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Smart Bridge Safety Monitoring System

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ABSTRACT

In this study, smart bridge safety monitoring system is developed. This system is composed of:(1) monitoring devices installed in the bridge environment; (2) communication devices connecting the bridge monitoring devices and the cloud-based server; (3) a dynamic database that stores bridge condition data; and (4) a cloud-based server that calculates and analyzes data transmitted from the monitoring devices. This system can monitor and analyze in real time the conditions of a bridge and its environment, including the waters levels nearby, cracks and other safety conditions. The detected data and images are transmitted to the server and database for users to have real-time monitoring of the bridge conditions via mobile telecommunication devices.

Keywords: Internet of things (IoT); bridge safety monitoring; data analysis.

I. INTRODUCTION

Because of climate and location, incidents of bridges or bridge piers severely damaged by typhoon floods and earthquakes are frequently reported each year. In addition to floods, typhoons and earthquakes may also cause disastrous accidents of fires, explosive gas leakage and liquid chemical leakage. Different disasters and damaged sites require different professional disaster rescue knowledge and equipment in order to achieve optimal rescue results. However, lack of information about the damage site can impede information management at the rescuecenter and rescue operation, resulting in poor rescue efficiency or even preventable causalities. Therefore, in this study, the IoT, wireless sensor network (WSN) and smart building technologies are adopted to solve the above mentioned problems of abridge safety monitoring system capable of monitoring the environmental data of a bridge and transmitting the data to the mobile devices of bridge safety management staff for reference and documentation. The data can be used for bridge safety management and, in the occurrence of a disaster, for disaster rescue. The system developed in this study can help promote the advancement of bridge safety management and control by providing breakthroughs to the above mentioned problems of conventional systems.

II. EXISTING SYSTEM

Traditional methods of bridge safety management have the following problems: (1) failure to collect data or monitor on-site conditions in real time and failure to comprehensively record or analyze the collected data of on-site conditions in real time, resulting in poor disaster rescue efficiency; and (2) data collection through visual assessments or use of large-size electronic equipment, often resulting in inaccurate monitoring results or higher costs and higher power consumption. Therefore, an IoT-based bridge safety monitoring system is developed in this

study with a view to solving the above-mentioned problems.

III. PROPOSED FRAMEWORK

The system adoptsIoT and WSN technologies.The system can monitor and analyze in real time the conditions of a bridge and its environments. Real time conditions include water levels nearby, crack detection and other safety conditions. The detected data and images collected by the monitoring units are transmitted to the server system for further computing and decision-making.The decision made by the system, related analysis contents and alert messages are all transmitted by the server system via the internet to the management center for them to have real time and comprehensive understanding of the bridge's surrounding environment and keep records of the data for appropriate responses when a disaster occurs. The detected data and images are also transmitted to the users to have the real time monitoring of the bridge conditions via mobile telecommunication devices.

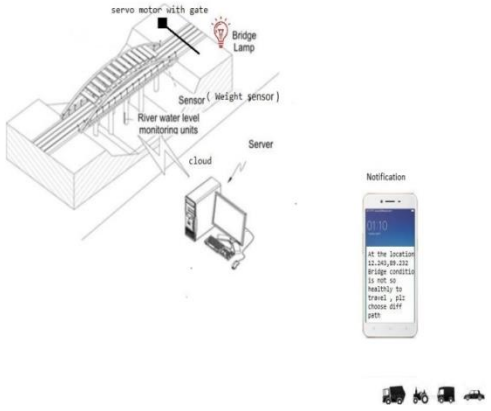

Figure 1. Bridge safety monitoring server system and notification mechanism

IV. CONCLUSION

This study is intended to develop a bridge safety monitoring system that integrates the technologies of IoT, crack detection and monitoring sensors. This system is unique in its ability to monitor the bridge environment, transmit the environmental data through wireless communication and send alerts to the bridge management staff in real time for prompt reactions. This system can enable 24x7 bridge safety management as well as prompt and appropriate responses to emergency incidents. All the collected environmental data sent to the server in the system can be used for big data analysis or follow-up research. The system developed in this study is a preliminary exploration. Future research is needed to improve the system by analysing data collected by the system and developing more advanced computing models and operational practices for the system.

V. REFERENCES

1. Y Sun, "Research on the Railroad Bridge Monitoring Platform Based on the Internet of Things," International Journal of Control and Automation, vol. 7, no. 1, pp. 401–408, 2014.
2. P Kinney, "ZigBee technology: Wireless control that simply works, 2003." 2003.
3. K Gill, S.-H. Yang, F. Yao, and X. Lu, "A zigbee-based home automation system," IEEE Transactions on Consumer Electronics, vol. 55, no. 2, 2009.
4. M Wiser, "The Computer for the 21st Century—Scientific American Special Issue on Communications," Computers, and Networks, no. September, pp. 94–104, 1991.
5. M Weiser, "Hot topics-ubiquitous computing," Computer, vol. 26, no. 10, pp. 71–72, 1993.
6. B Gates, N. Myhrvold, P. Rinearson, and D. Domonkos, "The road ahead," 1995.
7. C Alippi, R. Camplani, C. Galperti, and M. Roveri, "A robust, adaptive, solar-powered WSN framework for aquatic environmental monitoring," IEEE Sensors Journal, vol. 11, no. 1, pp. 45–55, 2011.
8. M T. Lazarescu, "Design of a WSN platform for long-term environmental monitoring for IoT applications," IEEE Journal on Emerging and Selected Topics in Circuits and Systems, vol. 3, no. 1, pp. 45–54, 2013.

9. S Misra, V. Tiwari, and M. S. Obaidat, “LACAS: learning automata-based congestion avoidance scheme for healthcare wireless sensor networks,” IEEE Journal on Selected Areas in Communications, vol. 27, no. 4, 2009.
10. Y. Zhang, L. Sun, H. Song, and X. Cao, “Ubiquitous WSN for healthcare: Recent advances and future prospects,” IEEE Internet of Things Journal, vol. 1, no. 4, pp. 311–318, 2014.
11. J. M. Corchado, J. Bajo, D. I. Tapia, and A. Abraham, “Using heterogeneous wireless sensor networks in a telemonitoring system for healthcare,” IEEE transactions on information technology in biomedicine, vol. 14, no. 2, pp. 234–240, 2010.
12. G. Song, Z. Wei, W. Zhang, and A. Song, “Design of a networked monitoring system for home automation,” IEEE Transactions on Consumer Electronics, vol. 53, no. 3, 2007.
13. J. Zhang, G. Song, H. Wang, and T. Meng, “Design of a wireless sensor network based monitoring system for home automation,” in Future Computer Sciences and Application (ICFCSA), 2011 International Conference on, 2011, pp. 57–60.
14. B. Zhou, J. Cao, X. Zeng, and H. Wu, “Adaptive traffic light control in wireless sensor network-based intelligent transportation system,” in Vehicular technology conference fall (VTC 2010-Fall), 2010 IEEE 72nd, 2010, pp. 1–5.