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Inmate Tracking

With Biometric and Smart Card Technology

By Sanford Seymour, Richard Baker and Michael Besco

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Across the country, new technologies are playing an increasingly important role in correctional institutions as a means to address critical health, safety and security issues. Recently, the National Institute of Justice (NIJ) and the U.S. Navy partnered to explore the feasibility of applying a combination of biometrics, and "smart card" tracking technologies to the difficult, high-priority requirement of monitoring inmate and staff locations within correctional facilities. An expanding prison population, with resources that are not keeping pace, has motivated administrators to explore practical and cost-effective technical solutions to this problem. However, in the real world of penology, there are many ethical, legal, safety and economic issues that must be considered, along with the important question of whether new technology can be integrated into a correctional environment.

Correctional administrators have been slow to embrace new technology, in part, because new systems sometimes are unreliable, difficult to maintain and exhibit high life cycle costs. Through a program sponsored by NIJ — Staff and Inmate Monitoring (SAINT) — the Navy's Space and Naval Warfare (SPAWAR) System Center in Charleston, S.C., (SSC-C) will systematically address these issues through continual development, testing and evaluation of a prototype system in a realistic prison setting — the Navy Consolidated Brig in Charleston.

Enabling Technologies

Biometrics, the automated recognition of a person based on unique physiological or behavioral characteristics, such as fingerprints, speech, face, retina, iris and hand geometry, is regarded as a highly reliable means of identification. A smart card is a credit card-size device with bar codes, a magnetic strip and an integrated circuit chip. It is capable of storing identity information, biometric templates or other data, such as medical and financial records, and transactions. It is a single-source data system that can include some aspect of the cardholder's physiology. When a biometric reader makes a physiological measurement of an individual and compares it to the information on the smart card in the person's possession, it provides a completely reliable determination of location and identity.

It also is feasible to configure a smart card with an active or passive device that can be sensed by detectors placed at strategic locations within the facility. If the data sensed are unique to a specific card, then the location of the card and its holder can be tracked. This tracking technology complements the positive identification provided by the biometric readers at the entries to major areas by providing supplementary in-transit data. Detectors colocated with the biometric readers can sense unauthorized attempts to bypass them as well. Tracking technology also includes a means of consolidating the sensed position and identification information for each inmate and comparing it to authorized locations and movement schedules.

There are a number of reasons for integrating biometrics and smart card technologies in a correctional environment. While it is possible to store the physiology data for all inmates and staff on a central computer rather than the smart card, this requires a time-consuming search of the entire database each time a biometric measurement is made. When data are stored on the smart card, a fast one-to-one match or rejection can be executed at a station reader. This feature also provides more flexibility because the card is portable and also may be used with non-networked biometric readers for other functions when positive identification is required. Coupling tracking technology with the smart card makes sense for additional reasons. As a form of identification, the card is unobtrusive and does not violate an inmate's limited privacy rights. And it can easily be incorporated into a correctional facility's standard operating procedures.

Evaluation Environment

The Navy Consolidated Brig is an excellent prototype demonstration site due to its colocation with SPAWAR and its willingness to host new technology demonstrations. The brig currently is modernizing its existing security systems into an integrated, leading-edge command center. It will contain touch-screen displays, fiber optic communications, programmable logic controllers, and supervisory control and data acquisition (SCADA) software designed to efficiently deploy available manpower. These technologies provide an ideal test environment for the SAINT program.

The objective of the SAINT demonstration at the brig is to evaluate the ability of an inmate tracking/scheduler application to provide the 24-hour, year-round location of inmates within designated areas of the facility. The tracking/scheduler application will accept biometrics, smart cards and radio frequency (rf)-identification tags as inputs and each of these technologies will be evaluated for practicality and effectiveness in various applications throughout the brig. The system is intended to eliminate duplication and paper passes, while assuring that designated inmates follow only preauthorized routes within allotted time frames to approved destinations. The goal is to reduce time and manpower to process passes and physically account for inmate location more accurately.

Concept of Operations

The operational concept for the initial prototype demonstration includes maintaining the authorized location and scheduled movement of each inmate in a central computer. Existing brig scheduler software will be interfaced to the prototype module and pass scheduled movement time, transit points and in some cases, the transit path to a central computer. Approved unscheduled movements may be entered by staff from any one of multiple, distributed display/entry stations located at key points throughout the facility. Alerts will be triggered and displayed to staff at the origin and destination points when scheduled movements are not initiated or transit times are exceeded.

Input by an inmate at a biometric station initiates the movement process, which is verified by a tracking sensor. Inmate status is logged and displayed as "in-transit" at display/entry stations. The computer then tracks elapsed time and the inmate's position is updated via several en route sensors. Failure of an inmate to depart/arrive at prescribed biometric stations triggers an alert at applicable display/entry stations. When standard operating procedures are followed, staff at any of the display stations can quickly access the location of each inmate throughout the facility. Discrepancies are automated, therefore, unauthorized movements will be far easier to detect and validation of inmate locations will be faster and less staff-intensive.

Technology Evaluation Plans

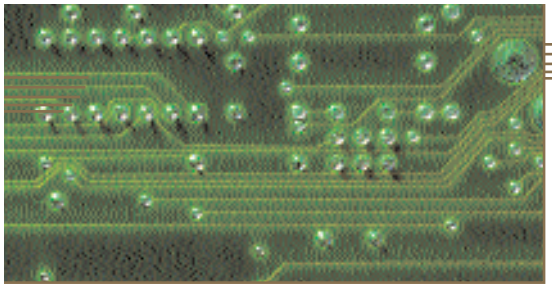
SAINT prototype development, evaluation and demonstration will be conducted in phases, wherein each successively more capable system builds on the one that preceded it. At the beginning of each phase, specific goals based on defined NIJ and local brig needs will be established, along with the criteria for evaluating performance and utility.

One technical goal of the SAINT program will be to determine which of the several types of biometric sensors are most suitable for different areas within the facility (e.g., holding cells, visitation centers, work and production areas, training classes and in-out processing spaces). Specific sensors to be tested include:

- Fingerprint readers that process a fingerprint image that is converted to a mathematical template based on minutiae points that define ridges, splits and end lines. The template is encrypted and compared to an encrypted fingerprint template stored on the smart card.
- The hand geometry reader is a device with five fixed pegs attached to a screen. When the hand is placed within the area defined by the pegs, the reader produces an image of the hand geometry. Ninety characteristics derived from the image (including three-dimensional shapes, length and width of fingers and shape of the knuckles) are compared to the features prestored on the smart card.
- Facial recognition uses a digital camera to capture a facial image. The digital image is analyzed and compared to the digital image on the smart card. Comparison points include the distance between the eyes and nose and the location and shape of cheekbones. The program compensates for glasses, beards and hats.
- Iris recognition is similar to the process of facial recognition as a video camera is used to produce a digital image that is converted to a code. The code is encrypted and compared to a stored image encrypted on the smart card.
- A voice verification device measures the cadence, pitch and tone of a specific phrase spoken by the subject and compares the results to encrypted data stored on the smart card.

A second goal will be to evaluate different types of tracking technologies and determine which are most compatible with the biometric smart card concept. The best candidate will be incorporated into the prototype in Phase 2 of the demonstration.

Initially, a very limited demonstration of the utility of the biometric smart card will be conducted. SPAWAR will configure the brig command center with the capability to track, store and display inmate loca-



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tion information electronically and integrate the existing scheduler into the tracking software. Eight different biometric devices will be rotated and tested in eight locations within the compound. The proposed areas include: housing, receiving and release, medical, clinical, inmate cafeteria and brig control center. At the end of a current six-month effort, SPAWAR will evaluate the prototype system against the existing inmate tracking procedure. Use of the various biometrics sensor types will be evaluated for the specific application that each area of the facility represents. Parameters to be considered include ease-of-use, false accept/reject rates and throughput.

From information gathered during the initial evaluation, additional brig locations will be included and evaluated for suitable tracking locations. In addition, SSC-C will explore the possibility of integrating the current brig's scheduler software system into the tracking system software. Another activity will be to examine the use of smart card proximity readers to further refine the accuracy of the tracking system. As inmates move through a facility, proximity readers can identify and transmit specific location information to the central database. During a future two-month evaluation, the brig will exercise the system in parallel with current methods and evaluate the system against the predetermined evaluation criteria.

In a follow-on effort, the prototype can be used to examine the feasibility and use of extending biometric/smart card technology to applications beyond inmate tracking. These could include its use in a paperless money system for inmate fund accounts, inventory control and a digital logbook with electronic signatures. Once the basic technology has been proved, it seems certain that many future applications will emerge.

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