Fast Facts

Project: Monitoring and early warning of landslides in Vietnam
Lead Organization: VNU University of Engineering and Technology
in collaboration with Vietnam National University
Country: Vietnam
Budget: AUD 30,000.00

Situation

Vietnam is a country heavily influenced by climate change. The effect of climate change leads to a series of dangerous phenomena, such as landslides. Landslides occur not only in the mountainous province, but also in Delta provinces, where hundreds of landslides are reported annually in the North-Western provinces of Vietnam. These events have catastrophic impact to the community as well as the economy.

Solution

This project precisely addressed the problems mentioned, by designing and implementing an efficient and reliable Landslide Monitoring and Early Warning (LMnE) system based on the 3G/2G mobile communication system combining with a wireless sensor network at monitoring stations. The system uses advanced processing algorithms combining obtained data at the central station.

In this solution, an integrated GPS (Global Positioning System) receiver and a (Microcontroller unit) MCU board with advanced sensors was added to each sensor node to measure temperature, precipitation, vibration, etc. and sent this information to the central station via 2G/3G transceiver. At the central station, the above information, combined with satellite images and geological maps, allows predicting the change in region’s geology and providing the landslide early warnings. The project selected a pilot location to conduct the local survey and research around Hoa Binh (Ha Giang provinces), as it is one of the areas that is most affected by the landslides in Vietnam, populated by many different ethnic minorities.

WSN system consists of sensor nodes that are capable of data acquisition, data storage, data processing, and wireless data transmission. The proposed WSN is shown in Fig. 2 which consists ten wireless sensor nodes to measure parameters of the environment for landslide monitoring. For this kind of application, the WSN can be designed as a star or tree network models. The data are sent to a data logger through a gateway from each node via Xbee standard. The data received from the data logger is pre-processed and uploaded to a database on a web server over the Internet and/or GSM/GPRS. A real-time program would analyze the data to monitor and give an alert (if need) to the designed people about the probability of landslides.

The objectives pursued were:

- Performing a survey on the distribution of the landslide area, the current sensor node to measure environment’s parameters and to construct a model of the Ad-hoc sensor network (coverage size and number of sensor nodes in a coverage area)
- Developing more detail communication model between sensor nodes and central station to improve communication link (sensor node-central station-sensor node).
• Developing the algorithms and software’s at central station.
• Evaluation and testing of the proposed network model and protocol in a laboratory environment using ten hardware boards controlled by computers. Feasibility study of hardware development for a complete, real system to be considered in future projects.

Outcomes
This study has successfully developed a sensor column for efficient wireless sensor network based landslide monitoring system. The sensor column has integrated different kinds of sensors to collect and process data. In each sensor column, there are three external sensors, a microprocessor and a wireless transmission module. The information on temperature, soil moisture, tilt, vibration, and the status of battery health is sent frequently to the data processing centre. The sensor characterization and wireless transmission were also tested carefully. It can be seen that the whole system can be implemented in real environment.

This project was one of the first researches in Vietnam that focus to develop a wireless sensor network in order to monitor the landslide phenomenon. The success of this project has proved that the project team can develop the WSN by themselves to assemble the real-time system in some specific locations. This kind of experiment was not in the scope of this project. Being convinced of this work, the university (VNU) has decided to fund the project team to implement the outdoor-location experiment (in HaGiang or HoaBinh provinces).

The most important output was the successful launch of a WSN for landslide monitoring. It will help the government authorities to see that the landslide monitoring systems are possible to implement in different locations in Vietnam for the protection of the natural environment, infrastructure, and human lives against landslide disasters.

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