

Earthquake Mitigation: An Application of Wireless Sensor Networks

Dwi Joko Suroso¹, Panarat Cherntanomwong², Sunarno³

^{1,2}*King Mongkut's Institute of Technology Ladkrabang
Chalngkrung Rd. 1, Latkrabang, Bangkok 10520, THAILAND*

¹s3601152@kmitl.ac.th

²krpanara@kmitl.ac.th

³*Department of Engineering Physics, Faculty of Engineering, Gadjah Mada University
Jln. Grafika 2, Yogyakarta 55281, INDONESIA*

³efs_sunarno@yahoo.com

Abstract— The high number of victim as the result of earthquake disaster needs some intentions in the technology application. The mitigation scheme to reduce the destruction caused by earthquake is developed. This paper describes the theoretical and empirical concepts of wireless sensor networks for earthquake mitigation applications. First, the existing researches about earthquake mitigation using wireless sensor networks are explored, and a review of each technique and system is provided. Then, the influencing factors which affect the result for each technique are explained. The comparison of the efficient system for earthquake mitigation for each technique and system is emphasized.

Keywords— Earthquake, Early warning system, Wireless sensor networks, Disaster Mitigation

I. INTRODUCTION

An earthquake is a nature phenomenon as the result of the sudden release of stored energy in the crust of the earth which creates seismic waves [1]. Earthquake can be one of the most devastating natural disasters. For instance, the 1995 Kobe earthquake in Japan killed over 6,400 people and over 100,000 houses and buildings were destructed. On Sunday, December 26, 2004, the Indian Ocean earthquake triggered the tsunami that killed about 200,000 people in Indonesia, Sri Lanka, India and Thailand [2], [3]. And recently, on March 2011, the 8.9 RS earthquake and followed by tsunami hit Japan. It killed more than 15,000 people and 125,000 buildings were destroyed [10], [11]. These issues attract the researches to conduct experiment in order to get the mitigation disaster, especially for earthquake disaster mitigation system that beneficial for saving lives.

This paper provides the analysis of the existing researches of earthquake mitigation using wireless sensor network (WSN). A sensor network is composed of a large number of sensor nodes which are densely deployed either inside the phenomenon or very close to it [4]. WSN as the recent technology in sensing capability can be applied as the key of technology to realize the ubiquitous computing and networking environment [5].

The research focuses on the reviewing the performance of the system from the existing works. The systems are developed to observe an earthquake by using WSN technology [6], [7]. The review comprises of WSN applications in structural monitoring system and ubiquitous earthquake observation system. The purpose of the paper is to

conclude the result of existing work and give the improvement points for the further research in WSN as the earthquake mitigation application. Therefore, giving more analysis and information inside of earthquake mitigation system using WSN can greatly improve the efficiency of saving lives.

The paper is organized as follows. The Section 2 summarizes the system overview of existing work. Section 3 describes the problem formulation of existing work. The Section 4 presents the design for each mitigation system. Then, we show our discussion in the Section 5. Finally, we conclude the paper in the Section 6.

II. SYSTEM OVERVIEW

Earthquake mitigation in structural monitoring has been addressed in a few works such as [1], [5-8]. In [6] the wireless sensor devices are deployed as the sensing element in order to recognize the earthquake using acceleration sensors. The application of ubiquitous structural monitoring system using WSN in [8] has the main purpose of detecting the damage of the structure.

Additionally, some other works conduct to propose the method for simulating and rescue scheme and navigation for earthquake effect. In [9] it provides the network for local government daily services, and especially useful for disaster mitigation. It will integrate a number of diverse kinds of simulators, it will helpful not only during earthquake but also for emergency drill response, etc.

A. Earthquake

Earthquake is the result of seismic waves due to energy. It used to sudden release of energy in the earth crust that