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DEVELOPMENT OF AN EXPERT SYSTEM FOR DIAGNOSING THE CONDITION OF CARS

Abstract

This article discusses the development and application of an expert system aimed at diagnosing and troubleshooting passenger cars. It allows you to automate diagnostic processes, facilitating the work of engineers and increasing the accuracy and speed of repair operations. The software is aimed not only at service stations, but also at ordinary users who can use it for self-troubleshooting. The article presents the structure of the program, including the main menus, operating algorithms and diagnostic modules. Functions such as displaying diagnostic parameters of vehicle components are described. The system includes step-by-step instructions for the user and troubleshooting recommendations. The introduction of such a complex significantly improves the quality and speed of service, which increases the overall profitability and efficiency of service stations.

Key words: Expert diagnostic system, car malfunctions, service stations, diagnostics

Introduction. Today, information technologies related to the accumulation, processing and storage of data are being actively implemented in various sectors of the economy and industry.

Special attention is paid to the development of information technologies in the field of maintenance and repair of motor transport [1].

This paper describes the implementation of an expert system for vehicle diagnostics, which contributes to the effective detection and troubleshooting. The use of such a software package is extremely important, since the number of service stations is constantly growing, and many of them need effective tools to optimize their work [2].

The software facilitates the work of specialists, automates diagnostics, minimizes errors and, most importantly, speeds up the repair process, increasing the profitability of service centers [3]. Since not every new service station can afford expensive software, creating an affordable diagnostic solution remains an urgent task [4].

Theoretical analysis. This software package can serve as an automated workplace for an engineer at a service station, as well as a useful tool for motorists who prefer to independently identify and fix malfunctions in their cars [5]. The user manual includes a step-by-step guide for working with the car repair system [6]. The development of an expert diagnostic system for passenger cars is relevant, since it finds application both in car service stations and among drivers themselves, who often face the need to eliminate breakdowns [7]. The program can be used by both engineers and motorists to work with the main components and systems of cars:

1. The engine;
2. Clutches;
3. Gearboxes;
4. Gimbal transmission;
5. Rear axle;
6. Wheel suspensions;
7. Steering control;

- 8. Brake system;
- 9. Electrical equipment;
- 10. Car bodywork.

Figure 1 shows the algorithm of the program's actions in the form of a flowchart.

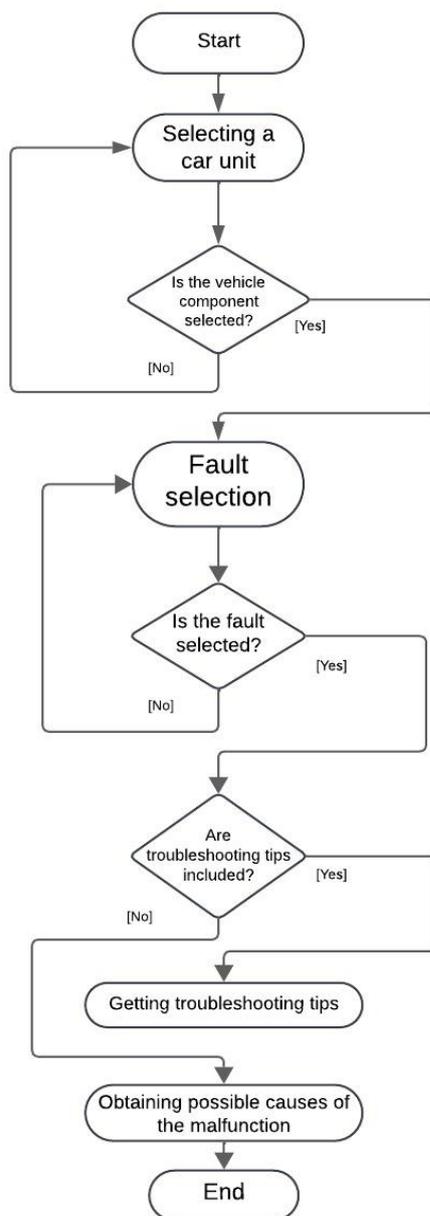


Figure 1 - Diagram of program actions in the form of an algorithm flowchart

The structure of the program menu is presented in the form of a diagram in Figure 2.

The technical inspection module displays in the form information about the main technical characteristics of the means of technical diagnostics of motor vehicles, including mandatory means of technical diagnostics:

- braking systems;
- Steering control;
- external lighting devices;
- windscreen wipers;
- wheels and tires;

- the engine and its systems;
- other structural elements,

where, according to the types of equipment of the main components of passenger cars, controlled (measured) parameters, the measurement range of these parameters and the maximum error of their measurement for the selected type of equipment.

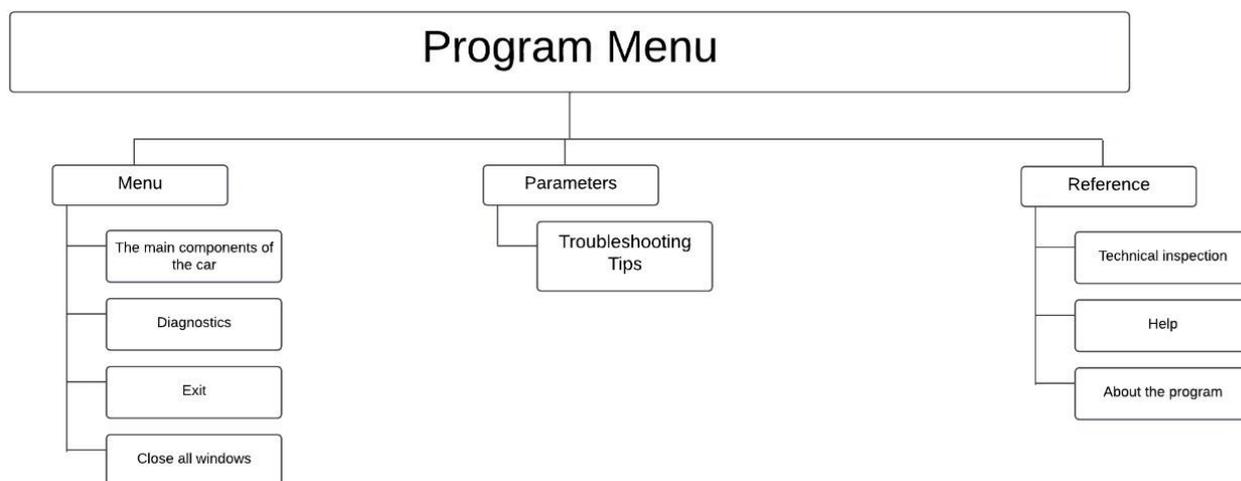


Figure 2 - The structure of the program menu

The menu items that were used in the development of the program are shown below.

The main menu is divided into 4 main menus:

N2 - The main components of the car

N3 - Diagnostics

N4 - Close all windows

N5 - Exit

The "Main components of the car" menu is divided into 10 submenus:

N11- Engine

N21 - Clutch

N31 - Transmission

N41 - Gimbal transmission

N51- Rear axle

N61 - Wheel suspension

N71 - Steering

N81 - Brake system

N91 - Electrical Equipment

N101 - Car body

The submenu "Electrical equipment" is divided into 7 submenu items:

N16 - Battery

N22 - Generator

N32 – Starter

N42 - Wiper motor

N52 - Electric heater motor

N62 - Sound signal N72 - Lighting and light alarm

The submenu "Car body" is divided into 3 sub-menu items:

N17 - Car doors

N23 - Car hood

- N33 - Car trunk lid
- The Help menu is divided into 3 submenus:
- N14 - Technical inspection
- N13 - Help
- N15 - About the program

Figure 3 shows the List of faults form of the selected vehicle assembly (engine), from the presented list it is necessary to select a fault.

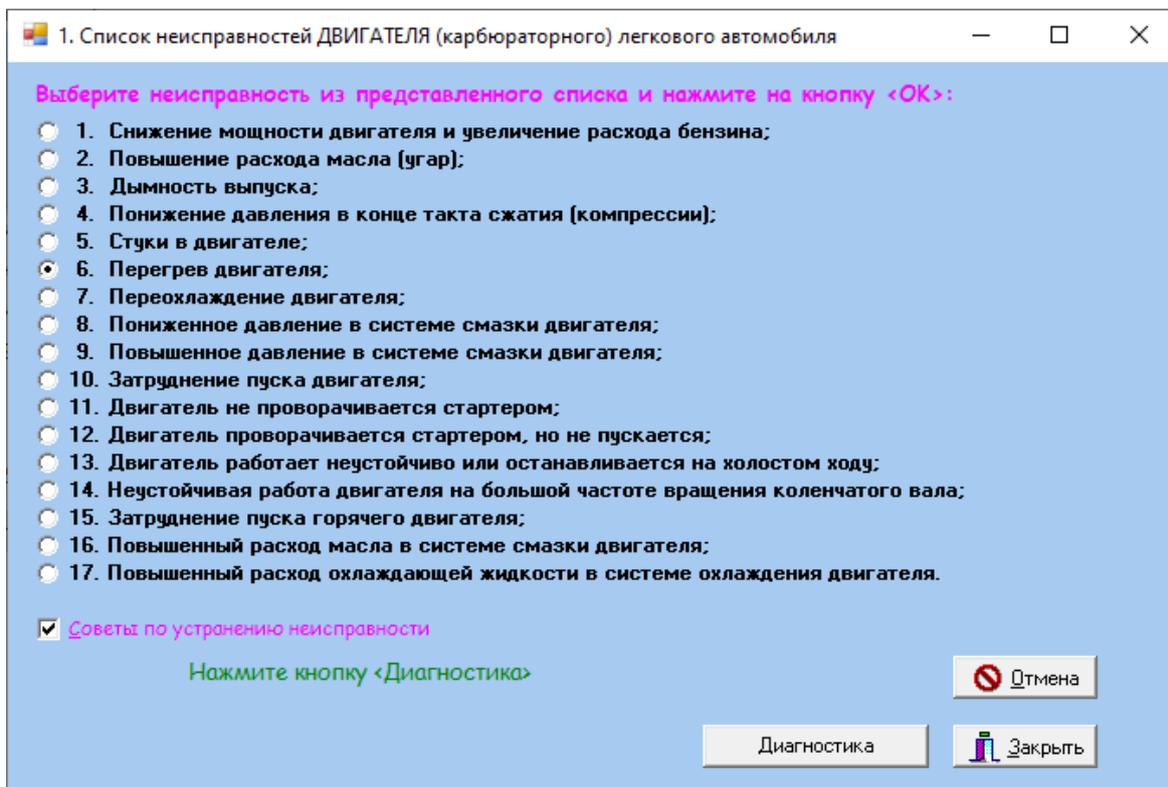


Figure 3 – List of engine faults

Figure 4 shows the Troubleshooting form for the selected vehicle assembly (gearbox), where you can get possible causes of the selected malfunction and tips for troubleshooting.

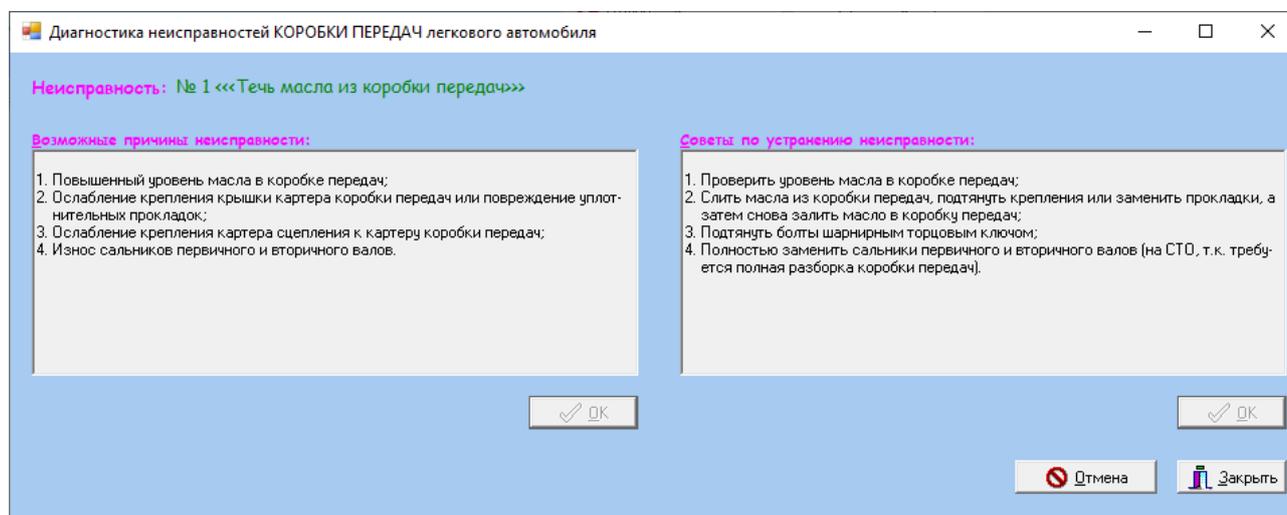


Figure 4 – Fault diagnosis

Conclusions. Due to the fact that in the maintenance center of the car center, the speed and quality of repairs completely depend on the speed of manual work of the service station engineer when detecting malfunctions in cars, using this software package, the engineer will be able to coordinate the processes of detecting all malfunctions in the car, determining the causes of the identified malfunctions, and what, in my opinion, is the most important, the process of qualitative elimination of all identified malfunctions.

Thanks to this software package, the time for car repairs will be significantly reduced, and the quality of repair and service will significantly increase.

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АВТОКӨЛІКТЕРДІҢ ЖАҒДАЙЫН ДИАГНОСТИКАЛАУҒА АРНАЛҒАН САРАПТАМА ЖҮЙЕСІН ӘЗІРЛЕУ

Түйін

Бұл мақалада жеңіл автомобильдердегі ақауларды диагностикалауға және жоюға бағытталған сараптамалық жүйені әзірлеу және қолдану қарастырылады. Бұл диагностикалық процестерді автоматтандыруға, инженерлердің жұмысын жеңілдетуге және жөндеу жұмыстарының дәлдігі мен жылдамдығын арттыруға мүмкіндік береді. Бағдарламалық жасақтама тек қызмет көрсету станцияларына ғана емес, сонымен қатар оны ақаулықтарды өздігінен іздеу үшін қолдана алатын қарапайым пайдаланушыларға да бағытталған. Мақалада бағдарламаның құрылымы, оның ішінде негізгі мәзірлер, жұмыс алгоритмдері және диагностикалық Модульдер келтірілген. Автомобиль түйіндерінің диагностикалық параметрлерін көрсету сияқты функциялар сипатталған. Жүйе пайдаланушыға арналған қадамдық нұсқауларды және ақаулықтарды жою бойынша ұсыныстарды қамтиды. Мұндай кешенді енгізу Қызмет көрсету сапасы мен жылдамдығын едәуір жақсартады, бұл техникалық қызмет көрсету станцияларының жалпы табыстылығы мен тиімділігін арттырады.

Кілттік сөздер: Сараптамалық диагностикалық жүйе, автомобильдердің ақаулары, қызмет көрсету станциялары, диагностика

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РАЗРАБОТКА ЭКСПЕРТНОЙ СИСТЕМЫ ДИАГНОСТИКИ СОСТОЯНИЯ АВТОМОБИЛЕЙ

Аннотация

В данной статье рассматривается разработка и применение экспертной системы, направленной на диагностику и устранение неисправностей в легковых автомобилях. Она позволяет автоматизировать процессы диагностики, облегчая работу инженеров и повышая точность и скорость ремонтных операций. Программное обеспечение ориентировано не только на сервисные станции, но и на рядовых пользователей, которые могут использовать его для самостоятельного поиска неисправностей. В статье представлена структура программы, включая основные меню, алгоритмы работы и диагностические модули. Описаны функции, такие как отображение параметров диагностики узлов автомобиля. Система включает пошаговую инструкцию для пользователя и рекомендации по устранению неисправностей. Внедрение такого комплекса значительно улучшает качество и скорость обслуживания, что повышает общую прибыльность и эффективность станций технического обслуживания.

Ключевые слова: Экспертная диагностическая система, неисправности автомобилей, станции технического обслуживания, диагностика.