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Evaluating Bolt-loosening via Digital Image Processing

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ABSTRACT

Steel structures are metal structures which are made from structural steel connecting components to carry loads and provide stiffness. In modern-day construction, steel structures are used for almost every structure. Considering Steel structures, the vital part that withholds the structure together are Steel Connections. Steel Connections acts as the glue that withholds a steel structure together. Therefore, steel connections are vital and are designed more conventionally. Bolted Connections are widely and commonly used connection type considering steel connections. Bolted Connections include bolts which are used to connect the pieces of metals by inserting them through the holes in the metal; at the thread end and tightened the nut. Eventually, the alarming factor considering Bolted Connections is that the self-bolt-loosening, due to its exposure to vibrations and shocks. Self-Bolt-loosening leads to a decrease in the clamping force acting upon the joint, causing stiffness and potential structural failure.

As self-bolt-loosening is rising factor authority are concerned about the maintaining defect-free structures. In order to achieve it, authorities are concerned about the novel, cost-effective researches in detecting the bolt-loosening in early stages, which would eventually increase the accuracy and labour cost compared to manual inspection.

To address the above factor of self-bolt-loosening, a new system is developed through this research project which uses digital image processing in analysing bolted connections. A desktop application is developed where an image of a bolted connection could be upload and evaluated whether the bolt and the nut are loosened or not.

The system is developed using Python programming language, OpenCV library was used as the image processing library. Implemented system was tested thoroughly under different conditions, and the system was evaluated by domain experts. Eventually, the test results proved that the analysis, design, implementation and documentation had been carried out effectively and efficiently.

Keywords: bolt-loosening; bolted joint; image processing; steel structure