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Cracks Detection and Measurement Using VLP-16 LiDAR and Intel Depth Camera D435 in Real-Time

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Abstract : Crack is one of the most common damages in buildings, bridges, roads and so on, which may pose safety hazards. However, cracks frequently happen in structures of various materials. Traditional methods of manual detection and measurement, which are known as subjective, time-consuming, and labor-intensive, are gradually unable to meet the needs of modern development. In addition, crack detection and measurement need be safe considering space limitations and danger. Intelligent crack detection has become necessary research. In this paper, an efficient method for crack detection and quantification using a 3D sensor, LiDAR, and depth camera is proposed. This method works even in a dark environment, which is usual in real-world applications. The LiDAR rapidly spins to scan the surrounding environment and discover cracks through lasers thousands of times per second, providing a rich, 3D point cloud in real-time. The LiDAR provides quite accurate depth information. The precision of the distance of each point can be determined within around ±3 cm accuracy, and not only it is good for getting a precise distance, but it also allows us to see far of over 100m going with the top range models. But the accuracy is still large for some high precision structures of material. To make the depth of crack is much more accurate, the depth camera is in need. The cracks are scanned by the depth camera at the same time. Finally, all data from LiDAR and Depth cameras are analyzed, and the size of the cracks can be quantified successfully. The comparison shows that the minimum and mean absolute percentage error between measured and calculated width are about 2.22% and 6.27%, respectively. The experiments and results are presented in this paper.

Keywords : LiDAR, depth camera, real-time, detection and measurement
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