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COMPARATIVE ANALYSIS OF ALGORITHMS FOR DETECTING COVERAGE DEFECTS

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This article discusses possible algorithms for assessing the quality of pavement, as well as a comparative analysis of existing approaches.

The importance of road infrastructure for the development of society can be compared with the importance of blood vessels for people. To ensure the quality of the road surface, it is necessary to continuously monitor and repair, as necessary, all defects. An optimal allocation of resources for road repairs is possible provided that comprehensive and objective real-time data on road conditions are available. Joint monitoring is a promising approach for road quality control.

Hazardous road conditions are the main distractions for safe and comfortable transportation. Both drivers and road repairmen are interested in fixing them as soon as possible. However, these conditions must be determined first. One of the approaches to detect damage on the roads and monitor them is to use a device that is affordable, having communication modules like GPS, an accelerometer.

To simplify the monitoring system of the condition of the road surface, it is advisable to use mobile devices (smartphones, tablets), because most modern mobile devices contain many different sensors, including an accelerometer, GPS controller, gyroscope, magnetometer and others. The optimal choice goes to mobile devices because of the relatively low cost, ease of use, lack of difficulty in installing a vehicle in the cab for data collection, and also because almost every person has such a device.

To determine the quality of the road surface using a mobile device, you can use the built-in accelerometer module [1].

The following algorithms for detecting pavement defects are considered:

The simplest and most convenient algorithm for detecting pavement defects is Z-TRESH (Figure 1), based on the Z-axis of the accelerometer. The function classifies the Z-axis of the accelerometer and values that exceed specific thresholds are defined as various types of defects, for example, pit, accumulation pits. This algorithm requires that the information on the Z axis be known in advance [2,3]

Figure 1. – Example of the Z-THRESH pavement defect detection algorithm

And the second algorithm under consideration is Z-DIFF (Figure 2).

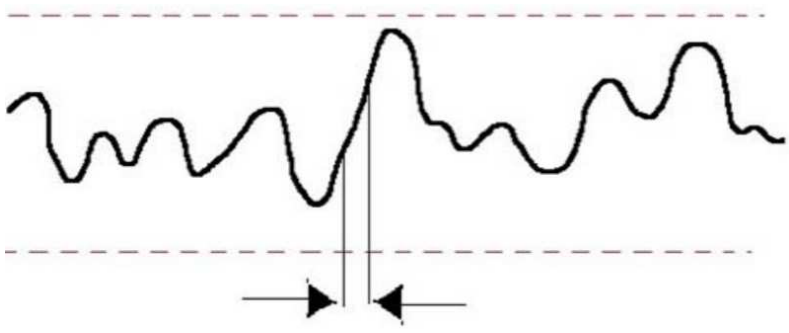

Figure 2. – An example of the Z-DIFF pavement defect detection algorithm

The Z-DIFF algorithm is based on the accelerometer readings along the Z axis. Unlike the Z-TRESH algorithm, the Z-DIFF algorithm searches for two consecutive values, the difference of which is above a certain threshold level. The algorithm detects rapid changes in vertical acceleration, according to which it is possible to classify the type of road surface defect. As for the previous algorithm, it is necessary that information about the position of the Z axis be known.

In the article, the test results of the used Z-THRESH and Z-DIFF algorithms are presented in Table 1.

Table 1. – The results of the applied algorithms Z-THRESH and Z-DIFF.

Class	Z-TRESH	Z-DIFF
Large pits	3(100%)	3(100%)
Small pits	15(83%)	16(89%)
Cracks	31(78%)	36(90%)
Hatches	10(59%)	17(100%)
Pit accumulation	25(83%)	27(90%)
Average	84(78%)	99(92%)

Based on the results of Table 1, in order to develop a system for monitoring the quality of pavement, it is concluded that the Z-DIFF algorithm is an accurate algorithm.

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