IoT BASED BUILDING QUALITY MONITORING SYSTEM WITH THINGSPEAK CLOUD ANALYSIS

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The worsening problem of aging and deficient infrastructure in this nation and across the world has demonstrated the need for an improved system to monitor and maintain these structures. The field of structural health monitoring has grown in recent years to address this issue. The goal of this field is to continually monitor the condition of a structure to detect and mitigate damage that may occur. Many structural health monitoring methods have been developed and most of these require sensor systems to collect the necessary information to assess the current strength and integrity of a structure. The motivation for this thesis is a proposed new micro electro mechanical systems (MEMS) sensor with applications in civil infrastructure sensing. The work required was to determine accurate estimates of the resonant frequencies for a fixed-fixed silicon bridge within the device so that further testing and development could proceed. Additional knowledge and information were essential, though, before these requested calculations could be performed confidently. First, a thorough review of current structural health monitoring concepts and methods was performed to better understand the field in which this device would be applied and what incentive existed to develop a new sensor. Second, an in-depth investigation of vibrational beam mechanics theories was completed to ensure the accuracy of the frequency results for the new MEMS sensor. This study analyzed the influence of three assumptions employed in the Euler-Bernoulli, Rayleigh, and Timoshenko beam theories by comparing their results to a three-dimensional, elasticity-based approximation for vibrational frequencies and mode shapes. The results of this study showed that all three theories are insufficient when a fixed support is involved, so the elasticity-based approximation was utilized to calculate the frequencies for the bridge component in the MEMS device. These results have been passed on to the developers so that the testing process could move forward in the hopes that the device could advance the field of structural health monitoring in the future.

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