Abnormal Behavior Detection System for Bridges using Size-adjustable Carbon Nanotube Patch Sensors

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This study introduces implementing size-adjustable Carbon NanoTube (CNT) patch sensors to monitor abnormalities in bridges. The developed CNT sensor, made of carbon nanotubes and polyurethane, detects bridge structural behavior through changes in electrical resistance. The CNT sensor's size and shape are customizable according to the type and surface condition of the bridge, allowing attachment in places where conventional sensors, such as strain gauges, are unable to be utilized. As such, the size-adjustable CNT patch sensor can accurately detect abnormal behaviors at any location of the bridge. The data collected by the sensors is transmitted to an IoT-based monitoring system for data analysis. This system enables proactive identification of potential structural issues. Field tests of the abnormal behavior monitoring system using CNT patch sensors were conducted on in-service bridges in the United States and South Korea. These tests confirmed the system's effectiveness in monitoring and detecting potential problems in bridges. To conclude, the structural abnormal behavior detection technology employing size-adjustable CNT patch sensors shows promise for effective application in various fields in the near future.

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Giwan Jo graduated from Carnegie Mellon University in Pittsburgh, earning both a B.S. and an M.S. in Civil Engineering with University Honors. Following graduation, he joined AECOM in Minneapolis as an ITS Specialist, contributing to various state DOT projects including White Bear Lake Automated Bus project, Metro Transit Bus TSP project, and Panther Express Bus Terminal Renovation project. Currently, he is a researcher at ENGSOFT in Seoul, South Korea, where he is involved in research projects such as the CNT Patch Sensor-based SHM System and the Smart Battery Monitoring System for Electric Vehicles.