

Mobile phone security — in your face



By Seiji Inoue

In recent years, mobile phones have become widely used in many countries. However, these phones clearly are not just used for conversations, but also as information terminals for e-mail, Web searches, and a variety of Internet services. They also meet consumers' entertainment needs for playing games, viewing movies, watching digital TV, and a host of other functions. Currently, mobile handsets are equipped with the same functionality as credit cards and railway commuter passes. On the whole, the importance of mobile phones in daily life has been rapidly increasing.

On the other hand, the illegal use of mobile phones has also risen, and there is a growing risk that e-mail addresses and other personal information can fall into the wrong hands when handsets are lost or stolen. Mobile phones need a reliable and easy-to-use security system to be accepted by users. An identification system based on facial recognition succeeds in protecting personal information and preventing its improper use when a mobile handset is lost or stolen.

The problem with passwords

The mobile phone market is keenly interested in terminal security. Due to the risks of significant loss or damage simply from losing a mobile phone, the market needs a practical means of dealing with the problem of handset loss. Users forgo the password lock function because of the inconvenience of entering a password each time the phone is used. Most phones produced today only have the password security option and lack fingerprint recognition capability. One common element that many phones now have, a built-in camera, can be used as part of a facial recognition security system to add a user-friendly security system to existing



Figure 1

phones without adding devices. Figure 1 demonstrates how the face recognition function works when opening a mobile phone.

Software obstacles

Adding software to a mobile phone to permit using the internal camera for face sensing creates several challenges. Major carriers have requirements that programs address these roadblocks.

Requirement 1: Code size

To succeed in this market, the first challenge is whether or not the software can be loaded into the mobile phone. The program must be small enough to comfortably fit in the space available on the mobile phone. If developers want to provide usable innovations, they must work as hard as possible to reduce the size of the software. The first question phone manufacturers typically ask is, “How big is the code?”

Looking at the world as a whole reveals the wide range in evolutionary speed of mobile phones in each country. The processing speeds and program sizes required by embedded software have to be as fast and as small as possible. And when the customer is a wireless phone carrier, not a mobile phone manufacturer, the software must be suitable for installation on all mobile phones, from high-end to low-end models as provided by that carrier.

Requirement 2: Software portability

Licensed software must have the ability to operate without trouble in the operating systems and on processors used by each mobile phone manufacturer. By designing programs with a high degree of portability, program providers can offer software with no compromises in software quality. Likewise, mobile phone manufacturers considering the adoption of a particular program can perform a rapid evaluation without having to spend much on porting

costs, making the software attractive in regards to the ease of decision-making. It is necessary to perform the design work independent of I/O and memory management.

Requirement 3: Processing power

Unnecessary code must be omitted since there is never enough processor power. Ultimately, if software runs slowly or not at all, a portion may be put into assembler code, and measures must be considered to make improvements in the cache hit ratio. Having completed this, developers should consider writing the embedded software in C language as much as possible because, even if the software is partly written in assembler, it becomes necessary to perform the development work while marking comparisons with the C language-based code to discover the difference with the code optimized by the compiler. However, since the transformation into assembler depends on the processor, it is preferable for optimization to be possible in C language without any changes.

Requirement 4: Quality

Naturally, mobile phone manufacturers perform thorough testing prior to shipment to avoid the discovery of bugs after mobile handsets have been shipped. Nevertheless, bugs can still turn up even after shipment, which is why a company’s quality record is so important in this market. If the program is already in use by a mobile phone manufacturer, an objective determination can be made about the stability of the program and the quality level of the software for the time it has been used.

Market challenges and the solutions required

Effectiveness of the inside camera

Many new phones now have two cameras. An external camera captures images and videos, while the internal or *inside camera* (see Figure 2), usually located under the display, captures images to be sent during a video call. In Japan, NTT DoCoMo’s FOMA phone has become very popular, as more than 20 million people signed contracts for *TV phones* as of 2005 year’s end. However, the TV phone function in a mobile phone is actually not used that much. The challenge, then, is to find an effective use for the inside camera. This camera is provided in TV phones, but if used only for that function, it represents nothing more than a cost from the standpoint of the terminal manufacturer.

Despite the fact that outside cameras have advanced to the point that they now have resolutions of 3 megapixels, inside cameras have hardly made any progress, and still have resolutions of only about 100,000 pixels. Telecom carriers have devised TV phone services to increase revenue streams through fees, but in light of the actual situation, some mobile phone manufacturers have proposed to carriers designs in which the inside camera has simply been eliminated. In Japan, the carriers determined the inside camera specification, so the industry must find a good way to use the inside camera given this situation.

Challenges to users

In Japan, the Act for Protection of Personal Information, a law mandating measures to protect against unauthorized disclosure of personal information held by corporations,

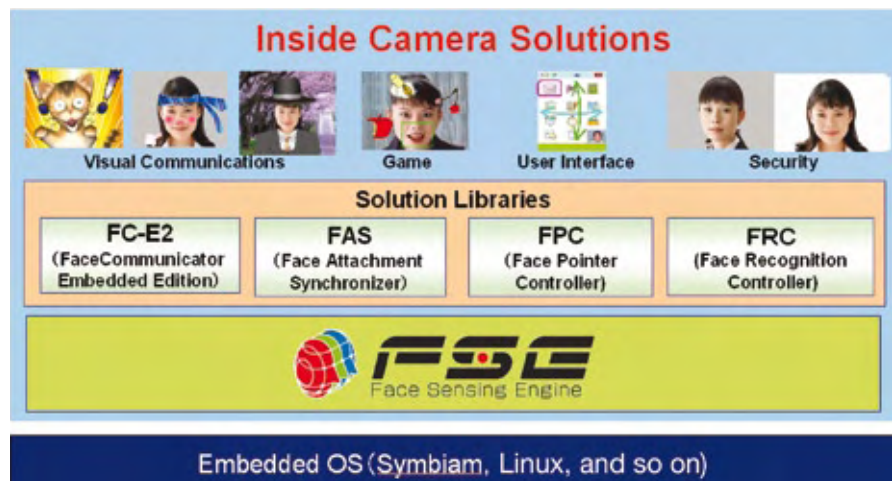


Figure 2

Using the inside camera for face recognition fulfills the need to protect mobile phone user information.

came into force in 2005. Other countries are taking note and following suit with their own legislation. The amount of customer information stored in mobile phones used for business purposes has increased dramatically. In parallel, however, mobile handsets are often left somewhere or simply dropped. Companies typically advise employees to lock their phones with passwords, but in reality, passwords are not used.

Face sensing technology for the mobile handset market

Face Sensing Engine (FSE), developed by Oki Electric, is a user authentication solution that uses face recognition technology. FSE is middleware developed to be embedded into mobile terminals to process images of individual faces. Vodafone K.K., for example, has adopted a face recognition function using facial characteristics for its 3G mobile handset, which began shipments this spring.

With the user authentication solution using FSE, entering a password becomes unnecessary, and simply looking at the mobile handset camera performs user authentication, as shown in Figure 1. Once the owner of the handset has been verified, all the internal data in the handset can be accessed, and phone calls can be made as well. But, the handset will be locked if it is determined that the individual attempting to use the phone is not registered as the owner. The handset will be locked, the internal data cannot be accessed, and calls cannot be placed.

This is far more convenient than access control by means of passwords, and puts into users' hands mobile phones offering a far higher degree of security than today's phones, in which the password lock mechanism is not actually used. Using the inside camera for face recognition fulfills the need to protect mobile phone

user information and creates a viable use for inside cameras of mobile handsets provided by carriers.

FSE is not simply an application program; it is also a collection of image recognition algorithms. Developing these algorithms while maintaining the technical requirements made implementation quite a challenge. The designers had to meet the goal of developing an algorithm that would perform face recognition processing 10 times per second, using a processor with a clock speed of just 100 MHz.

However, one may ask about the verification accuracy of FSE. Mobile phone manufacturers and carriers want to know how it compares with fingerprint recognition. They worry that a photograph can be used to trick the system, and some carriers have therefore declined to adopt the technology. Currently, many researchers are studying facial recognition technology, and they would probably say the same thing. But, users are not even locking their phones by using passwords, so compared to the present state, the use of FSE would represent a major increase in security without changing the way people actually use their mobile handsets. Anyone who, for malicious purposes, wanted to gain access to the contents of a mobile phone belonging to someone else would, in the process, have an incriminating photo of his own face recorded on that phone. Figure 3 shows a screen currently under development that verifies facial images.

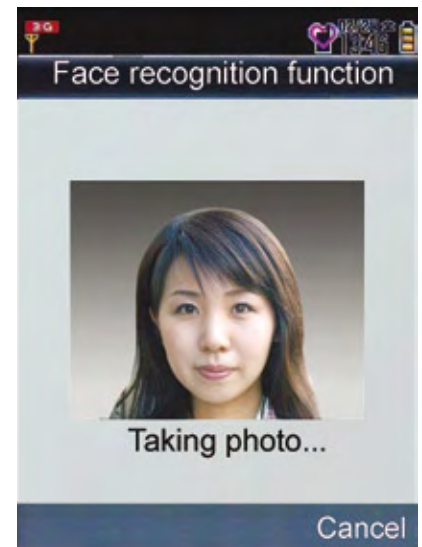


Figure 3

Implementation of FSE

FSE is positioned as a core platform of *Inside Camera Solutions*. Through this middleware, which provides face recognition functionality, a user verification solution can readily be achieved. FSE also offers a variety of auxiliary functions including facial location detection within the image, detection of characteristic feature points, and point-tracking functions. Thus, it provides a wide range of solution possibilities from security to games through the combined use of the solution library provided in the upper layer of FSE.

For instance, FaceCommunicator generates an animated image reflecting the facial expressions of the user in the form of a real-time 3D animated character that moves as the speaker's face moves when in TV phone mode. This gives peace of mind when the user wants to have a conversation without showing his or her face or the background. By making good use of the inside camera of the mobile handset, FSE offers a practical solution both for handset manufacturers and users.

As the trend toward using phones for personal information intensifies, phone manufacturers and carriers are discussing the concept of the *mobile wallet*. Security thus will play an ever-increasing role in whatever applications we choose in the future. **ECD**

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