INFORMATION OF DOCTORAL THESIS

1. Full name: Gian Quoc Anh   2. Sex: Male

2. Date of birth: 02/04/1981   4. Place of birth: Nam Dinh

5. Admission decision number: 1006/QĐ-CTSV   Dated: 07/12/2015

6. Changes in academic process:

Decision No. 271/QD-DT, dated 24/03/2017 of the Rector of the University of Engineering and Technology on adding supervisor; Decision No. 608/QD-DT, dated 13/06/2019 of the Rector of the University of Engineering and Technology on allowing Ph.D student to extend the study period in 12-month; Decision No. 443/QD-DT, dated 13/07/2019 of the Rector of the University of Engineering and Technology on allowing Ph.D. student to extend the study period in 6-month.

7. Official thesis title: **"Research and development of a landslide warning system using the wireless sensor network"**

8. Major: Electronic Engineering   9. Code: 9510302.01

10. Supervisors: Assoc. Prof. Dr. Tran Duc Tan

                  Prof. Dr. Bui Tien Dieu

11. Summary of the **new findings** of the thesis:

Propose a group of energy-saving solutions for a wireless sensor network applied in monitoring and warning of landslides due to rain on the slope. The solution group includes sensor selection, change of sampling frequency, network configuration switching settings based on operational scenarios, and improved compressed sensing. Based on applying a numerical model to calculate the factor of safe (FoS) in real-time, the thesis proposed a system model to automatically switch between tree configuration and star configuration to ensure reliability. The sampling frequency changes automatically based on the results of the FoS analysis of the slope. Another energy-saving solution at the sensor node is improved compressed sensing. Compressed sensing techniques are used to reduce the amount of data transmitted.

A landslide monitoring and warning system model is deployed on the hazard potential slope to forecast and warn of landslides in real-time. The system combines wireless sensor networks to collect, transmit information and the numerical model of slope for real-time forecasting and warning. The system divides warning levels into three levels. The warning thresholds are set based on statistics of historical landslides, rainfall

information, rain history, slope deformation, and the result of the FoS analysis. Different rainfall scenarios can be used to provide forecasts for landslides.

12. Practical applicability:

The thesis integrates new research results into the numerical slope model, successfully built a landslide warning system using a wireless sensor network. The system has been experimentally applied to typical sliding blocks in Nam Dan Commune, Xin Man District, Ha Giang Province with very good forecast results. Therefore, the thesis topic has high practical significance. Implementing technology from this thesis for other slopes in Vietnam will help better prevent natural disasters and landslides, helping to reduce the risk of human and property damage from landslides for the community.

13. Further research directions:

In the next study, it is necessary to applicate communication standards with longer transmission distances so that the system can be applied in many field conditions.

Integrating artificial intelligence models for the system to process information and operate automatically reduces expert intervention. Study feasible solutions to build a low-cost landslide warning system that is easy to deploy and operate.

14. Thesis-related publications:

[1]. **Quoc-Anh Gian**, Dinh-Chinh Nguyen, Duc-Nghia Tran, and Duc-Tan Tran (2016). "Monitoring of Landslides in Mountainous Regions Based on Fem Modelling and Rain Gauge Measurements." *International Journal of Electrical and Computer Engineering (IJECE)* 6, no. 5 (2016): 2106-2113.**[Scopus, Q2]**

[2]. **Quoc Anh Gian**, Duc-Tan Tran, Dinh Chinh Nguyen, Viet Ha Nhu, and Dieu Tien Bui (2017). "Design and Implementation of Site-Specific Rainfall-Induced Landslide Early Warning and Monitoring System: a Case Study at Nam Dan Landslide (Vietnam)." *Geomatics, Natural Hazards and Risk*, vol. 8, no. 2, pp. 1978–1996. doi:10.1080/19475705.2017.1401561.**[SCIE, Q1]**

[3]. **Gian Quoc Anh**, Tran Duc Tan, Nguyen Dinh Chinh and Bui Tien Dieu (2018), "Flexible Configuration of Wireless Sensor Network for Monitoring of Rainfall-Induced Landslide." *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, Vol. 12, No. 3, , pp. 1030~1036.**[Scopus, Q3]**

[4]. **Gian Quoc Anh**, Nguyen Dinh Chinh, Tran Duc Nghia, Tran Duc Tan, Nguyen Thi Kieu, Kumbesan Sandrasegaran (2018), "Wireless Technology for Monitoring Site-specific Landslide in Vietnam ", *International Journal of Electrical and Computer Engineering* Vol. 8, no. 6: 4448-4455.**[Scopus, Q2]**

[5]. **Gian Quoc Anh**, Cao Van The, Tran Duc Tan. "*Chaos-based Compression Sensing on Wireless Sensor Network: Enabling a Low-power and High-performance Systems*". Journal of Military Science and Technology (JMST). (Accepted for publication)