

I-Cube Face Recognition Solutions For Stadium

INTEGRATED INTELLIGENT IMAGING

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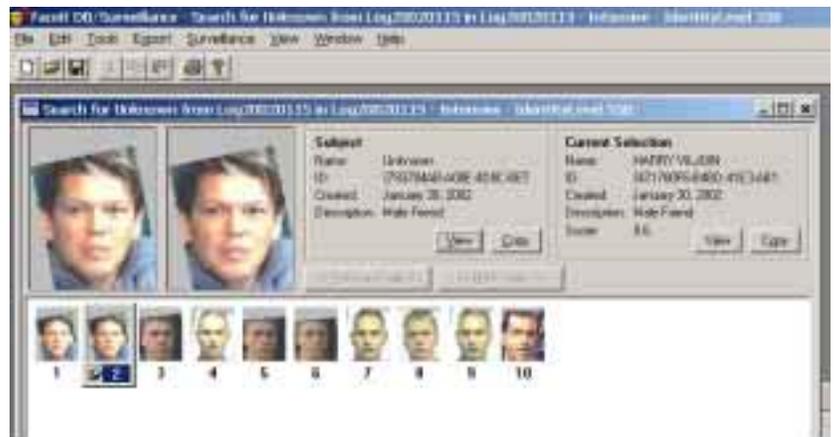
INTRODUCTION

This document presents ideas on improving stadium security and possible implementations of the I-CUBE Face Recognition System within stadium as a part of a comprehensive security solution to neutralize any threats to stadium.

Biometrics based on face recognition

has an intuitive appeal because computers look to the face to “recognize” individuals as humans do.¹ These systems rely on mapping key facial features such as eyes, nose, mouth, etc. and registering measurements of these features themselves and/or the relative positioning of these features *vis à vis* each other.²

Face recognition technology is no longer a fanciful notion from science fiction. It is now a mature technology, and its time has come. It can be an effective tool in making our stadium safe, and the cost of implementation is not extravagant relative to the damage and loss of income in attacks on referees, players, security personnel or crowds.



¹ By this I only mean that we as individuals naturally look at other's faces to recognize them, not their fingerprints, retina's, etc. The exact mental processes that we use as individuals to “recognize” a face may of course be far different from the algorithms used by electronic face recognition technologies.

² See MIT Media Laboratory Vision and Modeling Group, “Face Recognition Demo Page” available at <http://whitechapel.media.mit.edu/vismod/demos/facerec>; ASHBOURN at 56-59.

IMPLEMENTING FACE RECOGNITION TECHNOLOGY IN STADIUM

I-CUBE's Face Recognition System is an advanced face recognition system capable of fulfilling all biometric security needs relating to identity authentication, controlled access, and surveillance. It provides unparalleled verification and identification, true scalability, easy integration, and easy maintenance. The I-CUBE Face Recognition System can be implemented as a stand-alone solution, or integrated with existing security solutions. It requires no proprietary hardware.

While most biometric technologies can provide reliable identity authentication, some are more suited to the stadium environment than others. In designing a comprehensive stadium security solution, it is important to determine first what demands will be placed on the biometric technology. From this information, we can then determine the appropriate type of biometric, and, finally select the appropriate technology from the appropriate vendor.

One of the keys to effective security is keeping human intelligence in the loop. It is also the key to finding the correct balance between concerns over public safety and concerns over personal privacy. One noted privacy advocate has said that we must “guard against an over-reliance on technology”.³



³ Ann Cavoukian, [Public safety is paramount – but balanced against privacy](#), September 21, 2001. Ms. Cavoukian is Ontario's Information and Privacy Commissioner.



IMPLEMENTATION SCENARIOS

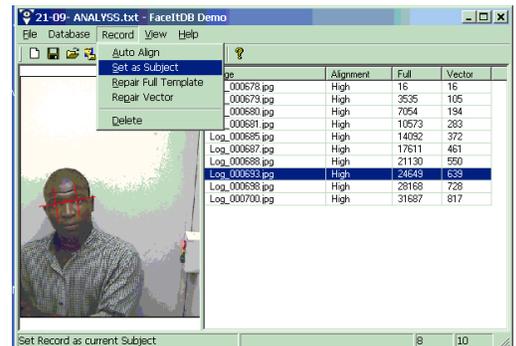
1.1 FACE RECOGNITION REQUIREMENTS

The requirements for a stadium face recognition system are:

- A computer or laptop (min. P2 300 MHz with 64 MB ram).
- High-end frame grabber and image capture software.
- A high-resolution dome camera to capture images of faces from the stadium crowd.
- A fixed digital camera to capture images of people that are being evicted.



1.2 SUGGESTED PROCEDURES



1 – Control room operator is alerted via phone, radio or sees that a person is being a problem in the crowd.

2 – Control room operator takes control of the dome camera and zooms into the area and starts recording the events.

3 – Finds the key instigator, and zooms in and takes a picture of their face.

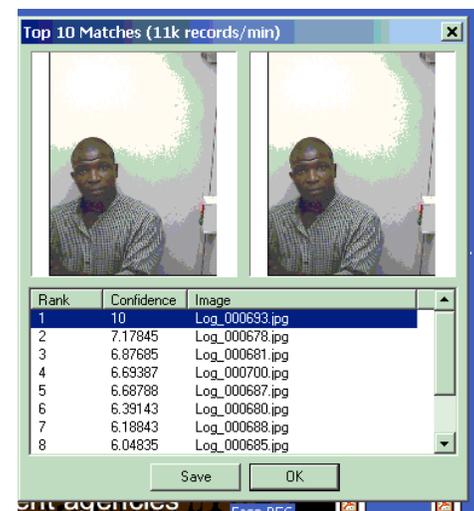
4 – This image of the potential troublemaker is compared automatically against the SA stadium database of know troublemakers.

5 – If a match is found security is informed and a decision can be made to watch the person or possibly to evict the person at half time.

6 – While the operator is watching a person throws a beer onto the field. This is a removal event, so operator calls security removal team, detailing place, dress and watches if the person moves.

7 – Security removal team take person in custody and evicts him from stadium. Just before evicting they take a picture of the person, with name, address etc. for addition into the SA stadium database of know troublemakers.

8 – The entire event is recorded in case there is any possible problem, resistance and for review of any possible problems.



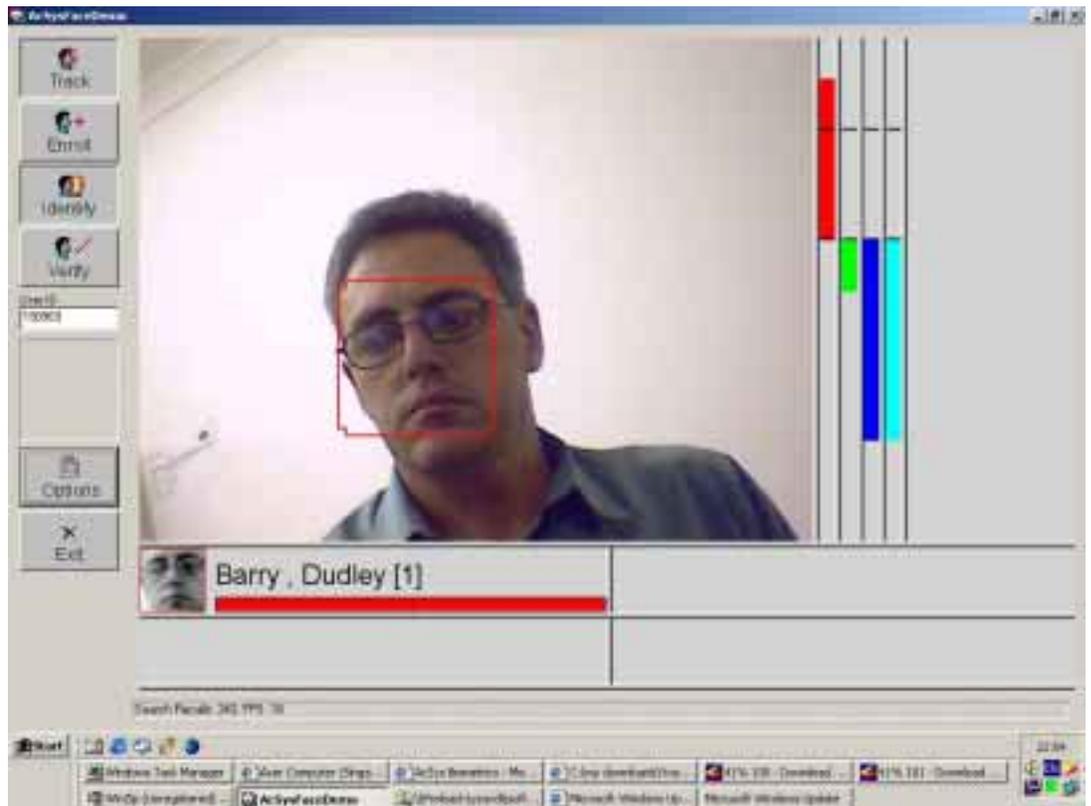
1.3 INTELLIGENCE GATHERING

The audit trail left in the I-CUBE Face Recognition System logs by an individual, as he or she is identified by biometric authentication could become a significant contribution to intelligence systems. For example, an intelligent, automated database system could send an alert to appropriate authorities if it detects a number of suspect individuals who show up in the same city at the same time.

I-CUBE Face Recognition System can log events and transmit them to appropriate data stores, but the key to this use of face recognition lies in the development of comprehensive, shared, intelligent, watch list databases. Such databases would be repositories for both automatically gathered intelligence and human intelligence. While the development of such databases with “data mining” capabilities is outside the immediate scope of biometric authentication and other procedural

initiatives, it is clearly the key to making such initiatives work to their full potential.

In this scenario, I-CUBE Face Recognition System is an enabling technology.



1.4 SURVEILLANCE SCANNING

I-CUBE Face Recognition System is adept at scanning faces in a crowd, and each instance of the software can track up to four faces simultaneously. We believe that our system can fulfil the requirements for face-in-a-crowd surveillance better than most, because it can track multiple faces at once, and does not need to retain images of people it does not find on a watch list, therefore posing no restriction to the individual's freedom of movement, unless that individual is a security threat. I-Cube Face Recognition System learns as a human does, and it is even better than a human at forgetting what is not relevant.



1.5 IDENTIFICATION MODE

Identification occurs when the individual provides only biometric input and the system compares that biometric input against all images on record to determine the individual's identity. This is a "one-to-many" face recognition system, because they compare a biometric sample representing one individual to many images in order to authenticate the user's identity. A good frontal image of the faces of persons to be identified needs to be captured by the systems' cameras in order for the matching process to work.⁴ Further, the faces of those individuals whom we would like to protect ourselves from – *e.g.*, pick pockets – must be entered into the system prior to any matching process.⁵ But, in many cases we will not have a good frontal image of the suspect's face until that person has been caught, photographed and removed from the stadium. If a picture is taken of every person removed from the stadium a database against which to search can be generated.



⁴ See *supra* note 22; see also ASHBOURN at 56-59.

⁵ See ASHBOURN at 56-59.

1.6 FEATURES AND BENEFITS

I-CUBE Face Recognition System offers the following features and benefits:

1. **Race Independent:** I-CUBE Face Recognition System is completely race independent and therefore eliminates any risk of racial profiling.
2. **Enrollment of Additional Images:** I-CUBE Face Recognition System allows the addition of images to an existing template to reflect changes brought about by aging, eyewear, beards, and other cosmetic differences, without increasing size of template.
3. **Proven FAR:** In the International Biometric Group's *Round Three Comparative Testing for IT Security and E-Commerce, Final Report*, I-Cube Face Recognition System scored 0% on False Acceptance Rate (FAR) meaning that it caught all impostors.⁶
4. **Recognition at Wide Angles from Frontal:** I-CUBE Face Recognition System is better able to recognize faces over a broad range of angles.
5. **Three Dimensional:** I-CUBE Face Recognition System is the uses 3 dimensions, it sees the whole face and does not merely measure contour lines, points, or distances.

Biometric security is no longer a fanciful notion from science fiction. With I-CUBE Face Recognition System and HNeT, face recognition technology comes of age.

CONCLUSION

Biometric security is not a silver bullet, but the capabilities provided by I-Cube Face Recognition System can be critical and effective pieces in an effective security solution that also includes improved procedures, better human intelligence, and local and remote monitoring by intelligence and security operatives.

I-CUBE Face Recognition System represents a substantive advance over earlier face recognition technologies based on Eigenface/Principal Component Analysis (PCA) and Facial Metrics/Local Feature Analysis (LFA). While these earlier technologies take a mechanistic approach to the problem of face recognition, I-CUBE FRS takes a holistic approach, much as you or I do when we recognize the face of a friend or co-worker.

Feature for feature, I-CUBE FRS compares favourably with other face recognition systems. If you allow us to demonstrate this truly revolutionary biometric authentication technology for you, we believe you will share our enthusiasm.



⁶ Performance metrics are derived from Round Three of International Biometric Group's Comparative Biometric Testing performed in 2001. Visit www.biometricgroup.com/study for details on testing methodology and information on obtaining complete results.