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THIRD PRIZE

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Network Level Bridge Health Monitoring using In-Vehicle Sensors & Machine Learning

The progressive deterioration of transport infrastructure is a challenging problem for infrastructure managers, faced with the maintenance of large transport networks with limited funding. Specifically, bridges are critical elements, and bridge failure can have significant impacts on the functioning of transport networks as well as posing a safety risk. In recent years several major bridge collapses highlighted the importance of ongoing inspection and monitoring of bridges. Traditionally, inspection regimes relied on visual approaches, or, when necessary, sensors can be installed on bridges to gather detailed information on the structural performance. These methods are time consuming, labour intensive and are not scalable to facilitate regular network monitoring. Besides the costs, these methods also pose logistical challenges and safety issues, meaning that there is a clear need for quicker and cheaper methods for monitoring bridge health. This proposal presents an approach deploying in-vehicle sensors to monitor the condition of bridges. This 'drive-by' bridge health monitoring approach uses vehicles on the road network to indirectly measure the condition of the bridges. This eliminates the logistical and safety challenges. The research presents a framework for bridge condition monitoring incorporating machine learning approaches solving primary technical challenges. Individual solutions to the various technical challenges are presented, with a view to developing a practical method, which will form the basis of a drive-by bridge health monitoring framework applicable at a network level. A purpose-built, laboratory-scale vehicle-bridge interaction model is also presented.