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DEVELOPMENT OF A SOIL CLASSIFICATION PROGRAM FOR SMART MOBILE DEVICES USING MICROSOFT VISUAL BASIC

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ABSTRACT

In recent years, smart mobile devices have acquired considerable computing power, plenty of memory and wireless network capability. Although smart mobile devices are very capable tools especially for geoscientists in the field, they found limited usage in geosciences because of the complexity in programming of such devices. However, Appforge Crossfire makes it possible for engineers to quickly create and deploy robust applications on most mobile platforms regardless of their operating systems by using Microsoft Visual Basic. In this study, a soil classification program was established for geotechnical purposes and complied and deployed for Symbian, Microsoft Mobile and Palm devices by using Appforge Crossfire in Microsoft Visual Basic programming environment. The application was tested successfully in the most common mobile devices.

Key Words : Mobile device, Soil classification, Crossfire, Symbian, Palm, Microsoft Mobile.

BİR ZEMİN SINIFLANDIRMASI PROGRAMININ AKILLI TAŞINABİLİR AYGITLAR İÇİN MICROSOFT VISUAL BASIC KULLANILARAK GELİŞTİRİLMESİ

ÖZET

Son yıllarda, akıllı taşınabilir aygıtlar, ciddi hesaplama gücü, bolca hafıza ve kablosuz bağlantı yeteneklerine kavuşmuşlardır. Akıllı taşınabilir aletler, oldukça kapasiteli aygıtlar olmalarına rağmen, programlanmalarındaki güçlükler nedeniyle, yer bilimleri alanında limitli kullanım alanına sahip olmuşlardır. Buna karşın, Appforge Crossfire, mühendislere, taşınabilir akıllı aygıtlar için kolayca ve platformdan bağımsız olarak Microsoft Visual Basic ortamında uygulama geliştirme olanağı sunmaktadır. Bu çalışmada taşınabilir akıllı aygıtlar için tasarlanan bir zemin sınıflandırması programı Appforge Crossfire kullanılarak Microsoft Visual Basic ortamında geliştirilmiştir. Geliştirilen uygulama Symbian, Microsoft Mobile ve Palm işletim sistemi kullanan aygıtlarda yüklenerek başarıyla çalıştırılmıştır.

Anahtar Kelimeler : Taşınabilir aygıt, Zemin sınıflandırması, Crossfire, Symbian, Palm, Microsoft Mobile.

1. INTRODUCTION

The smart mobile device market has made tremendous recent increases on the global level, with new entrants, devices and applications. Smart mobile devices include smart phones (pocket-sized device that positioned primarily for voice and offers two way data synchronization and operating system based applications), and handhelds (pocket-sized device, positioned primarily for data with or without integrated wireless network capability) (Casademont et al., 2004).

Faster processors and more memory on smart mobile devices, as well as wireless networks with greater bandwidth, have enabled development of powerful mobile applications and operating systems (OS). Smart mobile devices have their specific operating systems like Symbian, Microsoft Mobile and Palm, which are the global industry standards and are account for over 85 percent of annual worldwide sales (Vaughan-Nichols, 2003). Currently, the leader in the mobile OS segment is Symbian, owned by some of the world biggest handset manufacturers: Ericsson, Motorola, Nokia, Panasonic, Psion, Samsung Electronics, Siemens and Sony Ericsson, who own 62.8 % market share in the second quarter of 2005. Due to the enormous advances in computing and communication capabilities, a growing interest has emerged especially for the cell phone-centric Symbian OS devices, that began to support much features with reasonable costs (Figure 1) (Canalys, 2005)[1].

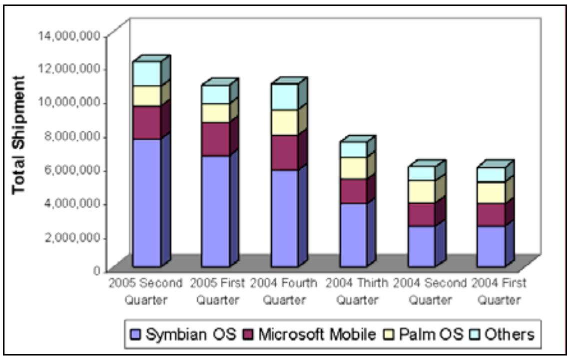

Figure 1. Smart mobile market shares by operating system.

Despite their great potential, smart mobile devices have limited usage in the geosciences except some pioneering field applications. For example, Ancona et al. (1999) have enabled mobile computing to field archeology. A server-client based system was established in C++ language for recording archeological evidence in the field by communicating between mobile handhelds and the server PC using wireless network. Moreover, Briner et al. (1999) used Hypertalk Language to program the Apple Newton Message Pad for geologic field data acquisition and analysis. The program enables geoscientists to record data on long geological field surveys and transfers data to a Macintosh Computer for analysis. Elsewhere, Vivoni et al. (2003) developed a field data collection system that streamlines the collection process and provides data sharing between multiple field teams and remote locations. They adopted geographical information system (GIS) environment to the system and collected spatial and water quality data during a watershed field. Similarly, Casademont et al. (2004) have presented a newly developed platform for the commercialization of advanced geographical information services for use in portable devices. Micro-gravity surveys are widely applied geophysical technique to quantify time-dependent sub-surface mass and/or density changes. For monitoring micro-gravity data, Gottsmann et al. (2004) developed a PalmOS mobile application in MobileVBLite[2]. The program can transfer the gravity data, recorded at considered time intervals by a field gravity meter, to a Palm device for analysis.

Due to the complexity of the readily available software development kits (SDK) and the need for considerable experience in C programming language, the widespread usage of smart devices in various fields was prevented. As an alternative, some third party developers (NS Basic[3], HB++[4] and GoDB[5]) have adopted the easy learn and use environment of the object oriented languages into the mobile application development area. However, these applications had limited support for the devices on different platforms. On the other hand, Crossfire, Appforge's last software for the mobile application development field, makes it possible for developers to quickly create and deploy robust applications on most mobile platforms regardless of their operating system using Microsoft Visual Studio.

AppForge Crossfire uses industry standard tools and languages such as Microsoft C#, Visual Basic .NET, and Visual Basic 6 and includes a large selection of controls and libraries to help create robust applications for target particular mobile platform (i.e. Symbian OS, Microsoft Mobile and Palm OS). Device specific capabilities like GSM, GPS, e-mail, camera, communication ports, and barcode scanners (etc.) can also be easily programmed with related controls offered by Crossfire in Visual Basic programming language.

The ability to program with a widely known language such as Visual Basic will help to reveal the potential of the smart mobile devices by the geoscientists especially for the field applications, where mobility is important. Using the existing

[1] Canalys research release archive, http://www.canalys.com/pr/archive_r.htm

[2] Appforge MobileVB Lite, http://www.appforge.com/products/enterprise/mobilevb/index.html

[3] NS Basic Coorporation, http://www.nsbasic.com

[4] Handheld basic (HB++) home page, http://www.handheld-basic.com/

[5] Consigntech Coorporation, http://www.handheld-basic.com/

programming knowledge, the geoscientists will be able to develop mobile applications without daunting experiences compare to other programming languages. Mobile computing and wireless communication opportunities allow these devices to process and transmit data in the field that minimize operator errors and time delays. The established program code can be deployed to several mobile devices regardless of their operating systems. Thus, the challenge for code conversion between platforms was eliminated.

This paper aims to present the development of mobile applications in Visual Basic using Appforge Crossfire for different mobile platforms. To test this ability, a soil classification program based on Unified Soil Classification System ASTM D2487-06 (ASTM, 1999) was established in Microsoft Visual Basic for Geotechnical engineering purposes and compiled and deployed by Crossfire for Symbian, Microsoft Mobile and Palm devices.

2. PROGRAMMING WITH CROSSFIRE

Appforge Crossfire was installed as an add-on to the standard Windows version of Microsoft Visual Basic 6 to create the soil classification program. Since the same development environment was used, the programming phase did not differ from any Visual Basic application.

2. 1. Designing User Interfaces

By starting the Appforge Crossfire application, the project manager appears on the screen. Using the project manager a new project or existing projects can be started. In the case of selecting a new project button, the design target platform is expected to select from the list (Figure 2).

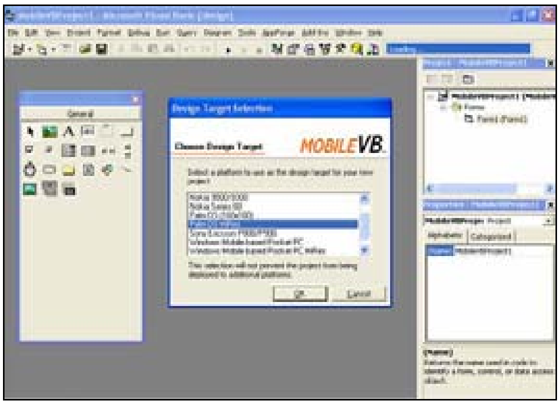

Figure 2. Project Manager.

After selecting the desired platform, Crossfire setups the project and automatically creates the first form. The toolbox controls, designed for selected platform (ingots), can be simply drag and dropped on the form just as any Visual Basic application. The program code and form layouts were established primarily for a Palm OS HiRes device and than adapted to other mobile devices. The user interface of the soil classification program was created by using the device specific controllers as shown in the Figure 3.

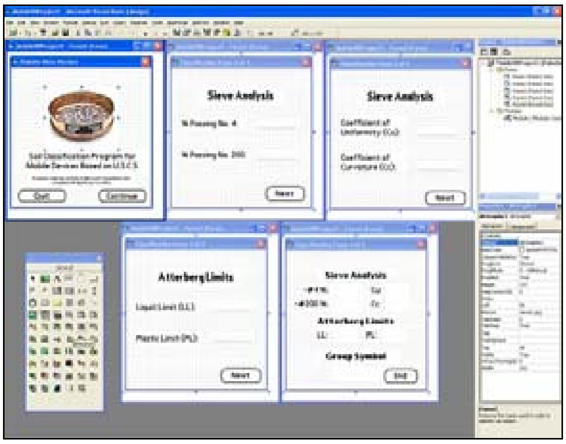

Figure 3. Forms of the soil classification program.

The application consists of five forms, of the first of which is the welcome screen. In the following three forms, the parameters of sieve analysis and consistency limits need to be entered in order to process the classification code and display the group symbol of the soil in the fifth form.

2. 2. Visual Basic Code

The developed program classifies the soil according to the Unified Soil Classification System ASTM D2487-06 (ASTM, 1999) and determines the group symbol of the soil. The program code consists of several subroutines, which were inserted in the command buttons of the program forms. Although not being a real field application, the soil classification application was chosen, in order to represent the ability of programming complicated routines in Crossfire.

The inputs of the program are sieve analysis and consistency limits test results. In the first form, the percent passing No.4 sieve (4.75 mm) and No.200 sieve (0.0076 mm) of the soil was asked in order to decide to show the following input forms. The passing amount of soil from No.200 sieve is to be known for deciding whether the soil is coarse or fine grained. If the soil is fine grained, only consistency limits are required for classification. Therefore, only third form will be shown.

If the soil has negligible percent of fine fraction (-No.200 < 5 %), the consistency limits form (Form 3), which evaluates the fine part of the soil, will be skipped in the program. Contrarily, by passing a considerable percent of the coarse soil from No.200 sieve (-No.200 > 12%), the characterization parameters, obtained from cumulative particle size distribution curve of the soil, C_U and C_C on Form 2 are unnecessary. In the case of being 5%<-No.200<12%, the input Forms 2 and 3 are needed for classification which is presented by dual symbols.

As the inputs are set, the program evaluates the soil according to flow chart as given in Figure 4 and displays the inputs and group symbol of the soil in the last form.

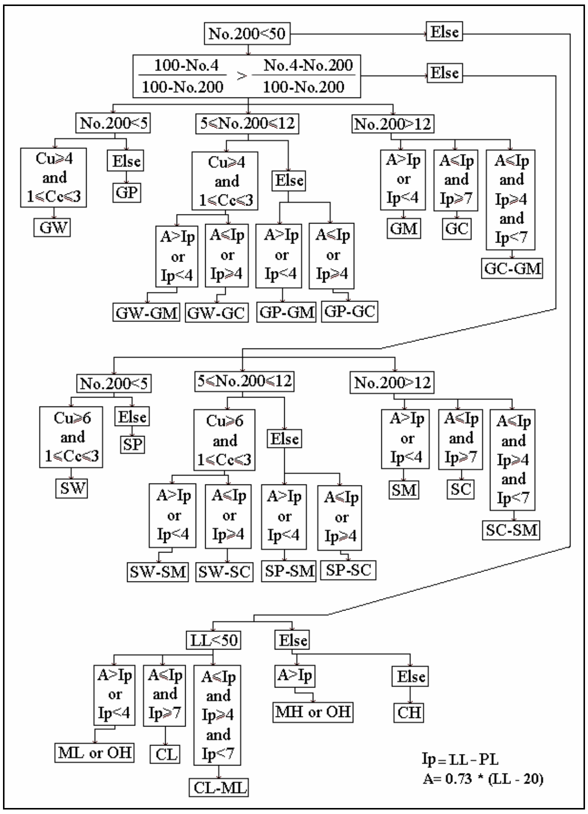

Figure 4. Flow chart of the soil classification program.

2. 3. Compiling and Deploying the Application to Targeted Mobile Device

As any usual Visual Basic application, programs can be tested and debugged right in the Visual Basic development environment without deployment. The Visual Basic project can be compiled by selecting the "Compile and validate" command from the Appforge menu. The recommendations and restrictions will be notified during this process. After validation, application can be deployed by selecting the desired platform from the "Deploy to device" menu (Figure 5).

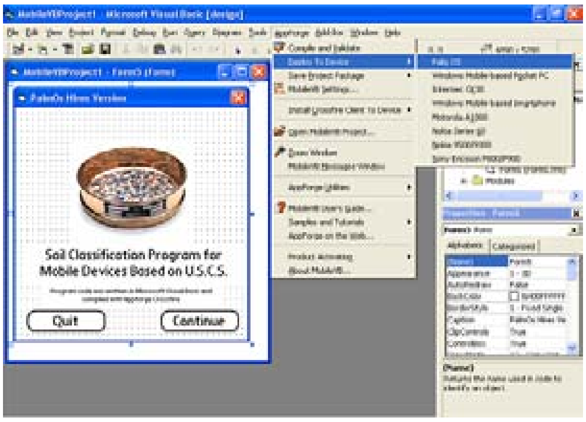

Figure 5. Deploying the application to the device.

The applications created with Crossfire need a client software present in the device. The Crossfire client consists of several individual files that reside on a particular mobile device and integrates the Visual Basic application with the desired platform. The Crossfire client application can be installed to the platforms by selecting the "Install Crossfire client to device" command from the Appforge menu. The client application is currently available for more than 400 mobile devices. The supported devices can be found at Appforge Crossfire client files list[6]. The Crossfire client file and the deployed application should be synchronized with the device or these files should be installed manually depending on the platform.

3. TEST OF THE SOIL CLASSIFICATION APPLICATION ON DIFFERENT PLATFORMS

The application was tested in the most common Symbian, Palm and Microsoft Mobile devices to verify the performance of the Crossfire development environment. Since different platforms have different screen sizes, the user interface was kept as simple as possible. In order to use exact the same programming code for different platforms, the controls (ingots) used in the user interface was kept the same for all platforms.

[6] Appforge Crossfire client files, http://scripts.appforge.com/clients/supported.asp

3. 1. PalmOS

The application was designed initially to run on a Palm OS high resolution device. Before testing the program, crossfire client and deployed application files were installed to the device via USB cable. During the tests, several inputs were made with the help of the integrated keyboard and touch screen of the device and observed that the Visual Basic application was operated faultless on Sony Clié PEG-NZ90 (Figure 6).

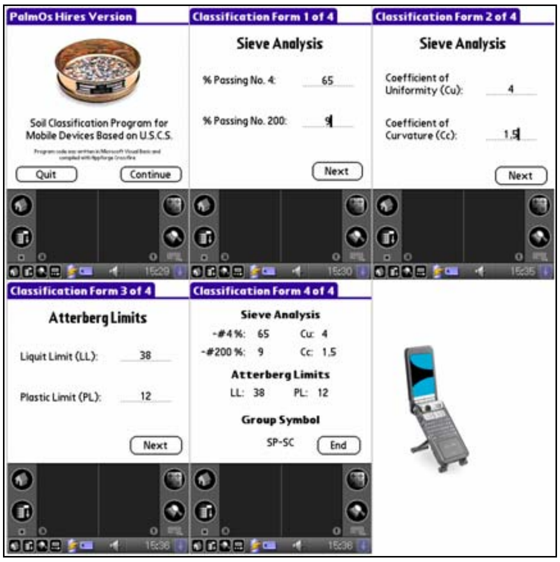

Figure 6. Visual Basic application on a Palm high resolution device.

The program code was also compiled for an older Palm (M105) with a monochrome low resolution touch screen (Figure 7). Although the relative low speed and memory of the PDA, no difference was noticed between two Palm devices.

Figure 7. Visual Basic application on Palm M105.

3. 2. Symbian Series 60

Due to the relative small screens of the Symbian 60 platform, the size of the controls and fonts was reduced to fit the user interface into the screen. The application was fully tested on Siemens SX1 for Symbian OS systems. The numerical data were inputted easily using the integrated numeric pads of the smart phone. However, text inputting is incommodious in these devices because the lack of a keyboard or a touch screen. The program operated free of error as shown in Figure 8.

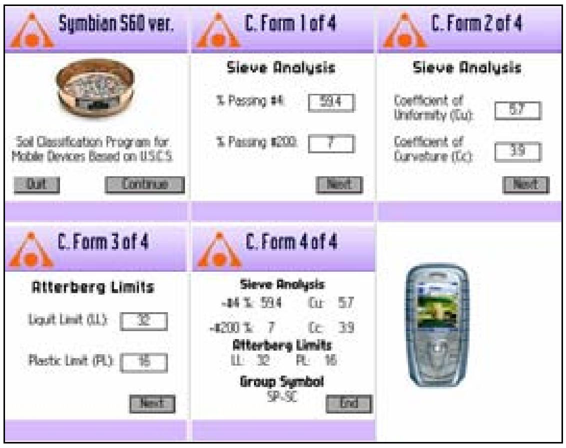

Figure 8. Visual Basic application on a Symbian 60 device.

Same files were sent via Bluetooth to the following Nokia Symbian models: 6600, 6670, 7610 and 3650. No difficulties were met during the tests on these devices (Figure 9).

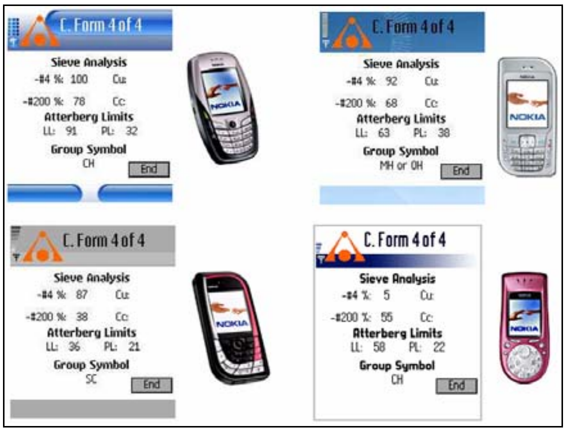

Figure 9. Testing of application on Nokia Symbian 60 models.

3. 3. Windows Mobile

The Windows Mobile segment can be grouped into two platforms, namely data-centric Pocket PC's and voice-centric Smartphones. Both operating systems are optimized and offered as a new single version with the Windows Mobile 5.0 in the third quarter of 2005. Pocket PC's are Palm-like handheld devices designed to run with a touch screen, whereas Smartphones are designed primarily for one handed usage with a numeric keypad like Symbian phones. The soil classification program was tested for Smartphones as shown in Figure 10.

Figure 10. Visual Basic application on a Windows Mobile based Smartphone (Motorola Mpx 200).

During the tests of the soil classification program on several platforms, mobile devices worked well with the Visual Basic code. Despite programming the device specific menu buttons, Visual Basic command buttons were used in the forms to maintain the congruity between the touch screen devices and smart phones. It was also observed that, the utilization of Visual Basic on mobile devices may be a good model for site engineers, who have limited computer programming knowledge.

The PocketPC and Symbian UIQ platforms were not tested. It has been recently announced that, the RIM BlackBerry platform will also be supported with the new versions of Crossfire. The Visual Basic application can be deployed to a variety of mobile devices. However, a trial period can be requested for evaluating the software. In this study, the evaluation version was used to experience the possible usage of the readily available smart mobile devices for geotechnical purposes.

4. CONCLUSION

In recent years, the smart mobile device market has seen a growing interest on global level. Most of these smart mobile devices have powerful processors and lots of megabytes of ram, which make them capable of complex processing and graphical user interface based applications. Contrary to expectations, smart mobile devices have limited usage in the geosciences, especially for the engineers in the field, because of the complexity of the software development kits and inability to program with common object oriented languages like Microsoft Visual Basic or Visual Studio.NET. In this paper a soil classification program was developed in Microsoft Visual Basic and compiled and deployed by Appforge Crossfire for Symbian, Microsoft Mobile and Palm devices. The ability to develop in a familiar language using known tools has greatly simplified the programming phase and the adaptation to different platforms. Although there are limited number of object oriented programming environments for mobile devices, Crossfire was used for their seamless integration into Microsoft Visual Basic and for the ability to deploy to all common smart mobile devices in the market.

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