# IMAGE PROCESSING IN THE NEW GENERATION OF SECURITY SYSTEMS

*lecturer eng. Iulian I. Corduneanu*
University "Stefan cel Mare" Suceava – Romania
str. Universitatii, 1, Suceava, Romania
e-mail: tehnocrat@assist.cccis.ro
tel.: 40-092-708.724

*Abstract*

*In the new generation of security system one of the most important action is control access with maximum exigency and the obstruction of trace passing from non-authorised persons. In this context the possibility of recognition of human beans can be one of the best factors that could be used in decisional process of starting final alert. The article present same possibilities of processing the images from the supervise video cameras. The methods of human physiognomy identifications in real time are not very precise because the human face presents parts variable in time and is difficult to find the invariable particulars characteristics for a correct identification.*

## INTRODUCTION

The security systems – for alarming at burglary, fire, sabotage, etc. – present a strategically importance in the best functionality from some important human objectives: banks, economical units, military bases, etc. In more cases for this type of systems, usually it uses passive equipment for survey: microwave detectors, infrared passive sensors, magnetically contacts, etc. This equipment is use for controlling all events with one central system helpful, without human assistance. If is necessary to increase the security level, it could be developing by mounting control access systems and video closed television circuits. These systems usually are assisted from human assistants. They have the principal duty to recognise in real time the video images of events from surveying space. The problem that must be solved is completing the existent structure with computers. Its must identify in most cases the new objects who can trace passing the secured area. This must be useful because in many cases the human presence can be unavailable or the guard agent is missing, or his decisions can be subjective.

For upstairs described cases, when is necessary the computerised assistance for video survey areas, the common structure for this kind of security systems is present in figure 1. The video objects identification is possible to be made with specialised graphics software. This programs processing some special conditions from image modifications and it extract any particularity that can be use in recognition process.

Further is present an identification of human body method from one security system without human assistance. This case is use in medium importance objectives with a less number of guards and actions agents. A human body identification with success accomplish in secured area will activate a video capture process from all event or a pre-set period of time from entire visible space. Video elements, as movies or images capture, will be used in the next rebuild of the activity of surveyed area.

For the beginning is necessary to make the accuracy that is possible to obtain a complex system composed of three video cameras disposed in a visualised 3D space, one camera from each axe. Each video camera look to the object and take it image by one of Cartesian axes: x, y and z. In this way with these three images is possible to recreate a new virtual 3D space. In this virtual space the images can rebuild the real object with some professionals 3D graphical programs, and after that it can be compared with any models from the internal database on computer.

In this way can be compared various kind of new objects forms inside the survey area. The disadvantage of this method consists in high price of the equipment supplemented with value of licence from graphical 3D software. The working computer who make the identification process must be at least a Pentium 90 MHz generation, or better, with 32Mb RAM memory (SDRAM preferred), and at least 4Gb external memory on HDD. With all this equipment required we could add another important disadvantage that is consisted in the number of three video cameras for one point of survey area. This will made to treble the price of video system, and generated very large expenses. The situation presented is used in research. In operational systems is too expensive and it is rejected by users.

If image processing identification works with a decreasing probability of success recognition, permitting an 80% of correct diagnose rate, than we can complete the security system with only one video camera. The captured images of this video camera can be used as input data in a program for generating pseudo-3D objects, start from one 2D image. Many times the

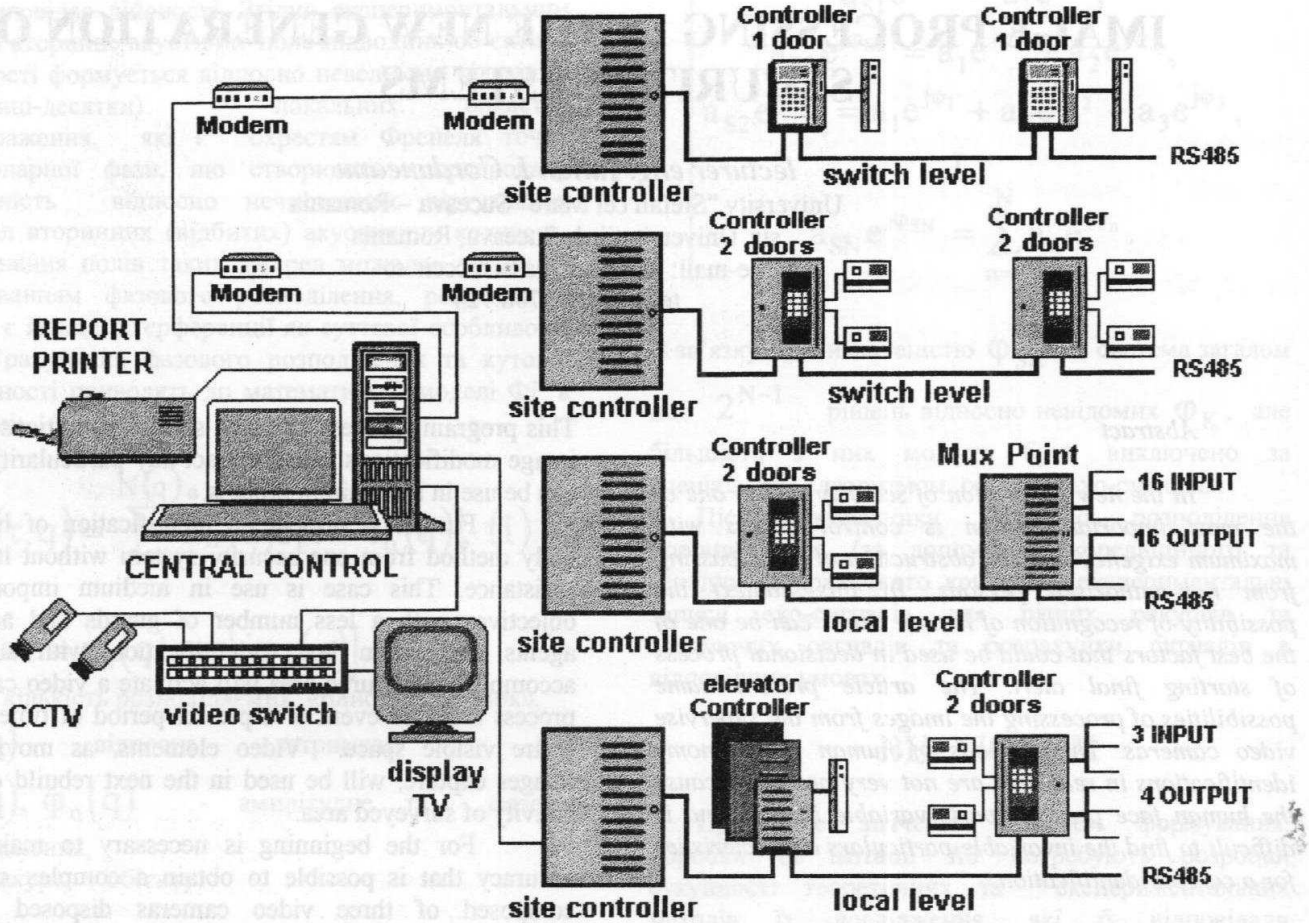


**Fig. 1** – The based structure for a security system for access control with video survey area

identification process not pass all the steps until 3D object is resulted. The comparison between generated pseudo-3D object and database on computer is made on partial stage of construction from virtual object. The model for database component could be generated in programs like Designer, 3D Studio, etc.

From a security system with video camera for survey a special space, like system from fig. 1, we want to activate video capture when is indicate a success identification from a human body in access area. From this purpose the video observation is made in continuum mode, in real time. The video signal is transferred as input signal from a video-Blaster. This device converts video signal in digital frame sequence. The capture device could be pre-set from a certain number of frames per second. For a computer with 32Mb RAM memory, microprocessor Pentium 150MHz, 4Gb HDD external memory and main board TX generation with PCIBIOS 2.1 compliance it could be realised video capture with 25-30 frames per second. But for security application it is not necessary this processing speed. It is considered more than satisfied a rate about 1 or 4 frames per second, if a person in less than time couldn't pass survey area between two key-frame in sequence. Also it is necessary to stop with success the converting images process in virtual three-dimensional objects and the identification step, in time between two real captured images.

On this stage when we want to isolate the object out-lines that will be recognise on computer it appearance a new problem, such as the background cancel. In this way the looking camera space is usually without some supplementary elements. It has in normal case, one single colour: mat white is preferred. The video camera is directed to a wall or a corridor. It will be paint in white usually for obtain a maximum contrast level. It will be illuminated with high and non-polarised light, sufficient to emphasise most details on survey object. When it uses directly light source is preferred the front position from the main video camera.

A human body image that pass the video survey area is recorded and send to the computer where it will be graphical transformed.

It will be start from the case when the record of object is one two dimensions image. This capture are not sufficient in most of cases for transforming it in a three dimensional complete configuration of virtual object. Is using in this stage some graphical software (as: 3D Studio, 3D Bryce, etc.), who can offer some special effects for simulating three-dimensions. In this way it can add virtual shadow or perspective effects, but without creating the real deep 3D space.

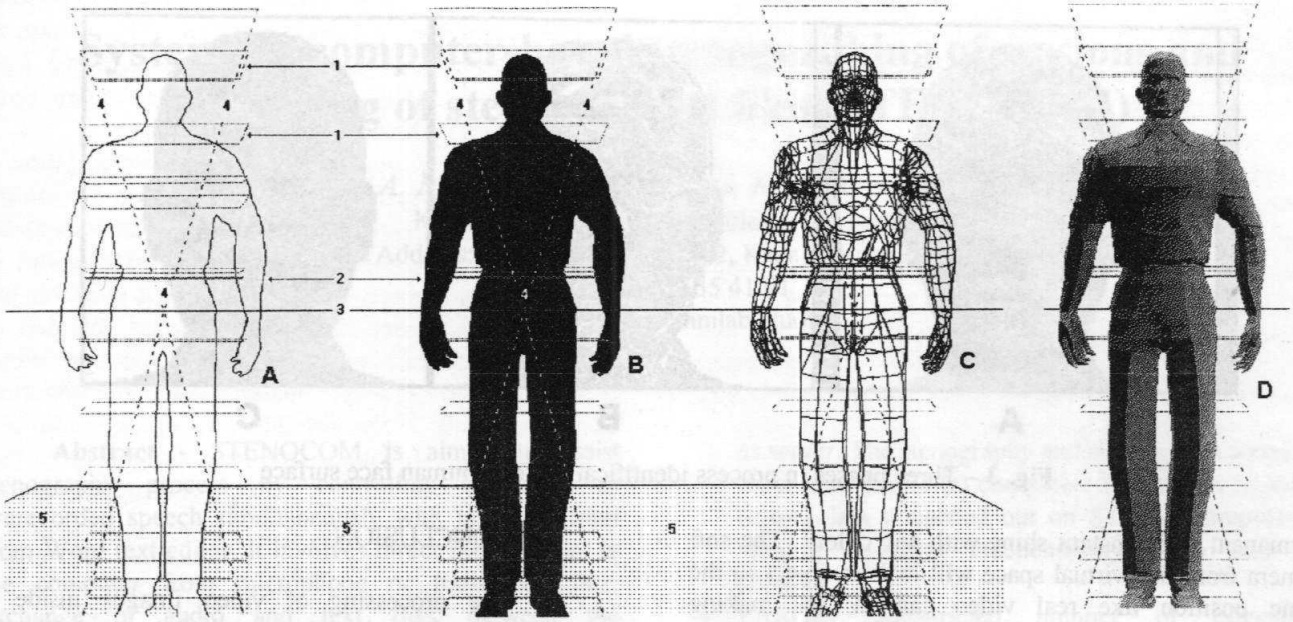


**Fig. 2** – Different kind of human silhouette and guides lines for positioning the video camera

Display: **A** – Outline
**B** – Silhouette
**C** – Wireframe
**D** – Flat Shaded

Guides: **1** – Head Lengths
**2** – Hip-Shoulder Relationship
**3** – Horizon Line
**4** – Vanishing lines
**5** – Ground plane

The images obtained from video scanning of secured area, could be use in various kind of detail complexity. If it will be use the best detail image of the recording object, with many particulars signs, the process of identification will be more complicated and it require one computing system with more hardware resource and high speed microprocessor.

The advantage of complex identification process is the higher level of success recognition from the video-recording object in secured area. For many cases when is necessary a high level of identification probability, the process of graphical modifications will take more time that is necessary to record two frame in sequence from the video camera. Some of the recorded key-frame will be jump from test process. Occur in this way long period of time, when a human beam has sufficient time to pass through secured area, without starting alert signal from the main security system.

The upstairs-presented case could be improved by activated video scanning from a movement sensor, such as passive infrared or microwave.

If we revert to our last video-scanning image, this is used to create a new graphic file, named "low detail 2D summary" or "2D summary". This last graphic format is the point for obtained new surfaces or volume 3D. This is the first step in three-dimensional creating process of a new virtual object starting with a 2D summary.

Next step is fixing the virtual look for exterior object surface. In figure 2, we can observe various presenting forms for a human body. The simple type is the "out-lines" body visage, which is possibly to used for object diagnose with less effort from the computing system, but with the minim probability level for success test. The second variant is to use the initial image type "silhouette" with increased chances in higher probability of successfully identification. This is the case with high frequency in diagnose process, because it use a medium database with eventually position from the real object. The success probability is increasing to 80% or higher. based to comparison software, the size of database and the computer resource. If identification database is increased with purpose to obtain a better diagnose. it result a medium processing time more expanded.

A high precision variant used in major importance systems is to achievement one "2D summary" using the flat-shaded human body silhouette. The video-scanned image is usually made in black and white colours. The final resulting image is in 16 tone of grey. This type of image is presented in figure 2-D. For better diagnose process is need a computer with Pentium at 233MHz or better, 64Mb RAM memory and 9Gb HDD. Hard-disk capacity is higher because one single key-frame image could have between 1Mb to 5Mb depended of deep colours palette and pixels image area.

Next step in image processing is referring to colour adjustment and if are possible some modifications for surface variable, such as: transparency, reflection and radiant property. These are more important in flat-shadow case identification.

Further is perfected video capture image through positioning the virtual light exactly like in their real correspondence. Each light is possible to illuminate the virtual object with almost all power disposable and any colour you wish. The simulated lights can shine over the virtual object identical with reality. Its could create intense shadows or vague shadows, could be very quickly top shine or instant darkness or its could have a

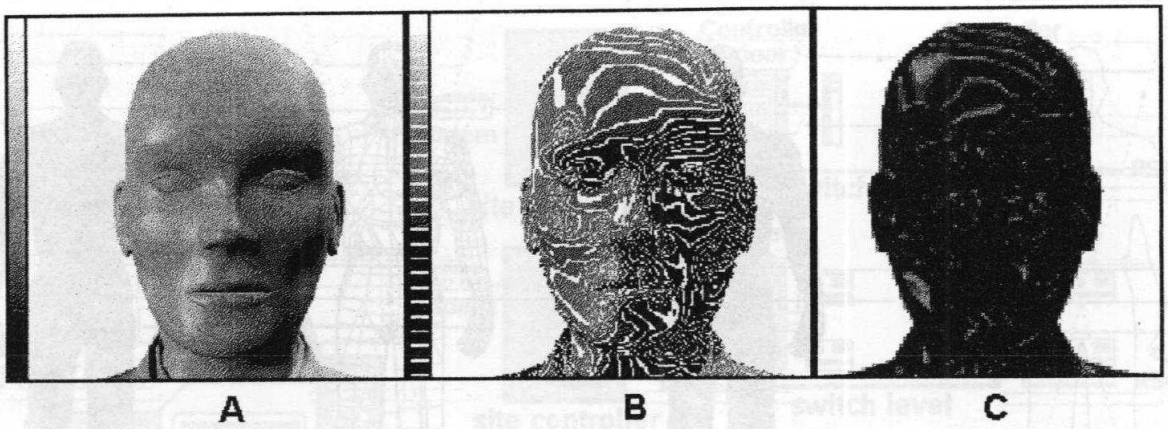


**Fig. 3** – Three phases in process identification for a human face surface

permanent and constant shine with any colour. The soft camera from this virtual space will look to object in the same position like real video camera, for making possible a preview from the same visual angle as in real case.

Last stage in captured images processing is the 3D-render operation. This phase is presented by one line tracing from the operator eye through each pixel from image. The way that visual ray will react when it touch the object surface, depend from the render program. Some programs for 3D-render allow to light ray to jump from one reflecting surface to another, passing through one object to another. Some 3D-render programs, named: ray tracing renders, permit from transparency objects to curve the ray line inside objects.

In each case, computer internal estimation involves crossing from the visual ray with object surface. This must be defining through a geometrical equation. If the render test is finalised with success, it allows modifying the pixel's colour, based on his material propriety. The computer executes the complex calculations, named often after their inventor's name, like: Phong or Gouraud. Evan a relative simple scene like is the silhouettes from figure 2-B needs iterate calculations from thousand times, before the shadows effects finished. In many times if we need an achievement render operation, is necessary a long time for calculation, in such cases by minutes order for a single image. It is possible that the final decision to come too late in real time and it will be useless.

In figure 3 is presented the images that we can obtain in final of recognition process from one human face (A), who was scanned with video camera. In part (B) it is transformed in 2D-summary with light gradient. This image is used to create one volumetric form in three-dimensional space. Looking in front to this face it will appear like part (C). This last 3D volume is connected to identification process. It will be compared one by one with all objects from database. The comparison is stopped when identification process give one result upstairs the probability fixed limit, and it is a valid result, or when the objects from database is finished and the result of recognition is negative.

## CONCLUSION

The processing of video images inside of security systems is a part from one last hour application, because until now this systems are based their functionality only on the signals from specific sensors, like: motions, temperature, noise, etc.

The identification process from a certain object or creature, based on it external form is a difficult method. It is necessary quality hardware resource, which made the system price to be expensive for an ordinary case, and it is accepted only from strategically objectives. Also the great possibility for a wrong result in identification process, if the object captured image is not included in computer database, make that recognition method to not be very frequent accepted. Yet this method of identification is object for study in many factory implicated in device production from security system.

Other factor who has an important contribution in smallest expansive utility from this method of video scanning of human physiognomy is the greater number of elements with major modifications in a short time. Also in human plan exist many methods from voluntary physiognomy changed (make up operations or esthetical surgery, etc.), who made to be very difficult to have trust in human body identification. It can be used only for general human presence recognition in a dedicated area.

## REFERENCES

[1]. Lammers J., Peterson T. M., "*3D Studio*", New Riders Publishing, U.S.A., 1995.

[2]. Norton P., Stanek W., "*Peter Norton Guide to Java Programming*", Ed. Teora, Bucharest, Romania, 1997

[3]. Krause K., Kotay S., Clevenger P., Wenger E., "*Bryce 3D*", MetaCreation, Carpentaria, U.S.A.,1997

[4]. Weinberg L., Reid G., Ahrems S., Prochazka D., "*Fractal Design Poser*", Interface Copyright 1996, Scotts Valley CA.