AUTOMATIC HUMAN DETECTION AND TARGETING SYSTEM IN DEFENCE

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Abstract: : High altitude borders of India pose a great challenge to our soldiers. Apart from their duty to defend the enemy, they have to struggle a lot to resist the extreme cold weather in those regions. Our project aims at providing an aid to this problem by replacing soldiers with this system. It is a fully automatic system, thus no manual assistance is needed. Our defence system s of features like automatic human recognition, automatic motion sensing, automatic firing, video recording system etc; Apart from this techniques, efficient human detection and targeting system identifies the presence of human and automatically target that person by tracking the location. Human detection is accomplished by skin detection technique. This system is outfitted with video camera, processing unit and embedded system, which cannot only detect intrusion attempts but also provide a video coverage of suspicious area for remote vigilance. As it is equipped with mechanisms for automatic firing only to the assailant, there is no harm for Indian soldiers as well as others, since we provide mechanism for differentiating friendly personnel from enemies. Also our device can withstand extreme climatic conditions, thus the device needed less maintenance.

I. INTRODUCTION

It is necessary to develop a fast and effective surveillance system to prevent increasing terrorist activities. Many tracking systems are being developed to detect the objects and track it's location [1]. The main function of these systems is to provide only visual information that regarding the track of the object. Targeting systems are developed from tracking systems by integrating a movable physical part which points to the detected object. Efficient human detection and targeting system identifies the presence of human and points the targeting device to human. This automated system is mainly used to recognize or monitor threats and prevent criminal activities in border areas.

The fastest routine to recognize the presence of human is hereby proposed to detect the skin tone features[2]. Other parts like nose, hair, eyes, mouth, etc are sometimes very difficult to identify if the object is very distant from the camera[3]. As the skin occurs more in area than others, it is better to detect skin tone features for human detection. It is very simple to assess the motion of an object by taking the difference in the consecutive video frames. It is also a fastest scheme but it fails to find the presence of human because wind and shadow may change the surroundings relative to the object and thereby producing false result. So it is better to identify the presence of human in a biological point of view that is the skin detection technique.

II. MATERIALS AND METHODS

Efficient human detection and targeting system has been divided into two subsystems.

1) Human detection and tracking system

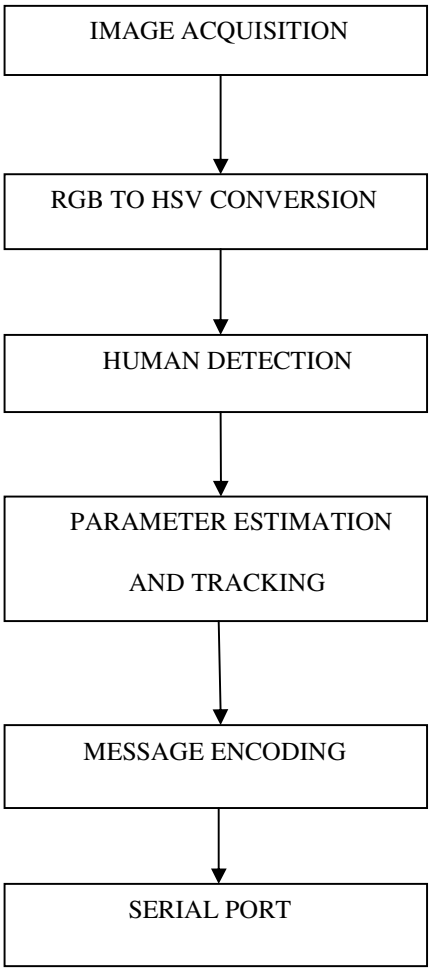
2) Authentication and targeting system.

Human detection and tracking system identifies the presence of human and track its location. Skin

detection modeling in HSV color space is used to recognize the presence of human which is a PC based system with image processing capability. Software for image processing consist of specialized modules that performs a specific task. It acquires the video frames from the camera and identifies the presence of human by processing the captured image. It also track the location of the human.

Authentication and targeting system is a separate microcontroller device which is connected to human detection and tracking system using a serial port. Servo motors are used as the targeting device those are driven simultaneously to achieve the desired angle to the object.

HUMAN DETECTION AND TRACKING SYSTEM



AUTHENTICATION AND TARGETING SYSTEM

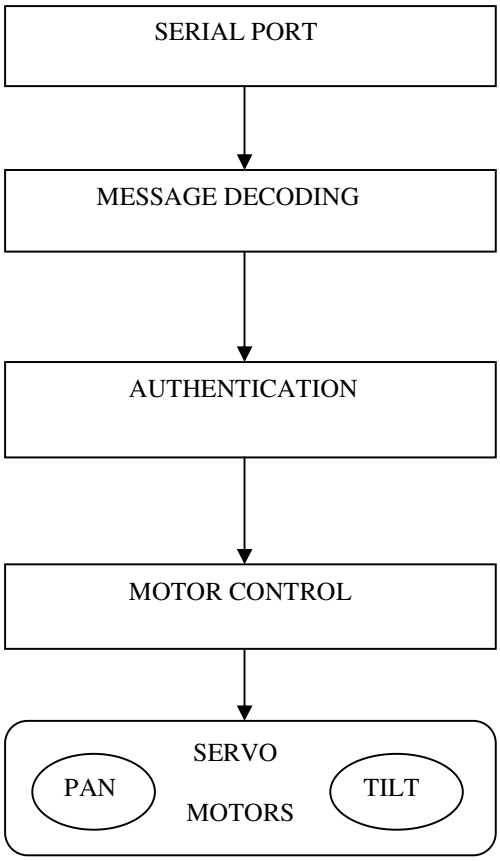


IMAGE AQCUISITION

To get images from any source, usually a hardware source is known as image acquisition. Using a camera, the moving images are recorded as video frames[4]. The human detection and tracking system reads each image and process it to extract the skin features. The image can be accessed and handled as a three dimensional matrix in RGB color space.

The image size depends on the resolution of the images. During further processing, increasing image size will affect the entire processing of the system. So as per the requirements, the resolution of the image can be fixed.

.RGB TO HSV CONVERSION

In RGB model, each color appear in its primary spectral components of red, green and blue. . HSV is the representation of points in RGB model into cylindrical coordinates. Hue is an attribute with the dominant wavelength is a mixture of light waves which represented as an angle in cylindrical coordinates. Saturation refers to the relative purity or amount of white light mixed with hue. Value is the intensity of pixel which ranges from 0 to 1. The radial position of the cylindrical coordinate system represents the saturation and vertical position represents the intensity value.

The HSV conversion can be consummated by the following equations.

I=R+G+B

r=R/I

g=G/I

b=B/I

h = cos-1 { [R - ½G - ½B] / [√ (R² + G² + B²) - RG - RB - GB]}

H= h ; B<=G

H= 360-h ; B>G

S= [Max(R,G,B) - Min(R,G,B)] / Max(R,G,B)

V= Max(R,G,B) / 255

HUMAN DETECTION

For identifying the presence of human, skin detection is the fastest method[5]. Other parts like nose, eyes, mouth, hair, etc can be detected but these are sometimes very difficult if the object is far from the camera. As skin occurs more in area than others, it is better to detect skin tone for human detection[6].

Human skin color ranges from darkest brown to pinkish-white hues. The human skin colors pigments will gather in small regions and differ more in brightness than in colors. Color component values are normalized with intensity values of the image.

Only r and g values are required to characterize the normalized color values. The condition for human skin in HSV colors pace is ranges from,

0.36 <= r <= 0.465

0.28 <= g <= 0.363

0 <= H <= 50

0.20 <= S <= 0.68

0.35 <= V <= 1

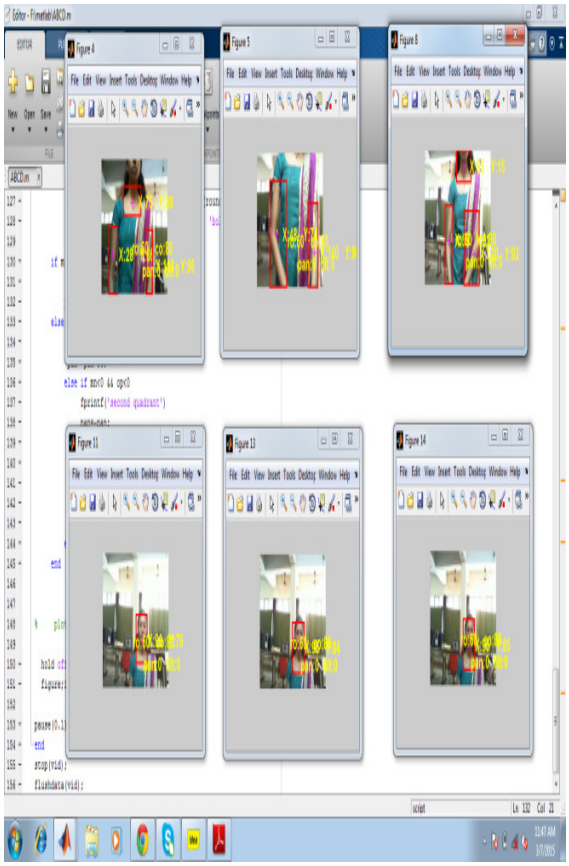


fig: output of human detection and tracking

PARAMETER ESTIMATION

The parameters to be calculated are the pan angle and tilt angle of the targeting device with response to the input . These parameters can be estimated from the captured image. The extracted skin region are represented with a bounding box. From the coordinates of the bounding box, its centroid is calculated and the targeting point is chosen with

reference to the centroid. If several skin regions are detected, then centroid of all regions are calculated and the midpoint of those regions are considered as the targeting point to the human[7].

Let centroid of the detected region be (X,Y).

pan= $\tan^{-1}$ (Y/X)

tilt= $\tan^{-1}$ (Y/D)

where D is a specified distance according to the resolution of the captured image.

MESSAGE ENCODING AND DECODING

The message is generated in human detection and tracking system, which is a control word. This message is used for successful and effective communication between human detection and tracking system to the authentication and targeting system. It is having length of 16 characters including pan angle and tilt angle details.

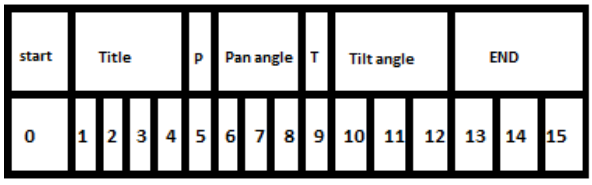


fig: frame format of control word

SERIAL PORT

During serial communication of microcontrollers with PC, MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic and vice versa[8]. The controller operates at TTL logic level (0 to 5)V whereas the serial communication in PC works on RS232 standards (-25 to +25)V. This makes difficult to establish a direct link between them to communicate with each other. So the intermediate link is provided through MAX232 [9].

AUTHENTICATION

Authentication is accomplished by IR detection technique. After recognizing the presence human, we have to identify whether it is an assailant or not. When IR receiver pick up the signal from the remote, it converts the light signal back to electrical signal. Then passes the signal to microcontroller. To avoid interferences caused by other sources of IR light, the IR receiver responds to a particular wavelength usually 980 nanometers.

MOTOR CONTROL

The microcontroller PIC 16F877A is used for motor control[10]. A buzzer is used to inform the intruder by making an alarm. Within a particular time, the detected person have to prove his identity using a password provided by the responsible authority. If the person fails to prove his identity, then he is automatically aimed and targeted. Laser light is used to point the target and Two servomotors are used to control the angular position of the pointer. An LCD LM016L is used to display the received message from human detection and tracking system.

III. IMPLEMENTATION OF THE SYSTEM

The human detection and tracking system consist of a webcam, personal computer and serial port interface. The authentication and targeting system included with a PIC microcontroller, servo motors, buzzer, IR receiver and a laser light. Mat lab is used to generate image processing program and this program directly acquires image from the camera and save as a three dimensional matrix. The image having skin tone features are segmented and PAN, TILT angle orientation with response to centroid of this segment are calculated by mathematical assumption. A message having 16 character length is formulated to communicate with the targeting system through a serial port. The micro controller PIC 16F877A is used in the targeting system with a buzzer warn the presence of intruder by making an alarm. Then it checks for the password and verifies whether it matches or not. If it does not match with the predefined keywords, the servomotors are set with the angular positions in accordance with the control word generated by human detection system. The 40 pin microchip PIC16F8A processor has 368 bit RAM, 256 bit EEPROM and 14KB flash memory which operates in 2 to 5.5 Voltage. MAX 232 IC is basically a 16 pin IC that used for serial communication.

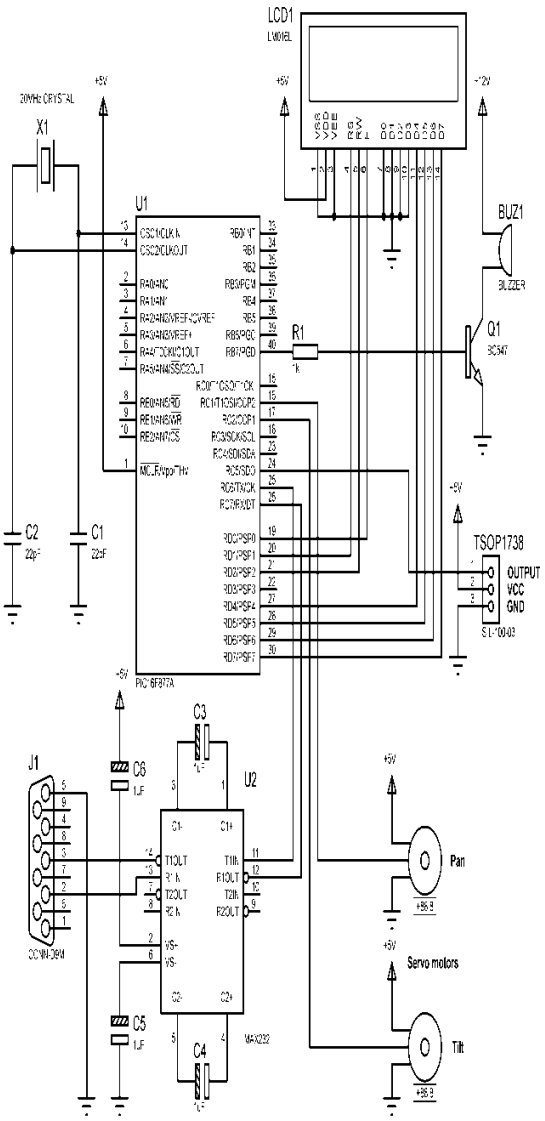


fig: circuit diagram for authentication and targeting system

IV. EXPERIMENTAL RESULT

The human detection system and targeting system are separately arranged and interconnected via serial port. A laser light is used to indicate the location of targeted person. The output of the camera is displayed on a window in the computer monitor through mat lab and the pan, tilt angle are displayed on the LCD as a message. The pointing device(laser) was moved according to the movement of human with a negligible delay. A simple and effective communication can be established by sending angle information through serial port. The performance of PIC controller can drive the servo motors to synchronize with human detection system. The processed frames can also be saved as image file so that to generate a video file.

V. CONCLUSION

An efficient human detection and targeting system is presented in this paper. This is an advanced and effective system for security. The skin detection technique in HSV color space is a faster approach to identify the presence of human. Converting the image into YCbCr color space can also be implemented instead of HSV conversion. This system can be used in different surveillance applications and having more future scope.

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