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A Review of Vibration-Based SHM RASP System of Civil Infrastructure in Coal Mining Areas

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Abstract: This paper presents a comprehensive review of the long-term structural health monitoring (SHM) system of civil infrastructure under the effect of coal mining operations by using MEMS-based accelerometers, Raspberry Pi (RASP) and a real-time vibration-based visualization embedded platform. The web-based RASP system could be a useful tool for monitoring the dynamic behavior of civil structures such as buildings, bridges, tunnels, and dams, which could be developed for early warning systems (EWS) of potential structural damage issues in real time under the impacts of coal mining activities. Intelligent data processing could be implemented into the web-based SHM RASP system with smart sensors installed in civil structures located near coal mining regions, where wireless sensor networks (WSN) could be managed and analyzed with large data sets by the Internet of things (IoT) platform. The vibration-based WSN applications of the web-based SHM system could be visualized to collect data sets of vibration signals with one sensor configured in Gliwice Poland and other sensors in Vietnam. The aims of these innovative solutions could be to establish an effective EWS-engaged SHM system of the existing civil infrastructure by the integration of AI, machine learning algorithms and web-based data management for informed decision-making to ensure structural safety by Telegram-integrated alerts. This online web-based monitoring system could be effectively utilized for actual low-cost emerging structural technologies related to seismic hazard zones, as well as environmental problems and weather change risks, so that these historical structural responses would be recorded for building AI-based prediction models.

Web-based Platform of RASP-engaged Structural Health Monitoring System

Figure1: Wireless acceleration sensor in 3G/4G/LTE-based RASP system

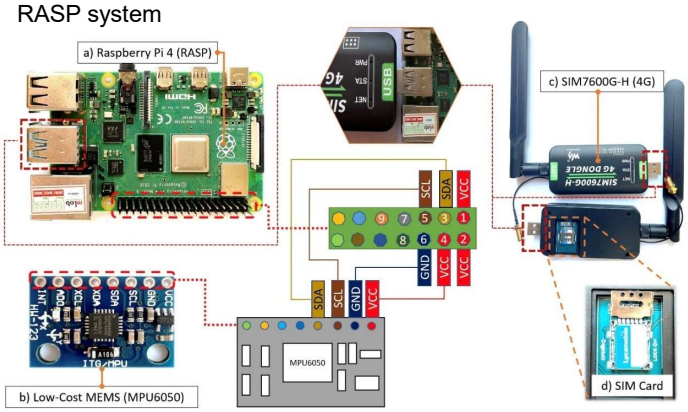

Figure 2: Web-based SHM system

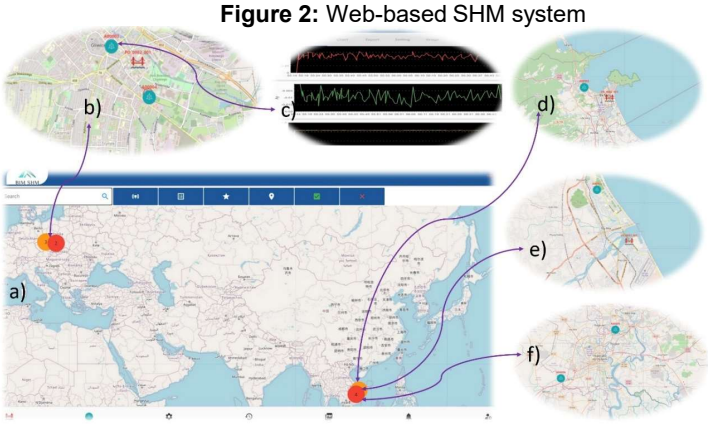

Figure 4: How integrating sensors into bridge structures

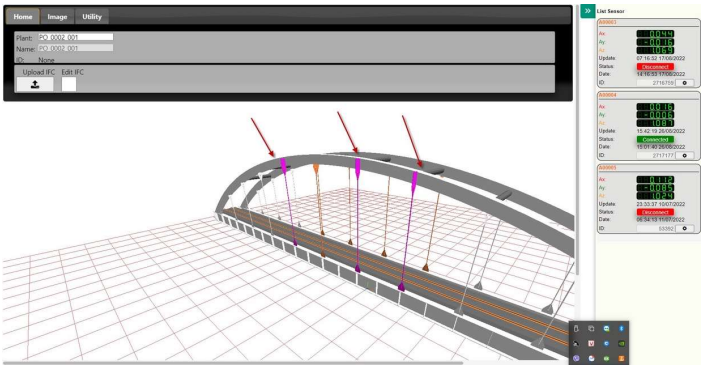

Figure 3: Web-based Wireless sensor networks

Conclusion:

- ❖ IoT-based SHM system was developed including wireless acceleration sensor networks by integrating MEMS-based RASP system and web-based server platform at home. The present work has aimed to develop low-cost SHM system.
- ❖ Vibration-based SHM system could be installed easier and faster to measure dynamic historical responses of existing civil structures in various regions as well as challenging coal mining areas.
- ❖ Other practical applications such as monitoring weather conditions, potential environmental factors near coal mining operations could be monitored as emerging technologies in real-time via applications of smartphones.
- ❖ AI technologies and machine learning Approaches could be integrated for intelligent data processing to predict the future behavior from the past responses of existing infrastructure.

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