

IDEAL BIOMETRICS

- Twofold accuracy
 - Never accept unauthorised persons (FAR)
 - Never reject authorised persons (FRR)
- MUST be
 - Unobtrusive
 - Intuitive (easy to use)
 - Readily accepted;

Cost Effective

Objective : Security + Functionality ! (& cost)

Facial Recognition

What is facial recognition?



- ! Face recognition is a non-intrusive, biometric method of matching a given face to a database of faces.
- ! Can be used to secretly identify one or many persons against an image database
- ! Can be used to identify a possible shop lifter / thief / suspect against an image database

Face Recognition

Applications

- Biometric authentication for credit cards, passports, drivers licenses
- Time and attendance/business security
- Prison security
- Border monitoring
- Automatic identification for government agencies
- Home security
- Hotel and casino security
- E-Commerce
- ATM machines



WHY FACIAL?

Casino Exclusion Technique Exploration

- Framework Development

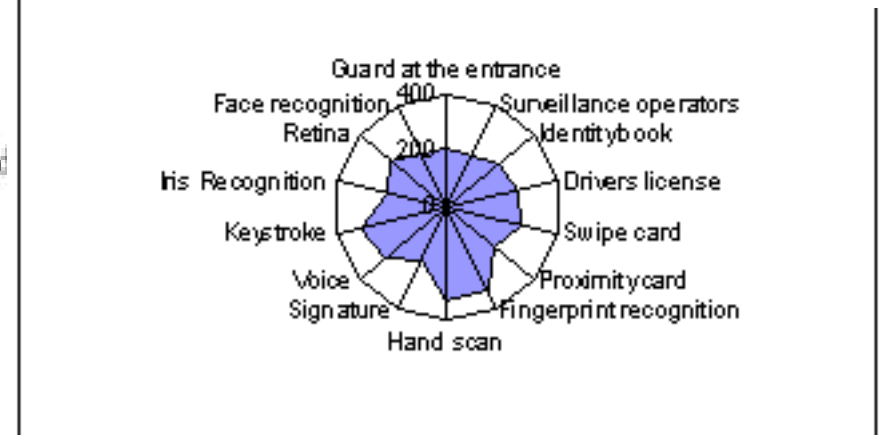
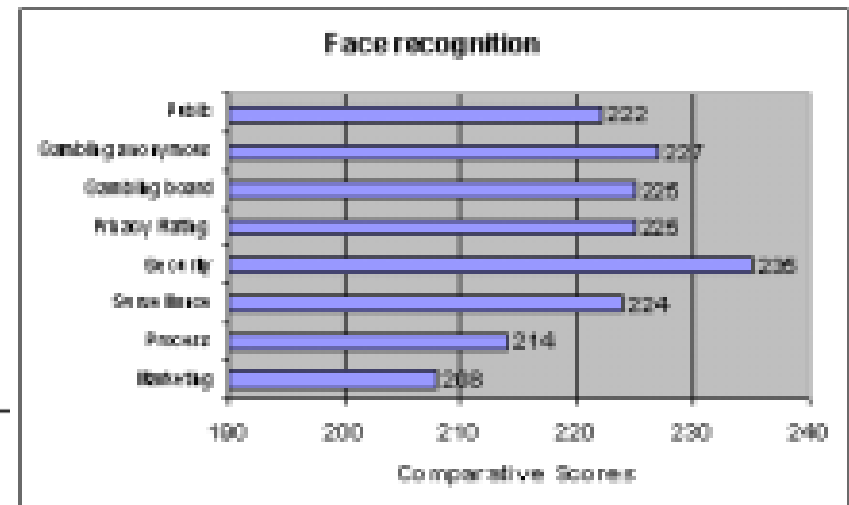
80%

B. T. DUDLEY MSc (Image Analysis, UNP, Cum Laude)

882207268

Submitted in partial fulfilment of the academic requirements for the d
MASTERS IN BUSINESS ADMINISTRATION

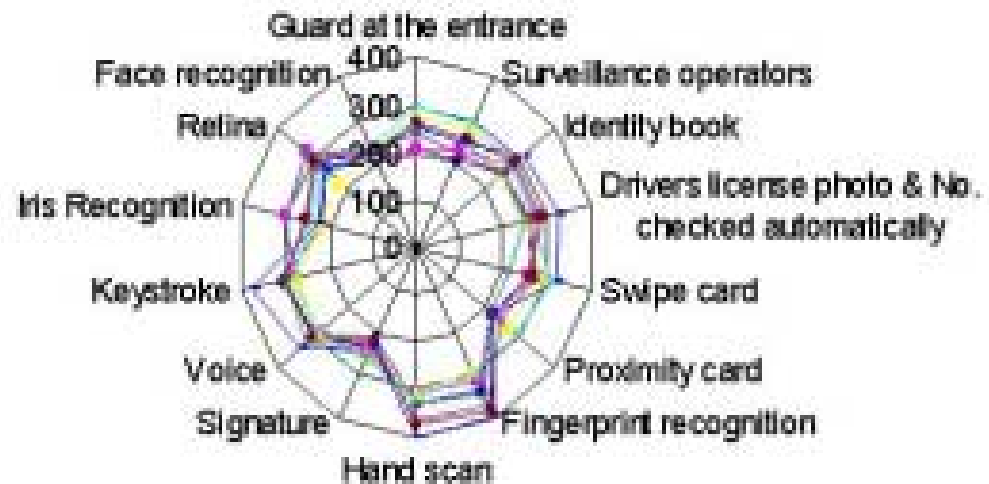
Graduate School of Business, Faculty of Management
 University of Natal (Durban)



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 Send an e-mail to:
MBA@I-Cube.co.za
 A 2 MB file will be sent to your e-mail address

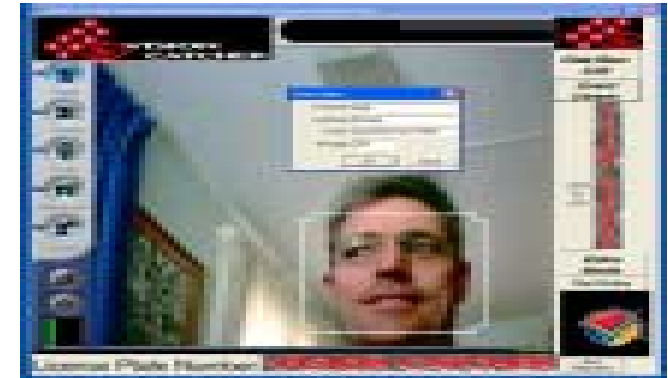
Exclusion techniques rated by role players



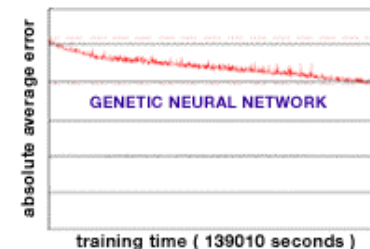
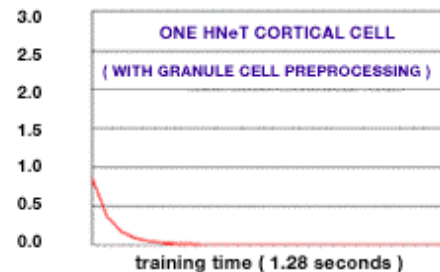
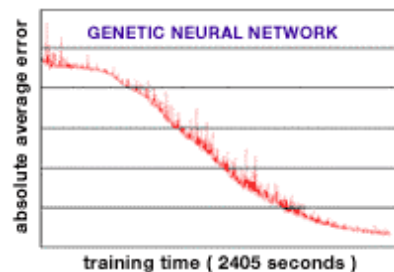
FRS

Facial Recognition System

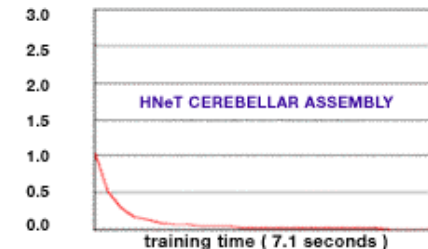
Unique differentiation



- 3D & HNet (Holographic quantum neural technology) automatic continuous learning
- Adjusting for difference due to aging and cosmetics without increasing the size of the biometric template



The Monte Carlo Test



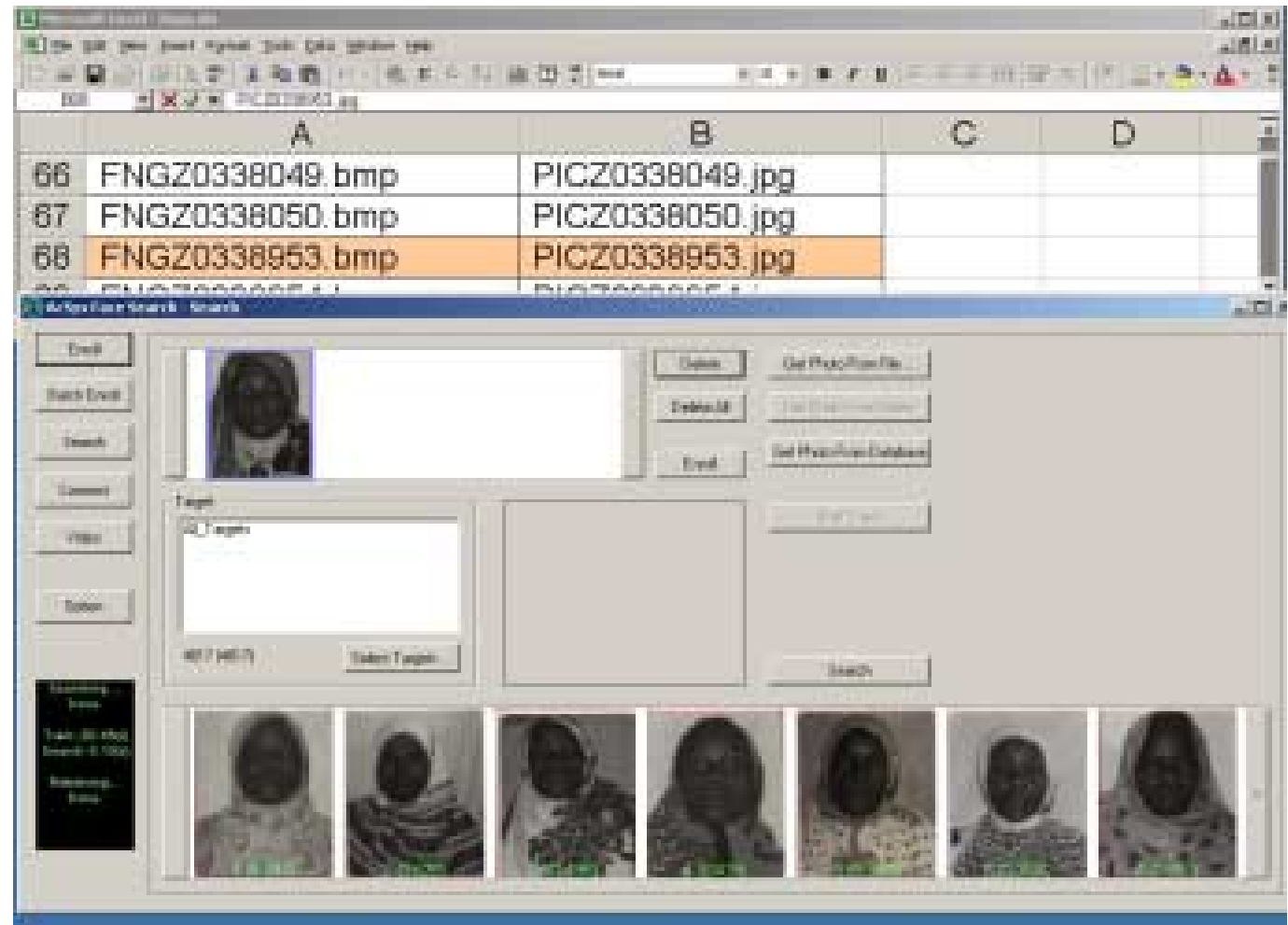
Facial Recognition

3D System – Speed

Using a revolutionary core technology HNet, based on neural networks, I-CUBE facial recognition delivers cutting-edge security and split-second processing times.



	A	B	C	D
66	FNGZ0338049.bmp	PICZ0338049.jpg		
67	FNGZ0338050.bmp	PICZ0338050.jpg		
68	FNGZ0338953.bmp	PICZ0338953.jpg		



Facial Recognition Tracking

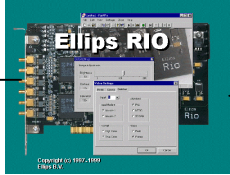
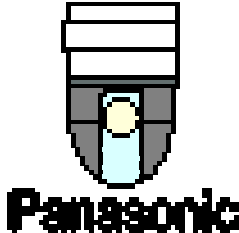
In order to make face recognition non-intrusive and flexible, the Discovery system automatically locates and follows any human face that is within the camera's field of view.

This allows the individual to act in a natural manner with freedom of movement and locomotion, and minimal cooperation with the system.

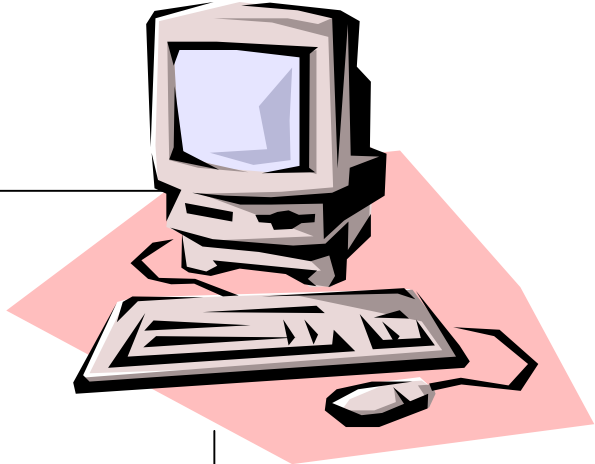


Camera (CCTV / Web Cam
/ IP / etc. CAMERAS

Facial SYSTEM



Frame Grabber



PC Station



**FACIAL
Software**

Facial Recognition

Equipment required:

ITEM	DETAIL	No. Provided
Face Recognition SERVER	Ability to add facial images and personal details, create multiple Databases, view closest matches	1
Face Recognition CLIENTS	Ability to capture from a VIDEO FOR WINDOWS source and	1 - many
Frame Grabber	Video capture device linked to cameras	1 - many
PC	<ul style="list-style-type: none"> • Microsoft® Windows® 2000 Professional (SP 4) • 3 GHz Pentium 4 Processor • 1 GB RAM • 1 TB HDD 	1 - many
Monitor	19" flat screen	1 - many
Key & M	Wireless Keyboard & Mouse	1 - many
Cables	BNC to RCA cable	1 - many
UPS	15 Min standby	1 - many

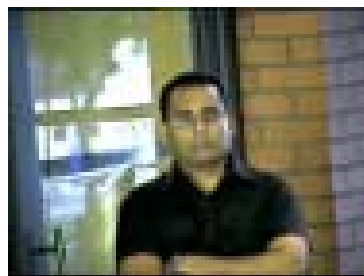


Face Recognition Front End

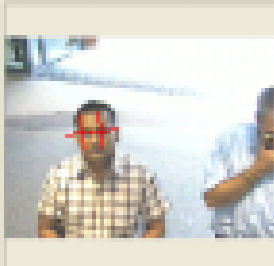

Solutions




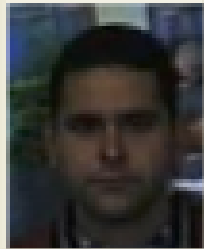
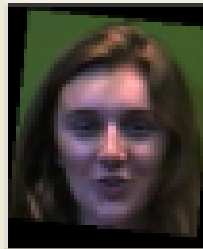

Facial ID



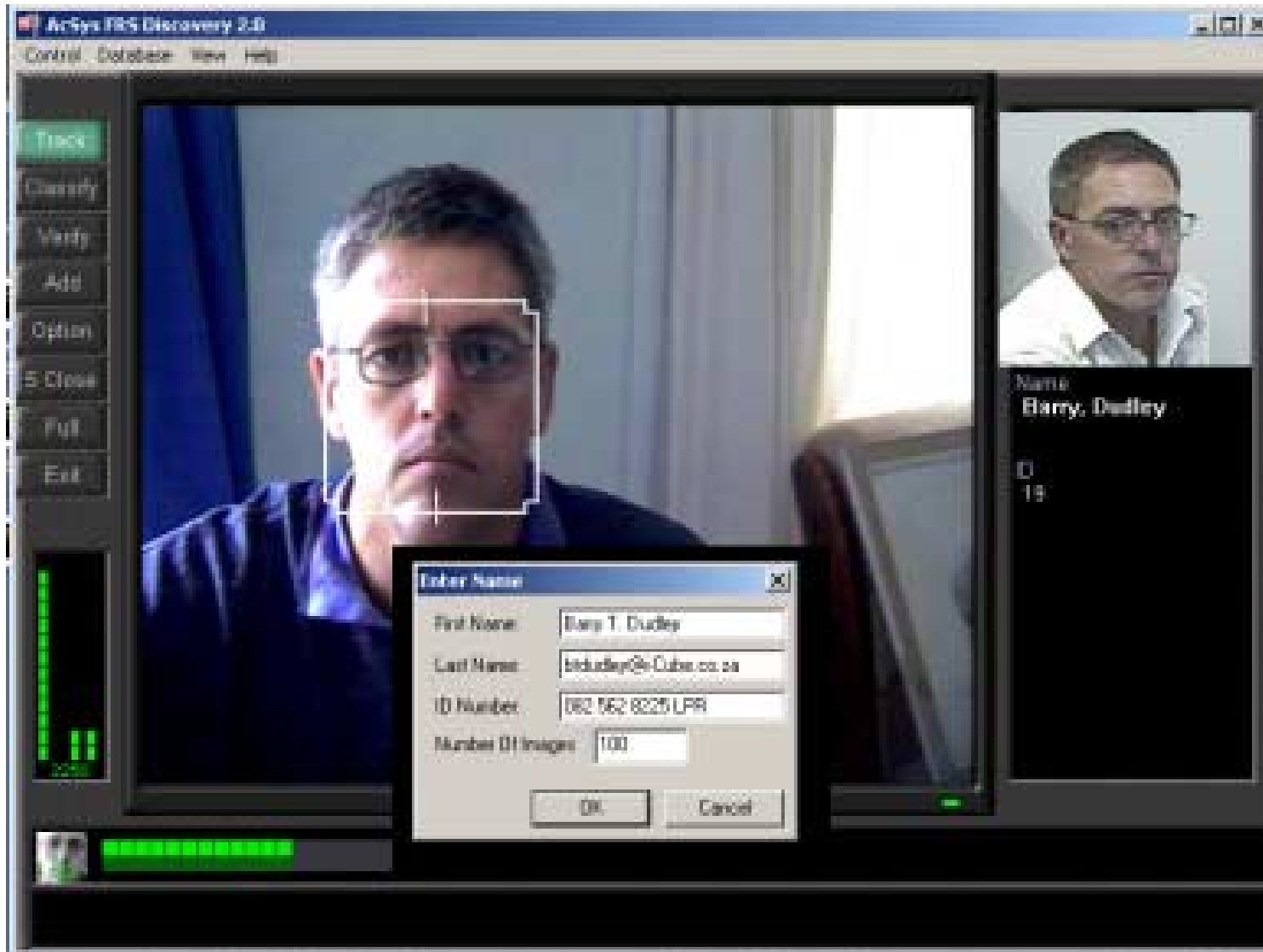
Batch Compare to DB
Compare Record to DB

Subject:  Current Record Image: 

Compare Results | Record Operations | Database Operations

			
Michael Doculian 9.1/10.0 Doculian_003.jpg	UK Acosta 7.8/10.0 vega_acosta_1.jpg_0	5.4 7.7/10.0 4_001.jpg	2 7.6/10.0 1_001.jpg

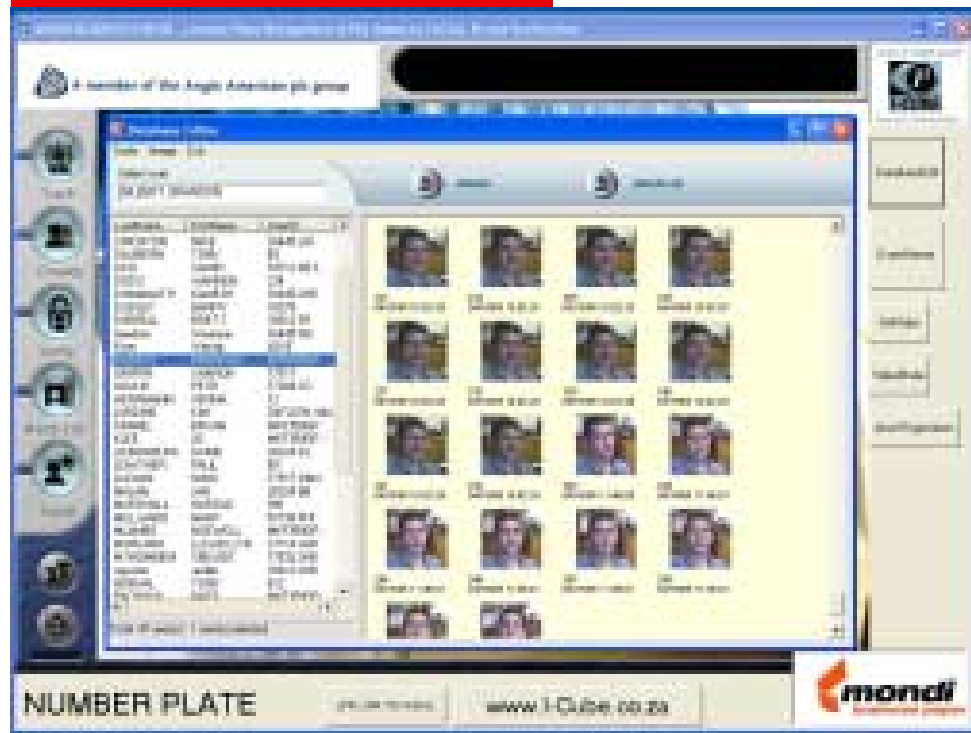
Facial ID



Facial Recognition

Enrollment

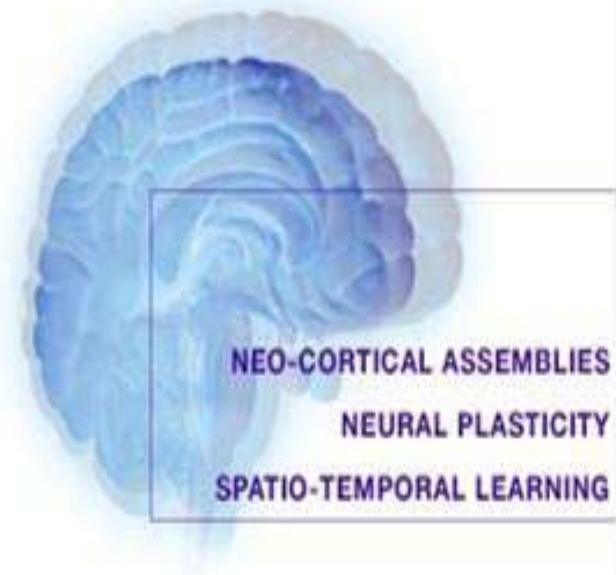
Enrollment is the capturing and storing of facial images of the user, in order to generate the facial biometric template. The greater the volume and quality of the enrollment images, the faster and more reliably the system will recognize the user during subsequent verify or classify operations.



Facial Recognition

3D System – Speed

Using a revolutionary core technology HNet, based on neural networks, I-CUBE facial recognition delivers cutting-edge security and split-second processing times.



Identification of an unknown



Compare person against existing relevant databases, RESULT list of closest matches.

Identification of a unknown, anyone seen by the cameras

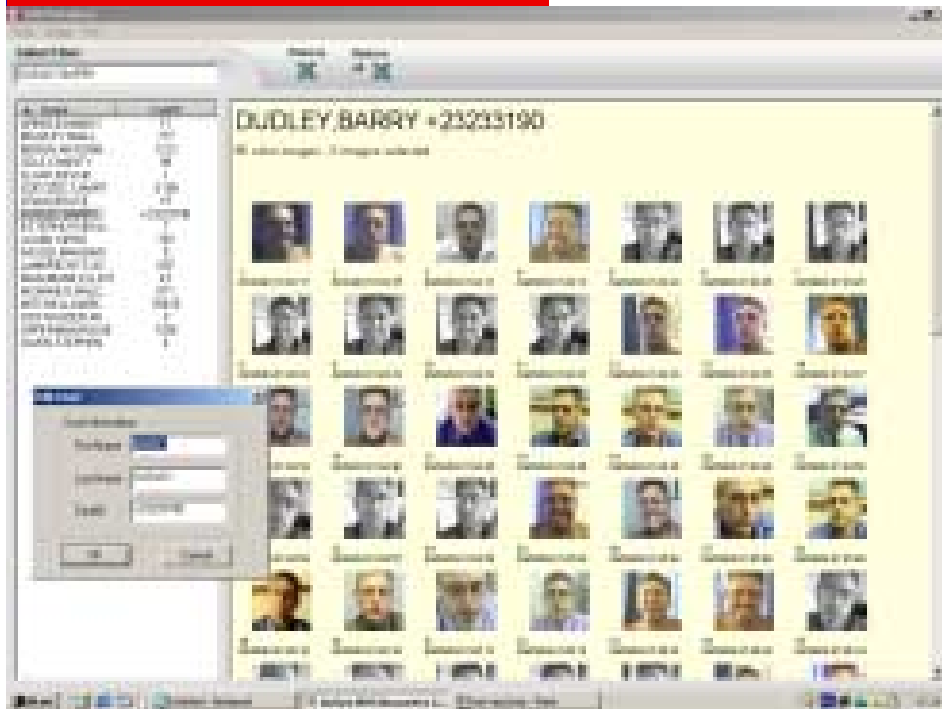


Compare Results | Recent Operations | Database Operations

Benj Dudley 8/0/100 Police_001.jpg	Robin Suter 7/7/100 Police_018.jpg	Shawn Hui 7/4/100 Hui_002.jpg	21 7/4/100 1_002.jpg	54 7/4/100 4_001.jpg	AS Adams 7/4/100 ad_s_adams_1.jpg
Derek Yonck 7/4/100 Yonck_001.jpg	test test01 7/3/100 test01_001.jpg	Males multiple images 7/3/100 multiple_images_005.jpg	Kevin Saunders 7/1/100 Saunders_001.jpg	UE Adams 7/6/100 Adams_002.jpg	unknown Name Jordan 7/6/100 Adams_003.jpg

Facial Recognition Training

Biometric templates are continuously updated through a process referred to as "Training" using facial images captured during enrollment operations or during subsequent verify operations. This ensures that the biometric templates are as up-to-date as possible.



Facial Recognition

3D System – Intelligence

The proposed FRS learns, remembers and recognises, becoming more familiar with your face each time it sees you, adjusting for difference due to aging and cosmetics.

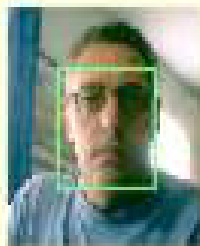
250 image(s) - 0 image(s) selected



1
11/11/04 10:34:30



2
11/11/04 10:34:44



3
11/11/04 10:34:49



4
11/11/04 10:34:51



5
11/11/04 10:34:56

Facial Recognition Classification

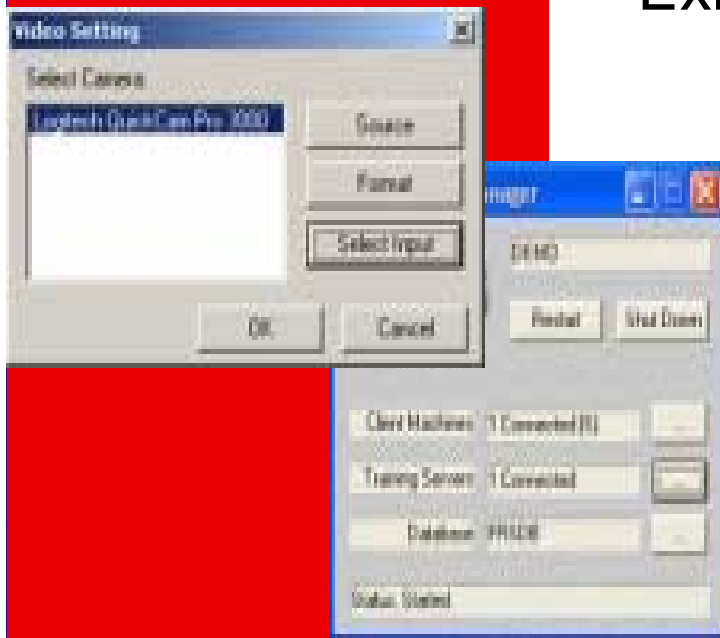
- If a user's identity is not known, the classification operation may be used to identify the individual from the group of facial templates loaded within the system. Classification works by attempting to match the unknown user against all users currently enrolled in the Discovery database. This process is also referred to as one-to-many identification.



Facial Recognition

System – Solution components

- Advanced FACIAL VERIFICATION Software (Server and a no. of clients)
- S-912 Video Grabber hardware to connect the camera via RCA to the Windows based PC's
- Existing (or new) cameras



Facial Recognition

3D System

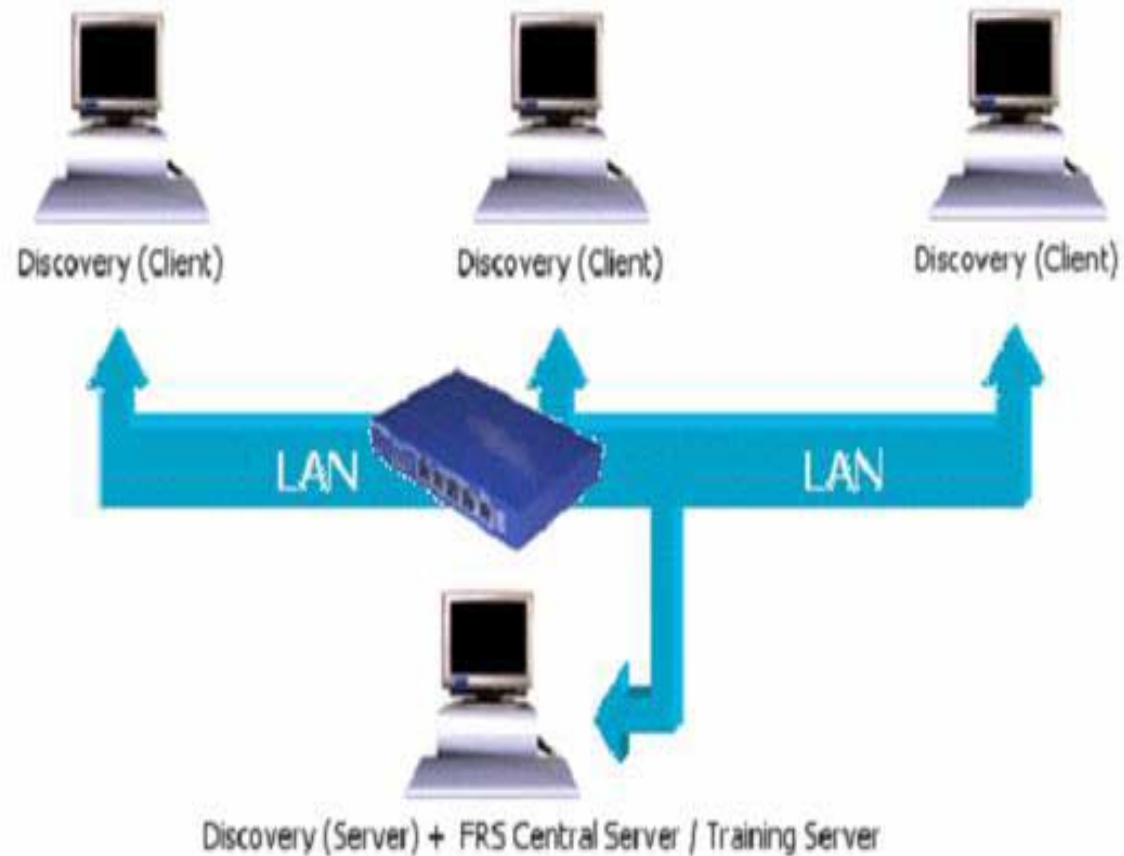


While operating in Track mode, the Discovery application will locate any human face within the video frame, place a Tracking Box around the face and follow the face within the frame. The Discovery application is able to track up to 4 faces simultaneously.

Facial Recognition

3D System – How does this get connected?

FRS Network (multiple clients, one server): -



Facial Recognition

3D System – What are the benefits?

Speed, accuracy and intelligence are among the key qualities

Facts, features and benefits *of facial recognition*

New real-time security alternatives are a reality today, says Lodge, with its lightning fast face recognition system. A leading developer of mission critical retail solutions, Lodge says it is committed to leadership, responsiveness and unparalleled results. "We are driven to empower our clients and partners to go beyond tradition to create new benchmarks for security. Accuracy is everything."

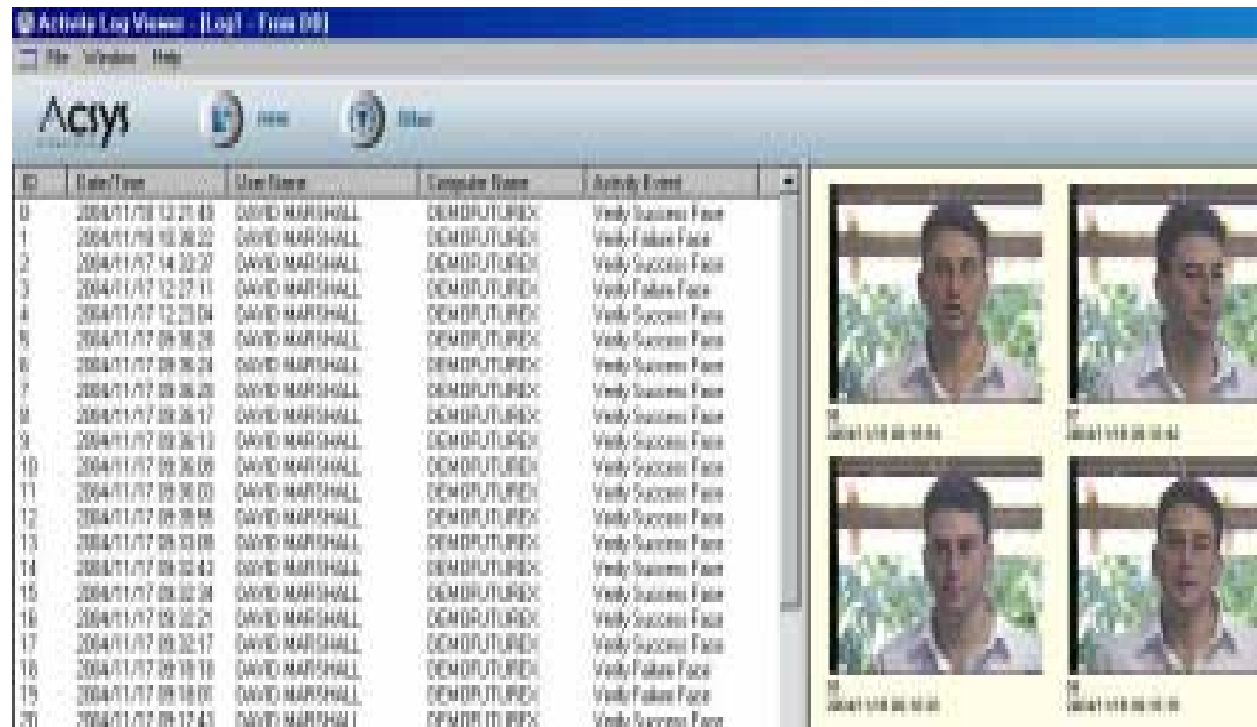
48 Security Focus April 2004



Facial Recognition

3D System – Accuracy

The proposed FRS was the most accurate technology tested in the International Biometric Group’s Comparative Testing for IT Security and E-Commerce

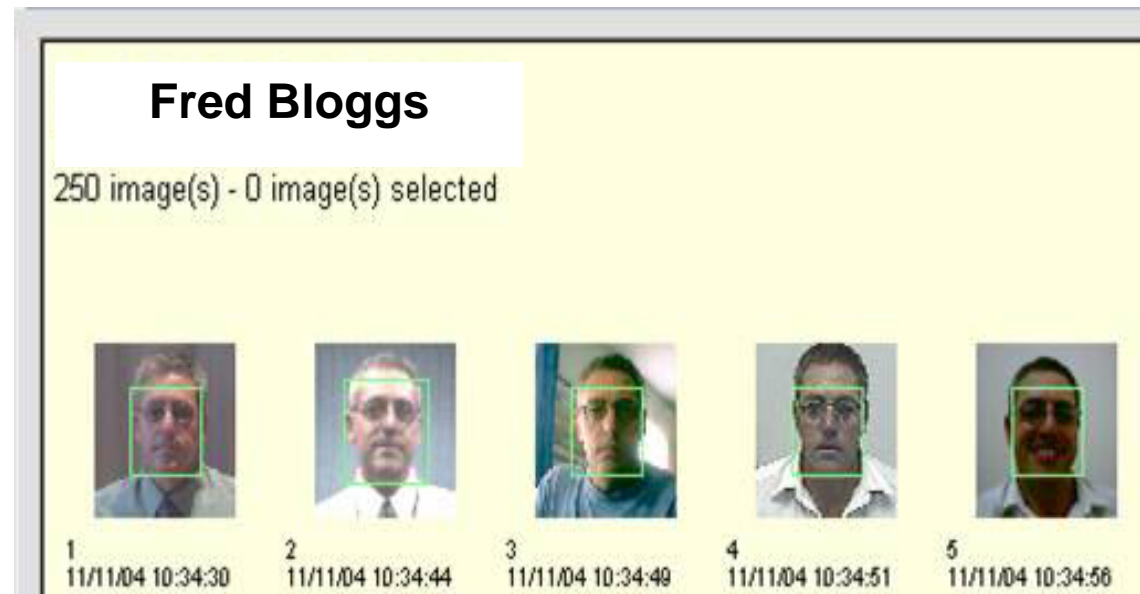


ID	Date/Time	User Name	Computer Name	Activity Event
0	2004/11/17 13:27:03	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
1	2004/11/17 13:28:20	DAVID MARSHALL	DEMOPUTURCH	Verify Failure Face
2	2004/11/17 14:20:27	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
3	2004/11/17 12:27:11	DAVID MARSHALL	DEMOPUTURCH	Verify Failure Face
4	2004/11/17 12:23:04	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
5	2004/11/17 09:38:28	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
6	2004/11/17 09:38:24	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
7	2004/11/17 09:38:26	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
8	2004/11/17 09:38:17	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
9	2004/11/17 09:38:10	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
10	2004/11/17 09:38:09	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
11	2004/11/17 09:38:03	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
12	2004/11/17 09:38:58	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
13	2004/11/17 09:33:08	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
14	2004/11/17 09:32:43	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
15	2004/11/17 09:32:34	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
16	2004/11/17 09:32:21	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
17	2004/11/17 09:32:17	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face
18	2004/11/17 09:18:18	DAVID MARSHALL	DEMOPUTURCH	Verify Failure Face
19	2004/11/17 09:18:01	DAVID MARSHALL	DEMOPUTURCH	Verify Failure Face
20	2004/11/17 09:17:41	DAVID MARSHALL	DEMOPUTURCH	Verify Success Face

Facial Recognition

3D System – Intelligence

The proposed FRS learns, remembers and recognises, becoming more familiar with your face each time it sees you, adjusting for difference due to aging and cosmetics.



POSSIBLE Requirements:



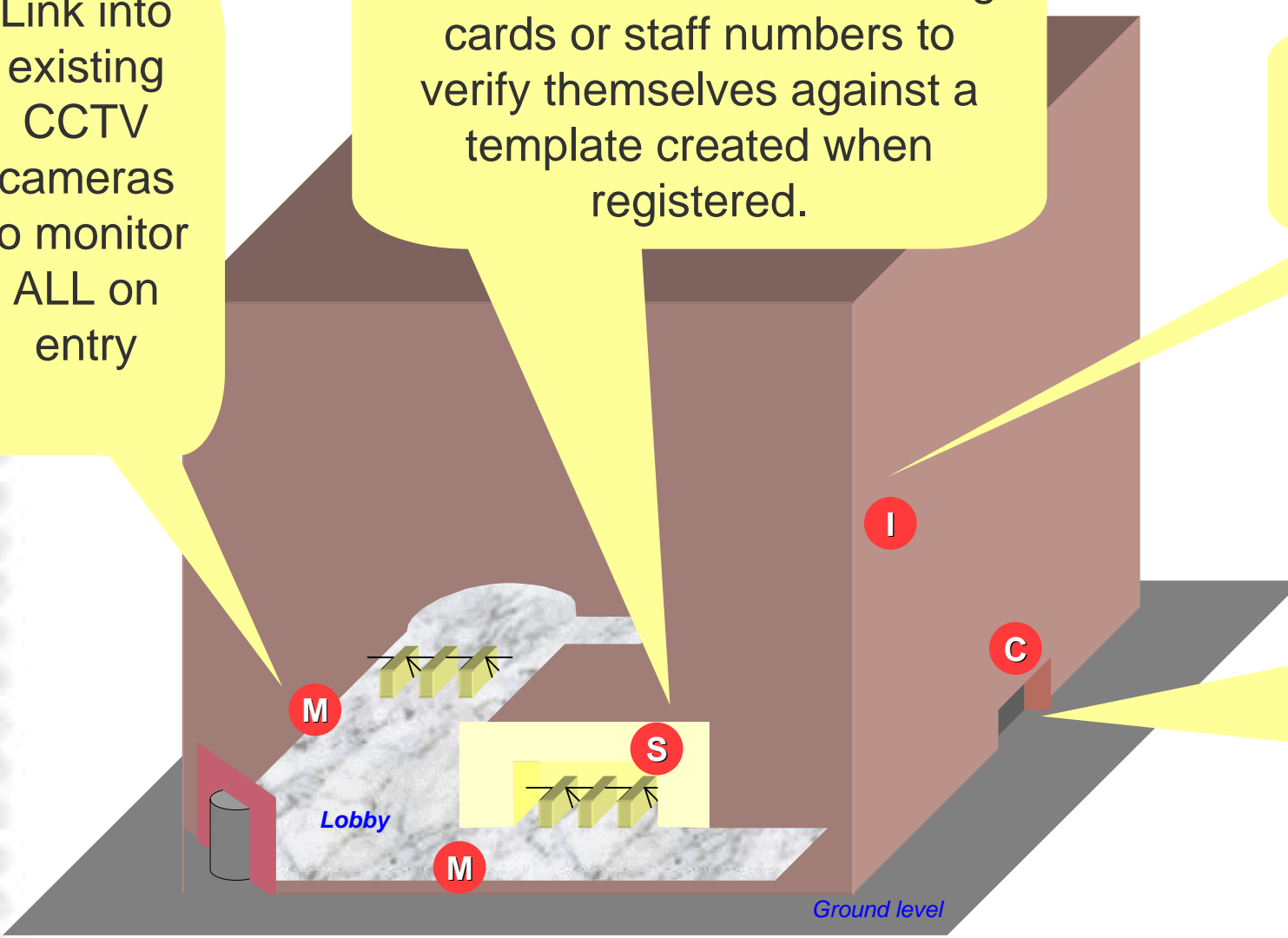
Solutions

Link into existing CCTV cameras to monitor ALL on entry

STAFF can use their existing cards or staff numbers to verify themselves against a template created when registered.

FACIAL ID to IDENTIFY suspects

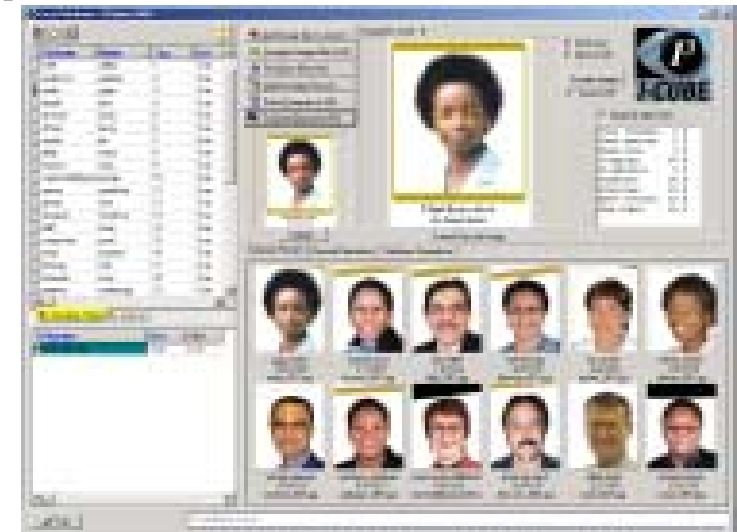
Facial capture of all people who come and go



Main entrance / lobby **S**taff entrance **I**dentify **C**apture



! The Facial system is based upon a two-tier client/server architecture. The system consists of a single Discovery Server application either running as a standalone application, or connected to one or more Discovery Client applications. All FRS data pertaining to images and biometric templates are stored centrally on the Discovery Server and facial recognition operations may be performed on either Server or Client machines.

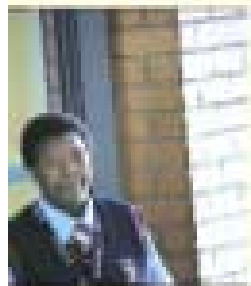




new



filter



055:12



121
2006/12/09 07:55:24



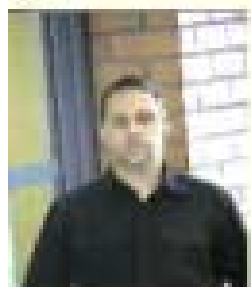
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123
2006/12/09 07:55:41



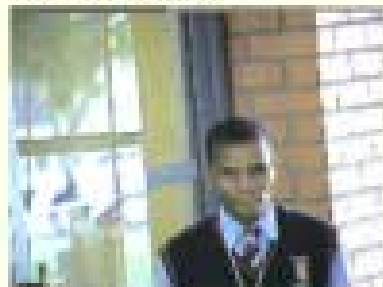
99
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046:09



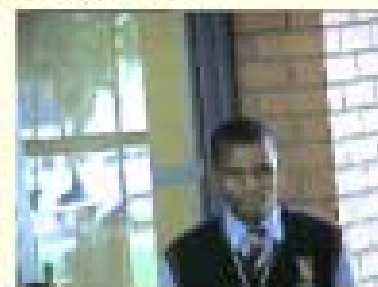
101
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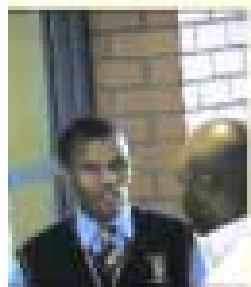
102
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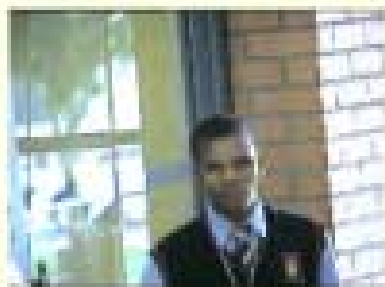
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2006/12/09 07:46:30



104
2006/12/09 07:46:41



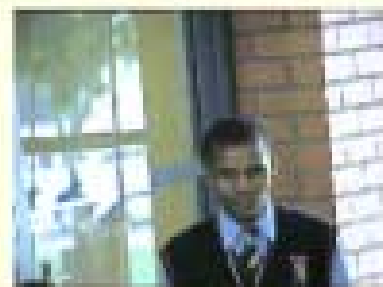
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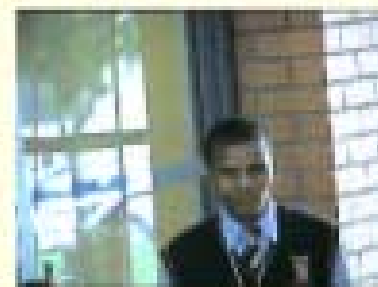
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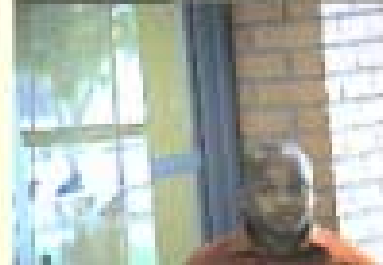
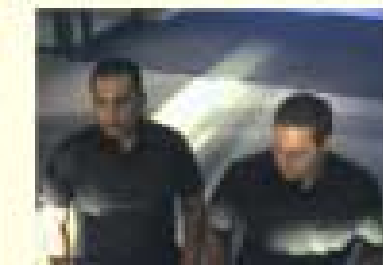
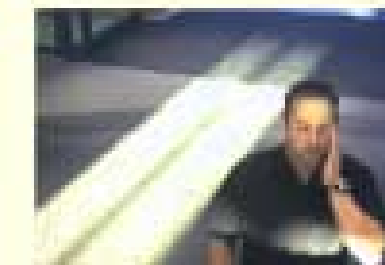
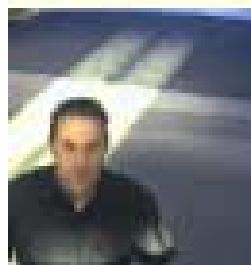
107
2006/12/09 07:46:50



108
2006/12/09 07:46:52



109
2006/12/09 07:46:54



FACIAL IDENTIFICATION

RESULTS: 31 977 images analyzed for duplication



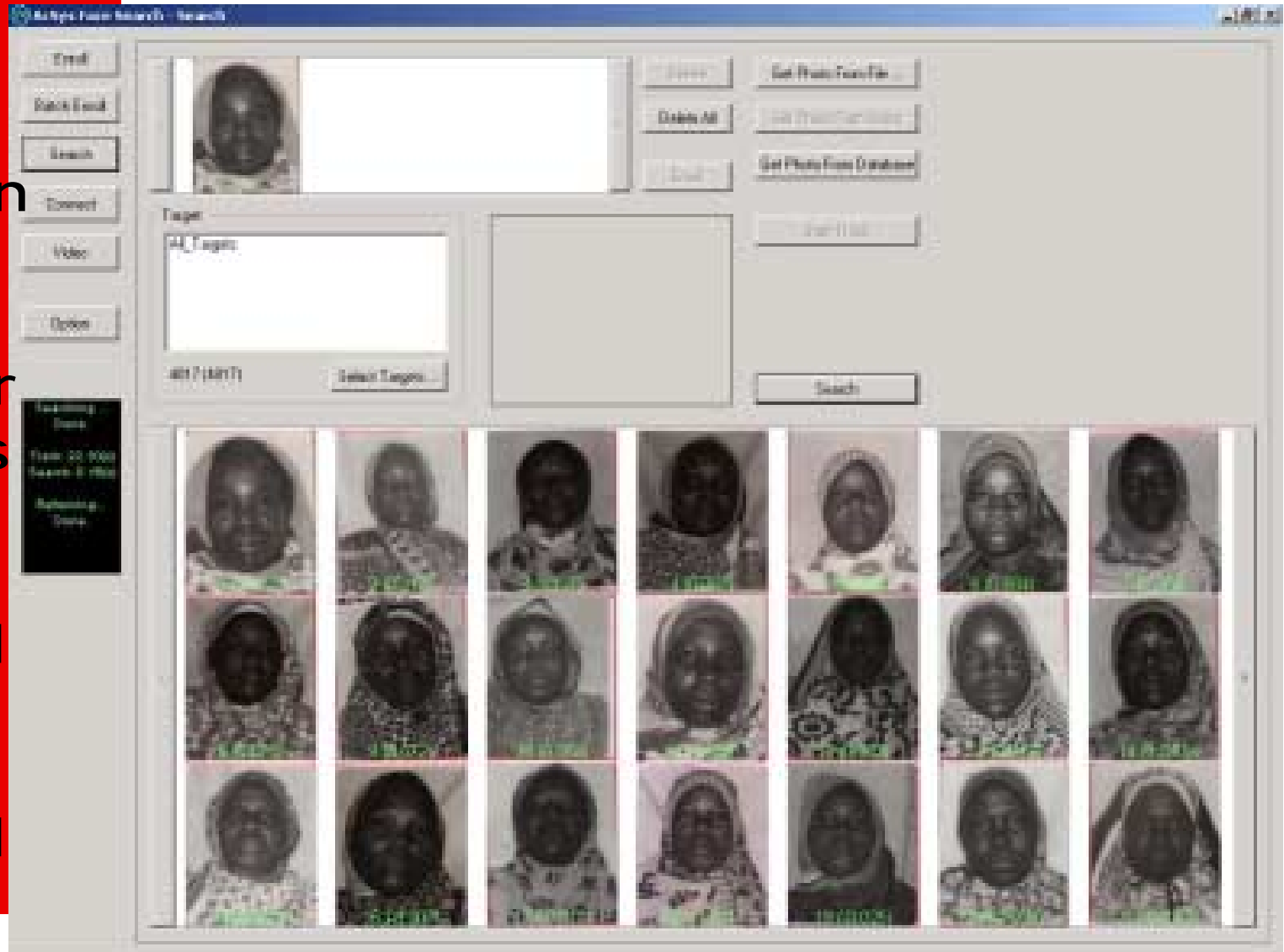
Facial Recognition

3D System

Once enrolled each of images was compared to every image in the DATABASE

EXAMPLE 1

The first image is an EXACT MATCH, every other image has a lower score compared to image being compared



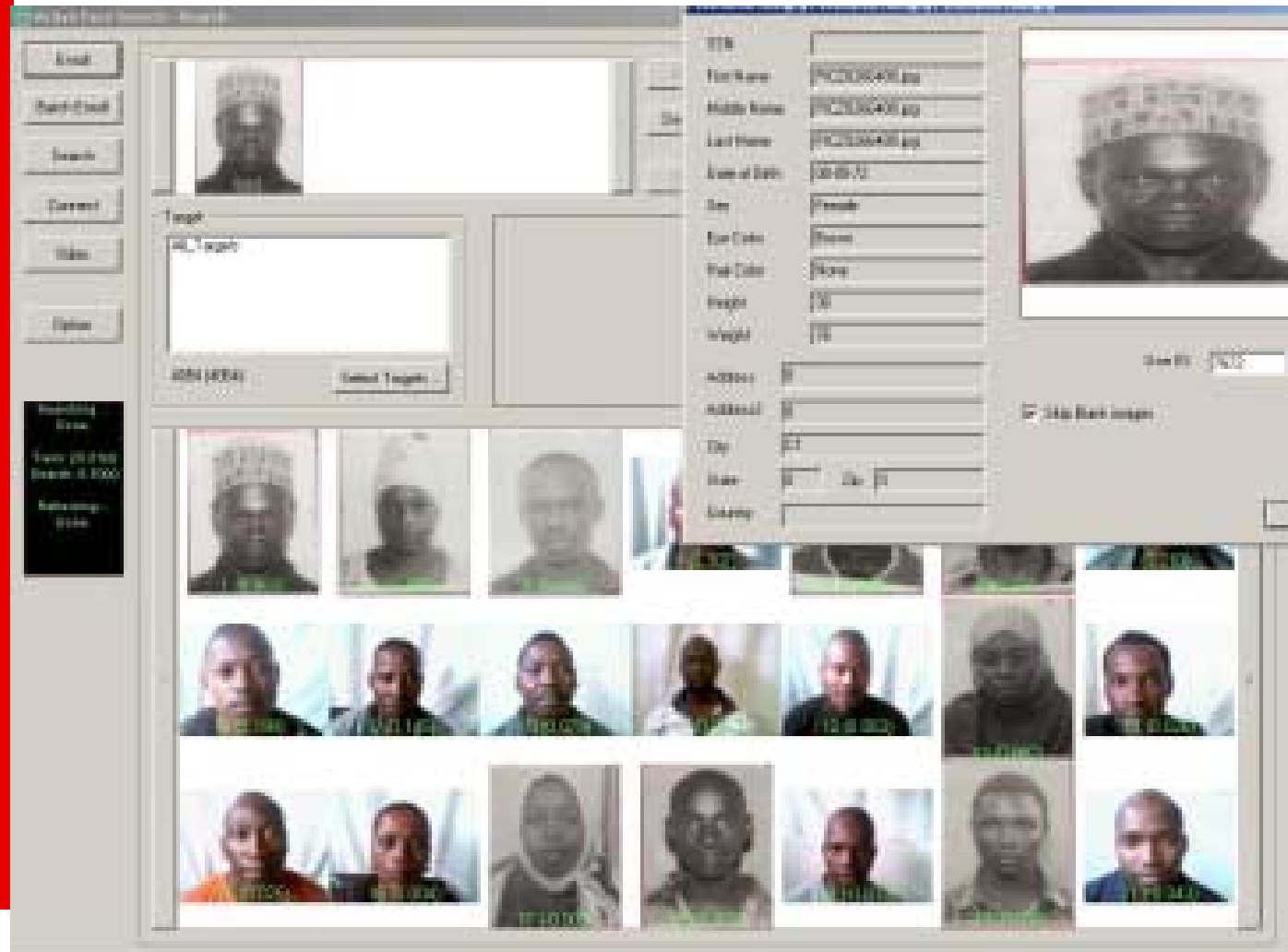
Facial Recognition

3D System

EXAMPLE 6

This is an example of a suspected duplicate, BUT NO DUPLICATE MATCHS WERE FOUND.

! The presence of a HAT OR SCARF *Solutions* made no difference to the results obtained



Facial Recognition

System – LOG of all FACES which appear in front of any camera connected to the software.

The screenshot displays a software interface for facial recognition. On the left, a log window titled 'Activity' lists numerous entries, each starting with 'DEMOFUTUREX:' followed by a status message such as 'Verify Success', 'Enroll Failed', or 'Face classified'. The main area of the interface is a grid of 12 camera feeds, each showing a different person's face with a white rectangular overlay indicating the detected face. The feeds are arranged in a 4x3 grid. The top right corner of the interface features the 'T³ I-CUBE' logo and several small control icons. The bottom right corner shows a 'NLM' label.

Questions

The screenshot displays a software interface for facial identification. At the top, there are tabs for 'Data Base Edit' and 'Event Viewer'. A status bar shows 'Name: CLOETE B.' and 'ID: MCTT' next to a green progress indicator. The main area features a large video feed of a man in a grey shirt and glasses, with a black bounding box around his face. To the left of the video feed is a 'Match List' containing four small portrait photos of the same man, each with a number and a timestamp: 29 (07/19/05 18:03:33), 30 (07/19/05 18:03:33), 37 (07/19/05 18:03:36), and 38 (07/19/05 18:03:38). A vertical toolbar on the left includes icons for 'Classify', 'Match List', 'Enroll', and other functions. The bottom of the interface has a footer with the text 'Specialised Video Solutions (Pty)' and buttons for 'Set Video', 'Video Mode', and 'Abort Registration'. In the bottom right corner, there is a logo for 'E SECURITY'.