A Rapid Prototyping Platform for Mobile Phone Based Services on Retail Products

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ABSTRACT

The mobile phone is set to change the way we shop in the future. Using its built-in camera to recognize the standard barcode present on virtually every product world-wide, consumers will be able to simply scan a product and access product-related information and personalized services while they are in the store. The creation of such mobile-phone based applications that provide services and information to real-world objects is currently very attractive: for prototypes, technology demos, or user studies. But even though many components of such applications and prototypes are recurring, the creation of even simple applications currently requires a lot of time and know-how – both limiting the progress and development of new mobile-phone based applications and ideas. This document introduces a rapid prototyping platform that allows for the creation of easy-to-use mobile-phone based applications based on the robust recognition of 1D barcodes on retail products – within minutes, without any sophisticated phone-programming know-how.

Keywords

Rapid prototyping, barcode recognition, mobile phones

INTRODUCTION

Today's consumer goods packaging lists a significant amount of product-related information. This includes nutritional information, ingredients, and possibly handling or recycling instructions. Some product packaging also comprise promotions with links to free song downloads or competitions. Due to the limited amount of space available on the product packaging and its static nature, the information cannot be customized for each consumer. Visually impaired people might prefer seeing allergy-related information in large print and non-natives might like to see the information in a different language. There is also a wealth of additional product-related information available that is not directly printed on the product packaging at all due to size constraints and possibly commercial considerations, e.g. reviews by consumer watch groups or price comparisons. Mobile phones have the potential to address many of these issues since they comprise display, long-range communication capabilities, processing, and user profile storage capabilities [1].
Since many of these potential applications are especially useful when being "on the go", e.g., while shopping, a

simple and fast user interaction is essential, requiring the automated recognition of objects. Even though RFID technology is very promising, the widespread use of RFID tags on supermarket products remains unlikely for at least several years. In contrast, barcodes are already ubiquitous – printed on virtually all consumer items world-wide.

Figure 1. Screen-shots of the Allergy-Check application

While there is an abundance of potentially highly useful applications for both consumers as well as companies, implementing application ideas or prototypes in this domain remains difficult. This is due to the required know-how for the optical code recognition, as well as the often intricate programming environments on such devices (e.g., Symbian C++).

In this document we present a rapid prototyping platform that tries to ease and accelerate the development of product-identification based mobile phone applications. We also describe its underlying 1D barcode recognition system that allows code recognition on standard mobile phones, using the built-in camera.

RAPID PROTOTYPING PLATFORM

Figure 1 shows screenshots of a typical application on retail products: the Allergy-Check application. It is based on the recognition of 1D barcodes. Once the user defines a profile that contains all substances he or she is allergic to, holding the mobile phone in front of a product's barcode gives the user a simple answer to the question "Is that product compatible with my allergies?".
Developing a mobile phone application like this is typically a very time consuming and tedious process. The goal of our rapid prototyping platform is to enable non-professional programmers to create mobile phone based services for

real-world objects, and specifically retail products. Our emphasis is hereby not on replacing, but on complementing existing general programming environment for mobile phones, such as J2ME or C++ Symbian, with features that enable a very easy and rapid creation of prototypes, without requiring any knowledge of mobile-phone programming or the involved technologies.
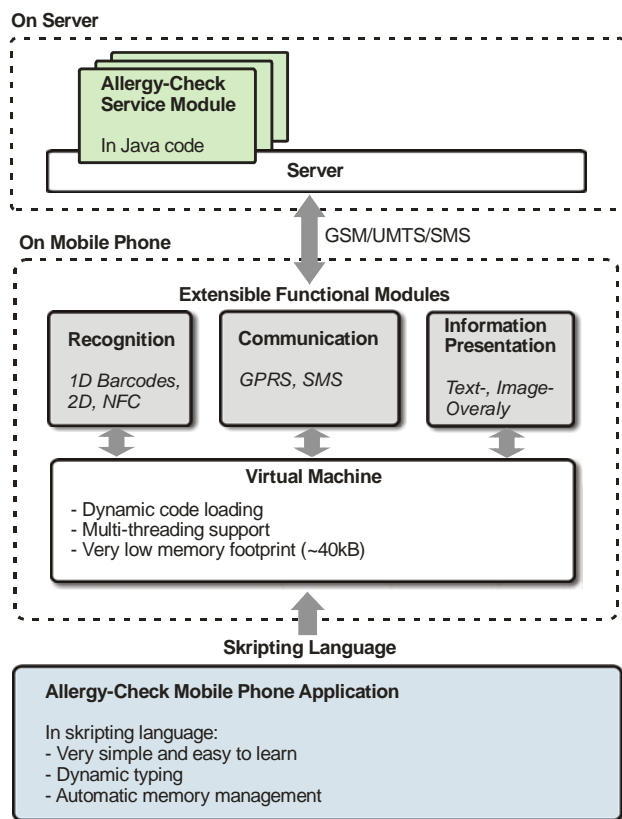

Figure 2. General architecture of the prototyping platform

The general architecture of the platform is shown in Figure 2: The mobile phone contains predefined C++ Symbian components (libraries) for the major tasks: Object recognition, communication with a remote server as well as presenting the final information to the user, e.g., using graphical overlays like those shown in Figure 1. Additional components (*functional modules*) can easily be added. Given these components, experienced C++ Symbian developers can already create functioning applications, even without knowledge about the required image recognition task. But implementing even simple C++ applications still takes a considerable amount of time and won't be feasible for inexperienced developers due to the intricacies of mobile phone development, e.g., concepts like ActiveObjects or Descriptors in Symbian, or its complex memory management and missing documentation. J2ME is more accessible, but often lacks the required APIs and speed, especially for recognizing 1D barcodes in real-time. In order to facilitate the simple and fast creation of comprehensive applications, the functional modules are

tied together with a small *virtual machine* located on the mobile phone. This allows users to write applications in a very easy-to-learn scripting language, which is then executed on this virtual machine.

Since product-related applications typically require access to remote information, we additionally provide a Java server that runs on a remote computer and manages several "services", written in Java. Creating such a service and making it easily accessible from the mobile phone is reduced to the creation of a Java class that implements a simple interface. Developing new service for retail products is thus reduced to writing code for the mobile phone application in the simple scripting language, and implementing the service on the server using Java. The developer doesn't have to worry about how to enable the communication between the mobile phone and the server on a lower level.

BARCODE RECOGNITION

The component responsible for the recognition of barcodes that is contained in the recognition module (c.f. Figure 2) is based on the Batoo-Toolkit [2]. The algorithm uses several scan lines that are laid trough the barcode, after the orientation of the code has been determined using an approach relying on an optimized version of the Hough transform. The system features certain distinct advantages compared to the existing commercial solutions for the recognition of 1D barcodes as well as proposed recognition algorithms like [3]: The recognition is robust, even under realistic conditions and is performed on the real-time video images of the mobile phone, requiring no key-presses by the user. This way the recognition is very fast and simple. Since no hardware specific features like DSP were used, the software is in general working on all standard C++ Symbian devices.

CONCLUSIONS

We presented the outline of a toolkit that has the potential to ease as well as accelerate the creation of mobile phone based applications and prototypes that are concerned with the recognition of real-world objects. In combination with the included component for the recognition of 1D barcodes on mobile phones, this allows for a simple creation of services to retail products and the fast implementation and testing of novel application ideas.

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