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CONTROLLING OF MEASUREMENT PROCESS OF STRONG GROUND MOTION USING MOBILE TECHNOLOGIES IN SEJS-NET SYSTEM

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ABSTRACT
The SEJS-NET system is based on Internet technology and is designed for monitoring of strong ground motion and building vibration. The system, making use of present feasibilities of telecommunication, conducts automatically, practically without maintenance, recording of seismic vibrations at any number of measurement points. The access through a WWW browser to a recording database, equipment with handy and flexible functions for visualization, selecting, editing, and maintained in the *Measurement Central Base* – the system's server, is independent of mutual location of *Recording Stations*, the Central Base and user's workstation. Thanks to implemented solution, SEJS-NET system, supporting routine processing of collected data, builds at the same time a simple and flexible basis for advanced processing.
Designers of sophisticated measuring systems try to use high telecommunication technology, which gives possibility to make easier controlling of measurement process and data distribution. The work presents practical application of WAP technology in SEJS-NET system. Implemented WMOBILE module gives access to system resources via WAP browser from mobile phones and palmtop browsers.

KEYWORDS: seismology system, engineering seismology

1. INTRODUCTION

SEJS-NET system is designed for monitoring vibrations coming from different type of sources, especially from mining tremors. This system is realized with Internet technologies and uses newest telecommunications technologies. Registration is done automatically in many measurement points. Users communicate with the system by web browser. Easy to use web interface provide many function for data visualization, selection and edition (Lasocki, Mirek, 2001). Data is collected by distributed on interested area recording stations and it is transmitted through the Internet to the Measurement Central Base. This solution gives independence between location of recording stations, Measurement Central Base and user workstation. Although system works automatically, it requires some control because of possibility of failures caused, for example, by atmospheric phenomenon. On the other side system SEJS-NET is fully automatic and doesn't require permanent supervision (Mirek, 2000). Solution for this problem is software module that gives access for authorized users at any time in any situation. System SEJS-NET contains new module WMOBILE, which provides access to the system through WAP browser, installed in cellular phones and through web browsers installed in palmtops. Authorized user using cellular phone or palmtop can remotely control system and reach data collected in Measurement Central Base and measuring parameters of recording stations. This solution gives possibility of system controlling at any time and anywhere.

2. SEJS-NET ARCHITECTURE

SEJS-NET system has client-server architecture. The Measurement Central Base is a server realized administrative, archive and interpretation functions. The system has two different clients. Recording stations are first class of clients, which provide registration of seismic events and transmitting data to the server. System users are second class of clients, which communicate with system through user interfaces. Standard user interface is based on web browser and accessible from Internet (Mirek, 2002). Newest mobile user interface is based on cellular phone's WAP browsers and palmtop's web browsers. Scheme of user access to the system shows Fig. 2.1.

SEJS-NET system has opened and scalable architecture. Scalability of the system gives possibility of manipulating of the system size (Mirek, 2001). Typically, the system contains a server and several recording stations located in a field. In special application it is possible to integrate measurement central base with recording station. Hybrid like this is one-station measuring and interpretation system. On the other side it is possible to install Measurement Central Base on cluster with several servers attended different layers of software. Opened system means

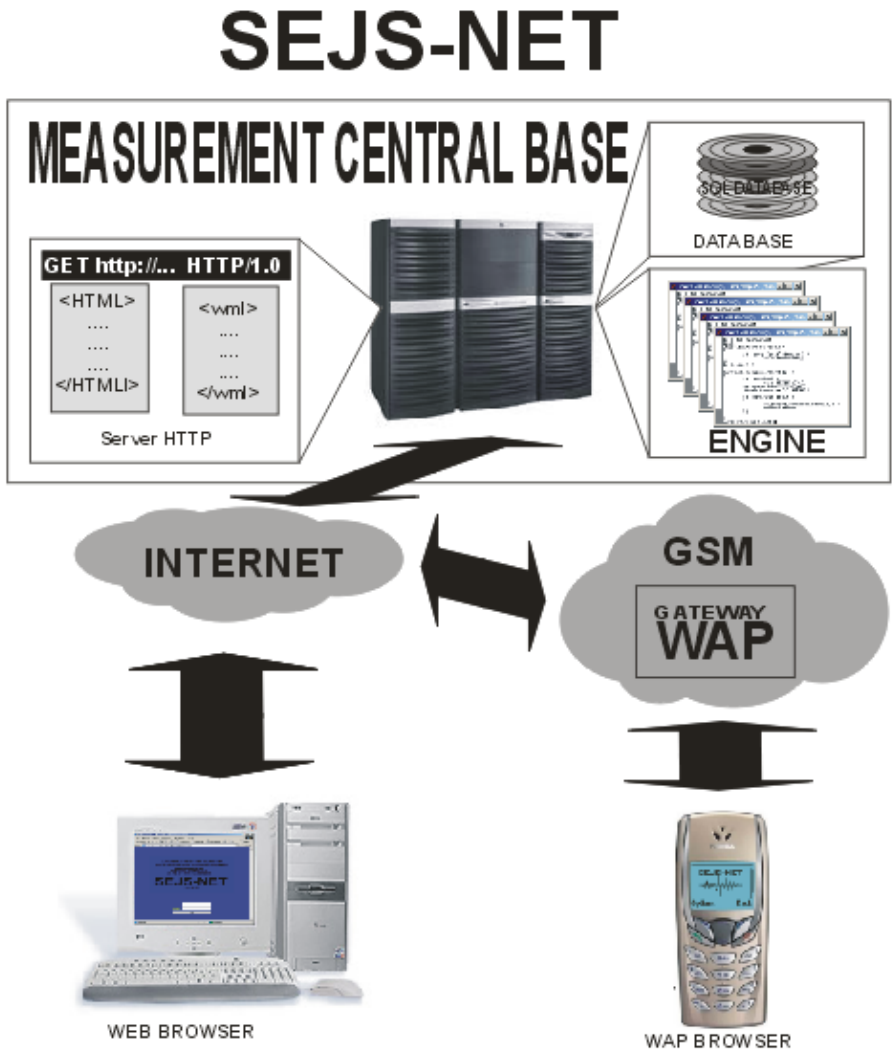

Fig. 2.1 SEJS-NET architecture

that SEJS-NET system works with foreign system (Mirek, Bowanko, 2002). These features are effects of dividing out functional layers.

3. IMPLEMENTATION OF THE SYSTEM

The data is archived in Measurement Central Base. Access to this database provides software organized as modules. Software modules attending database create engine of measurement central base (Fig 2.1). There are four main layers: database layer, network layer, application layer and presentation layer (Fig 3.1).

The database layer is responsible for reading and writing to relational database used in the system. This layer has interfaces to databases like Oracle, Sybase, PostgreSQL, and MySQL. Data guided by this layer is formatted and transferred to the next layers in format independent of type of database used in the system.

The application layer collects modules responsible for processing data between database layer and presentation layer, and vice versa. This layer also controls data flow between network layer and database layer. The application layer is independent of database type, data transfer and character of presentation.

The network layer controls data coming from recording stations. Application belonging to this layer can receive and convert data coming from various recording stations to the internal data format. The SEJS-NET system works with recording stations type SNRC but it is possible to use different type of recorders. Format of data obtained from foreign recorders must be conformable to the SEJS-NET internal data format. The network layer can be easily adapted to a new type of recorders. The network layer serves also data importing from offline-working recorders and backups. During import data is processed like data received from recording station. This solution eliminates software modules specially designed for the import.

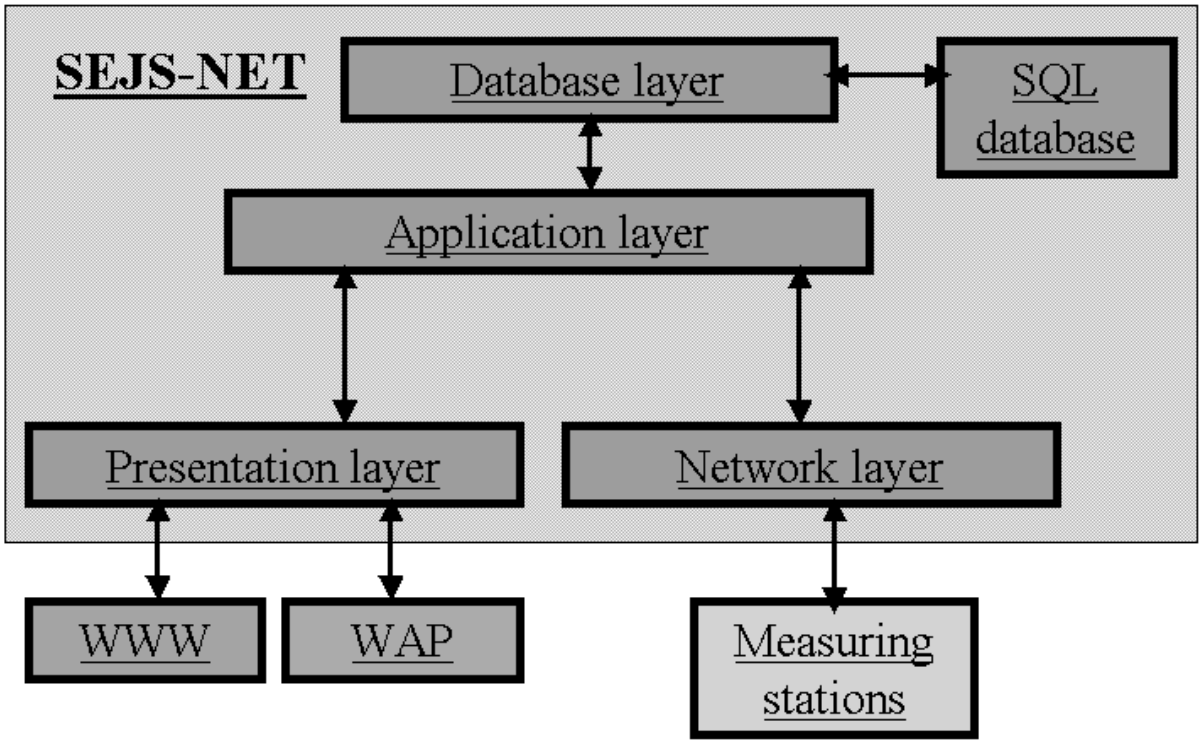

Fig. 3.1 Layered implementation of the SEJS-NET system

The presentation layer formats the data transferred to the user interface. Software modules collected by this layer communicate with application layer. Data received from application layer is formatted dependently of user interface type. The most typical user interface is Internet browser (Netscape, MS Internet Explorer etc.). Data designed for this kind of interface is formatted in HTML and transferred via http server. The same data format is used for presentation in browsers installed on palmtops. Another accessible user interface is done via WAP browser installed in cellular phones. In this situation data is encoded in WML and transferred to the WAP browser through http server and WAP gateway. These user interfaces are designed to online use. Second part takes modules designed to generate reports in PDF formats and fax interface.

4. USER INTERFACES

Most frequently used user interface is realized via typical web browser and is reachable through Internet. Through this interface Measurement Central Base gives access to the information about projects, recording stations and their localization, event catalogues, reports, interpretation software and administrative module (Fig. 4.1). Web browser gives very convenient access to the Measurement Central Base from any computer connected to the Internet for user located in whole word.

The palmtop mobile interface is very similar to the standard web browser interface. Because of less screen resolution in palmtops, displayed information is divided in smaller parts. Example screenshot of palmtop user interface shows Fig. 4.2.

Mobile interface accessible from WAP browser, installed in cellular phones, gives access to the Measurement Central Base at any time for the users equipped with cellular phone only. Using this interface user can receive list of projects, recorders and event catalogue (Fig. 4.3). It is also possible to obtain accelerogram and spectrum of specified signal (Fig. 4.4).

5. CONCLUSIONS

SEJS-NET is sophisticated measuring system especially designed for monitoring of strong ground motion and building vibration. Implemented WMOBILE module gives access to system resources through WAP browser, installed in cellular phones and through web browsers installed in palmtops. Authorized user using cellular phone or palmtop can remotely control system and reach data collected in Measurement Central Base and measuring parameters of recording stations. This solution gives possibility of system controlling at any time and anywhere.

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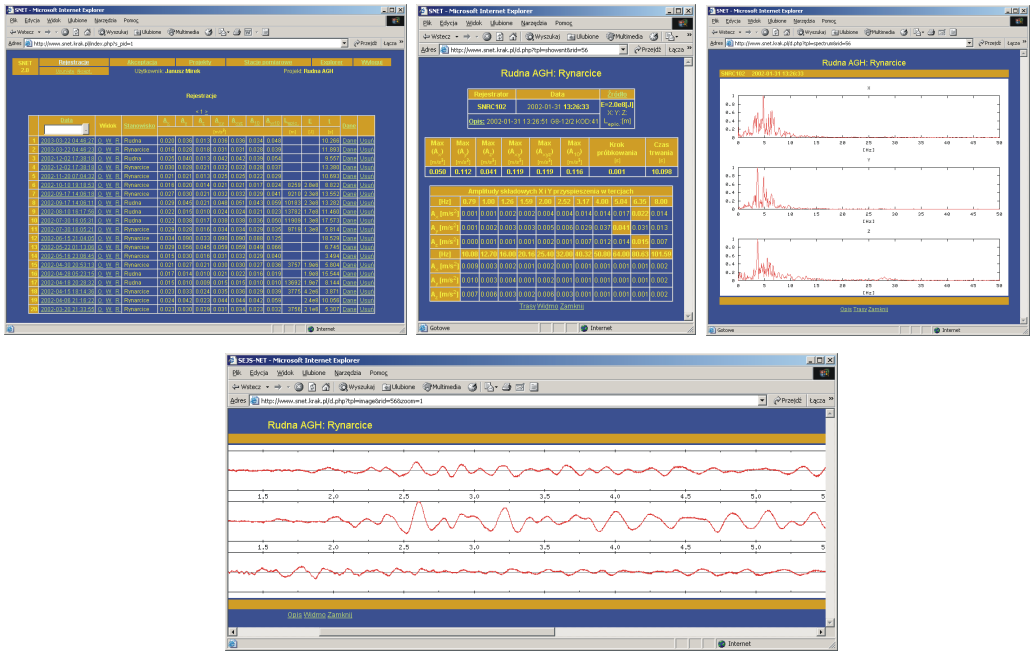

Fig. 4.1 Standard user interface

Fig. 4.2 Palmtops user interface

Fig. 4.3 WAP user interface on cellular phone: list of projects, recorders and event catalogue

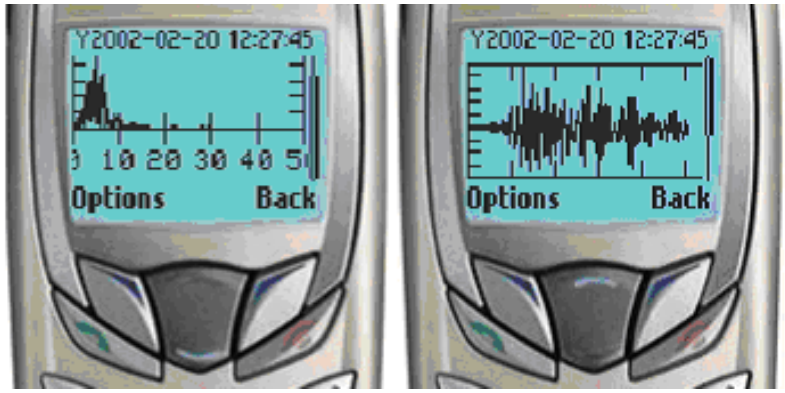

Fig. 4.4 WAP user interface on cellular phone: accelerogram and spectrum of specified signal

REFERENCES

Lasocki, S. and Mirek, J.: 2001, SEJS-NET: wide area system for ground vibration monitoring realized in Internet technologies. Streszczenia Referatów Konferencji „Geofizyka w inżynierii i ochronie środowiska dla potrzeb samorządności lokalnej", J. Jarzyna, red., Kraków, 34-36.

Mirek, J.: 2000, Wide area system for acquisition and interpretation of ground vibration caused by mine seismicity. Materiały Sympozjum "Warsztaty 2000 Zagrożenia naturalne w górnictwie", E. Pliecka, red., Kraków, 319-324.

Mirek, J.: 2001, SEJS-NET: ready-for-use wide area network system for ground vibration monitoring. Materiały Sympozjum "Warsztaty 2000 Zagrożenia naturalne w górnictwie", E. Pliecka, red., Kraków, 561-568.

Mirek, J.: 2002, System SEJS-NET. Publs. Inst. Geophys. Pol. Acad. Sci. M-27 (340).

Mirek, J. and Bowanko, M.: 2002, System SEJS-NET for ground vibration monitoring localized in Commune Rudna area. Materiały Sympozjum "Warsztaty 2000 Zagrożenia naturalne w górnictwie", E. Pliecka, red., Kraków, 173-177.