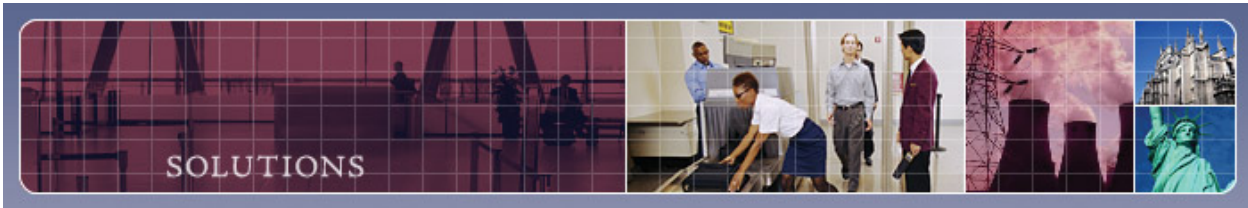


CryptoMetrics Helios® Adaptive Illumination System

Solution Profile





CryptoMetrics® was established in 2000 to meet the rising need to assure a new level of safety and security. Since then, CryptoMetrics has grown to be a leader in security solutions by globally building and integrating secure trustworthy systems using the most advanced technology in cryptography and biometrics. CryptoMetrics provides internationally standardized face biometric technology to secure national borders and protect the traveling public; as well as secure physical points of access to commercial and government facilities, plants, campuses and critical infrastructure.

CryptoMetrics' Facial Recognition products are the evolution of identifying the needs of our clients for their common and unique security challenges while improving the capabilities that biometrics provides. Our success is based on working cooperatively with our clients to provide superior products, advanced support and continual evolution to meet their needs today and in the future. Imagery Integrity Identity – CryptoMetrics provides absolute solutions.

CryptoMetrics Helios® Adaptive Illumination

The Problems with Illumination in Facial Recognition

The success of facial recognition depends to a large extent on the quality of the facial images to be compared. The quality of the facial image in turn depends on many factors such as the sensitivity, resolution, dynamic range, responsiveness etc. of the camera (by camera here is meant the entire system; lens, sensor and electronics). It furthermore, obviously, depends on the intensity and directivity of the light shining on the face.

In most situations where facial images are captured a suitable camera system can be specified that will capture good quality images provided the illumination of the face meets certain requirements. Seldom does the environment in which a camera is installed provide adequate illumination of the face necessitating the use of extra illumination sources. Commonly there are three basic problems with the ambient illumination conditions in a given locale:

1. Insufficient light. Many indoor locations are not sufficiently lit to provide adequate illumination. This can often only partially be overcome by using faster lenses at the expense of reduced depth of focus or by using cameras with larger sensors and/or more sensitive sensors which are costly.
2. Inadequate illumination direction. Many indoor locations have only overhead lighting which results in shadows being cast from above. Often this causes shadows to be cast across the eye sockets thereby making the correct determination of the centre of the eyes more difficult if not altogether impossible. The correct determination of the centre of the eyes is one of the most important metrics in facial recognition.
3. Variable illuminating conditions. Obviously outdoor applications experience wildly fluctuating illumination conditions depending on the position of the sun in the sky and the amount of cloud cover, mist or rain. Indoor applications, too, suffer often from fluctuating illumination conditions, especially if there are nearby windows or glass doors, as often is the case. The effect caused by overcast skies, precipitation, sunshine and its variable intensity caused by time of day and cloud cover through windows and doors plays a role in the degradation of proper image capture. In addition to these factors, taking into account the change in light output from existing light sources (over head lights, pole lamps, wall lamps, etc.) due to degradation of the bulb output, dust collection and repositioning needs to be taken into account as well.

Although additional, well placed, illumination sources can provide some relief in certain locations this is not always the case or practical.



For example, in order to compensate for a condition where the sun is more or less directly above or behind a subject's head very powerful additional frontal illumination would have to be employed as to blind the subject or at least be very uncomfortable to him/her. Although this clearly would be an extreme case a much less severe situation, that being an indoor application with windows or transparent doors nearby, still present a situation where simple additional light sources are not sufficient to guarantee an even, well lit illumination across the face over time.

The Solution: CryptoMetrics Helios® Adaptive Illumination

Since the facial recognition process involves finding a face in an image we now have the capability to apply image processing techniques to determine if the overall level of illumination of the face is sufficient, if both sides of the face are equally illuminated and whether there are shadows cast across the face, especially across the eye sockets. The results of this analysis are transformed into commands to illumination sources, the output of which are controllable, so as to obtain the desired illumination profile across the face of the subject.

In a typical situation a first image is obtained using default illumination settings which may be fixed (constant) or be derived from historical data (such as time of day or an average of a recent number of optimized settings) or by other heuristic means. This first image is then analyzed and the optimized illumination profile computed before taking other images for facial recognition purposes.

Although, in principle, a number of illuminating technologies can be used applying the above described idea most are not practical in this application. The use of incandescent lights (including halogen) is restricted because of their change in color temperature when dimmed and also their relative slow response times (tens of milliseconds). The use of fluorescent lights is also restricted due to slow start-up time, their limited dimming range and the relative high cost of electronics of the dimming circuitry. Most other illuminating technologies have a variety of other associated problems; however the recent advancements in white LED's (Light Emitting Diodes) present a suitable solution. The efficiency (Lumens per Watt) of these LED's now equal that of incandescent and halogen lights and it is expected that within a few years their efficiency will approach that of fluorescent lights.



In the application described above the use of white LED's is particularly attractive since they have a full spectrum output with a range of color temperatures optimized for such applications. Furthermore they can be dimmed over the full range (0% - 100%) without a noticeable change in color temperature. Also, this dimming can be done effectively, (i.e. without wasting much energy) using pulse-width-modulation technique. Lastly, the response time (turn-on or turn-off) is in the sub-microsecond range allowing precise timing control of the illumination, reducing overall power requirements and inconvenience to the subject.

In a typical application the illumination sources would be on at a reduced level so as to save power and extend the life of these sources. A first image would be taken using default settings and further images taken at the computed intensity levels for the various illumination sources. These computed intensity levels can be applied for the duration of the image taking session or only during those times when the actual images are taken. This latter scenario would mean that the sources are "strobed" every time an image is taken.



What is new?

CryptoMetrics is the industry leader in using face-finding of an image and using that facial image to control the illumination sources to optimize the illumination across the face.

Why is this needed?

When properly implemented it increases the accuracy of facial recognition in many applications because it results in images that are better suited for facial recognition purposes.

What is next?

CryptoMetrics Helios units are currently in use by customers around the world to increase the effectiveness of their identification and facial recognition systems. Future improvements will be a combined digital camera and light area with smart illumination controls. By doing so, the camera is protected and hidden within the lighting structure providing better security and containment of the camera while optimizing the subsystem (lights, camera and lighting controls) for easier development, use, and deployment.

Contact CryptoMetrics, Inc.