TRID System

Biometric Identification / Recognition through Eye Colors

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Introduction

With terrorism on the rise all over the world, attention is now focused on the potential to identify them at the port entries or at public places, passively from remote distances and in shortest possible time. In either of these cases, unambiguous identification of the suspected individuals is a very important defense requirement against terrorism. In this paper we explore the potential for the use of visible light (or IR) in passive and remote detection of human face characteristics particularly, the colors of the individual's eyes to achieve the goal.

While many techniques including fingerprinting, iris recognition, and proportions of individual's facial characteristics are in use to-day, our focus is on identification that utilize optical absorption strengths of the colors of eye or other features of human face that clearly isolates one person from others.

The utilization of optical absorption technology is spreading thought many industries particularly for active or passive remote sensing. In the past decade there has been an explosion of digital camera technology with an ever-increasing number of detectors (pixels) in a single Focal Point Arrays (FPA). They range from inexpensive commercial digital cameras to high resolution IR sensors for satellites. The technology is finding its way into many other industries such as medical instrumentations and spectrographs.

The increase in the densities of FPA, has forced scientists and engineers to find other avenues in image processing, particularly filtering and detection methodologies for higher resolutions and higher speeds.

This paper is concerned with a new method of hardware filtering of visible light, suited to be utilized in many applications, particularly for positive identification of suspected terrorists. In particular a system with the following benefits:

- Extremely reliable with very low probabilities of false detection
- Minimal time for identification
- Registration and identification from remote distances
- The issue of platforms for an ease of system operations
- Low costs and lower times for the system to operate
- Adaptable to be Installed at sensitive areas and or to be carried like a cell phone

Present Technology

The present technology for identification of people through iris is similar to identification through finger prints. Detection through iris is based upon recognition of patterns (lines and spots) inside the iris and then comparison with the existing data files. All leading technologies for identification are based upon pattern recognitions as follows:

- Fingerprint identification
  Fingerprint ridges are formed in the womb; you have fingerprints by the

fourth month of fetal development. Once formed, fingerprint ridges are like a picture on the surface of a balloon. As the person ages, the fingers get do get larger.

- Hand geometry
  Hand geometry is the measurement and comparison of the different physical characteristics of the hand.
- Palm Vein Authentication
  This system uses an infrared beam to penetrate the users hand as it is waved over the system; the veins within the palm of the user are returned as black lines.
- Retina scan
  A retina scan provides an analysis of the capillary blood vessels located in the back of the eye; the pattern remains the same throughout life.
- Iris scan
  All current iris recognition systems use these basic patents, held by Iridian Technologies.
- Face recognition
  Facial characteristics (the size and shape of facial characteristics, and their relationship to each other). Typically, this method uses relative distances between common landmarks on the face to generate a unique "faceprint."

Although the present technology of recognition through iris patterns is continually improving and has made significant improvements in recent years, a close study of a government sponsored document (Independent Testing of Iris Recognition Technology (ITIRT) Final Report, May 2005), indicates many issues and drawbacks amongst them are:

- Platforms
- Sample and IrisCode Collection Processes
- Matching Processes and Results Calculations
- IrisCode Comparison
- Attempt-Level and Transaction-Level Error Rates
- Matching and Analysis Optimization
- Enrollment, Acquisition, and Transaction Duration Results
- Enrollment Transaction Durations
- Recognition Acquisition Rates
- Recognition Transaction and Attempt Durations
- Accuracy Results
- Equal Error Rates

Proposed Technology

The proposed technology utilizes the colors of the eyes (a new invention awarded patent number 7,529,404 issued in mid-2009, Electronic Tunable Filter), rather than the patterns (black and white) of the iris. The eye colors include retina, iris, and the outer white segments of the eye, are all specific to an individual. When these colors are captured by a digital color camera, the pixels can be used to identify a person extremely accurately. Mathematical analysis for the resolution (recognition) of the method reveals that it will identify an individual among one trillion number of people. Recent proof of the concept and tests towards the proof of concept, confirms the same capabilities. Please refer to the following Figures 1, 2, 3 and 4. Details of the scientific evaluations and

mathematical analysis will be provided upon request.

Why identification with eye colors

The following are the main advantages of the proposed eye color detection and recognition technology:

1) Platform
a. The proof of concepts tests were performed with a simple commercial digital camera provided:
- Minimal Failure to Enroll Rates (FTE)
- Minimal Enrolment Transaction Times
- Minimal False Rejection Rate and False acceptance Rate
- Convenience to enroll, including distance and angle from the camera
- Minimal time to upload one person eye sample from data bank
- Others

2) Extreme high resolutions that minimize **False Rejection Rate and False acceptance Rates compared to the present technology**.
a. The proposed technology provides the possibility to collect color samples of eyes from a distance. Further research is needed to determine the distances.

3) Time to recognize an individual is in the order of 15 to 30 *milliseconds.*
a. The color filtering and recognition routines are implemented in hardware.

Proof of concept and Results

Software simulation of the new detection technology for recognition of eye colors has provided extremely good results. The subjects test input to the simulation was nine different set of eyes Figure 1. For identification, the colors of one of the eye colors (Figure 2) were selected as a test subject (data base). The test was performed and the simulator found the exact color of the same eye among nine different eye colors.

Note: The filtering routine to get rid of the scattered similar colors in the figure 2 was not used. The filtering routine for to eliminate scattered same color detections was used in Figure 4.

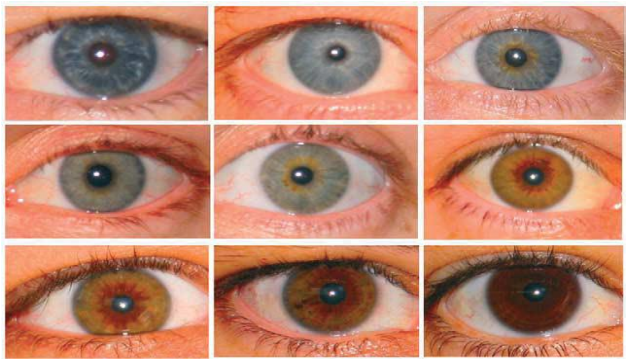

Figure 1- Nine sets of eye belonging to different people

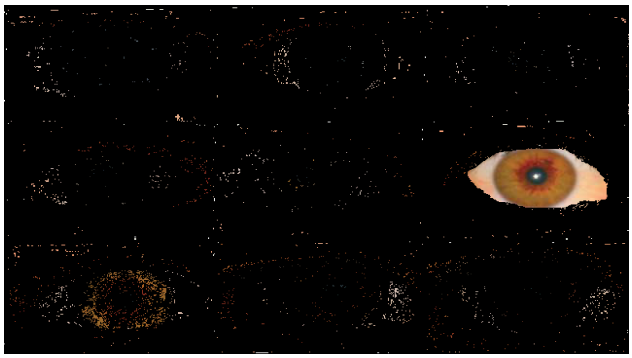

Figure 2 – Identification of one eye including colors or white part of the eye

Figure 3 is the picture of a young man as a test subject. The picture was taken by a commercially available digital color camera of 3 Mega pixels. The color (pixels) of only

one eye was selected as the stimulus to the simulator.

Figure 3 – Picture of a person

Figure 4 is the result of the eye color detection (with blue color background that was selected by the software simulator). The colors of the left eye were selected as the stimulus and the detector found the pixels of left eye.

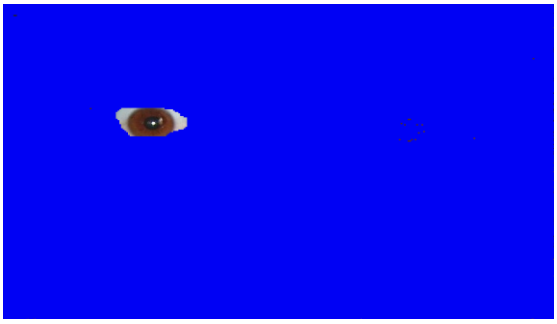

Figure 4 – Selected and Detected colors of one eye

The above tests for the proof of the concept prove the following:

- All colors of the eye are the basis of the color detection.
- The colors of the right eye were different from the left eye.
-

Conclusion

The continual improvements in the biometric pattern recognition and identification technology, has not properly addressed the inaccuracies. **False Rejection Rate and False acceptance Rate** still remain high. For this and several other reasons, the technology remains unsuited for widespread use in the field of human identification. As an example, one application that it could widely be used is the closed circuit T.V; to identify individual card holders and prevent credit card thefts. Another one is personal computers that require passwords for identification to replace fingerprint readers. The fingerprint readers installed on some personal computers, fail on average 2 or 3 successes out of 5 trials. This is not a good error rates.

For instance at immigration entry ports the delays make them impractical to be used by the immigrations officials. There is a need to immediately identify a person as he or she approaches the booth. The immigration officials do not have the time to wait for the system to respond.

Another issue is the lengthy process to register a person for iris pattern recognition. The system is not suited to be used for greater distances from the camera. Regardless of the degree of research and development on the biometric pattern recognition, the technology does not provide the capability to be used remotely. This means identifying people from a distance.

The new eye color recognition technology is a method for a simple, fast and accurate,

registration and identification process. It will provide the following advantages:

- It will highly reduce False Rejection Rate and False acceptance Rates.
- Reduce registration and recognition times.
  - The design implementation is in hardware to provide extremely fast responses (Refer to Appendix A).
  - Provides a simpler platform for registration and recognition.
- Allows for remote detection from further distance to register and recognize.

The preliminary work towards the proof of the concept for color detection method has provided very positive results. It has provided far better recognition resolutions in less times (15 milliseconds). With further research and development, this new technology provides for "remote sensing" of eye colors of suspected individuals to be used as a data base.

The technology has many other uses in military applications, such as satellites, UAV's. For commercial purposes, it could replace PI cards (used as personal identifications), PI cards or keys in the hotels, homes and cars. Nowadays personal computers use finger print technology that provides identification after many swapping of finger. Most computers are already supplied with a camera. This invention can easily replace that. There are so many other applications in medicine. This technology will boost the United States Security and boost the helping the United States economy.

Proposed Technology

The new technology (invention 7,529,404, issued May 5, 2009 and others pending) is a high resolution detection (filtering) of electromagnetic signals. The invention relates to a new innovation in tunable electronic filtering of electromagnetic waves, replacing FFT and Kalman filtering concepts suitable for remote, and passive sensing od colors.

A prototype software simulation (proof of concept See Appendix B) of the tunable electronic filter has been developed and tested. The tests point to an unprecedented high resolution sensitivity (detection) for measurement of biological and chemical contaminants. It will allow for a very low probability of false negative (PFN) detection for measurements from far distances, such as satellites, UAV's and high flying aircrafts.

There is a follow-up patent application (12-657/986) for measurements of the concentrations of chemicals even in the presence of adverse environment conditions. The technology provides for a detection and measurement system to be deployed on satellites or a high flying plane, for immediate detection and measurements.
The innovations allows for analyzing the present threats and act according to the need for a sound defense or offense.
One of the immediate applications of this invention in military and commercial is the identification through the colors of the eyes (Please refer to the Appendix B).
Brief Description of the Invention

Principal Investigator

Ned M. Ahdoot, Project Manager, senior scientist and investigator

Biometric Identification / Recognition through Eye Colors

Education: BEE., Electrical Engineering New York City college, New York, N.Y. 1970

MSEE., Electrical Engineering New York University New York, N.Y. 1973 **Secret Clearance.**

Ned Ahdoot has over 35 years of experience in the aerospace and electronics field including design and development of communication and recommence satellite for the United States Air Force. As a program manager, Ahdoot has extensive experience in GPS Satellites design with responsibility for definition of technical requirements (Requirement Specification), definition of scope of the work, planning of schedule and budget, and assigning key personnel to specific positions.

Recommendations and assistance for resolving complex technical issues. As a key member of Independent Readiness Review Team (IRRT System Lead Engineer) for STSS, WGS and DMSP satellites.

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