REMINDER BASED ON THE USER'S LOCATION

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ABSTRACT

The sense of technology and its future development has been primarily led by the idea of finding ways in which to make life for people easier. Simplicity, practicality and functionality represent characteristics of good products. Mobile information and communication technology determines the society and behaviours since it represents an element of individual quality and a way of communicating and doing business. The potential provided by hardware can be fully used only by adapting to the users' requirements by improving the software side. Today's development of the information and communication technology has to be created with the focus on the humans and with technology transparent for the user.

Regarding the mobile information and communication technology, the problem has traditionally been that the mobile applications focused too much on the technology, which means that applications had been developed for certain purposes or for special technologies. The new standpoint has been led by the idea that the application has to provide the users with what they want, anywhere they want it and in the best possible way. The user has to be able to employ the mobile device and software based on the installed applications in different environments and independent of the environment.

Developing an application that may make everyday life easier is a sufficient motive to turn an idea into reality. The topical feature of the application development technology for mobile devices called for an idea that would take into consideration the users' requirements and satisfy them by providing a simple solution for their everyday life. This idea is a reminder based on the user's location.

1   USER POSITIONING BY MEANS OF GPS TECHNOLOGY

GPS is a complex system which combines three segments – *space, control and user segment*. Such distinction of segments emphasises the main objective of the combined segments: to create a functional system that at a global level makes people aware of the possibility and potential of the services based on navigation. GPS uses the satellite constellation, where each of the satellites transmits the signal in the range which encompasses the message navigation. The latter contains also the information necessary to determine the satellite coordinates and brings the satellite clocks in accordance with the GPS time. At the same time the measurements of at least four satellites are required in order to determine the positioning of three-dimensional and time capacity. The satellite constellation provides a range of possibilities for each user who is located anywhere and anytime on the Earth. Tracking of GPS satellite, using its operative controls and determining their location in space, is performed by the Operational Control Segment (**OCS**).

Additionally, the segment takes care of [1]:

- maintenance of orbiting satellites through small manoeuvres;
- introduction of corrections and adaptation of satellite clocks and capacity;
- monitoring of the GPS satellites and *upload* of navigation data for each satellite;

- giving orders for big changes in case of satellite failure.

GPS users belong to either military or civil environments. GPS lets them determine, free of direct charge, their position anywhere in the world and they use the information for several combined applications. Depending on the ensured accuracy, the GPS provides two levels of services: the *Standard Positioning Service* (**SPS**) and the *Precise Positioning Service* (**PPS**).

2   USER LOCATION-BASED SERVICES

The *Location Based Services (LBS)* are mobile applications that depend on the location of the mobile device, such as cellular phones. LBS services can be categorised as imposed LBS services (push services) and as user-requested LBS services (pull services). In order to make the LBS services possible, some infrastructure elements are necessary, including [2]:

- mobile devices,
- applications,
- communication network,
- positioning of components,
- servers,
- services.

Mobile devices are tools used to access LBS services, send requests and correct results. Such devices can be *Personal Navigation Devices* (**PNDs**), *Personal Digital Assistant* (**PDA**), portable computers, cellular phones, etc. [3].

The user's interface for access to LBS services represents an application. Usually it is software-developed by the service provider, uploaded and installed on the user's device. The specific application is usually developed for specific LBS services. Because of the constraints of the mobile devices (small display size, processor of limited power and memory, battery capacity), LBS applications have to be light and save batteries.

Communication network refers to mobile networks that transfer the requested services from the user to the service provider, and the requested information back to the user. The Global System for Mobile Communications (GSM) is currently the most common standard for mobile networks and used mostly for mobile phones at the global level. Mobile networks are usually controlled and maintained by the operators who provide connections for the mobile users and are responsible for the data and voice transfer.

The positioning of components is usually necessary in LBS applications in order to determine the location of the user's mobile device. In the majority of current LBS services the user is not required to enter the location manually, nor the input of post codes or street names. Instead, the position of the user device can be obtained by using the positioning technology, such as satellite positioning, positioning by mobile network, WLAN stations or radio connections.

The service providers are engaged in server maintenance which sends different types of LBS services to users, and are responsible for the processing of service requests and for returning the request result. The server calculates the positions, looks for the routes or specific information based on the user's location. The service providers usually maintain all information requested by the user. Instead, the content providers are responsible for the collection and storage of geographic data, location-based information, etc. These data will be requested and processed by the server and then returned to the users.
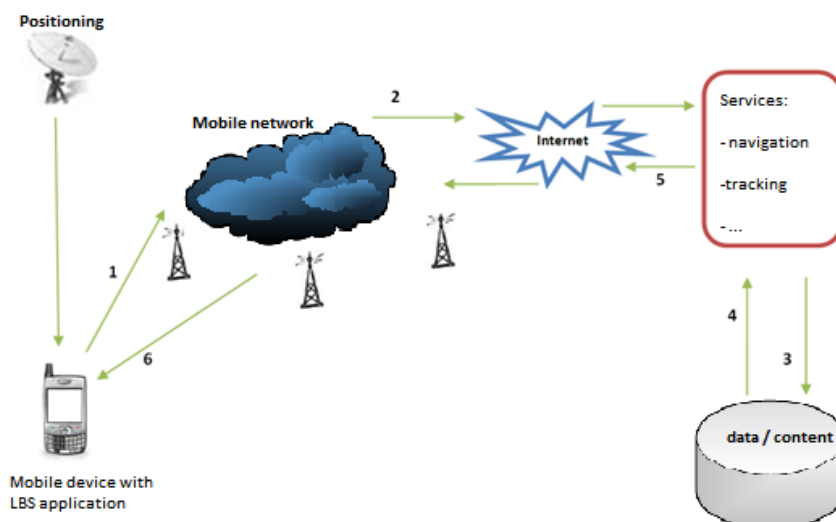
**Figure 1: Interaction of segments in the LBS process [2]**

There are six types of LBS services [4]:

1. assistance,
2. orientation,
3. information,
4. advertising,
5. tracking,
6. charging.

3   OPERATING SYSTEMS OF MOBILE DEVICES

The functionality of mobile devices does not depend only on hardware. The discussions about the functionality and the possibilities are increasingly being directed to which operating system will run the mobile device and which platforms are available on the market. The device is, naturally, important but the difference in software possibilities offered by an operating system can be decisive. The shift of focus from hardware to software may be the effect of the development from the cellular phones to multifunctional smart phones, which means that the user today can indeed install programs on a telephone almost identically as on a PC. The Mobile Operating System (**MOS**) is a system which manages the mobile device, similar to an operating system (Linux or Windows) which controls a home computer. Currently they are somewhat user-friendlier and deal more with wireless methods of wideband connection and mobile multi-media possibilities.

The currently leading platforms on the market are Android, Iphone, Symbian, BlackBerry, Windows Mobile and PalmWeb. Regarding everyday changes it is difficult to determine precisely what is the share of individual operating system on the market, but the trends, advantages and drawbacks of one platform in relation to another or others are known. The users' desires and needs determine most the usage of a certain platform, but sudden developments and improvements indicate that there is a battle on the market, and thus also big advancements making the user the biggest winner.
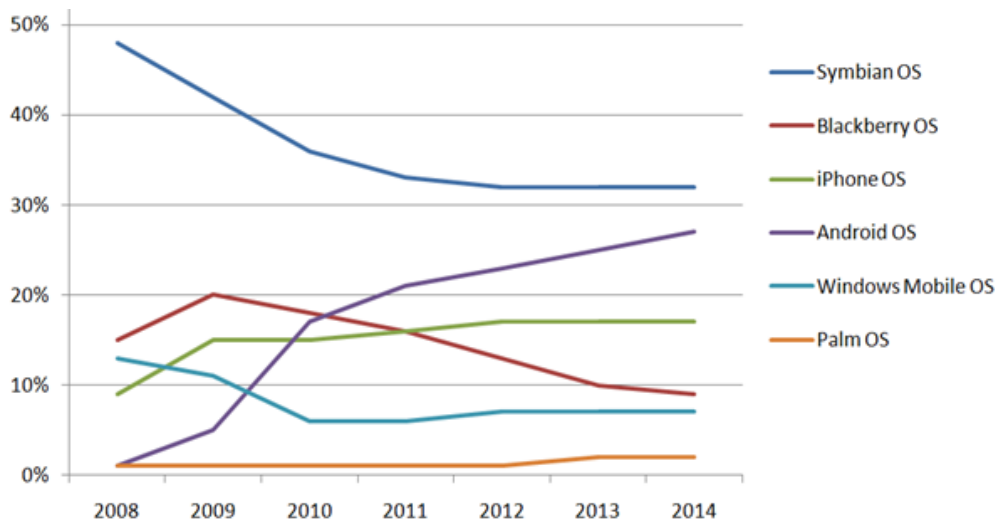
Graph 1: Statistics of the future usage of mobiles device operating systems [5];
Source: RIM, Gartner, Goldman Sachs Research

4   SYSTEM ARCHITECTURE

The architecture of the location-based reminder called GpsALARM[1] consists of several segments that are sufficient to create a fully functional unit. The absence of any of these parts means at the same time the impossibility of developing the system.
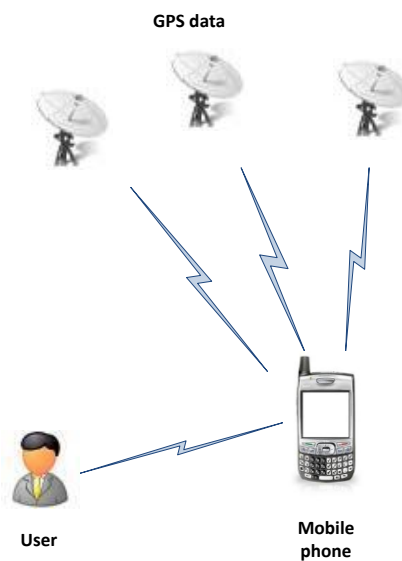

Figure 2: System architecture

As can be seen, there are three basic segments:
- User – represents a person who uses the possibilities provided by the mobile device and the GpsALARM application installed on the mobile device;
- Mobile terminal device – hardware-equipped terminal which enables the usage of GpsALARM application;
- GPS system – system of satellites and receivers intended for positioning.

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[1] Arbitrary name of the application

5 WORKING CONCEPT

The purpose and functionality of GpsALARM application is informing the users when they arrive to a certain location, provided the user has requested to be alarmed at precisely that location, i.e. provided the user has entered the geographical coordinates of the respective location.

The basis for the running of the application lies in the mathematical concept, i.e. formula which compares the geographic position entered into the application and at which the user wants to be alarmed, and the position given by the GPS system that shows at which coordinates the mobile terminal device is currently located.

The figure explains graphically the principle of alarming the user. It should be mentioned that the user in the application activated the request to be alarmed at the location with the following geographical coordinates: N 45°23'14"; E 15°43'32". Since the GPS system has determined that its current location, i.e. location of the mobile device is N 47°47'21"; E 15°11'23", the user is still not at the location of the alarm and will not be alarmed before arriving at that location.
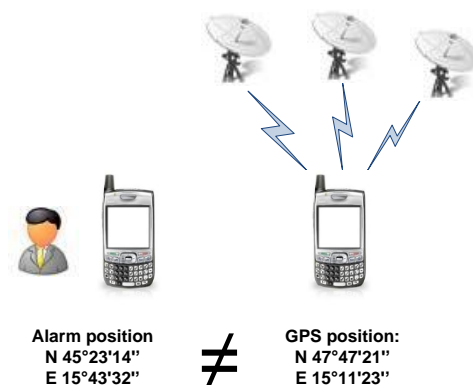
Figure 3: The device is not at the location at which the user is to be alarmed

The second case represents the situation in which the mobile device is at the position where the alarm has been set, which means that the user will be alarmed since being at this location, which is the purpose of the application itself. In other words, the position of the alarm and the position of the mobile device are identical (or almost identical).
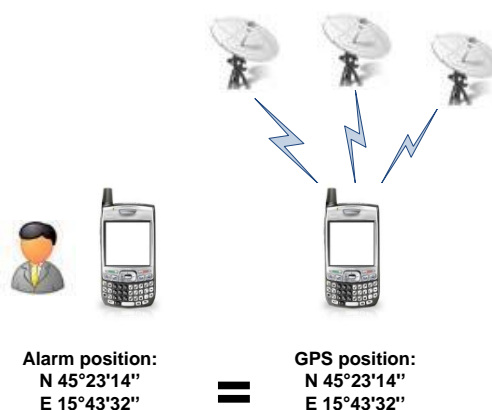
Figure 4: The device is at the position at which the alarm has been set and the user is informed
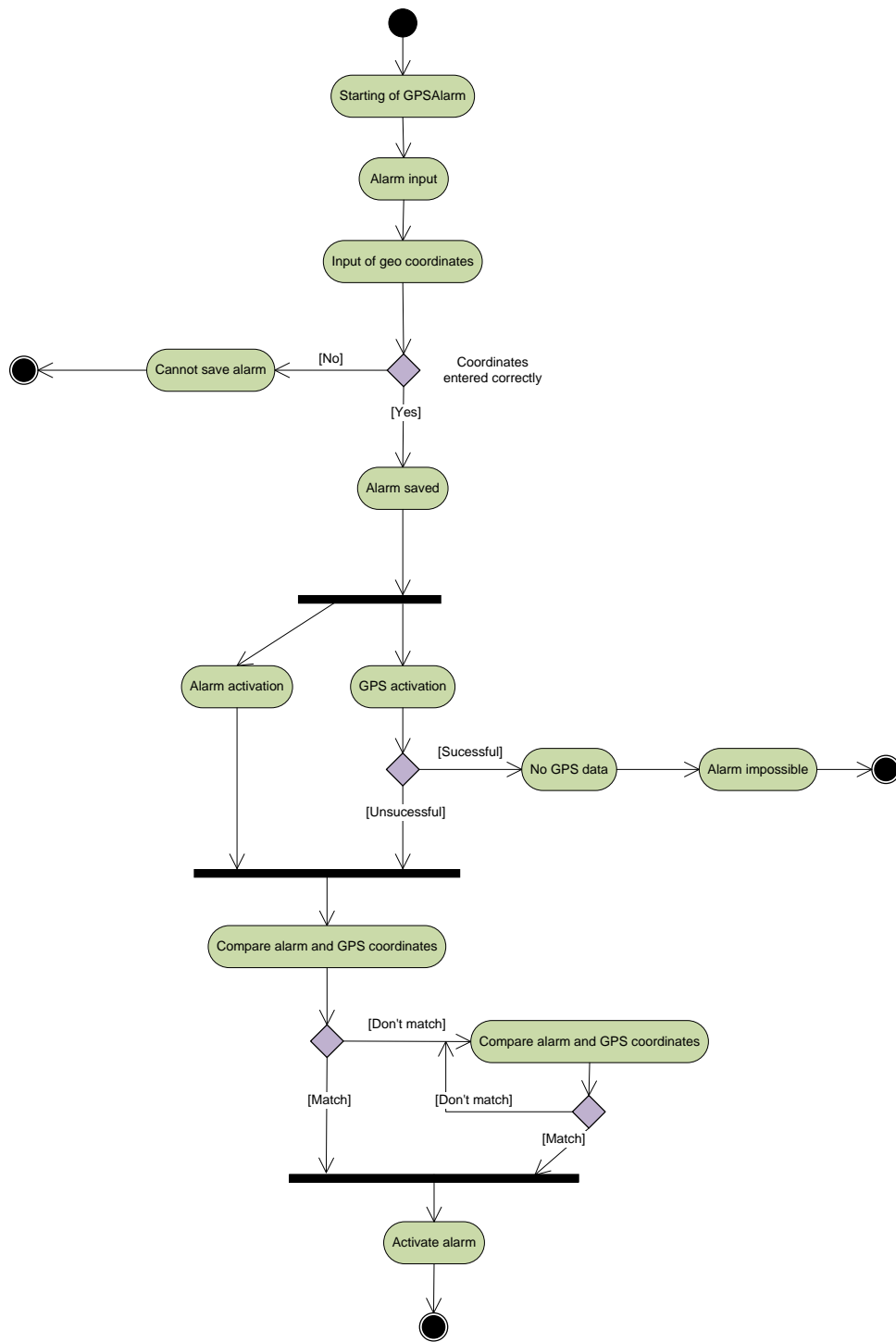
Figure 5: Diagram of GPS alarm application activities

6 PRESENTATION OF APPLICATION DEVELOPMENT AND IMPLEMENTATION

The whole process of developing the application named GpsALARM was also implemented in its practical part. Two types of platforms on which the application has been implemented need to be highlighted and differentiated.

The final version of the application based on Windows Mobile operating system consists of several tabs, each having its own functionality, and facilitating the application usage.

Figure 6: The application in *emulator*[2] MS Visual Studio 2008

In the design of the application more attention was paid to the functionality itself in relation to the graphic interface and the look. The idea was to develop a fully functional application that can be upgraded regarding design, new possibilities and work simplification. The basis of the running of this application is the menu with several options that can be selected. The user-friendliness and clear layout are one of the biggest advantages of the mentioned application.
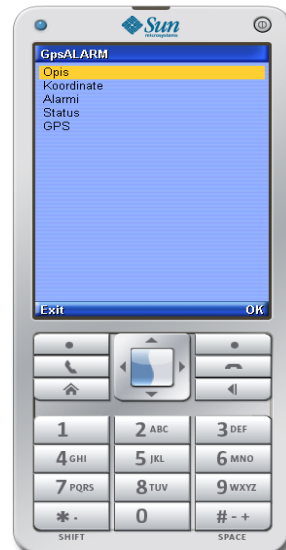

Figure 7: Initial menu of GpsALARM application in *emulator* Java ME SDK 3.0

As a rule, the very functionality of GpsALARM application is completely equal if we compare the application developed for the operating system Windows Mobile and the application developed through Java Micro Edition software interface. Big difference can be noted in the graphical interface and the details that were taken into consideration. By comparing and using both applications one can notice equal logic in which the design does

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[2] Part of MS Visual Studio application that serves to simulate the work of mobile terminal

not participate as an important factor in performing the main purpose of the application. Application functionality:

- Description – brief explanation of the application functionality;
- Coordinates – input of alarm and its geographic coordinates;
- Alarms – display of saved, activated alarms or stand-by alarms;
- Status – simple display of currently activated alarms;
- GPS – GPS device on/off.

7   IMPROVEMENTS OF APPLICATION

Since GpsALARM application has been developed as part of the Work, it represents a potential commercial project. The idea, running process and logic of application have been described in detail in the previous section thus eliminating all the possible lacks of clarity. The developed application meets its purpose, i.e. realizes the given functionality. However, the fact is that the majority of the systems can be improved, which means that the GpsALARM application also belongs to that category. The planned upgrades of the application are possible through:

- Sound alarm;
- Possibility of activating infinitely many alarms;
- Activation of alarm within a certain date and time;
- Determining the distance from the point at which the application is to alarm us;
- Display of the alarm location on the map;
- Determining of geographic coordinates of the alarm according to the data on the map;
- Sharing of alarm with other users (sending/receiving);
- Personalisation of application (background, font, sounds);
- Groups and categories of alarm.

8   CONCLUSION

The reminder based on the user's location such as the GpsALARM application represents a synergy of an idea and the latest technology. The practical characteristic of the use can be seen in the simple menu and easy installation, and the system functionality is immeasurable since the application is available at any moment. The reliability and accuracy depend primarily on the GPS system which gives us a large dose of security.

The display of the system architecture and process model enable development and transfer of application from one operating system to another, which makes it a fully flexible solution. Additionally, this makes the application almost "immortal" since the mentioned processes can be easily transferred to all the past, present and future operating systems. The only changes are in the software code. An example of a developed application proves the authenticity and accuracy of the process model. The graphic interface and the design depend on the desires and priorities of the development team of this type of reminder, and this paper presents the forms and ideas in their basic form.

The possibility of upgrade and enhancement of the application is huge, and depends first of all on further development and improvement of the technology and the ideas that originate thereof. The improvement of the precision of the GPS system positioning as well as any software improvement will have positive reference to the functionality of this type of reminder.

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