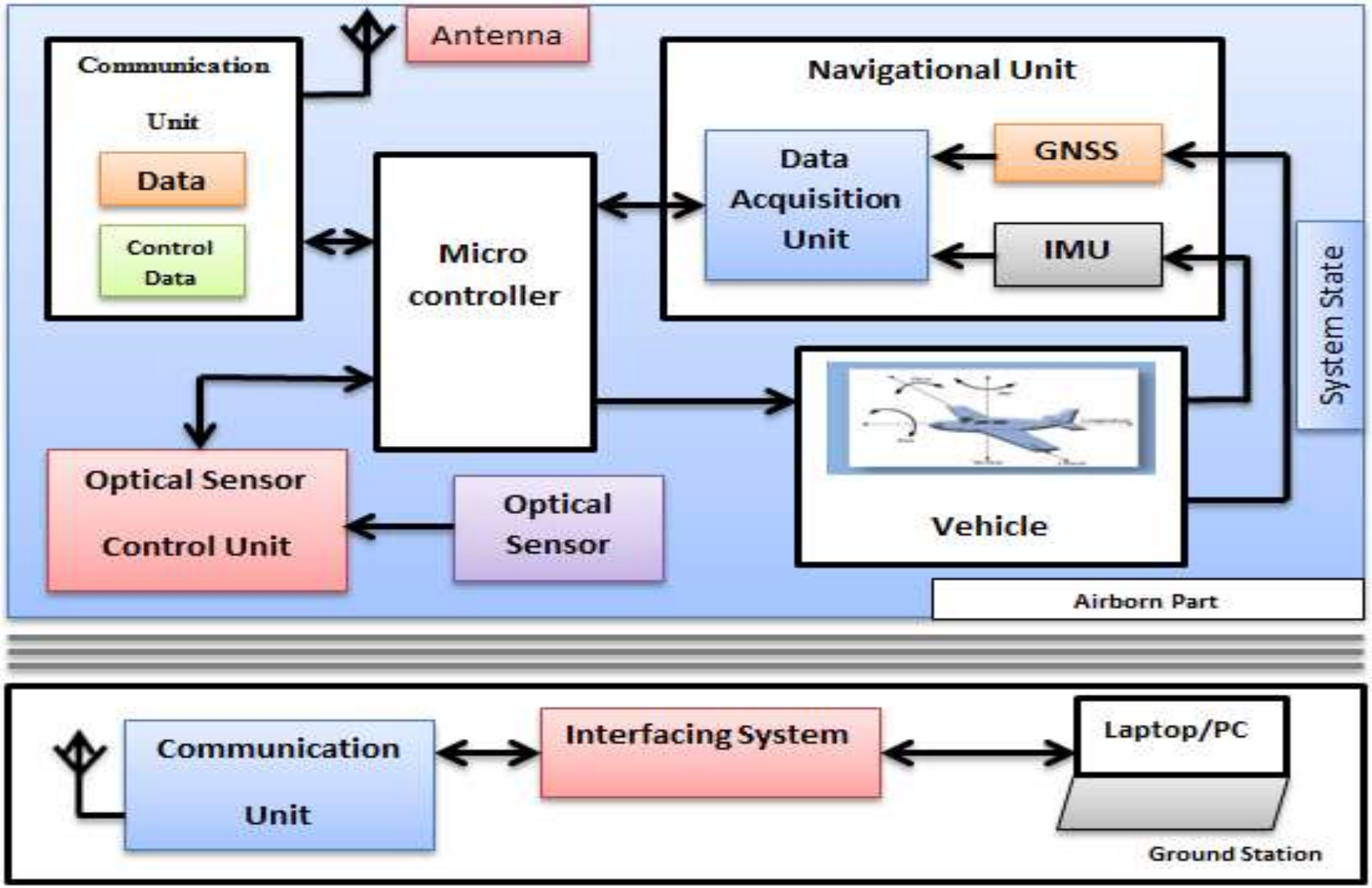
➢ **Objective :**

to develop a low cost UAV system for acquisition of geo-spatial data.

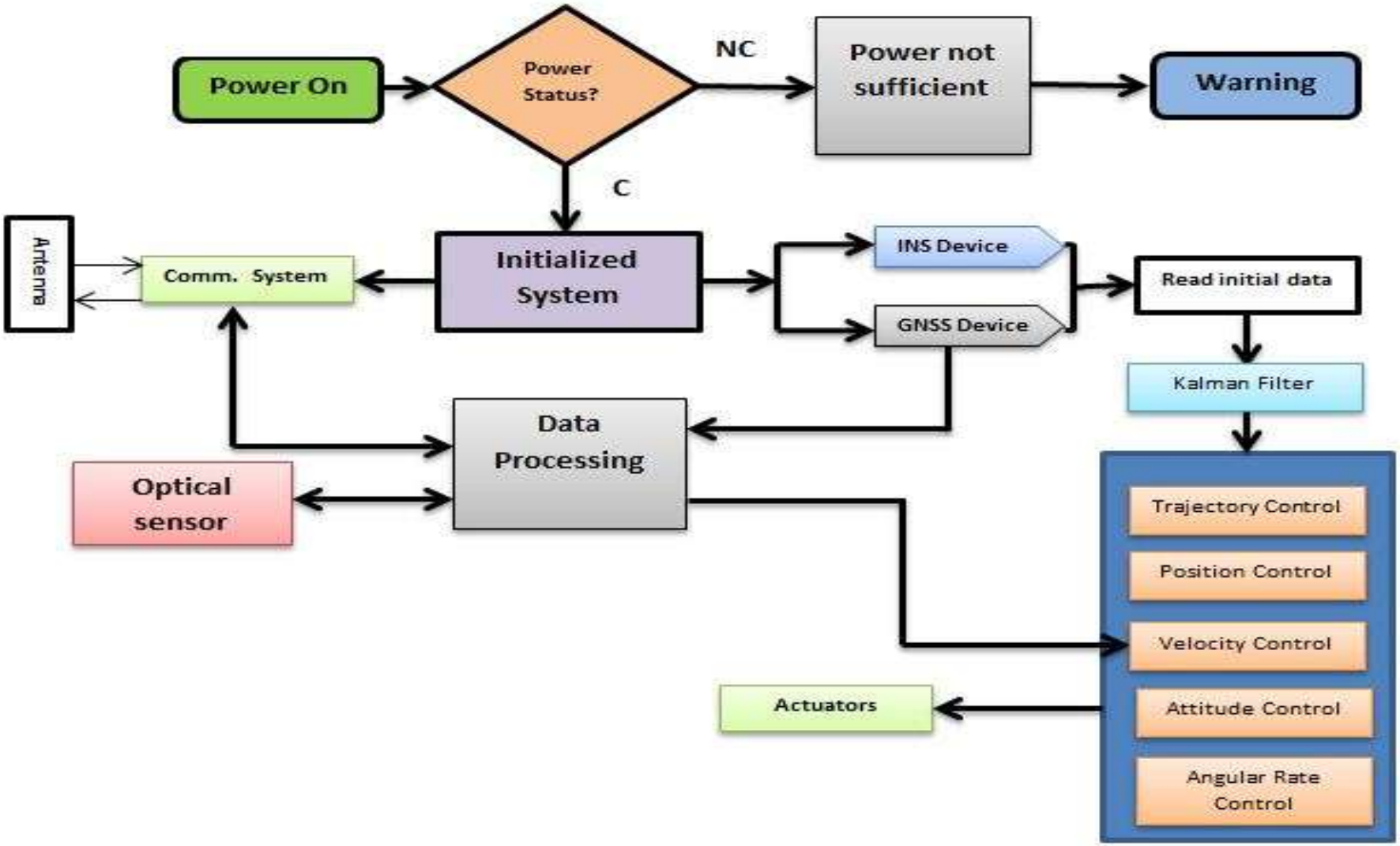
SYSTEM

- **development consists of two broad components : hardware and software.**
- **Hardware component consists of sub-systems such as UAV platform, Global Navigation Satellite System (GNSS) receiver, inertial navigation system (INS) system, data acquisition sensors and wireless communication device etc.**
- **Software : interface between/among different units, automated maneuverability, UAV control, Data Transmission etc.**

1..Block Diagram of the Proposed UAV System



1. .. Functional Description of the Proposed UAV System



1… Technical Challenges

- Stabilization and Control of UAV system
- Determining the position and orientation offset between the GPS/INS system and camera;
- Clock synchronization of GPS/INS system with camera to get real time geo-data
- To maintain constant offset and orientation during each mission Interfacing of modules;
- Wireless data transmission and reception.
- To acquire quality geo-data.
- To convert data in a particular format at the receiver end.
- Development of an intelligence system that can store and pre-process the acquire data.

1….

- **Data collected by the UAV will be communicated through WI-FI.**

➢ **GUI to control the UAV navigation - domain information & processing etc;**

➢ **Interfacing of hardware modules – ICT technology etc;**

1.. Hardware

- **So far, a terrestrial navigation system has been developed for automated collection of geo-data through GPS.**
- **A video display of the developed system is as follows: C:\Users\presenter\Desktop\Day 3\New folder\Jayanta\combined.mp4**
- **will be extended to achieve desired objective.**

BACK

2. Auto-Navigation and Preprocessing

- **Objective**

  to automate the navigation of UAV and to process the acquired data compatible for application unit.

- **Software will carry out data mission planning, auto-navigation, visualization and quality checking/control, geo-referencing, ortho-rectification, radiometric corrections, geo-spatial processing (like bundle adjustment, mosaic preparation, DTM extraction, DSM preparation etc).**

BACK

3. Application Development

- **Objective**

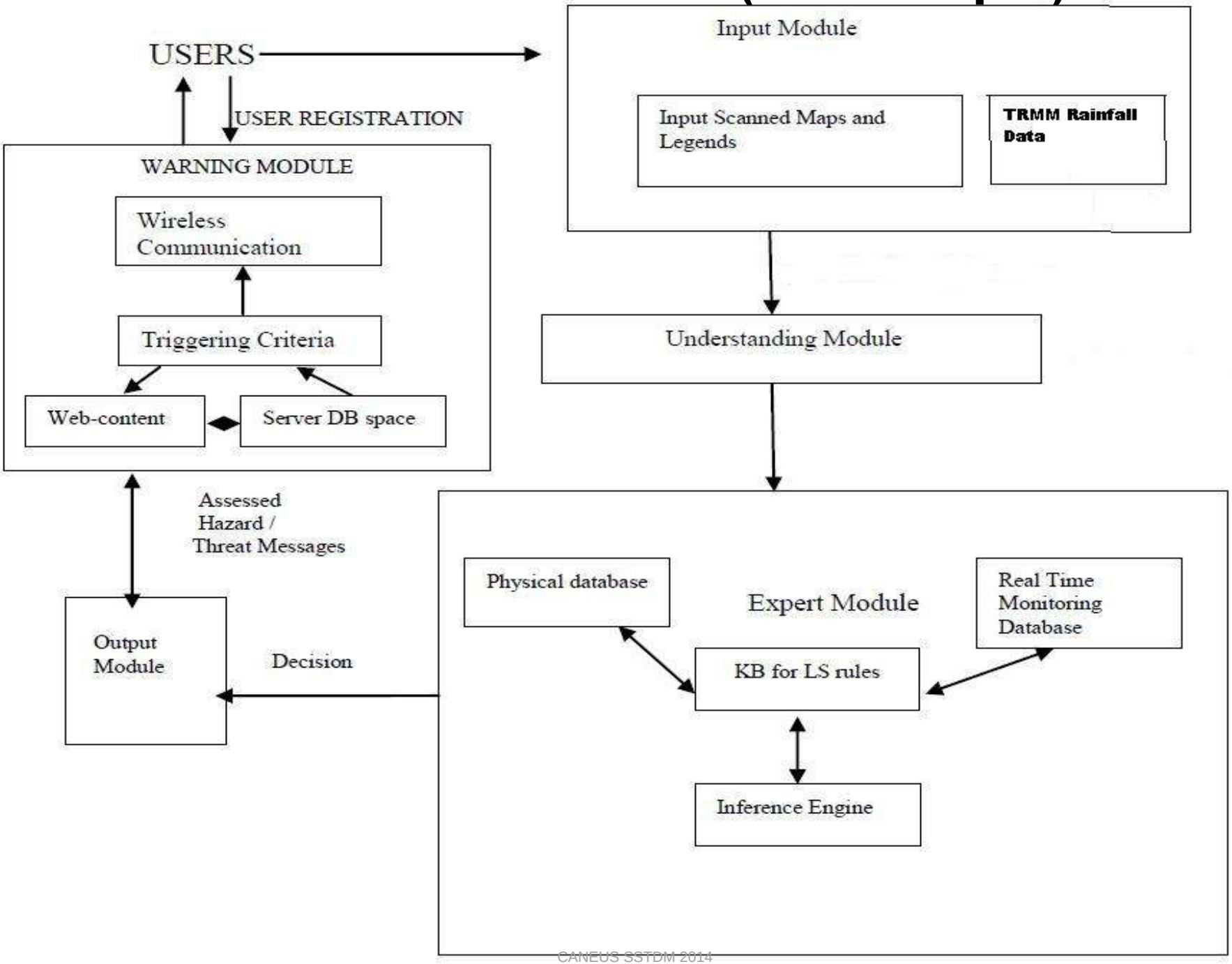
  to monitor and emergency response for a disaster.

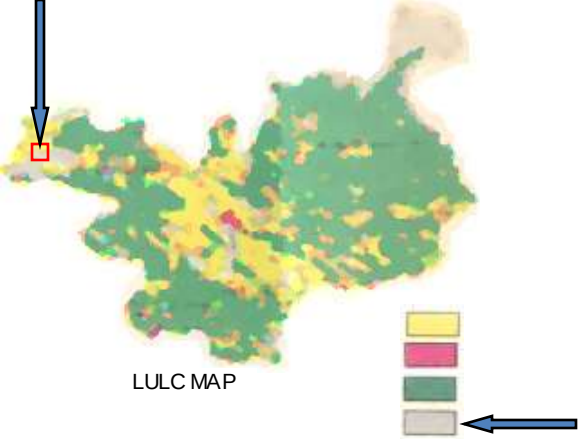
- **Will be realized through two sub-modules: hazard evaluation and warning communication.**
- **The unit will be realized through interfacing of communication technology with database management; modular architecture enabling encapsulation as well as abstraction of data and information; domain knowledge; AI techniques for automated initiation, interactions, processing and dissemination of information etc.**
- **So far, we have developed GEOWARN, an automated landslide hazard warning system .**

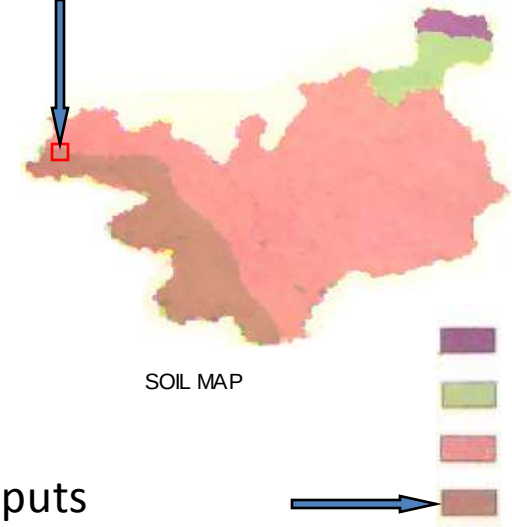
3.. GEOWARN

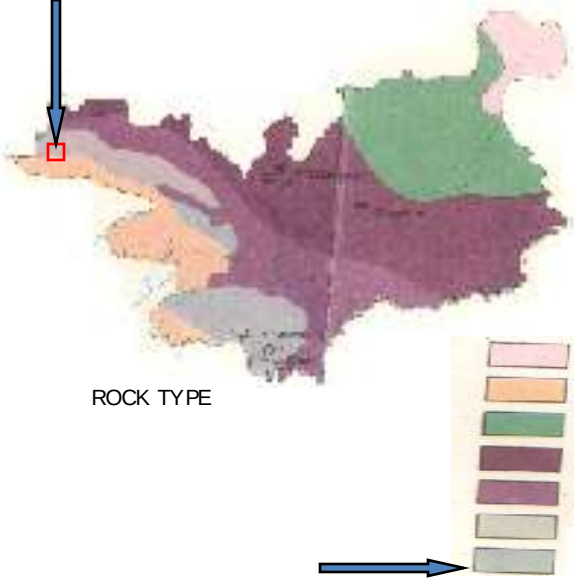
- **an automated integrated landslide hazard warning system capable of sending warning SMS directly to registered users in the affected region.**
- **validated for evaluation of landslide hazard and dissemination of warning messages in Indian as well as in Italian conditions.**
- **The system communicates warning message to registered user within the acceptable limit as outlined by the UN.**
- **a low cost, integrated and stand-alone system for dynamic hazard warning is available for service to civil community. Such a handy system could be very useful in a densely populated country where people are unaware of the impending hazard.**

SYSTEM ARCHITECTURE DEVELOPMENT (ASCE JCCE publ)

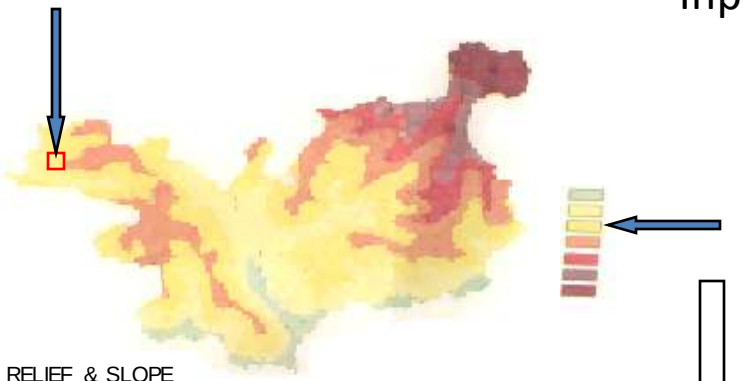


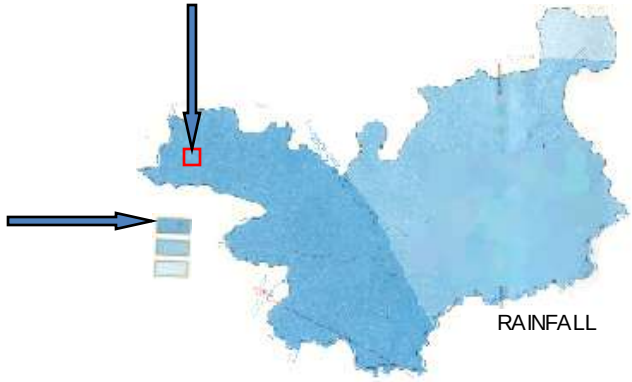


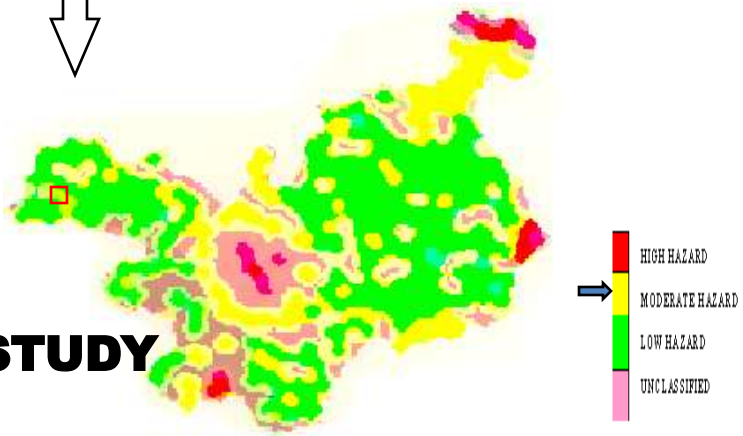




Inputs







TEHRI-GARHWAL CASE STUDY (ASCE publ)

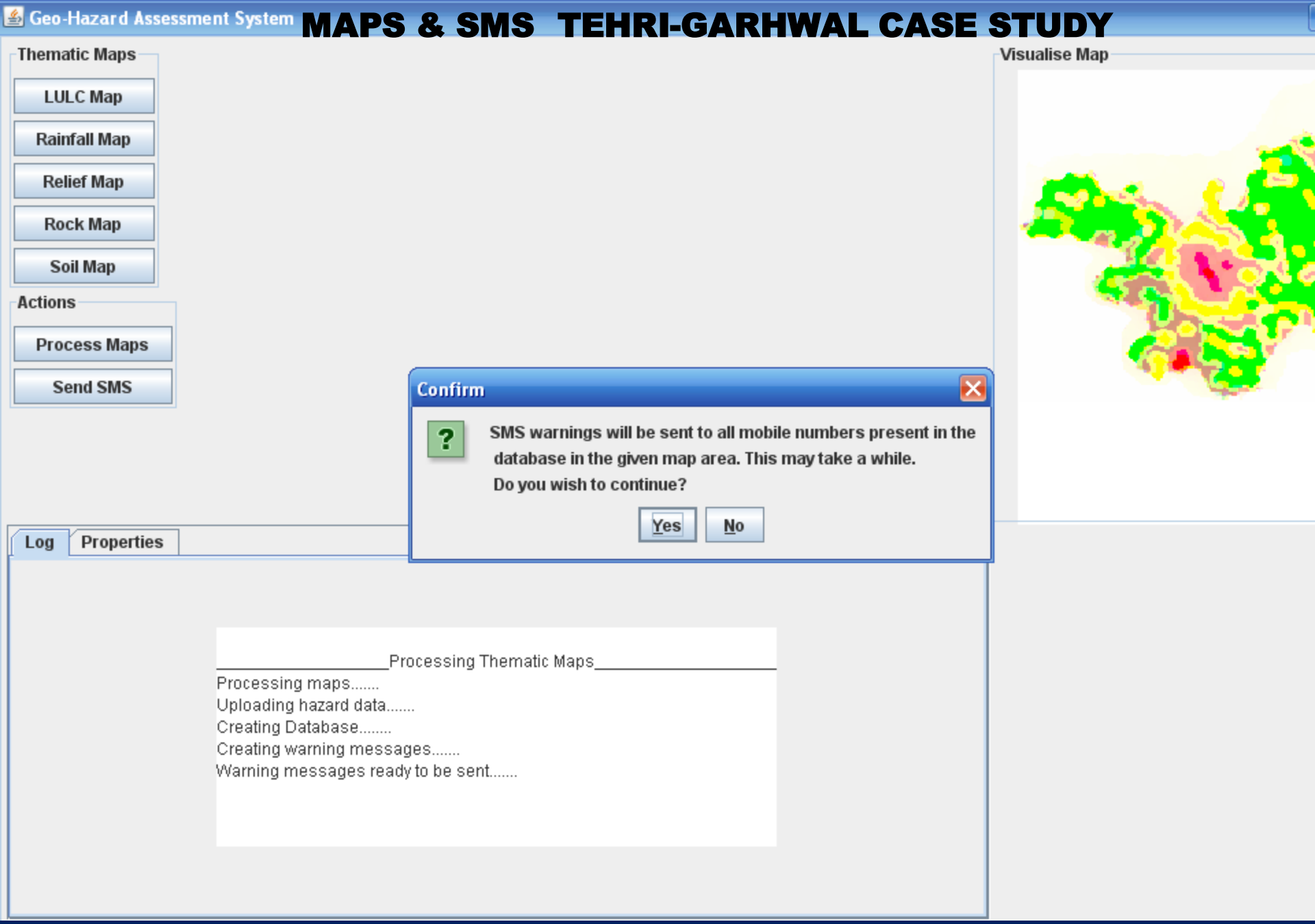


Figure : A snapshot of the running of the developed system

MAPS & SMS TEHRI-GARHWAL CASE STUDY

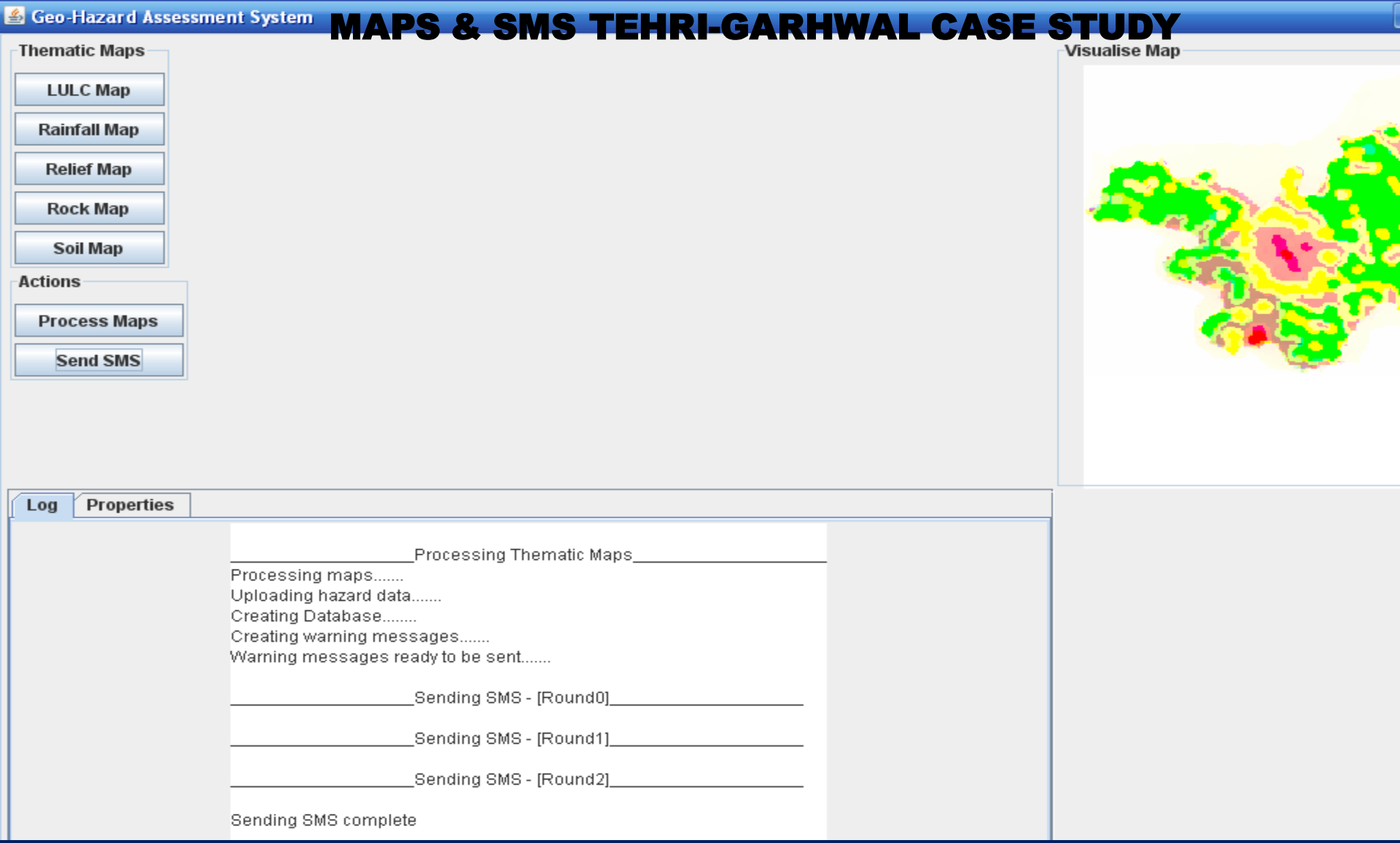


Figure : A snapshot of sending SMSes phase of the develope system

MAPS & SMS TEHRI-GARHWAL CASE STUDY

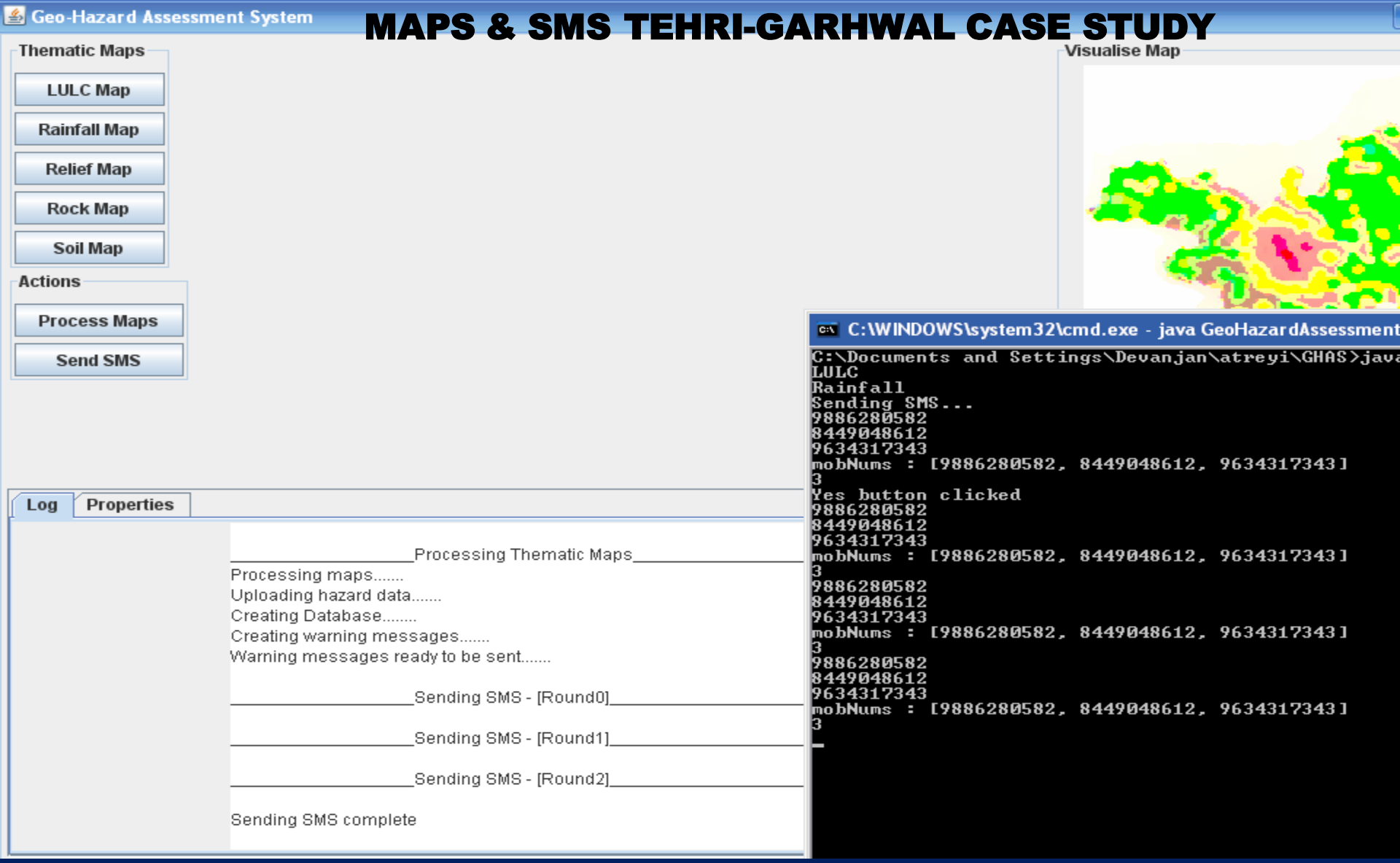


Figure : A snapshot of the background processing of the developed system

000 000	30° 04' 00" N and 30° 05' 00" N 77° 50' 00" E and 77° 51' 00" E	Moderate landslide threat in Devaprayag.
010 020	30° 05' 00" N and 30° 06' 00" N 77° 51' 00" E and 77° 52' 00" E	Low landslide threat in Muni ki reti.
050 050	30° 04' 00" N and 30° 05' 00" N 77° 52' 00" E and 77° 53' 00" E	Low landslide threat in Rudraprayag.
070 060	30° 04' 00" N and 30° 05' 00" N 77° 53' 00" E and 77° 54' 00" E	Low/no landslide threat in Chamoli.
090 090	30° 04' 00" N and 30° 05' 00" N 77° 54' 00" E and 77° 55' 00" E	Low/no la threat in Pra

30° 04' 00" N and 30° 05' 00" N 77° 50' 00" E and 77° 51' 00" E	9634317343 9448734189	Moderate
30° 05' 00" N and 30° 06' 00" N 77° 51' 00" E and 77° 52' 00" E	9986572110 9411149587	Low
30° 04' 00" N and 30° 05' 00" N 77° 52' 00" E and 77° 53' 00" E	9634317343 9448734189	Low
30° 04' 00" N and 30° 05' 00" N 77° 53' 00" E and 77° 54' 00" E	9634317343 9448734189	Low

Trial	Min duration	Max duration	Average delay
1	13	45	29
2	11	49	30
3	15	44	29.5
4	10	50	30
5	12	46	29
6	13	44	29

MAPS & SMS
TEHRI-GARHWAL
CASE STUDY

3… Achievements

- **Thesis : Ph.D. (1), M.Tech (1);**
- **Recognitions received :**
  - **FIG (International Federation of Surveyors, Copenhagen, Denmark) Foundation 2009 Grant winning paper at Eilat Israel.**
  - **Best Doctoral Thesis Award 2012 Indian National Academy of Engineering (INAE) New Delhi.**
  - **Gandhian Young Technological Innovation Award-2013 by National Innovation Foundation & SRISTI, @ IIM-Ahmedabad.**
  - **EU Erasmus Mundus EXPERTS Award as Post-Doctoral Scientist 2013.**

- **Research Papers**: International Journal (7); International conferences (11), Book chapter (1), Monograph (2),

Conclusion

In summary, some preliminary works related to concept paper (specifically steps 1 & 3) has already been carried out by the group

Proposed concept is being considered as a challenge for the group to get implemented. However, judging the enormity of its utility, specifically at the back drop of Uttarakhand disaster (June, 2013), the team is working keenly to achieve the goal.

Thanking You