

LoRa BASED LANDSLIDE MONITORING SYSTEM

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Abstract—An early warning system for landslides, monitoring of one areas is a long-lasting process, little human intervention, and a resource less environment. Data changes in the monitoring area may be noticed in many days, months, or years depending on the weather characteristics. Therefore, a frequent and large amount of data of monitored area is not required to send on a cloud server. Moreover, Long-range communication provided comprehensive spectrum communication protocol and low power consumption with fewer data rates. Over the advantage of LoRa technology, we designed a customized sensor node and gateway node to monitor the changes periodically with low energy power consumption. We evaluated the distinct metrics of spreading factor, sensitivity, time-on-air, energy consumption, link budget, and battery life of sensor and gateway nodes. Finally, this study concludes with challenges faced in real-time in which the sensor data received via a customized sensor node and gateway on the cloud server.

KEYWORD: LoRa, ACCELEROMETER, VIBRATION SENSOR, wireless, Internet of Things, IMU SENSOR, GSM.

1. INTRODUCTION

Landslides is a geological phenomenon that has caused numerous death toll and loss of properties every year. In regions susceptible to slope failures, land slide risk assessment must consider the available economic resources, environmental impact and safety. Once a landslide is triggered, material is transported by different components including sliding, streaming and falling. The sorts of landslides vary with respect to the type of material, rate of movement and nature of movement. Constant monitoring of environmental disasters such as landslide can reduce the number of fatalities especially in developing countries. Wireless Sensors Networks WSN is one of the innovations that can rapidly react to fast changes of information and send the information to the collector section in territories where wired or cabling is not accessible or expensive. WSN innovation has the ability to process and transferring transmission of required data continuously. There are several limitations of WSN such as low memory, limited processing capability, low power transmission and low data transfer capacity.

However, its ability to be deployed in hostile condition, energy efficient and require minimal support made it one of the most appropriate technologies for continuous monitoring of steep sided hills that are prone to landslide. In this paper, a development of an early warning system for landslide utilizing Wireless Sensor Networks WSN

technology namely Zigbee protocol and Internet of Things IOT is presented. WSN enables the developed system to be distributed and deployed over a relatively vast area at relatively low cost. Unlike other landslide monitoring system, the alerting system and data collected by the proposed system is assessable through smartphone application. A study conducted by estimates that global smartphones adoption stood at 59 percent in 2017 and projected to increase by 79 percent in 2025. Therefore, the proposed system can provide an early warning to communities residing in regions susceptible to landslide. Moreover, the ground movement data can be analyzed by governmental agencies formulate effective national policy, strategy and action plan to reduce public risk and minimizing the loss of economic activities.

A landslide is movement of a mass of rock, debris, or earth down a slope. In monsoons the rain water percolates and develops hydraulic pressure which exceeds the elastic limit of the soil or rocks. Due to this the strain gets accumulated which forces the soil and rocks to loosen their adhesive strengths entailing landslides. Landslides can also be said of "Mass Wasting", which refers to any down slope movement of soil and rock due to gravity. It causes property damage, injury and death.

In the last few years Kerala also faced the loss of human landslide. Mainly landslide season in Kerala starts with the onset of the south-west monsoon every year. Landslides include debris flows, rock slides and mud slips. Apart from claiming human lives it destroys hills and vast tracts of agricultural lands, buildings, roads, economic and infrastructure. Researchers are still doing different case studies on landslide prediction, detection and monitoring. Landslide detection can be done by using diverse methods like visual inspection using image processing, digital aerial photographs, and laser projector, using statistical methods. Landslide detection can also be based on data driven approaches using wireless sensor networks (WSN). The main objective to study the landslide detection is to prevent the natural calamity by detecting its early movement and this will reduce or save the human loss caused by the landslide. Also, the objective is to find a certain way in which the sensing elements should respond quickly to rapid changes of data and send this sensed data to data analysis Centre. The proposed Internet of things (IoT) based landslide detection and monitoring system is a low cost, robust and delay efficient.