5th INTERNATIONAL CONFERENCE
TRANSPORT SYSTEMS TELEMATICS TST'05

ZESZYTY NAUKOWE
POLITECHNIKI ŚLĄSKIEJ 2005
TRANSPORT z. 59, nr kol. 1691

database, diagnostic, operation, railway traffic control

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OPERATION AND DIAGNOSTIC DATABASE OF DEVICES FOR RAILWAY TRAFFIC CONTROL

Development of computer technology and evolution of software makes it possible to deal with the problem of use of databases in the diagnostic and operation process of devices for control of railway traffic. Technical diagnostics, when we take into consideration safety of passengers, carried goods as well as service staff, is of great importance, first of all due to the introduction of remote control, growing speed of train movement, diminishing number of the service staff employed. Seeing the growing demand for diagnostics and want to achieve a higher safety level with simultaneous simplification of service staff work it is obvious that introduction of a modern system of databases will help in proper maintenance of devices for railway traffic control.

EKSPLOATACYJNO-DIAGNOSTYCZNA BAZA DANYCH DLA URZĄDZEŃ STEROWANIA RUCHEM KOLEJOWYM

Rozwój techniki komputerowej oraz ewolucja oprogramowania umożliwia szersze zajęcie się problemem wykorzystania baz danych w procesie diagnostyczno eksploatacyjnym urządzeń sterowania ruchem kolejowym. Diagnostyka techniczna, w aspekcie bezpieczeństwa pasażerów, przewożonych towarów jak i personelu obsługi ma duże znaczenie, przede wszystkim pod względem wprowadzenia systemów zdalnego sterowania, rosnącej prędkości jazdy pociągów, zmniejszającej się liczby zatrudnionego personelu obsługi. Widząc coraz większe zapotrzebowanie na diagnostykę oraz dążąc do zwiększenia bezpieczeństwa, przy jednoczesnym uproszczeniu pracy personelu obsługi, wprowadzenie nowoczesnego systemu bazodanowego pomoże w prawidłowym utrzymaniu urządzeń sterowania ruchem kolejowym.

1. INTRODUCTION

Development of computer technology and evolution of software makes it possible to deal with the problem of use of databases in the diagnostics and operation process of devices for railway traffic control. At present, there does not exist a centralized or even a local system of record of devices for railway traffic control in the Polish State Railways (PKP) company,

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which will enable recording of devices for railway traffic control with regard to their type and all operation parameters. It causes a lot of problems connected with the process of operation service. In case of damage of a certain element of the system there may appear a problem with identification of individual parts, what may unfavourably influence spare parts management. Moreover, information about faults is kept in the E-1758 books, where actions leading to the fault removal are recorded in such a way, which an outsider may sometimes find difficult to identify.

Acquiring information about faults and computer-recorded certificates of devices are indispensable sources of data for the system of the decision process assistance for the service staff. Such a system shall allow to:

- lower the cost of operation processes,
- improve working conditions of the service staff,
- improve safety,
- decrease of load of ineffective diagnostic process for the service staff,
- introduce an ahead diagnostics.

These aspects should be of growing importance, especially in the situation where it is necessary to limit the costs of employment – present reduction of service staff without introduction of the system of the decision process assistance may lead to considerable lowering of the quality of service.

2. CHOICE OF THE SYSTEM

While choosing the database system for the needs of a railway station one should take into consideration its accessibility, standardization and easiness of service resulting from the achived standards of interface. The most obvious solution in this case is the use of a remote customer – server application, using on the part of the server a relation database (e.g.: MySQL, Oracle, PostgreSQL) as well as a script PHP language of programming, and on the part of the customer, the Internet previewer. The drawback of this solution is the necessity of fixing a solid Internet link on the station. That is why in the initial phase of the project creation, for the needs of collection of data about the ergonomics of service of the future system, it was decided to use the Microsoft Access programme, the programme for creation and management of databases, which is one of the elements of the Microsoft Office packet quite commonly applied in the PKP.

2.1 FIRST LOOK AT THE POSSIBILITIES OF MICROSOFT ACCESS

With the help of the Access programme one can administer all indispensable information using one database file. In this file all data are divided into separate parts – tables. Forms enable to watch, add and update data in the tables. With the help of queries one can find and load only these data, which are really indispensable at the moment, while reports make it possible to evaluate and print data in a definite arrangement (Fig.1).

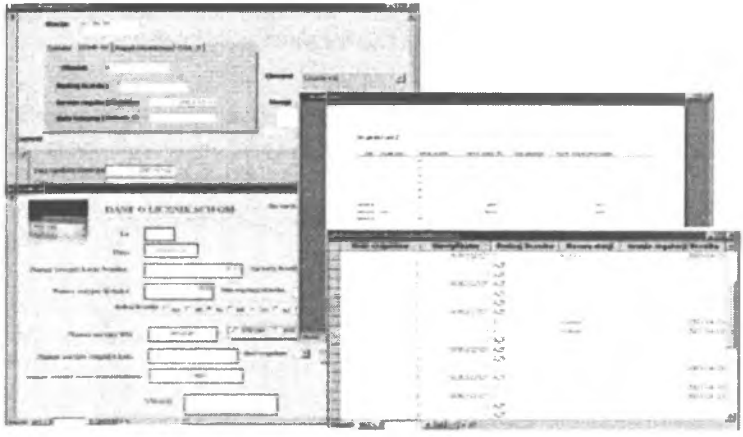

Fig.1. Data storage in Access

The optimal way of data storage is creation one table for each type of information that is to be evaluated. Data from different tables may be later combined in queries, forms or reports - in order to achieve this only relations among the tables should be defined. (Fig.2).

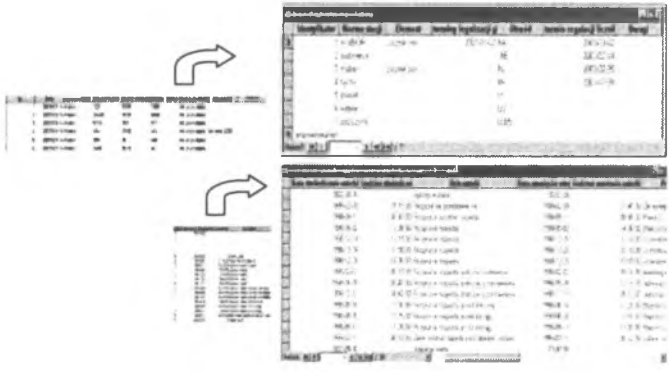

Fig.2. Rule for creation of forms, reports and queries

In order to find and load only these data, which fulfill certain conditions, a query should be created. A query may contain data coming from different tables, it may update or remove many records simultaneously, it also enables to make calculations on the data, and these calculations may be both built-in (existing in the programme from the beginning) and non-standard ones (defined by the user).

In order to easily display, introduce or change data in tables a form should be created. During form opening the Access programme loads data from one or more tables and displays them on the screen (Fig.3). Data arrangement on the screen can be selected both from the data creator and also defined independently from the beginning.

Fig.3. Form opening is connected with the opening of a suitable table

Data analysis or preparation for printing should be preceded by a report creation. The available methods of filtering or sorting may also be used.

2.2 COOPERATION OF MICROSOFT ACCESS WITH THE ENVIRONMENT

Thanks to other Office packets the users of the Access programme may take advantage of the database by including it as a control element contained on the pages of Access Data Pages.

The "Sheet" component, allows the users to introduce text and figures, create formulas and make calculations. Formulas found in the sheet can refer to other elements from the Access Data Pages Page through easy references.

The "Graph" component delivers graphic representation of the subordinated data in it.

The "Inverted Table" component acts similarly as an inverted table of the Excel programme, as it also delivers a dynamic method to analyze interactive data through "inversion" or moving data parts. The "Inverted Table" component can make analysis of data coming from different sources, including the Excel programme, relative databases such as SQL Server or databases from the Access programme.

A user working in the Access programme can make analysis of data in the base. The results of this analysis are most often printed in the form of a balance. A report is the component of base directed at the printout of these balances.

The Access programme cooperates with different programmes enabling them data import (graphic programmes, text programmes) and analysis of data with the help of programmes (Word, Excel, Statistica).

3. OPERATION AND DIANGNOSTIC DATABASE

The proposed operation and diagnostic database shall make it possible to:

a. Prepare reports about devices. It will facilitate stock-taking and help with the spare parts management due to recording of all devices;
b. Prepare reports about device faults. It will standardize the system of fault recording and facilitate information flow among all administrative levels. Full information about faults will enable to eliminate devices with "weak" operation parameters;
c. Create a system reminding about the deadlines for control, authentication and inspection. It will allow to use devices in accordance with the producer's technical recommendations, and as a result to keep to all required periodical inspections and authentications;
d. Present information about faults in a graphic form. It is an accessible form of data presentation easy to apply for the user and also enlarging the possibility of analysis of information of this kind;
e. Sort data due to different search parameters. It will facilitate finding a definite group of faults and devices that have influence on efficient analysis and easiness of finding of specific information;
f. Better standardize and send data about faults from local units to the headquarter. It will enable efficient communication among the executive units and among executive units and central level;
g. Prepare statistical analyzes thanks to cooperation with specialist tools e.g.: the Statistica programme. After a longer period of operation it will allow to create models of diagnostic devices, what as a result will enable introduction of diagnostic directed at the state of devices that is dynamic diagnostics;
h. Preview, by entitled users, demanded information with the help of the Internet. It will accelerate sending of the obtained information to the decision sector and will enable overview of all data in each place with the Internet access making it possible to follow the diagnostic and operation actions as they come. It will facilitate the decision taking mode, what offers a possibility of an extensive supervision of the work of executive units;
i. Replace paper version of documentation by the electronic one. It will standardize the form of records, and allow you to follow records and documentation changes possible for reading at any moment in any place.

The assumed solution basing on a modified system of relative databases service allows, in an easy way, to adjust both the user's interface and the shape of the whole base to the present demand without the need of base creation from the rudiments, without the necessity of compilation etc.

3.1 DATABASE SERVICE

Control panel is the main menu of the base interface, which enables to move between the elements of the base. This screen is not used for data introduction; it is a panel of switches used for crossing between forms and reports. In order to introduce data to e.g.: the DIAGNOSTC BASE, it is enough to press the suitable button (key). A user gets to the data forms about operated devices with the help of an OPERATION BASE switch (Fig.4).

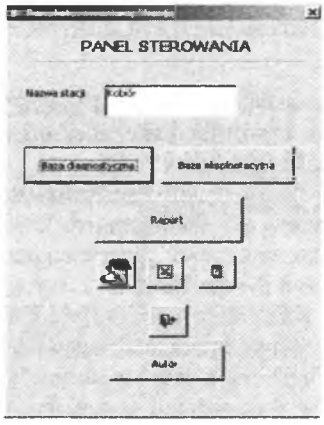

Fig.4. View of the control panel

By choosing the DIAGNOSTIC BASE (Fig.5) the user has a possibility to choose the kind of device from the system of bookmarks (e.g.: semaphore, axel counter systems, switch drive, OSA-H).

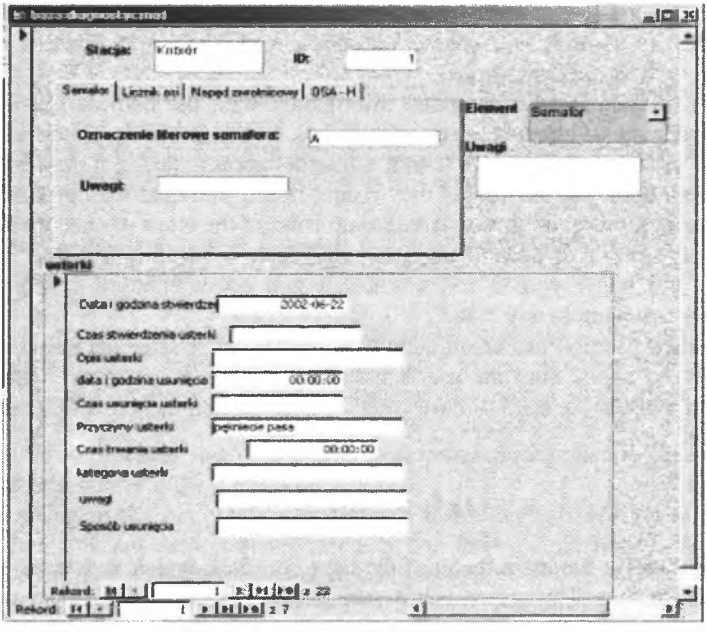

Fig.5. A form for introduction of DIAGNOSTIC BASE data

To include new elements to the DIAGNOSTIC BASE a list of element choice should be used. Changes in records will be recorded automatically.

In order to avoid repetitions the DIAGNOSTIC BASE form was equipped with a function of automatic identification (name giving). Automatic identification is the key to the possible searching and sorting. As the Access programme also enables the change of view of introduced data without influence on their physical arrangement in the database itself, so, thanks to it, it is possible to organize data in a more legible way. Two techniques of data arrangement: sorting and filtering are used most often.

While the OPERATION BASE forms are filled in one should remember that the field STATION (Fig.6) is automatically read in the CONTROL PANEL.

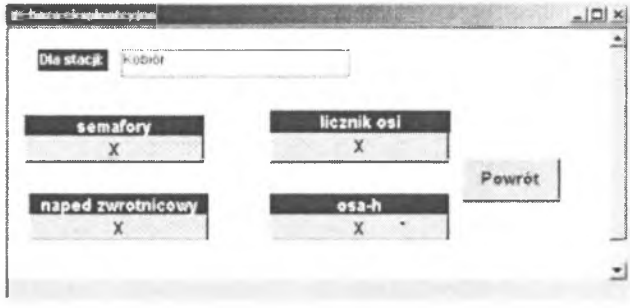

Fig.6. Activated OPERATION BASE form

When in the form of used device switches the DEVICE CATEGORY button is chosen you move to detailed data relating to this device (Fig.7).

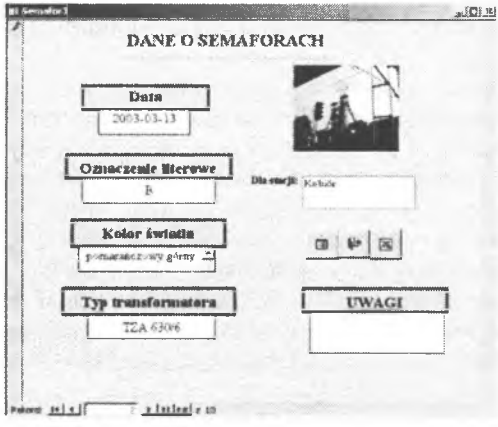

Fig.7. A window of the DATA ABOUT SEMAPHORES form

A form was additionally equipped with the following fast choice buttons (keys): CONNECTION with the Excel spreadsheet, CLOSING of present application and a button, which moves you directly to the data form about a device. To sum up, a user may move among forms using shortcut keys included in given forms or keys from the operation base level.

An exemplifying (hypothetical) report (Fig.8) is created for each form. Data contained in the report are not subject to changes. A user can compose on his own the look of the report adjusting the data contained in it to his needs.

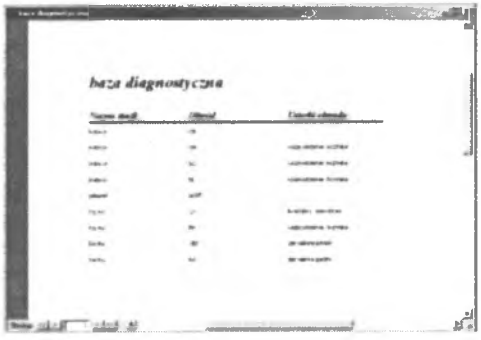

Fig.8. An exemplifying report

4. CONCLUSIONS

The paper presents possibilities of databases application in the diagnostic and operation process of devices for railway traffic control and possibilities of the Access programme as a tool for databases creation.

The offered solution is an introduction to the subject of databases in railway traffic control. It is an example of an application that shows the grounds for the use of computer for device and event recording as a tool used for unification of the way of documentation keeping on the railway traffic posts and finally for data transmission between line posts and sections, plants and management.

Up to the present no one has done stocktaking of devices for railway traffic control in the whole PKP system. Introduction of the databases system will enable to do such a stock-taking and in the future, it will allow to follow the life cycle of devices from the moment of their construction and commissioning up to the time of their breaking for scrap. Obviously, creation of a completely functional database is connected with cooperation of the railway infrastructure employees with the (computer) programmers and the need of bearing of financial expenditures.

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