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The System for Keeping Records of Radio and TV Receivers based on the Java J2ME Platform

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Introduction

The core of a basic system for monitoring unknown frequency signals is a group of aerials for the entire frequency spectrum to be monitored, which is connected to a receiver or spectrum analyzer with an aerial switcher selector. The entire hardware is controlled by a system controller (PC or laptop), with a software for monitoring station signals. Measuring stations can be fixed, portable and mobile. Flexibility of the monitoring software provides that mobile or portable systems are equipped with the same software as fixed stations. A mobile station for monitoring signals is mostly used for locating fixed receivers or, more precisely, for guidance (detection of mobile transmitters). These stations are used in case that the receiving range of a fixed monitoring station is not adequate for the target transmitters, or in case that large areas cannot be covered with sufficient number of fixed monitoring stations due to high costs.

Mostly jeeps or vans are desirable platforms for monitoring stations, but other vehicles and small trucks are also used. For special applications, monitoring systems can be mounted in helicopters, planes and ships. A vehicle becomes a completely integrated mobile monitoring station if equipped with a GPS receiver. Portable stations are needed for determining precise location of transmitters in areas where vehicles cannot be used (e.g. in buildings) [1]. It means that portable devices are equipped with manually directed aerials. Portable stations for signal monitoring have special functions so that they can be used as fixed stations with and without supervision, as mobile stations, or even portable stations. It means that coverage of the existing network area based on fixed and remote controlled stations can be expanded according to users' demand in a very flexible way. Furthermore, these types of stations can complement the existing stations for network monitoring, since they have a compact design which facilitates fast transport and adjustments. Measuring and monitoring can be carried out over an unlimited period.

Development of the initial system for keeping records of radio and TV receivers

For the needs of the record, manipulation, maintenance and analysis of the Telecommunications Agency RATEL system, a three-layer application was developed. Its task was to provide mechanisms for keeping records, manipulation and spatial data analysis. The initial application represented a transition step that made possible for users to have access, a review, to make changes and enter data from a desktop computer. The data measured in the field had to be entered to the database manually so that they could be registered and recorded.

In the beginning, the initial system named RATEL system – Version 1 covered the needs of the agency referring to archiving and organizing information and data. Information was written down manually by a technician in the field, and then entered into application in the basic station. In time, due to an increased volume of data, this led to mistakes. Therefore an idea was born, as well as the need for expansion and improvement of the RATEL system – version 1, in the sense of providing for the data

collected in the field to be directly sent and recorded in the central database. For this purpose we used functionality of the GPS technology, precisely mobile phones with integrated GPS receiver, which provided for automatic detection of exact location where a signal was recorded, which was then connected and entered in the electronic database.

Basic GPS concept

A GPS receiver calculates its exact position by measuring time of signals received from the GPS satellite above the Earth. Although it was initially intended for the needs of the army, GPS is today available for civil and other uses free of charge. The use of GPS is combined with one of three basic components: absolute position, relative movement and time transmission. Capable of detecting absolute location, GPS receivers can serve as navigation and survey devices. The capacity for recognizing relative movement gives the receiver local velocity and orientation [2]. The fact that the GPS system is capable of synchronizing clocks gives a big advantage to large communication centers and observatories. GPS guide is another example of the usage. GPS is used in order to detect what contents should be displayed on the receiver screen.

GPS works in all weather conditions and has become a widespread supplement to the navigation system, as well as a useful tool for creating maps, measuring land, commercial and scientific needs [2,3]. There are a lot of systems using GPS for obtaining accurate reference values, such as systems for exploring earthquakes or synchronization of telecommunication networks.

Short overview of a J2ME platform

J2ME has now become organized architecture for mobile devices, which includes the group of Java Application Programming interface (API) for PDA devices, IJCSNS Embedded devices, as well as limited devices such as mobile phones. Configuration of this platform provides basic functionality, but it doesn't provide services for additional application life cycle management, management of user interface, maintenance and updating of the existing data on a device or secure access to information saved on the network server. These types of functionality are provided by profile or optional packages. Profile adds a number of specific API functions to the basic group provided by configuration. It supports specific purpose of devices and provides functionality, which is missing in the basic configuration. Optional packages add special services useful on various devices, but they are not available on all devices.

Applications are usually based on a configuration suitable for a desired category of target devices, on a profile supporting basic software functionality, and optional packages supporting needed specialized functions, such as messages or multimedia. The profile is based on the main configuration and added API for user interface, existing saving classes, as well as other classes needed for development of launched programs. One device can support more profiles. Besides J2ME configuration, profiles and optional packages [4] described above, include a supplier of specific classes when needed.

Specific API suppliers are extensions for profiles and configurations. Standard J2ME does not consist of specific interfaces, but they can be added, thus expanding functionality for a specific device, e.g. API for control of radio trans-receivers of the device.

Basic components of a GPS application for mobile phones

For the needs of the new system usage, special procedures [5] were defined for using a mobile GIS application in the field. Prior to going out into the field, besides basic equipment for identifying unknown frequencies, RATEL technicians should also have a third generation mobile phone with integrated GPS receiver.

Since GPS receivers started expanding in mobile phone technology, as we mentioned, an idea was born to make use of such a fusion for solving everyday problems facing an institution such as Republic Telecommunications Agency of Serbia. Every day RATEL technicians check emission of excessive intensity signals at forbidden frequencies. Fig. 1 shows architecture of a GPS mobile application based on the J2ME architecture and its components.

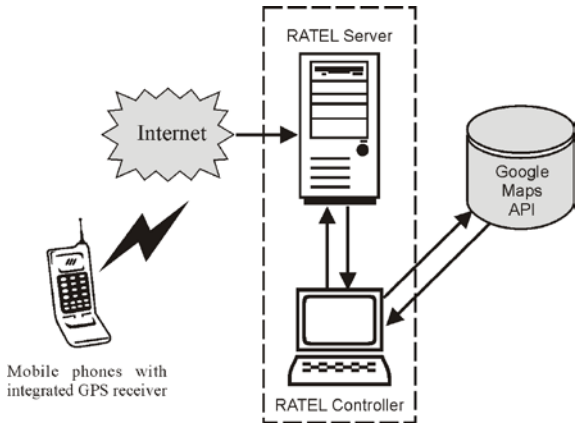

Fig. 1. Architecture of a GPS mobile application based on the J2ME architecture

On the basis of the above mentioned, each of the detected signals was manually entered into the database so that it could later on be compared with the original database in order to determine whether the allowed values were exceeded. As it is shown at the beginning of this work, the procedure of manual writing down of the location where a signal was detected, as well as other parameters, turned out to be incompetent at certain moments and led to mistakes. It was therefore needed to enable the application to detect and show the GPS location, and make possible to send the determined location with other accompanying information (frequency, signal volume, etc.) to the electronic database at the Agency if needed, via GPRS/EDGE/3G. On checking locations obtained from technicians in the field, a controller sitting in the Agency needs a picture of the very location on the global map. Display of detected, as well as predefined locations of radio and TV receivers is made possible due to

free digital maps available over the Internet, such as Google service (Google Maps API).

After performing an analysis of existing GPS software and Java applications, we came to the conclusion that it is necessary to introduce some of those contemporary keeping records, manipulation and spatial data analysis, so that technicians could storing the forbidden frequency signals in the best possible way. On the other hand, Google Maps is a free web mapping service application and technology provided by Google for non-commercial use. Also, Google Maps is currently considered the best, the most popular, and the most used online mapping service in the world, and it is possible to embed Google Maps site into an external website, by using the Google Maps API.

The system for entering a noticed location by technicians consists of a client application displayed on a mobile phone, with the help of the J2MEGPS179 server library used by the integrated GPS system on the mobile phone (Fig. 2). This application is designed in a way which provides for future adding of new modules used with other J2ME applications as well.

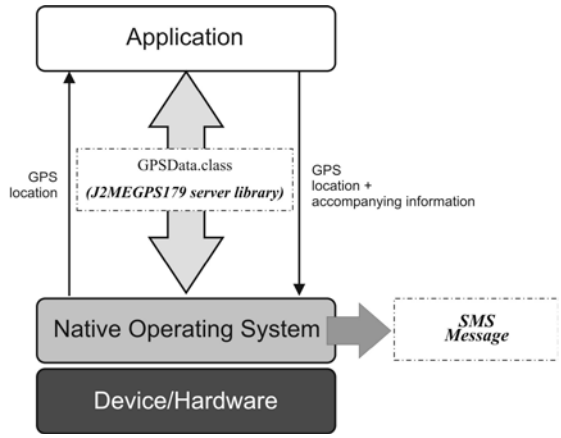

Fig. 2. J2ME application model

RATEL technicians in the field discover emission at forbidden frequencies by identifying signals at the same forbidden frequency at three different points - locations: A(X_a,Y_a), B (X_b,Y_b) and C (X_c,Y_c). When a signal at a forbidden frequency is identified at some point, from the integrated GPS system a technician obtains on his mobile phone coordinates of the spot where the unknown frequency signal was detected. An improvement in comparison with the previous application is the fact that the obtained coordinates of the location (latitude and longitude) are sent in form of an SMS message, where the URL parameter is the RATEL database server located in the Agency. The procedure is repeated twice more in order to obtain all the three points (A, B, C) [6] needed for future review of their intersection, i.e. point X.

J2ME application is a program written for mobile phones that have support for launching a JAVA application. The main condition for regular functioning of this application is that a mobile device has an integrated GPS receiver, since J2ME application is designed for this type of devices exclusively. The application initial window contains information regarding the GPS receiver status, as well as the current location. Until the GPS receiver is activated, the data (latitude and longitude) will not be available. The GPS receiver is activated by pressing the left or right function key and by selecting the option „Activate GPS“.

AJAX, which continuously listens to incoming SMS messages in the form of URL with parameters [7], is generated on the RATEL central database server at the Agency. Only the data needed for executing tasks in preselected fields are prepared from the database. After coming back from the field, data from a mobile device are synchronized with data in the central database. Any changed or entered information should be verified by the authorized person – controller. After that the collected data on radio and TV station locations become valid.

When coordinates of point X are calculated – the position from which the registered unknown frequency signal is emitted (latitude and longitude), a http request from the client computer is sent to the Google server, which displays the exact position and location on the Google map on the basis of obtained coordinates. After determining the point X coordinates and position on the Google map, detection from the central database is performed automatically – whether it is really a signal emitted by an unknown broadcaster (Fig. 3).

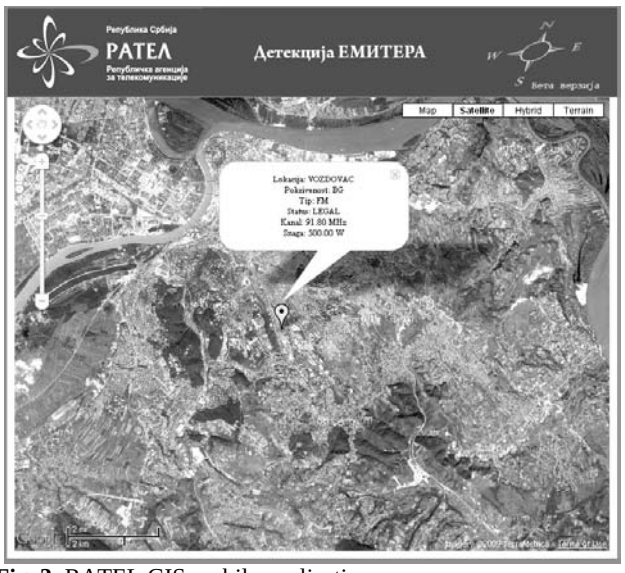

Fig. 3. RATEL GIS mobile application

When Google started developing some new technologies with AJAX, the public began paying attention to AJAX. Some of large Google products presented in the past several years, which were made via the AJAX model, are Google Groups, Google Suggests and Google Maps.

Google Maps API enables putting Google Maps onto a web page using JavaScript. API offers numerous possibilities for manipulating with maps and adding contents on the map through a series of services, thus enabling creation of a robust application for maps within the web page.

Conclusions

Other authors [8] that deal with access positioning and geographic information anytime and anywhere also used integrated GPS receiver and applications for mobile

devices. Their application used the Microsoft SQL Server 2005 Mobile Edition to develop the database for this application (a table to store the GPS data from the GLL messages and a table related with the messages sent to the PC application). The PC application manages the connection between the mobile system (XF55 and PDA) and the traffic centre, receiving and sending messages, and storing the received information in a SQL database.

After Google began to develop some new technology with AJAX the public began to pay attention to AJAX. The client may use AJAX in its web application by writing your JavaScript code that directly uses a protocol called the XML HTTP request API. A framework for integrating AJAX models into the browser based GIS Visualization Web Services systems was presented in [9]. In that approach, authors use all the technologies in AJAX with their original forms. Client actions are interpreted by the browser through the Google Mapping tools. JavaScript captures these actions by ActionListeners and Google Binding APIs.

RATEL GIS mobile application based on the J2ME platform combines various technologies, such as GPS, Google Maps, Ajax and Web as a distributed system. Absolute positions of emitted signals were automatically determined with a GPS receiver integrated into a mobile phone. The maps used in the RATEL GIS mobile application are downloaded in real time from the original Google map server. The object-oriented approach used during implementation guarantees a simple and fast way of expanding functionality. As a result of the system architecture modularity, the created framework of the application can be used for future applications as well.

The presented concepts represent a good initial basis for development of mobile GIS for activities in the field. Development of new wireless Internet technologies will enable introduction of a high interaction level between a person in the field and a person in charge of checking the collected data. The application architecture enables development of client mobile applications intended for other user profiles.

References

1. **Technical support**, Spectrum Monitoring and Management System, ARGUS–IT. Online: www2.rohde–schwarz.com/file/argus_en.pdf.
2. **Pundt H.** Field Data Collection with Mobile GIS: Dependencies Between Semantics and Data Quality // GeoInformatica, 2002. – Vol. 6. – P. 363–380.
3. **Dunham M.H., Kumar V.** Location Dependent Data and its Management in Mobile Databases // DEXA'98 – 9th International Workshop on Database and Expert Systems Applications. – Vienna, Austria, 1998. – P. 414–419.
4. **Isakow A., Shi H.** Design and Development of GlobeTrotter – An Innovative Location–Based System using J2ME // IJCSNS International Journal of Computer Science and Network Security, 2008. – Vol. 8. – P. 201–207.
5. **Luqun L., Minglu, L.** A Research on Development of mobile GIS architecture // Environmental Informatics Archives, 2004. – Vol. 2. – P. 920–926.
6. **Rančić D., Predić B., Stojanović D., Milosavljević A.** Mobile Devices as Personal GIS Client Platforms // International Journal of Computers, 2008. – Vol. 2. – Iss. 4. – P. 470–478
7. **Pranevicius H., Paulauskaite–Taraseviciene A., Jarutis A.** Simulation of Protocol for Initiation of Communication Sessions using dynPLA Model // Electronics and Electrical Engineering. – Kaunas: Technologija, 2010. – No. 5(101). – P. 35–38.
8. **Ana L. R., José V. F**., **Jaime B.** An Integrated GPS/PDA/GIS Telegeoprocessing System for Traffic & Environment // Journal of Systemics, Cybernetics and Informatics, 2009. – Vol. 7. – P.47–53.
9. **Sayar A., Pierce M., Fox, G.** Integrating AJAX Approach into GIS Visualization Web Services // Proceedings of the Advanced International Conference on Telecommunications and International Conference on Internet and Web Applications and Services, IEEE Computer Society. – New York.

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This work gives an overview of structures and organization of a GPS application based on J2ME architecture, which was applied in a system for keeping a record of radio receivers. Development of a mobile GPS application based on the J2ME platform usage has been launched for the needs of the RATEL company. It also combines various technologies, such as GPS, Google Maps, Ajax and Web as a distributed system, in order to show the location, i.e. position of an unknown frequency broadcaster on a digital map in mobile phone. Ill. 3, bibl. 9 (in English; abstracts in English and Lithuanian).

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Pateiktos GPS sistemų architektūros, sudarytos taikant J2ME platformą. Įmonės RATEL užsakymu buvo sukurta mobilioji GPS sistema J2ME pagrindu. Tokia sistema apima GPS, „Google Maps“, „Ajax“ ir pasaulinį kompiuterių tinklą siekiant parodyti vietovę, pvz., nežinomo dažnio skleidiklio padėtį mobiliojo telefono skaitmeniniame žemėlapyje. Il. 3, bibl. 9 (anglų kalba; santraukos anglų ir lietuvių k.).