**Title of the Project: CRACK DETECTION IN CONCRETE STRUCTURES USING ULTRASONIC SENSORS**

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**ABSTRACT**

**The invention, called "Crack Detection in Concrete Structures Using Ultrasonic Sensors", provides a smart IoT (Internet of Things)-enabled system for real-time detection, monitoring, and prediction of cracking in concrete structures. It encompasses ultrasonic sensing technology and an IoT-enabled version of continuous non-destructive automated structural assessment. The ultrasonic transducers, either embedded in concrete or surface mounted are used to sense acoustic signals which are processed at the edge, and securely transmitted to the cloud. At that point, advanced AI and machine learning algorithms are used to evaluate whether crack formation has happened, classify cracks, and forecast future cracking trends. The data is provided to the engineer via a digital twin and an interactive dashboard, as well as visually rendered illustration of the data collected and recommendations for maintenance. The described system offers many benefits compared to traditional methods, particularly by decreasing human interaction, increasing accuracy, and facilitating predictive maintenance, which makes it a safe, practical and environmentally sustainable scalable solution for maintaining the safety and longevity of modern infrastructure.**