ABSTRACT

PROTOTYPE DEVELOPMENT OF A SINGLE DEGREE OF FREEDOM BRIDGE HEALTH CONDITION MONITORING SYSTEM USING DYNAMIC RESPONSES

By

Muhammad Satria Wibawa

1202154224

Infrastructure is a structural economic element consisting of basic structures, facilities, equipment that are built to facilitate the flow of goods and services between buyers and sellers or to facilitate economic activities developed by bridges. The bridge is a structure that connects two parts of a broken road due to geographical terrain to pass obstacles and existing natural terrain. The bridge will repair damage from time to time and need to be taken care of checking the bridge needs to be done to check where the bridge is declining quality and ability depends on various f*actor*s that exist. The checking process is carried out by conducting routine inspections and evaluations for the needs of the bridge carried out manually and also the results of the data obtained from the checking can also different from one team with another dispatcher who can help improve data accuracy data from the condition of the bridge and also checking or *Monitoring* is done indirectly and automatically enters the system. The results of checking bridges are important to be able to prevent severe damage to the bridge because damage to the bridge can prevent safety from one place to another which is moved by the bridge. So we need a system that can supervise the bridge with a fast time, low cost, accurate data accuracy, automatic, and can display the results directly from the inspection that contains the value of the bridge needs.

The construction of this system is applied to Structural Health *Monitoring* (SHM) which is the process of implementing damage detection and characterizing strategies for engineering structures that can be useful to supervise construction structures, especially bridge construction structures combined with Wireless Sensor Networks (WSN) to be a detection device or tool data retrieval so that a bridge *Monitoring* system can be created that can calculate the *rating* value, *capacity* and also *Mode Shape* of the bridge condition. The method used in the application of this research system in terms of damage detection is vibration-based damage detection where this method detects damage that can arise from the bridge by measuring the *frequency* changes that occur on the bridge when passed by vehicles crossing the bridge.

The system to be built is a bridge health condition *Monitoring* system that can display the *rating*, *capacity* and *Mode Shape* of the bridge obtained from data taken by the Sunspot *Accelerometer* sensor by detecting the vibration of the bridge when passed by a passing vehicle, especially a car or truck then the data will be processed by the sensor into *frequency* and amplitude data. If the *capacity* data is obtained by using a load cell that will calculate the weight and speed of a passing vehicle, then the data from the *Accelerometer* sensor and the load cell will be sent to a *Sink Node* to be collected and further processed into data according to *rating* needs, *capacity* and shape mode, then the data will be sent by the *Sink Node* to the *Server* to save the data into a *database* that uses MySQL. Then the data stored in the *database* will be retrieved by the Graphical User Interface (GUI) by requesting the data and will be sent by the *Server* which will then be retrieved or read every second by the GUI so that *fundamental frequency* data, *capacity* and shape mode can be displayed and also to the *rating* will be obtained from the calculation of the *frequency* obtained and the natural *frequency* owned by the bridge which is checked or supervised.

The results of this study are expected to solve the existing problems so that the bridge supervision process can be done quickly and accurately so that the results of the bridge supervision can be used as a basis for decision making for handling and to handle further actions taken against the bridge, such as determining the priority of bridge maintenance so that bridges with worse conditions will be treated first to prevent severe damage or collapse of the bridge.

Keyword: Bridges, Sensors, *Sink Node*s, Structural Health *Monitoring* (SHM), Wireless Sensor Networks (WSN), Vibration-based Damage Detection, Graphical User Interface (GUI)