

# A Research on an Intelligent Urban Disaster Control with an Integrated Management and Monitoring System Using IoT Smart Sensors

Linh Van Ma<sup>1</sup>, Yonggwan Won<sup>2</sup>, Taeksoo Ji<sup>3</sup>, Sung-Hoon Hong<sup>4</sup>,  
GeunChang Choi<sup>5</sup>, Jinsul Kim<sup>6</sup>

<sup>1,2,3,4,5,6</sup> School of Electronics and Computer Engineering Chonnam National University, 77,  
Yongbong-ro, Buk-gu, Gwangju 500-757, Korea

<sup>1</sup> linh.mavan@gmail.com, <sup>2</sup> ykwon@jnu.ac.kr, <sup>3</sup> tji@jnu.ac.kr, <sup>4</sup> hsh@jnu.ac.kr,  
<sup>5</sup> t\_o\_p1412@naver.com, <sup>6</sup> jsworld@jnu.ac.kr (corresponding author)

**Abstract.** Increasing number of people have been migrating to density areas where they could find a convenience life and good jobs. Crucially, research about organizing and planning in these urban areas must be carried about intensively. Recently, many studies have been proposed to improve living quality and living condition in urban such as the researches about the smart city. Consequently, this research studies on the urban disaster. Mainly, we focus on intelligent indoor/outdoor fire control with an integrated management system and monitoring system using IoT smart sensors. Throughout the study, we show that by using the monitoring system, a user can detect and be noticed if an area occurs a fire, which could make their life more convenience in the sophisticated city.

**Keywords:** IoT, Urban Disaster, Monitoring System, Smart Sensors, Fire Control

## 1 Introduction

Natural disasters often come with or without an advance warning. Consequently, it does not allow us to spend much time preparing for an emergency response that naturally involves emergency relief measures. On the other hand, long-term strategies such as psychosocial support for affected people and communities, resettlement, social infrastructure provision, livelihood development require careful planning of the interventions. The authors [1] demonstrated the need for a holistic or integrated approach to assessing disaster recovery and developing a multi-dimensional assessment framework. As a result, their propose is new to disaster recovery assessments and is very useful for monitoring and evaluating rehabilitation.

Similarly, we research on intelligent indoor/outdoor fire control with an integrated management system and monitoring system using IoT (Internet of Things) smart sensors. The rest of paper is organized as follows. In section II, we present related

works. Subsequently, we introduce the system overview and working flow in Section III. We also describe our experiment and discuss the results achieved. Section IV presents our findings with future research directions.

The rest of paper is organized as follows. In section 2, we present related works which interest smart city, urban disaster and IoT. In Section 3, we introduce the intelligent system. In section 4, we describe our experiment and discuss the results achieved. Section 5 presents our findings with future research directions.

## 2 Related Works

Every year, lots of cities have water flooded or waterlogging problem in China. At the same time, the world is facing a challenge of water shortage. To address this issue, the authors [2] showed the study of a storm-water management system. Their experimental results indicated that the numerical error of predicted value shows a downward trend, and it gradually tends to its real value.



**Fig. 1.** System Overview

Recently, several types of research concerning with smart and connected communities have been studied. In the article [3], the authors enumerated several research issues to be developed in the distributed computing systems community in the next decade for building safe, smart cities resistant to disasters.

Finally, the authors [4] proposed a mining-based municipal climate disaster index service according to potential risk. The proposed method constructed extensible markup language files provided by Meteorological Administration and Open Data Portal in the form of a tree. As a result, their study could detect, predicts, and analyzes the trend of various risks such as disasters and safety accidents.

### 3 System Overview

The research goal focuses on an intelligent indoor/outdoor fire control with an integrated system management and monitoring system using IoT smart sensors with the following items. First, we build the system using IoT smart sensors as shown in Figure 1. In the system, the server gets fire data in real-time, and we manage fire/weather through a web application. It also predicts and monitors the spread of fire direction based on current weather location such as wind direction, humidity, etc. Secondly, we employ the system for risk detection and notification/alert based on current location data getting from IoT devices. Functionally, it shows location by using real-time sensor data detection and analysis methods. It can also alert fire to users based on existing disaster occurrence points and real-time risk detection as shown in Figure 2.

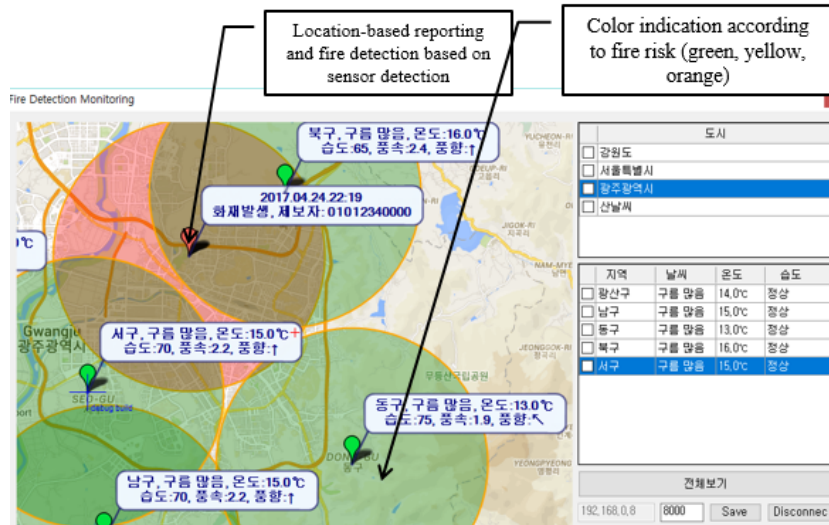
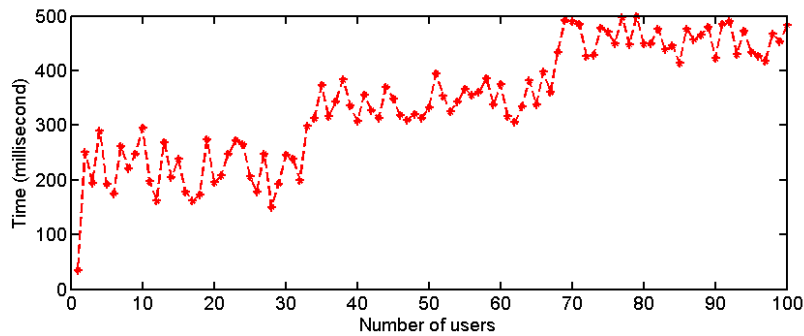


Fig. 2. Real-time monitoring and forecasting server.

In the system, we use weather measurement information which was provided by government website (Korea meteorological administration) on the system servers. Also, we build an android application which connects to the servers where information is processed before emitting to users.

## 4 Experiment and Discussion

We built the system server and set up 100 users located around Gwangju city which is the four largest city in South Korean. Each user is simulated in an Android application with its location. They send reported data such as fire occurrence information, traffic information, etc., within their random interval. The server is responsible to notice these users and assist them to go out of the effect area. Fig. 3 shows the response of the implemented system after getting and processing information from reported users.



**Fig. 1.** System response to users reported information.

As a result, the response time is gradually increased when the number of user increased. Although, it still less than a second.

## 5 Conclusion

In this article carried out research on the urban disaster. Primarily, we focused on intelligent indoor/outdoor fire control with an integrated management system and monitoring system using IoT smart sensors. As a result, it showed that by using the control and monitoring system users can detect and be noticed if an area occurs a fire, which could make their life more convenience in the sophisticated city. In the future, we intend to investigate the system in network virtualization environment.

## Acknowledgments

This research was supported by the MSIT (Ministry of Science and ICT), Korea, under the ITRC (Information Technology Research Center) support program (IITP-2017-2016-0-00314) supervised by the IITP (Institute for Information & communications Technology Promotion), and also supported by the IT R&D program of MSIT (Ministry of Science and ICT), Korea / NIPA (National IT Industry

Promotion Agency) 12221-14-1001, Next Generation Network Computing Platform Testbed.

## References

1. Hettige, Siri, Siri Hettige, Richard Haigh, and Richard Haigh, "An integrated social response to disasters: the case of the Indian Ocean tsunami in Sri Lanka", *Disaster Prevention and Management: An International Journal*, Vol.25, No. 5, pp.595-610, 2016.
2. Zhou, Mo, and Xiaoshu Zhu, "A study of urban stormwater management and waterlogging controlling based on internet of things", *International Education and Research Journal*, Vol. 2, No. 4 2016
3. Higashino Teruo, Hirozumi Yamaguchi, Akihito Hiromori, Akira Uchiyama, and Keiichi Yasumoto, "Edge Computing and IoT Based Research for Building Safe Smart Cities Resistant to Disasters", In *Distributed Computing Systems (ICDCS)*, 2017 IEEE 37th International Conference on, pp. 1729-1737, 2017
4. Kim, Joo-Chang, Hoill Jung, and Kyungyong Chung, "Mining based urban climate disaster index service according to potential risk", *Wireless Personal Communications* Vol. 89, No. 3, pp.1009-1025, 2016