

The FIG WW Eilat 2009

## **GEOWARNS**

### **A System to Warn Geo-deformation Failure**

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## **1. INTRODUCTION**

- **Geo-deformation failures leading to landslides cause huge socio-economic losses.**
- **An automated warning system to people around an imminent landslide warrants towards disaster preparedness and mitigation.**

## **2. Objective**

**To develop an automated system for proclamation of landslide warning through existing cellular network infrastructure in a region.**

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## **3. Background**

- **Landslide susceptibility is due to complex interaction among different factors.**
- **An automated system based on domain knowledge is versatile and offers flexibility.**

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## **4. METHODOLOGY**

- **Integration of two broad divisions: hazard evaluation and warning proclamation.**
- **Hazard evaluation through superimposition of causative factors and through addressing of domain knowledge.**
- **Warning proclamation through existing cellular network infrastructures.**

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## **5. System**

- **Input module (IM)**  
**accepts scanned images**
- **Understanding Module (UM)**  
**matching algorithm emulating human interpreter**
- **Rainfall Module (RM)**  
**A soft computing based dynamic model**
- **Expert Module (EM)**  
– **consists of Knowledge Base (KB) and Inference Engine (IE).**

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## 5. System (contd.)

- **KB**  
causative factors with their sub-factors and ratings
- **IE**  
– Searching and matching algorithm to arrive at a decision by forward chaining strategy.
- **Output Module (OM)**  
– Stores hazard level with position location
- **Warning Module (WM)**  
– holds network coverage details and location of service towers.

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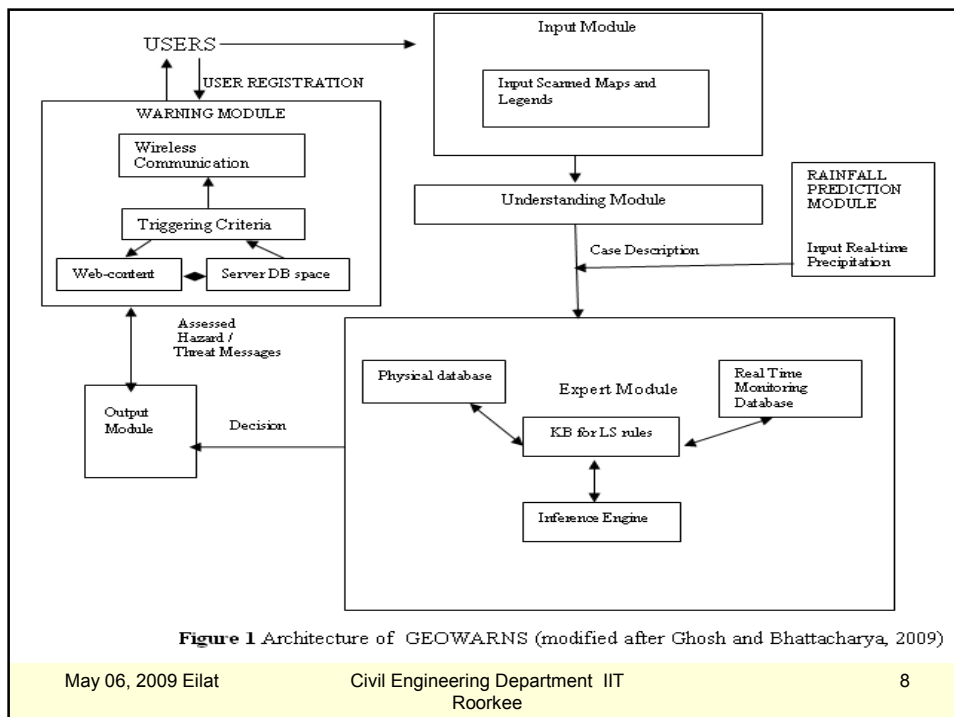


Figure 1 Architecture of GEOWARNS (modified after Ghosh and Bhattacharya, 2009)

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## **6. Working of the System**

- **Initialization with a fixed and distinct digital identification for each of the legends to the UM those will be present in the thematic maps of the causative factors of landslides.**
- **Rainfall module will provide predicted rainfall based on amount of PWV from GPS data, temperature, pressure, humidity etc.**
- **Knowledge base of the expert module will get searched by an informed searching and matching technique to extract the hazard rating associated with the particular contributor factor.**

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## **System Working (Contd.)**

- **The inference scheme will pick up the facts from the input images and applies searching and matching logic to KB to fire a rule.**
- **The output module will store the decision for each pixel as a function of the degree of threat for the region represented in that pixel.**
- **The output database about the warning message will be updated and the information will be sent to the server and the warning module will get invoked.**
- **The warning information will then be retrieved by the warning module and sent to bunch of mobile numbers in the danger zone.**

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## **7. IMPLEMENTATION**

- ❖ **Each image pixel is classified and each classification is assigned a relative weight with which it contributes towards landslide occurrence.**
- ❖ **System follows a continuous process, processing the input images from the specified path and keeps on updating the database of output module storage with the warning information.**
- ❖ **Warning module acts on the warning information.**
- ❖ **The system will be coded in Java as this programming language has facilities for implementing internet-based and intranet-based applications and software for devices that communicate over a network.**

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## **8. DISCUSSION**

- **A warning system for rainfall-triggered landslide has been proposed to be made available in local perspective.**
- **Understanding of maps for contributing factors, and processing of real time GPS data for rainfall forecasting are salient unique features of this work.**
- **Use of existing mobile communication infrastructure will make the system readily useful.**

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## **9. CONCLUSION**

- **An integrated approach making use of existing infrastructure for public warning is under development.**
- **Use of information & knowledge, hazard evaluation, forecasting and communication are required to be done precisely and systematically.**
- **The proposed system will warn in advance and thus likely to reduce society's vulnerability to natural disasters.**
- **The system will help policy planners to prepare for disaster and its mitigation.**

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## **10. FUTURE WORK**

- **The system can be extended to any other region by incorporating domain knowledge of the area under consideration.**
- **The system can be made more and more generalized for different types of disasters.**

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