



MBARK

MULTIMODAL BIOMETRIC APPLICATION RESOURCE KIT

2149
42675491
7168472
47581917
184915768
849797536
419414651
39147621
76819712
519728172
685491548
419872678
31985491
21879517
57278126
5742764
5147641
7641756
115172
8179179
1756712
9175984



National Institute of
Standards and Technology
U.S. Department of Commerce

Once a tool primarily used by law enforcement to help identify criminals, biometric technologies increasingly are being used by government and the private sector to authenticate a person's identity, provide security at the nation's borders and restrict access to secure sites—both buildings and computer networks. New software and other tools that can be used to help build improved biometric applications are now available from the National Institute of Standards and Technology (NIST).

Most biometric systems are "unimodal," meaning they rely on a single distinguishing physical characteristic—such as a fingerprint—for authenticating identity. However, using a single feature can present problems. Poor illumination can make a face image unrecognizable; dirty or damaged sensor plates can affect fingerprint equipment. A multimodal system that has several sources of informa-

tion, including fingerprint, face, and iris data, can be more flexible and reliable. However, most biometric equipment, including the sensors that capture data and the database that stores the information, is not interoperable. Organizations must either purchase a complete system or develop "middleware"—custom integration software—to link together applications.

Despite existing efforts, building modern biometric applications (or "clients") that are flexible with respect to these problems—changes in sensors, workflow, configuration, and responsiveness—remains both difficult and costly. The **Multimodal Biometric Application Resource Kit**, or **MBARK**, reduces the complexity and costs of implementing such an application. MBARK is public domain source code that may be leveraged to develop the next generation of biometric and personal identity verification applications.

Incorporating the MBARK libraries can yield a variety of enhancements critical for the success of any real-world system. For example, MBARK provides a usability-tested and consistent user



MBARK represents a ready response to the *National Biometric Challenge* of developing middleware techniques and standards that will permit “plug-and-play” capabilities for biometric sensors. This Challenge was issued by *The National Science and Technology Council’s Subcommittee on Biometrics & Identity Management*.

interface. MBARK provides operators the means to quickly recover from both minor mistakes and major hardware failures. In addition, the use of Extensible Markup Language (XML) facilitates true sensor interoperability via plug-ins and allows for changes in workflow on-the-fly.

The following are just some of the features of MBARK that make it robust and flexible with respect to changes in sensors, workflow, configuration, and responsiveness.

Provides a consistent user interface

Often biometric systems change interfaces depending on which sensors are being used. MBARK, however, provides a consistent and user-centered interface, reducing errors and minimizing the need to retrain users as vendors develop new sensors and software. User-centered design is a formal process that helps ensure the efficiency, effectiveness, and user-satisfaction of a system throughout the system’s lifecycle.

Allows users to recover quickly and easily from mistakes

Significant costs may accompany any system that does not allow recovery from both common and uncommon mistakes. With MBARK, an operator may not only easily recover from mistakes, but may also save a snapshot of a session (in the form of an XML file), allowing that session to be re-loaded at a later time.

Provides flexible user configuration

The workflow of a system is the logic that defines the order in which things happen. Typically, biometric clients have a fixed workflow—for example, a right index fingerprint is always followed by a left index. A fixed workflow means that the tasks to be performed can never be changed.

Alternatively, a highly configurable biometric client empowers users to define and experiment with various biometrics and workflows. With the workflow described in its XML files, MBARK allows users to define precise custom workflows specifically tailored to their needs.

Adjusts workflow automatically

Defining a workflow that accommodates mistakes becomes more complex as "edge cases" are added. For example, how should the system behave if a fingerprint sensor detects that a finger is missing, but the operator has not indicated such? MBARK will warn the operator if it detects a conflict between what was expected and what was captured.

Multitask whenever possible

Users expect modern applications to be responsive to their input at all times—during initialization, startup, capture, task editing, and so on. How does a user distinguish between a long-running operation and a system that is simply "frozen"? MBARK uses a natively multi-threaded architecture to allow as much "background" processing as possible. For example, for some sensors, initialization can take up to 30 seconds. MBARK will initialize sensors simultaneously. Applications that don't do this force the user to wait for each sensor in turn.

Provides true sensor interoperability

MBARK uses a plug-in style mechanism that allows true sensor interoperability based on a unified application programming interface (API). This common digital interface has been used to successfully integrate face cameras, fingerprint scanners, and iris sensors. To add a new sensor to MBARK, developers only have to write the code necessary to communicate with that particular sensor. All of the user interfaces, workflow logic, and 'plug-and-play' capabilities are written already.

Open and free

MBARK source code is public domain. This means that anyone is free to modify MBARK for their application with minimal commercial and intellectual property restrictions.

RELATED PROJECTS AND CAPABILITIES

The following is a list of related projects and capabilities that are under development within the NIST Biometric Clients Lab.

The first two projects, the **Adaptive Sensor Testbed** and the **Biometric Clients Configuration Language (BiCCL)** have general applicability to multimodal biometric systems. The second two projects, **NBIS.Net** and the **Data Interchange Code Generator**, are more focused towards the multimodal biometric application developer.

Adaptive Biometric Client Testbed

The NIST Biometric Clients Lab has initiated research into biometric systems that automatically adapt to a user's need. The basic concept of an adaptive client is straightforward. First, as a user approaches the biometric sensors, a signal is sent to the system that indicates a user's desires or requirements. Then, the system acts on that signal, enabling or disabling various features based on those user requirements. By the time the user is ready to present their biometrics, the system has been automatically configured in a personalized fashion.

Biometric Clients Configuration Language

The Biometric Clients Configuration Language (or BiCCL) is a simple, domain specific language for describing biometric client configurations and workflows. The Biometric Clients Lab has developed a compiler that transforms BiCCL into an MBARK XML configuration file, which greatly simplifies the configuration of any MBARK-based system.

NBIS.Net

NBIS.Net is the Biometric Clients Lab proof-of-concept interoperability layer so that the NIST Biometric Image Software (NBIS) tools can be efficiently called directly from the .NET runtime (i.e., — no inter-process communication or file system interaction is required).

The NBIS project is a suite of public domain biometric libraries and applications. It includes (a) a neural-network based fingerprint pattern matcher, (b) a fingerprint minutiae detector, (c) the NIST Fingerprint Image Quality (NFIQ) metric, (d) a reference implementation of the ANSI/NIST-ITL 1-2007 *Data Format for the Interchange of Fingerprint, Facial, Scar Mark & Tattoo (SMT) Information*, and (e) JPEG 2000 and WSQ image compression and decompression algorithms.

Data Interchange Code Generator

The NIST Biometric Clients Lab is currently developing a tool to automatically generate class libraries for use in reading and writing biometric information in the ANSI/NIST-ITL family—ANSI/NIST-ITL1-2000, *Electronic Fingerprint Transmission Specification (EFTS)*, ANSI/NIST-ITL-2007, *Electronic Biometric Transmission Specification (EBTS)*, or any ANSI/NIST customized application profile. The tool can generate code in any language for which a custom 'codec' is written.

For comments, questions, or inquiries (including source code), please contact mbark@nist.gov.

Although it is being developed at NIST, MBARK is sponsored by the Standards Portfolio of the Department of Homeland Security's Science and Technology Directorate.

NIST has recently completed a handbook that provides an overview of the user-centered design process, along with examples of how the process can be specifically tailored for biometric systems. This 75-page handbook can be downloaded from NIST Biometrics Usability project homepage, <http://zing.ncsl.nist.gov/biousa/>.

MBARK was developed at NIST by employees of the Federal Government in the course of their official duties. Pursuant to Title 17 Section 105 of the United States Code, this software is not subject to copyright protection and is in the public domain. NIST assumes no responsibility whatsoever for use by other parties of its source code or open source server, and makes no guarantees, expressed or implied, about its quality, reliability, or any other characteristic.

Specific hardware and software products identified in this open source project were used in order to perform technology transfer and collaboration. In no case does such identification imply recommendation or endorsement by NIST, nor does it imply that the products and equipment identified are necessarily the best available for the purpose.

**Biometric Clients Lab
Image Group
Information Access Division
Information Technology Laboratory**
mbark@nist.gov
<http://mbark.nist.gov>