Spectrum Journal of Innovation, Reforms and Development

Volume 29, July - 2024	ISSN (E): 2751-1731

Website: www.sjird.journalspark.org

EVALUATION OF ACCURACY LEVEL OF GPS MONITORING SYSTEM INDICATORS

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Abstract

Operational characteristics of cars are directly related to its driving modes [1]. Determining the vehicle's average speed, acceleration and deceleration and improving their characteristics under these conditions is an urgent issue.

Determining the driving modes of vehicles is currently carried out with the help of a widely used GPS monitoring system [2]. The purpose of the study is to recommend the use of GPS monitoring system in determining vehicle movement modes by evaluating the accuracy level of this system.

Introduction

Primary test studies were conducted in the following order on the main ring road of Tashkent city and the streets of professors' town.

Purpose of the test: To master the methods of operation and calibration of the designed equipment and to evaluate and improve their level of accuracy.

Necessary equipment for testing: Nexia car equipped with 5th wheel mounting device; 5th wheel; GPS device; laptop; distance meter (dalnomer); Necessary equipment for the installation of the 5th wheel.

Test conditions and location: The test is conducted on a level road with little traffic. Since the accuracy of the GPS unit is affected by the turning of the vehicle and the slope of the road, it is necessary that the road consists of turns.

Test procedure:

– Preparing the vehicle for testing (installation of 5th wheel and GPS device);

– Preparation of a straight horizontal track with a measured distance (500 m depending on the conditions) for the calibration of the 5th wheel.The starting point of the straight road is marked by measuring the required distance using a distance meter;

– Calibrating the 5th wheel – the bearing surface of the 5th wheel is set to the initial mark. A calibration program is run on the laptop and the vehicle travels a measured distance at an arbitrary speed. It is important that the 5th wheel stops on the second line of the distance measured by the road support surface. During the calibration period, the rolling radius of the wheel is determined by the number of teeth of the gear wheel detected by the sensor of the 5th wheel and loaded into the program. The accuracy of the calibration is compared to the program readings by driving the vehicle in the above manner over a measured distance. If the indicators match, the test can be continued on the car, otherwise the calibration will be repeated.

- Carrying out the main test - the car is driven on the test track for 30 minutes, covering different modes, turns and significant and continuous slopes (the time of the car's turning and movement on the slopes is recorded). In order to verify that the calibration parameters of the 5th wheel are saved, the car is driven on the road with a repeatedly measured distance.

Analysis of test results

- Initial assessment of the accuracy of the GPS device was carried out by the value of the total distance covered by the test program indicator, and the obtained data was uploaded to the Excel program.

The results of the conducted test were analyzed by the speed of the car and the traveled path over time (Fig. 1).

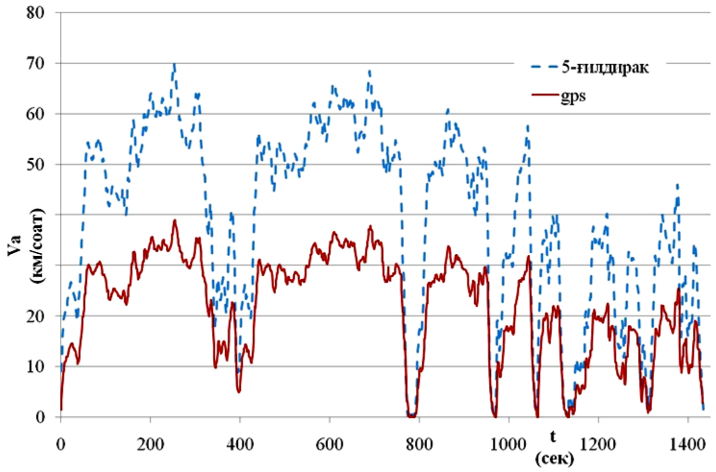

Figure 1. Preliminary test results to evaluate the accuracy level of the GPS device

As can be seen from Figure 1, the speed of the vehicle according to the data of the GPS device is low, but the change behavior is consistent with the speed detected by the 5th wheel. Therefore, the results of the GPS device were corrected by a correction factor.

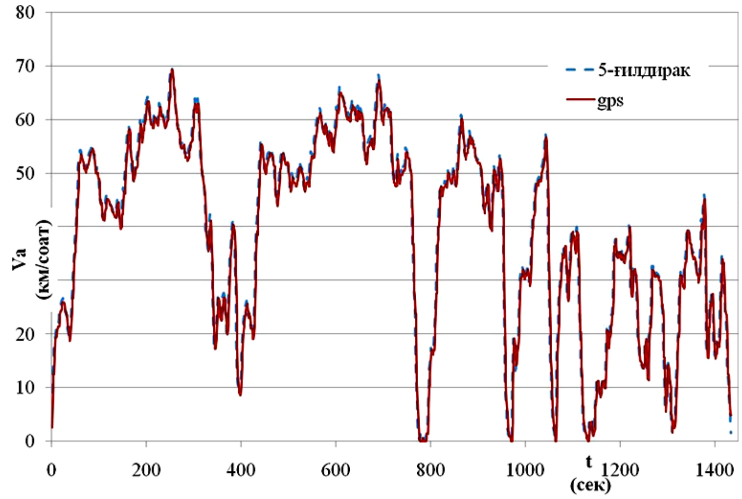

Fig. 2 Adjustment of the test results for the assessment of the accuracy of the GPS device

As a result of the analysis, the determined speed indicator was found to be 1.778 times less, and the GPS system speed indicator was corrected (Figure 2). After adjusting the GPS speed indicator and zooming in time, it became clear that the GPS analysis results were late for a certain time (Figure 3), and the equipment was synchronized in time. After the calibration steps above, the GPS system speed reading error was found to be less than 2%.

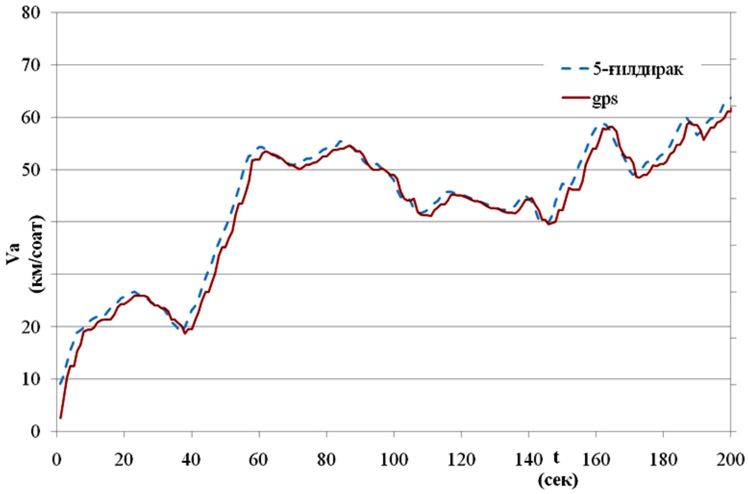

Fig. 3 Calibration test results for estimating the accuracy level of the GPS device

Based on the above analysis and the conducted tests, it can be concluded that the level of accuracy of the GPS device is sufficient in the study of speed indicators in urban operating conditions..

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