

Date of Submission	30-March-2018
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World Centre of Excellence (WCoE-2017-2020)
Progress Report Form 2017
29 May 2017 to 31 December 2017

1. **Short Title of WCoE:** Enhancement of the existing Real-time Landslide Monitoring and Early warning System in Western Ghats & Himalayas, India
2. **Name of Institution (Name of leader and email):** Amrita Vishwa Vidyapeetham, Dr. Maneesha Vinodini Ramesh, maneesha@amrita.edu, maneeshasudheer@gmail.com
3. **List of core members:**
 1. Dr. Venkat Rangan, Vice chancellor, Amrita Vishwa Vidyapeetham, Coimbatore, Tamilnadu, India
 2. Dr. Nirmala Vasudevan, Associate Professor, Amrita Vishwa Vidyapeetham, Amritapuri, Kerala, India
 3. Mr. Sangeeth Kumar, Research Associate, Amrita Vishwa Vidyapeetham, Amritapuri, Kerala, India
 4. Ms. Hemalatha T, Research Associate, Amrita Vishwa Vidyapeetham, Amrita University, Kerala, India
4. **Progress report of activities up to 31 December 2017 (up to 30 lines)**

The WCoE has focussed on several areas during the last one year. The major areas of focus are on:

- ❖ **Research & Development:** To enhance the existing landslide monitoring and early warning system research, new sensor systems has been developed and tested in the laboratory for the deployment in Himalayas. In Western Ghats, we have deployed real-time monitoring ERT systems to understand the vulnerability of one of the slopes. Site specific rainfall thresholds and other sensor based thresholds are being developed.
- ❖ **Networking & Dissemination:** An Indo-Italian joint workshop on “Multi-Hazard Mitigation of Risks to Cultural Heritage” was held during 4-5 December 2017. Dr. Maneesha was invited to present a distinguished lecture titled “Online Monitoring of Landslides”. This talk was well received by the Italian and Indian scientists, leading to initiation of new collaborations with multiple institutes. Amrita along with four other international institutes in Europe and UK is hosting a session titled “People-centered Early Warning Systems for Natural Hazards” at the International Tech4Dev Conference on 27-29 June 2018 at EPFL, Switzerland. This has issued call for papers in the same to increase the dissemination, networking and visibility in the area of People-centered Early Warning System.
- ❖ **International Collaborations & Networking:** (a) An Indo-Italian Joint Workshop on “Multi-Hazard Mitigation of Risks to Cultural Heritage” was held during 4-5 December 2017. Eight potential joint initiatives were identified as an outcome. Dr. Maneesha from Amrita is partnering with Dr. Fausto Guzzetti, from Research Institute for Geo-hydrological Protection in the research and development of the joint initiative for “Multi-Hazard Risk Analysis: Monitoring and Early Warning”. (b) In collaboration with BGS we have initiated a project in Western Ghats for real-time monitoring of landslides using ERT systems. (c) In collaboration with BGS, Kings College London, Newcastle University and GSI India we have initiated research on landslide hazard assessment using crowdsourcing techniques
- ❖ **Digital Learning:** A MOCC course on “A Resilient Future: Science and Technology for Disaster Risk Reduction” was conducted by EPFL, Switzerland in January 2017. Amrita contributed to the chapter “Science and Technology for Early-Warning and Preparedness”. The new iteration of the same course was conducted again on 15 Sept 2017.
- ❖ **National Landslide Task Force:** Dr. Maneesha V Ramesh, from Amrita has been appointed as one of the members of the national landslide task force for developing “National Landslide Risk Management Strategy” for India. This task force has been constituted by National Disaster Management Authority (NDMA). Dr. Maneesha V Ramesh is contributing for the sub group “Development of landslide monitoring and early warning system”. This subgroup aims to undertake R&D work and pilot deployments which will lead to the development of indigenous technology and implementation of the same at large level for dissemination of information to avoid any untoward situation.
- ❖ **Capacity Development:** New PhD and master’s students has been initiated their project with this center. The center has also initiated work on capacity development for north eastern states of the country. The center has also initiated processes to select a few employees to train them in deploying and maintaining landslide early warning systems

5. Plan of future activities (up to 30 lines)

One of the major objective is to enhance the existing landslide monitoring and early warning system, includes our research in the below directions

- ❖ Deployment of 12 intelligent wireless probe (IWP) integrated with heterogeneous sensors for monitoring landslide in North Eastern Himalayas.
- ❖ Analysis of antecedent hydro-meteorological conditions for early warning of landslides
- ❖ Site specific rainfall threshold development and enhancement
- ❖ Dynamic thresholds for sensors, sensor fusion and integrated interpretation
- ❖ Implementation of Electrical Resistivity Tomography (ERT) techniques for slope stability analysis in collaboration with British Geological Society (BGS) and integration of ERT technology with sensor based technology for large scale landslide monitoring and early warning.
- ❖ Understanding the usage of social media and penetration of social media during natural disasters in India
- ❖ Developing landslide ontology and creation of new databases relating to landslide inventories, social analytics, impact and multi-hazards
- ❖ Usage of twitter, Facebook, and other online news medias to collect information related to landslide and explore the possibility of using social media data for early warning of landslides.
- ❖ Collaboration and Joint Initiatives with National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA)-Kerala, SDMA-Sikkim
- ❖ Joint center with the Italian National Research Council (CNR). This joint center is to promote international academic and research collaboration.
- ❖ Joint center with Politecnico de Milano (POLIMI). This joint center agrees to cooperate in joint scientific investigations in the field of "Numerical Simulation of Landslides and Real-time monitoring of Natural Disasters". The scientific investigations from Amrita shall be carried out in the Amrita Center for Wireless Networking and Applications, those from Polimi in the Department of Civil and Environmental Engineering
- ❖ Dr. Maneesha was invited to give a report on the research on "Landslide monitoring Early Warning Research in India" by Career 360 magazine. This article will be published in 2018.

6. Publication (in Landslides, proceedings, meeting reports, or WEB)

Guntha, Ramesh, Sangeeth Kumar, and Balaji Hariharan. "Scalable, secure, fail safe, and high performance architecture for storage, analysis, and alerts in a multi-site landslide monitoring system." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Ramesh, Maneesha Vinodini, et al. "Wireless Sensor Networks for Early Warning of Landslides: Experiences from a Decade Long Deployment." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Ramesh, Maneesha Vinodini. "Slope Stability Investigation of Chandmari in Sikkim, Northeastern India." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Hemalatha, T., Maneesha Vinodini Ramesh, and Venkat P. Rangan. "Adaptive Learning Techniques for Landslide Forecasting and the Validation in a Real World Deployment." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Ramesh, Guntha, Hariharan Balaji, and T. Hemalatha. "High Performance Heterogeneous Data Storage System for High Frequency Sensor Data in a Landslide Laboratory." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Ramesh, Guntha, Hariharan Balaji, and T. Hemalatha. "High Performance Heterogeneous Data Storage System for High Frequency Sensor Data in a Landslide Laboratory." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Ramesh, Maneesha Vinodini. "Slope Stability Investigation of Chandmari in Sikkim, Northeastern India." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Kumar, Sangeeth, P. Venkat Rangan, and Maneesha Vinodini Ramesh. "Design and validation of wireless communication architecture for long term monitoring of landslides." *Workshop on World Landslide Forum*. Springer, Cham, 2017.

Note:

Please fill and submit this form by **30 March 2018** to ICL Network <icl-network@iclhq.org>

Less than 2 printed pages.

Activities are recommended to submit to the ICL-IPL activities of Landslides: Journal of International Consortium on Landslides.