

DESIGN AND DEVELOPMENT OF A ROAD DAMAGE DETECTION SYSTEM FOR AUTOMOBILE TRANSPORTATION USING THE YOLO (YOU ONLY LOOK ONCE) ALGORITHM

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ABSTRACT

Damaged road infrastructure, such as potholes and cracks, remains a significant contributor to traffic accidents—particularly at night or when vehicles are operating at high speeds. Despite the crucial role of early damage detection in ensuring driver safety, automated road damage detection systems are still rarely integrated into private vehicles. This study proposes a computer vision–based detection system utilizing the YOLOv8 (You Only Look Once) algorithm, implemented on a Raspberry Pi 5 microcomputer. The system is equipped with a camera to capture real-time visual input and a Bluetooth speaker to provide audible alerts. The YOLOv8 model was trained on a dataset of 3,106 annotated images of damaged roads for 75 epochs using the Google Colab environment. Performance testing was conducted under varying lighting conditions—morning, afternoon, and night—and at different vehicle speeds. Experimental results indicate that the Raspberry Pi 5 achieved a low frame rate of 0.3 FPS, with its highest detection accuracy being 82.87% in morning light, followed by 72.78% in the afternoon, and 35.16% at night. In contrast, a GPU-powered laptop reached a frame rate of up to 30 FPS with slightly higher accuracy: 82.79% (morning), 73.39% (afternoon), and 37.61% (night). In conclusion, while the system demonstrates satisfactory pothole detection under sufficient lighting conditions, the Raspberry Pi 5, in its current configuration, is not optimal for real-time deployment without the support of external accelerators.

Keywords: Image Processing, Road Damage Detection, YOLOv8, Raspberry Pi 5