



## THE THIRD EYE: SURVEILLANCE SYSTEM

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**Abstract:** - This research is about providing internal security to the country through advancement of many available technologies. The research is about surveillance technology which will give full detailed information about the person in footage at the same time, as it connects the whole running system with database which contains all the information of citizens of the country and the persons who are in the country and deals with it on real time with advancement in the technologies. The purpose to do this is that we can get all the appropriate information of the persons present on that place and if you think anything is unusual or any unauthorized person is present or any suspicious activity is going on you can directly see information from the database and you can take any action you want. This will help in identifying tourists, robbers, unauthorized persons etc. So that we can eliminate incident possibility like Mumbai attack, we can make arrests of the wanted criminals and many more.

**Index Terms** - Surveillance, CCTV Cameras, Facial Recognition, Controlled Scene, Random Scene, Infrared Thermal Scanning, Retinal Scan.

### I. INTRODUCTION

Surveillance is the tracking of the behavior or activities of people for the purpose of managing, directing or protecting them in case of any suspicious activities. This can be achieved through observing from a distance

using electronic equipment such as CCTV cameras, or seizing of electronic information such as traffic on internet or phone calls and it may include simple, or relatively non technical methods as human intelligence agents and postal interception.

Surveillance is used by authorities for information gathering, the prevention of crime, the protection of any particular or groups, or for the investigation of crime over a very long time period. Criminals use it plan and commit criminal activities, or by businesses to gather quotations of other enterprises, and by private investigators.<sup>1</sup>

As we know a country is concerned with its security whether it's external or internal security. For the external security many advanced technologies are used, like radar to identify an unauthorized invasion of aircraft but in the internal security this type of security is not used or can say implemented. Countries like India, Srilanka, Pakistan etc which are so called developing countries they should be concerned about their security. Not only developing countries we can say that all the countries are concerned about their security. Although governments and many private authorities of the countries are installing CCTV surveillance cameras on the Footpath, Banks, Bus Stops, Railway Stations, Airports etc to record suspicious activities, but the question arises, "Is this technology sufficient as compared to the technology which we are using for external threats?"

No, that's why we are bringing a new technology in the field of surveillance named "The Third Eye"<sup>2</sup>

*The technologies used in our system are:*

- Facial Recognition
- Infrared Thermal Scanning
- Retinal Scanning

#### A. Facial Recognition

This technology is considered a natural means of biometric identification since the ability to distinguish among individual appearances is possessed by humans. Facial systems can range from software-only solutions that process images processed through existing closed-circuit television cameras to fully fledged acquisition and processing systems, including many digital cameras, workplaces places with many processing systems.<sup>3</sup> In facial recognition technology, a high resolution digital camera image is used to analyze facial characteristics such as the distance between mouth, nose or eyes and about 80 facial nodes. These types of measurements are stored in a database and used to compare with a subject standing before a camera.<sup>4</sup>

#### B. Infrared Thermal Scanning

In infrared Thermal scanning whole of the body is scanned and it works on the principle of heat it create a distinct image of the object carried by person as the temperature of it will be different from rest of the body. So we can identify what the person is carrying for example we can take we can know whether the person is armed or not and many more.<sup>5</sup>

#### C. Retinal Scanning

The human retina is a thin tissue composed of neural cells that is located in the posterior part of the eye. As capillaries have complex structure which supplies blood to the retina, each person's retina is unique. The networks of blood vessels in the retina are not entirely genetically determined and thus even identical twins do not share a similar pattern.

As retina has a unique and unchanging nature, the retina appears to be the most precise and reliable biometric, aside from DNA.<sup>6</sup>

In retinal scanning laser light produced from system will reach retina and scan it, now the scanned data of retina will be matched with

available data and person will be identified. It is accurate as it has an error rate of one in ten million.<sup>7</sup>

## II. PROPOSED MODEL

This consists of new type of the surveillance system which is capable of identifying a person right on that place. Which basically uses the latest technology which can be used together to do their job in a better way and in the right direction.

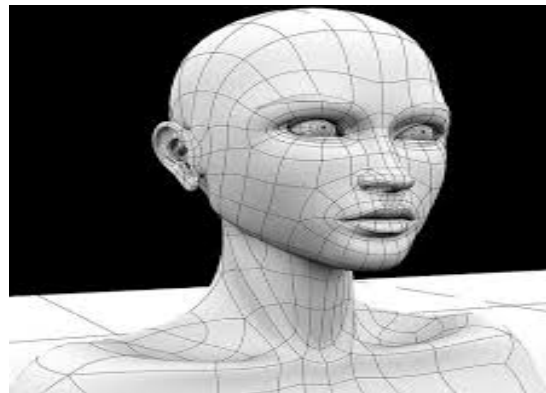
*The system works on principle of the following technologies:*

- Facial Recognition
- Infrared Thermal Scanning
- Retinal Scanning

#### A. Facial Recognition

In face recognition, face of person will be scanned and matched with available data. But as we also found that the feature of face recognition is accurate up to 60% - 70% only. With facial recognition technology, a high resolution digital camera image is used to analyze facial characteristics such as the distance between mouth, nose or eyes and about 80 facial nodes. These measurements are stored in a database and used to compare with a subject standing before a camera. It usually takes less than 5-10 sec.<sup>8</sup>

Facial recognition systems are divided into two primary groups.



First there is what is referred to as the "controlled scene" group whereby the subject being tested is located in a known environment with a minimal amount of scene variation. In this type of case, a user might face the camera,

standing about 2-3 feet from it. The system locates the user's face and performs matches against the stored person's identity or the facial database. The system mainly takes 5 seconds to take decision.<sup>9</sup> The second group is known as the "random scene" group where the subject to be tested might appear anywhere within the camera scene.<sup>10</sup>

This situation can encountered within a system attempting to identify the presence of an individual within a group or crowd.

Facial-scan technology is based on the standard biometric sequence of image processing, image characteristics, distinctive characteristic location, template creation, and matching.<sup>11</sup> A clean image is captured through a high-resolution camera. The stored images define the facial characteristics to be used in future verifications, thus a high-quality image data is essential.<sup>12</sup>

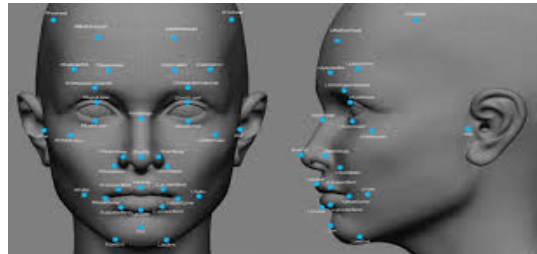
There are several matching methods available for facial scans which attempt to match visible facial features in the way similar as people recognize each other. Areas of the face which doesn't change over time such as areas around the cheekbones, sides of the mouth and nose shape distinctive characteristics most often used in image matching. Areas which do not change over time are normally used for verification.<sup>13</sup>

Face recognition has many advantages because of its scanning a person from far away process. As face images can be taken or scanned from a distance without touching the person being identified and identification can be done without any interaction with the person. In addition, face recognition can help us to remove crime activities because face images that have been recorded and archived can later help identify a person<sup>14</sup>.



There are some standards that help in processing of face recognition system. Face recognition system only works when it knows what a basic face looks like. Face recognition system is based on ability to first recognize faces and then measure the various features of each face. If you look through your face then you can see that your face has certain distinguishable landmarks sometimes called as nodal points in face recognition. Human face has about 80 nodal points on their face some of them are:

1. Distance between eyes
2. Width of nose



3. Depth of eye sockets
4. Cheekbones
5. Jaw line
6. Chin etc.

These nodal points are used to create numerical code, a string of numbers that represents the face in database (called face print). Only 14-22 nodal points are needed to complete the recognition process.<sup>15</sup>

*Features of face recognition system:*

1. It is non intrusive and requires no physical interaction on behalf of the user.
2. It is much accurate and allows for high enrollment and verification rates.
3. It does not require an expert to interpret the comparisons.
4. It can use your existing hardware infrastructure; existing cameras and image capture devices will work with no problem.
5. You can use existing images without having to re-enroll every user. (e.g.: passports, ID cards, Citizenship card, driving licenses etc.)
6. It is the only biometric that allows performing passive identification in 1 to

many environments (e.g.: identifying a terrorist in a busy airport terminal).

*The following types of hardware and software can be used:*

**Hardware:** High resolution cameras, Display Monitors.

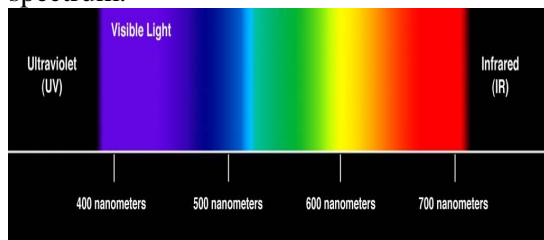
**Software's:** Open CV (Open source), Photoshop Ele (Adobe) etc.

**Database:** My Sql with php.

## B. Infrared Thermal Scanning

Infrared thermography (IRT), thermal imaging, and thermal video are examples of infrared imaging science. Thermo graphic cameras detect radiation in the infrared range of the electromagnetic spectrum (roughly 900–14,000 nanometers or 0.9–14  $\mu\text{m}$ ) and produce images of that radiation, called thermo grams. Since infrared radiation is emitted by all objects above absolute zero according to the body radiation law, thermography makes it possible to see one's environment with or without visible illumination.<sup>16</sup>

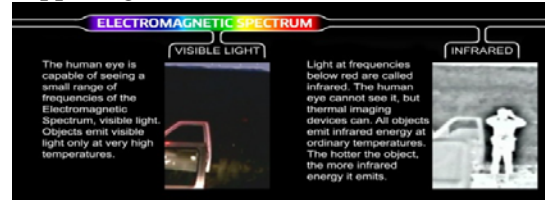
The amount of energy in a light wave is related to its wavelength: Shorter wavelengths have higher energy. Of visible light, violet has the most energy, and red has the least. Just next to the visible light spectrum is the infrared spectrum.



Infrared light can be split into three categories:

1. Near-infrared (near-IR) – Closest to visible light, near-IR has wavelengths that range from 0.7 to 1.3 microns, or 700 billionths to 1,300 billionths of a meter.
2. Mid-infrared (mid-IR) – Mid-IR has wavelengths ranging from 1.3 to 3 microns. Both near-IR and mid-IR are used by a variety of electronic devices, including remote controls.
3. Thermal-infrared (thermal-IR) – Occupying the largest part of the infrared spectrum, thermal-IR has wavelengths ranging from 3 microns to over 30 microns.

The key difference between thermal-IR and the other two is that thermal-IR is emitted by an object instead of reflected off it. Infrared light is emitted by an object because of what is happening at the atomic level.<sup>17</sup>



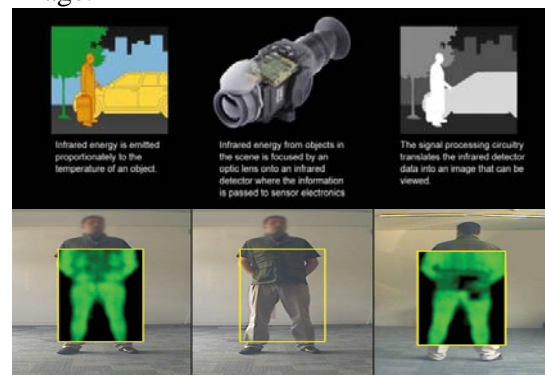
A special lens focuses the infrared light emitted by all of the objects in view.

The focused light is scanned by a phased array of infrared-detector elements. The detector elements create a very detailed temperature pattern called a thermogram. It only takes about one-thirtieth of a second for the detector array to obtain the temperature information to make the thermogram. This information is obtained from several thousand points in the field of view of the detector array.

The thermogram created by the detector elements is translated into electric impulses.

The impulses are sent to a signal-processing unit, a circuit board with a dedicated chip that translates the information from the elements into data for the display.

The signal-processing unit sends the information to the display, where it appears as various colors depending on the intensity of the infrared emission. The combination of all the impulses from all of the elements creates the image.



Intelligent video is a comprehensive term for any solution where the video surveillance system automatically performs an analysis of the captured video, such as motion detection, audio detection, and virtual fences, or sets off an alarm when cameras are vandalized or tampered with. With thermal network cameras,



this analysis can be distributed out to the cameras leading to improved efficiency and scalability.<sup>18</sup>

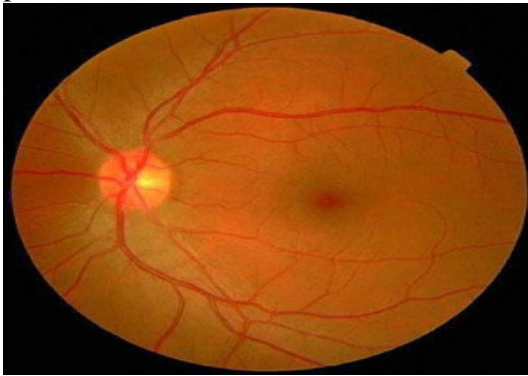
*The following types of hardware and software can be used:*

*Hardware:* Thermal infrared sensors, Quantum infrared sensors, Display Monitor.

*Software:* Infrared thermal scanning Software's.

### C. Retinal Scanning

The Retina-scan technology makes use of the retina present in eye, which is the surface, on the back of the eye that processes with light entering which bypass through the pupil. Retinal Scan technology is based on the blood vessel pattern present in the retina of any eye. The principle of the technology is that the blood vessels at the retina give a unique pattern, which may be used as a proof for personal identifier. As infrared energy is absorbed faster by blood vessels in the retina than by surrounding tissue, so it is used to illuminate the eye retina. Analysis of the retinal blood vessel image then takes place to find characteristic patterns.<sup>19</sup>



Now it is possible to acquire retinal scanning with eye moment, as human eye is normally not still. So for scanning a low intensity light source is taken in order to scan the vascular pattern at the retina. This procedure involves a 360 degree circular scanning of the retinal area taking over 400 readings in order to establish the blood vessel pattern. This is then reduced to about 192 reference points before being distilled into a digitized 96 byte template and stored in memory for subsequent verification purposes. Normally it takes 3 to 5 acceptable images to ensure the stored pattern data. Because of this, the enrollments process can be lengthy. Enrollments can take over 1 minute but now it

is possible in 0.25 seconds only. It seems the more that a person is acclimated to the process, the faster the pattern matching process works. After image acquisition, software is used to compile unique features of the retinal blood vessels into a template.<sup>20</sup>



*The following types of hardware and software can be used:*

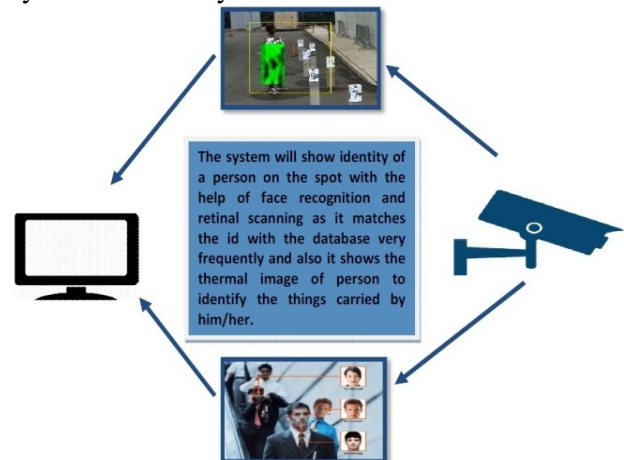
*Hardware:* Lasers with low intensity, Display Monitors.

*Software's:* Retinal scan.

*Database:* My Sql with php.

### D. The Third Eye

All three technologies will not work together first the Face Recognition system will be in action and it is accompanied by Infrared Thermal scan, if face recognition is not able to give appropriate results then it will be replaced by Retinal Scan system.<sup>21</sup>



### III. CONCLUSION

As we had come to an end, it's time to conclude the research. We are in the generation where lots of surveillance cameras are used. Organizations and Authorities of various countries are installing CCTV cameras in all possible areas to keep a keen observation on people and also on suspicious activities. But we found many disadvantages in this type of systems, as we have footage only, which gives us the recorded data where human has to find evidence with its own intelligences. So we decide to develop a new type of surveillance system which gives us live status of the person in the frame of camera. So time is not wasted in analyzing recorded data. So with this we can say we have moved a step forward in the generation of surveillance system.

The need of this type of surveillance technology is that we can identify wanted criminals and take action against them at that moment only and many more features will be also provided.<sup>22</sup>

- Can be used in places like banks, toll gate, clubs etc
- Can be used to identify persons and track them.
- Can be used to keep check in out of the persons on many places.
- Not only persons it can be also used to identify vehicles and can be checked for their validity and track them.
- We can also check the things carried by a person or in any vehicles.

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