

ROAD CONDITION MONITORING

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ABSTRACT

In the dynamic landscape of urban development and transportation, the necessity for an efficient, real-time road condition monitoring system is paramount. The problem at hand is multifaceted, involving the need for accurate, real-time data that can be easily accessed and interpreted, ensuring timely maintenance and repair. The challenge is exacerbated by the diverse and unpredictable nature of road damages, requiring a solution that is both comprehensive and adaptable.

Customer requirements are centered around the need for a reliable, efficient, and user- friendly system that not only identifies and reports road conditions in real-time but also is robust enough to withstand various environmental conditions. The need for a cost-effective solution that can be easily integrated into existing transportation and communication infrastructures is also a significant customer requirement.

Our methodology to address this complex issue involved an integrative approach, combining advanced sensor technology, machine learning algorithms, and data analytics. The core of the solution is a device equipped with an Inertial Measurement Unit (IMU) and a mono camera, tasked with capturing intricate details of road conditions. The Jetson Nano processor, renowned for its computational efficiency, is employed to process and analyze the data. GPS integration ensures that the data is location-specific, enhancing the accuracy and usability of the information.

The final product is a sophisticated road condition monitoring device that is capable of real-time data collection, analysis, and transmission. It is designed to be installed on vehicles, transforming every equipped automobile into a mobile data collection unit. The data, once collected and processed, is made available to relevant authorities through a user- friendly interface, ensuring timely maintenance and repair.

Unique achievements of the project include the successful integration of various technologies to create a cohesive, efficient, and user-friendly system. The device's ability to capture, process, and transmit data in real-time sets it apart in the market. Moreover, the incorporation of machine learning algorithms ensures that the system is adaptable, capable of learning, and improving over time, ensuring that it remains relevant in the ever-evolving landscape of road conditions and repair technologies. The project stands as a testament to innovative engineering, offering a viable solution to one of the most pressing urban development challenges of our time.

Index Terms — Road condition monitoring device, IMU, camera, Jetson Nano, Data collection, Data processing