STEREO VISION BASED HUMAN TARGETING SYSTEM

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Abstract-: To get the visual information of object so many tracking systems are being developed .Object detection is the main function and tracking gather the latest position of object. Targeting systems are developed from tracking systems by incorporating a movable physicalpart which points / targets to the detected object.Intelligent human detection and targeting system identifies human and points the targeting device to human. In this paper , stereo vision based approach is demonstrate to detect the presence of human and target his location by estimating the distance of the human. The stereo vision detection establish the depth between camera and the human .This system identifies the human and track its location with an image processing application. 3D model of the object is used to track its distance. Skin color modeling in HSV color space is used to recognize the presence of the human. Two servo motors are used to achieve the two dimensional motion of the targeting device in the microcontroller unit.

Keywords : Automatic Targeting system, Human Detection, Video Tracking, serial Port Communication, PIC, Servo motor

I.INTRODUCTION

The area of human detection and tracking plays an important role in many applications such asvideo surveillance, biometrics, or video coding. Many different methodologies have been proposed in literature and can mostly be categorized as featured-based, appearance-based,or color-based. Among these approaches, color-based human detectionalgorithm was found tobe most efficient as it required low computational cost while being robust to variations inlighting, facial expressions, and skin colors.The humandetection and tracking method isalso used in Sports,Medical field, expedition, search and rescue operation,movie editing, queue monitoring system etc. Manyalgorithms were developed for detection and trackingsystem

II.SYSTEM ARCHITECTURE

This system can divide as two subsystem.

1) Human Detection System (HDS)
2) Human Targeting System (HTS)

HDSsystem identifies the human and track its location with an image processing application. HSV color space is used to recognize the presence of human.The image processing application

acquires the video frames and identifies the location of human from the image frames. The HTS is a microcontroller system which is serially connected with the PC through the RS232 cable. The control word which having a length of 16 characters is transferring through this serial communication.The microcontroller decodes the message and drives the two servo motors connected with it for Pan and Tilt motion to achieve the desired angle of target.

A. *IMAGE AQUISITION*

Two camera is used to observe the moving images as video frames. The image can be accessed and manipulated as three-dimensional matrix as the image is in RGB. HD camera are used to extract higher amount of information from the high resolution images frames.

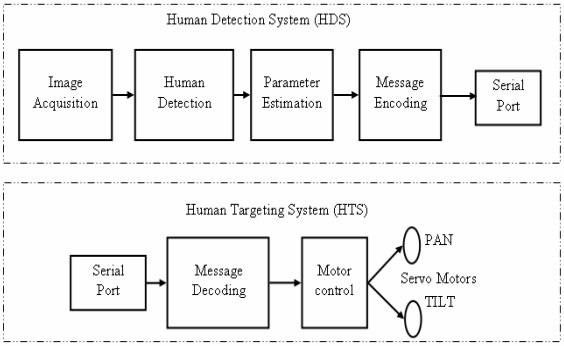

Fig.1 block diagram of system.

B. *HUMAN DETECTION*

The fastest way for identifying the human is skin color detection.For accuracy other techniques can also be included such as hair detection , face detection or eye detection. The range of human skin is vary from dark-brown to pinkish –white.Human skin colors differ more in brightness than in color. Color components values are normalized with intensity.RGB model is not perceptually uniform and doesn't hav separate intensity and color component. So HSV(hue,saturation,value) color model is used to extract the information from human skin.

HSV model is the cylindrical co-ordinates of RGB model.**H**ue is expressed as a number from 0 to 360 degrees representing hues of red (starts at 0), yellow (starts at 60), green (starts at 120), cyan (starts at 180), blue (starts at 240), and magenta (starts at 300). SATURATION- **S**aturation is the amount of gray (0% to 100%) in the color.VALUE- Value (or Brightness) works in conjunction with saturation and describes the brightness or intensity of the color from 0% to 100%.

Brightness value I= R+G+B , color component value can be normalized with the brightness value I.,

$$r=R/I \quad g=G/I \quad b=B/I$$

Where r+g+b=I

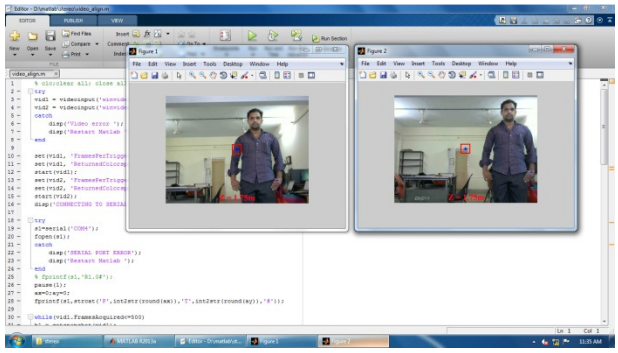

Fig.2 Human detection and tracking.

The condition for human skin is

$0 \le H \le 0.2 \qquad 0.2 \le S \le 0.7$

C. *PARAMETER ESTIMATION*

The PAN and TILT angle and the depth Z are the parameters in this paper.All these are calculates from the frames from the two cameras,The

condition is field view of both camera shouldbe in one direction.The detected portion marked as '+' sign.Which is the centroid of the detected location.Estimated depth is shown in the displaying frames.

The θt ,θp are the tilt and pan angles which determines the angle of rotation of two servo motors. At initial conditions the pan and tilt angles are set to be zero and this point is acted as the origin. The visual self calibration methods of PAN and TILT kinematic structures are defined as

$$\begin{pmatrix} Ct & 0 & -St \\ 0 & 1 & 1 \\ St & 0 & Ct \end{pmatrix} \begin{pmatrix} Cp & -Sp & 0 \\ Sp & Cp & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} CtCp & -CtSp & -St \\ Sp & Cp & 0 \\ StCp & -StCp & Ct \end{pmatrix}$$

Rc(θt ,θp)=Roty(θt). Rotx(θp)

St= sinθp Cp=cosθp
St=sin θt Ct=cosθt

Consider the centroid of the detected region be (X,Y,Z)

Ct=Y/Z , Cp=X/$\sqrt{(Y^2+Z^2)}$.

Considering the λ distance

Ct=Y/λ , St=X/λ
Cp = X/$\sqrt{(Y^2+\lambda^2)}$ Sp = Y/$\sqrt{(Y^2+\lambda^2)}$
From left camera
The PAN angle $\boldsymbol{\theta p_l = atan2(Sp,Cp)}$,
The TILT angle $\boldsymbol{\theta t_l = atan2(St,Ct)}$
From Right camera
The PAN angle $\boldsymbol{\theta p_r = atan2(Sp,Cp)}$,
The TILT angle $\boldsymbol{\theta t_r = atan2(St,Ct)}$

The PAN angle $\boldsymbol{\theta p = (\theta p_l + \theta p_r)/2}$

The TILT angle $\boldsymbol{\theta t = (\theta t_l + \theta t_r)/2}$

L and R are two cameras with parallel optical axes. Let 'f' be the focal length of both cameras.

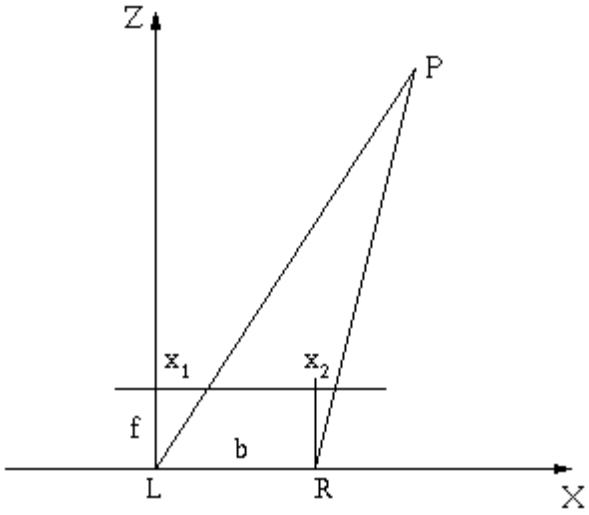

fig.3 triangulation of object and camera

The baseline (that is the line connecting the two lens centers) is perpendicular to the optical axes. Let b be the distance between the two lens centers.XZ is the plane where the optical axes lie, XY plane is parallel to the image plane of both cameras, X axis equals the baseline and the origin O of (X,Y,Z) world reference system is the lens center of the left camera. In this setting the equations of stereo triangulation are:

P be the position of object ,

Z = (b * f) / (x1 - x2)

$$X = x1 * Z / f$$

$$Y = y1 * Z / f$$

Finally calculated the depth Z using triangulation method. The depth Z is the distance from object to the camera base line.

D. *ENCODING AND DECODING*

The MATLAB sents the angle information(both PAN & TILT) through the computer's serial port.The max232 ic in the HTS system convert the serial data to parallel and is given to the micro controller.

III. IMPLIMENTATION OF SYSTEM

Human tracking system having a micro controller pic16f877a ,a serial to parallel converter ic max232, 20Mhz crystal oscillator,two servomotors , an LCD display, a buzzer and buzzer driver ciruit.

The 40 pins 8-bit Microchip's PIC16F877 (with 8 MHz clock) processor has 368×8 bit RAM (data memory), 256×8 bit EEPROM (data memory), and 8k×14 flash memory . TxD andRxD line of the microcontroller are used for serial communication with baud rate 9600 bps. It has high performance RISC CPU and has only 35 simple word instructions ..

The micro controller converts the angle to pulse durations to drive the two servo motors connected with the micro controller. Here the RKI 1210 servo motors having 0.55ms pulse for 0 digree,1.5ms for 90 digree and 2.40ms for 180 digreerotations.Thereshould be a 20ms gap needed for back action. An external 5v power supply is connected to sufficiently drive the servomotors.

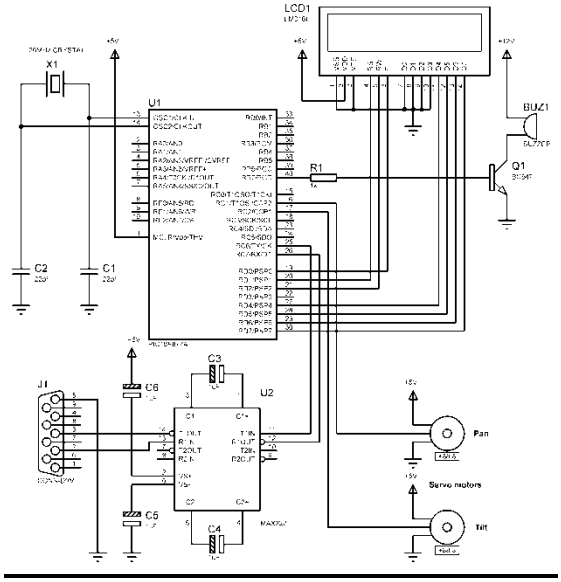

Fig.4 circuite diagram of HTS

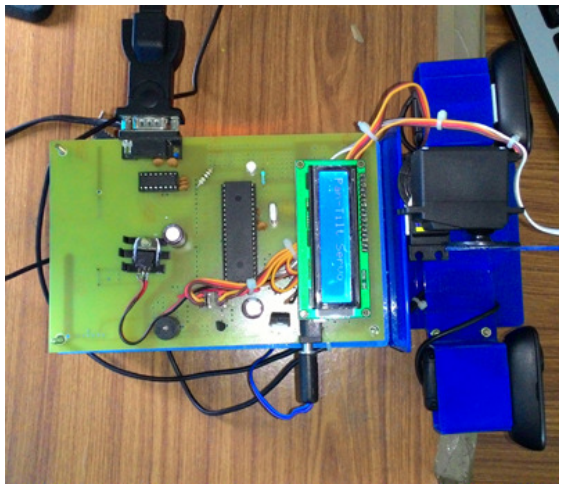

Fig.5.Hardwere of HTS

IV.EXPIRIMENTAL RESULT

The HDS and HTS are separately setup and interconnected through serial Port. A laser light wasused as the pointing device. The laser light is placednear the camera so as to synchronize their direction ofactions. Initial position of the pointer is considered asthe origin (angle zero degree). The experiment wasconducted successfully. The output of the camera isdisplayed in a window in the computers monitor throughMATLAB. From this,

track of the human was observed.The PAN and TILT angle information are displayed inthe LCD as a message The depth(Z) is show in the output video frames in metrics. The pointing device was movedin response of the movement of the human with anegligible delay. A Simple and efficient communication was established by adopting a standard message format for the communication. The smarter performance of PICcontroller could drive the servo motor tosynchronize theHDS and HTS. Theframes can also be saved as imagefile so that to generate a video file.

V. CONCLUSION

Stereo vision based human targeting system is presented in this paper. Stereovision method used to the parameter estimation and it improve the depth range of the system.This system is an expedite and effective system for security threats. The skin detectionmethod in HSV colorspace is a faster approach torecognize human being.. The data format is designed to incorporateadditional information for communication. This system can be used in different camera surveillance systems.

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