

Date of Submission	30 - March - 2017
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## IPL Project (IPL - 213) Annual Report Form 2017

1 January 2016 to 31 December 2016

1. **Project Number (approved year) and Title:** IPL-213 (2016), Real-time Landslide Monitoring and Early warning System in Western Ghats & Himalayas, India.

2. **Main Project Fields:** Monitoring and Early Warning

3. **Name of Project leader :** Dr. Maneesha Vinodini Ramesh

**Affiliation:** Professor & Director, Amrita Center for Wireless Networks & Applications,

**Contact:** Amrita School of Engineering, Amritapuri Campus, Amrita Vishwa Vidyapeetham, Amritapuri, Kollam, Kerala, PIN- 690525

### **Core members of the Project:**

#### **Names/Affiliations: (4 individuals maximum)**

1. Dr. Venkat Rangan, Vice chancellor, Amrita University, Coimbatore, Tamilnadu,
2. Dr. Nirmala Vasudevan, Associate Professor, Amrita University, Amritapuri, Kerala.
3. Mr. Sangeeth Kumar, Research Associate, AmritaWNA, Amrita University, Kerala
4. Ms. Hemalatha T, Research Associate, AmritaWNA, Amrita University, Kerala.

#### **4. Objectives: (5 lines maximum)**

The objective is to enhance the existing large scale real-time landslide monitoring and early-warning system for landslide prone regions of Himalayas and Western Ghats using wireless sensor networks, Geotechnical devices, and satellite information. The above objective is achieved by increasing in-situ & remote measurements, developing thresholds for real-time data analysis, developing thresholds from landslide simulation setup, developing an enhanced slope stability model for landslide detection; developing automatic context aware data dissemination software for issuing alarms in real-time.

#### **5. Study Area: (2 lines maximum)**

In a selected landslide prone zone of The Himalayan Mountains & The Western Ghats.

6. **Project Duration (1 line maximum):** 3 years

#### **7. Report**

##### **1) Progress in the project: (30 lines maximum)**

The project was formally granted in November 2016. As mentioned in the deliverables / time frame section in the proposal, we have progressed in the below mentioned sections

### **a) Selection of site in Himalayas**

Multiple landslide prone sites in Himalayan ranges, which are located in different Indian districts of such as Uttarkhand, Sikkim, Darjeeling are visited. The impact of landslides in these locations on mankind are analyzed and a landslide prone region in Chandmari area of Sikkim district is selected for the project. The selected landslide prone site in Chandmari is analyzed for the available wireless networks and initial plans are being done for establishing a wireless network in that area.

### **b) Design of Low cost sensors**

Research is being done for the prototype development of low cost sensors such piezometer sensors and tilt meters.

### **c) Algorithm development for Intelligent Wireless Probe (IWP)**

Availability of resource is a main constraint in the landslide monitoring and early warning system. In order to make the system function efficiently for a longer duration in harsh environmental conditions, intelligent algorithms for data collection, data sampling rate, data aggregation, data transmission and forecasting methodologies need to be developed. We have completed implementing the following algorithms ‘Adaptive Minimum Sampling Rate (AMSR)’, ‘Context Aware Data management models (CAD)’, ‘Context Aware Energy management model (CAE)’. AMSR algorithm is developed to sense the environment adaptively considering the context of the environment at an optimum sampling rate without compromising on the accuracy of the decisions made. Based on the context, CAD model uses adaptive sampling from AMSR algorithm to consume the limited resources and extend the lifetime of the network. Whereas CAE model uses adaptive sampling from AMSR algorithm and hierarchical sensing to consume the limited resources and extend the lifetime of the network.

## **2) Planned future activities or Statement of completion of the Project (15 lines maximum)**

The future plans include, performing geological and electrical resistivity survey on the selected landslide prone sites. Initial prototype completion of low cost sensors. Designing and developing an Intelligent Wireless Probes (IWP) containing sensors such as moisture sensors, pore pressure sensors, geophones, tilt meters, inclinometers, strain gauges, and a low cost GPS system integrated with intelligent algorithms, which adaptively senses the environment.

## **3) Beneficiaries of Project for Science, Education and/or Society (15 lines maximum)**

Beneficiary for science: This landslide research would lead to the development of low cost sensors for monitoring landslide prone terrains. The relations existing between vital parameters such as moisture, pore-water pressure, movement will be studied in laboratory and validated with the real-time data

Beneficiary for education: This project will initiate many master's and doctoral students to work on landslide research, developing new methodologies etc.

Beneficiary for society: Direct beneficiary from this project will be public people and their properties. Along with the people, the economic loss happening to the government will also be saved. The disaster management board of that region will also benefit from this project.

**4) Results: (15 line maximum, e.g. publications)**

Note:

- 1) If you will change items 1)-6) from the proposal, please write the revised content **in Red**.
- 2) Please fill and submit this form by **30 March 2017** to ICL Network <[icl-network@iclhq.org](mailto:icl-network@iclhq.org)>