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Design and implementation of Camera Based Object Tracking in 3D Space

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Abstract- Object tracking is the task of capturing the 3D position and pose of an object from frame to frame.In this paper we have presented an application based on gesture to control robotic arm through human arm.This arm is based on ATmega16.It is a servo motor based robotic arm with multiple degrees of freedom and having capability to rotate at maximum point in region.This microcontroller based servo motor controller will be controlled through computer system in order to control the individual motor on the basis of provided angle. The Vb.net designed software processing approach has created human computer interaction in order to control hardware baesd robotic arm in 3D co-ordinates.

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I. INTRODUCTION

Camera based object tracking has always been a most demanding area of research in different experiments.The camera based object tracking finds a target object within different images, either with or without explicit usage of temporal correlations.This problem is especially challenging when the object is fast moving and partially or totally occluded in a couple of images. The major problem with any camera view is that, it works on frontal view and it gives result as 2D image only. Using 3D camera image can be viewed 3D visually but not actual co-ordinates of each object can be tracked.This implemented designed system finds out the all 3 co-ordinates details of an object in 3D space,with software processing creates human computer interaction in order to control the hardware based robotic and in 3D co-ordinates.

Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait, proxemics, and human behavior's is also the subject of gesture recognition techniques. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

Our prototype implemented system will identify the user action in 3D space and calculates the 3D co-ordinate detail and controls the robotic arm hardware in 3D space,calculate the Z co-ordinate of the object from front view and plot graph to get the location of object in all 3 co-ordinates then control the robotic arm actions in 3 dimensions.

II. LITERATURE SURVEY

Karl Pauwels,Vladimir Ivan,Eduardo Ros and Sethu Vijayakumar [2], in their paper they have used a real-time system for joint multi-object and manipulator detection and tracking in complex, dynamic scenarios involving imprecise calibration. The method achieves a high degree of accuracy and reliability by constantly updating a detailed 3D scene representation on the basis of large amounts of dense visual data.

Nazim Mir Nasiri[6],in their paper they have used image processing techniques to identify and locate the object in 3D scene and motion control algorithms to direct the camera towards the object.The advantage of this system his that it does not require camera calibration and manipulates will all measurable parameters only in pixel values.

Giorgio panin,Alois knoll [5] a robust real-time system for 3D object pose tracking in image sequences, which integrates an extended and optimized implementation of a powerful local curve fitting algorithm, and a robust global reinitialization module based on point feature matching.

Wenjun Zhu,Peng Wang ,Fudong Li,Jianhua Su,Hong Qiao[1],in their paper a novel method of real time 3d tracking of work piece based on CAD model with monocular camera.The work piece is localized with high is localized with high precision precision and real time speed in 3D work piece localization process.

Takashi Okuma,Takashi kurata,Katsuhiko Sakaue[9] we described a natural feature based 3D object tracking method for video see through wearable augmented reality

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systems.This method is based on a combination of BUA,TDA and automaticdatabase addition.

III. OBJECTIVE

It is mainly design to identify the user action in 3D space and calculate the 3D co-ordinate detail and control the robotic arm hardware as per,

[1] To design and implement a system to track motion or the object in 3D space.

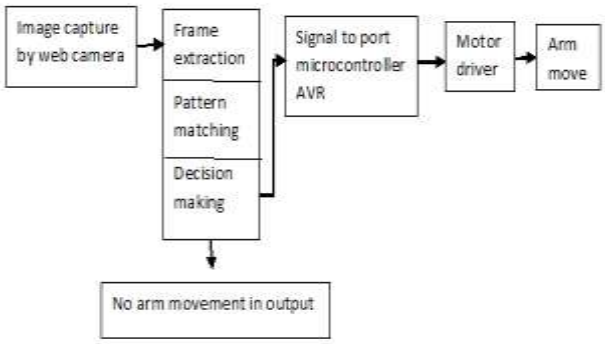
[2] To calculate the Z co-ordinate of the object from front view.

[3] Plotting a graph to get the location of object in all 3 co-ordinates.

[4] Controlling robotic arm actions in 3 dimensions.

IV. METHODOLOGY

BLOCK DIAGRAM



This implemented system divided in to following modules. First is video capturing to get the video frames, next is image processing to get the images from frame, and next is to get the pixel information from the image, the detection of color from pixel and at last controlling the hardware.

Camera capturing: Image is capture by connected web camera.

Feature extraction: Image features at various levels of complexity are extracted from the image data. Typical examples of such features are –

- Lines, edges and ridges.
- Localized interest points such as corners, blobs or points.

Pattern matching: In pattern matching we extract RGB value for each pixel and we also compare those value with predefined value.

Detection/segmentation: At some point in the processing a decision is made about which image points or regions of the image are relevant for further processing. Examples are

- Selection of a specific set of interest points
- Segmentation of one or multiple image regions which contain a specific object of interest.

Hardware control module: It is a servo motor based robotic arm with multiple degrees of freedom and having a capability to rotate at maximum point in region. Microcontroller based servo motor controller will be controlled through computer system in order to control the individual motors on the basis of provided angle to the servo controller for particular motor. Service controller also responsible for controlling the motor using pulse width modulation techniques.

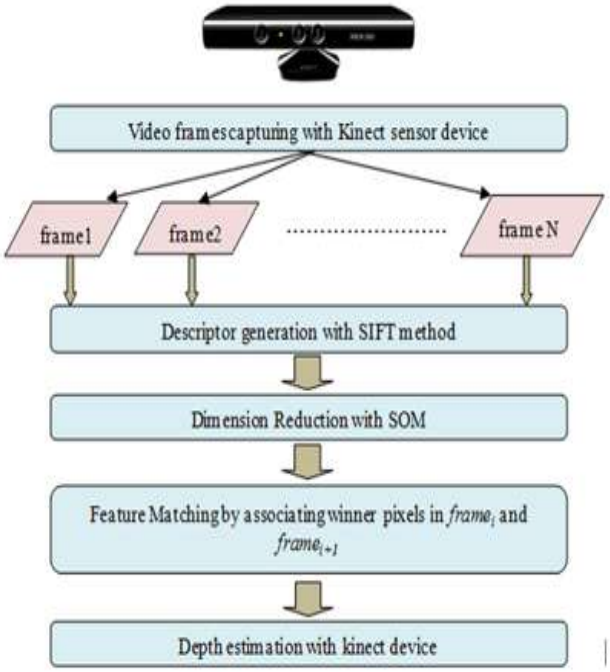


Image capturing and frame processing are the two important methods we are using in our project. The working methodology includes capturing the gesture through camera as image, extracting the frame and then extracting the pixel.

A. *Processing:* First we get the web camera device object then get the frame by frame that is the image. As we get the image then we try to extract the pixels from it and as we get the pixel we try to get the RGB color value from the pixel, as pixel made up from the RGB value of the color. By creating object of these drivers we can get input to application provided by device which can be displayed to user interface objects like picture box, frame, and panel.

B. *Loading driver:* In Visual Basic 6.0 language there is a function "capGetDriverDescription" to detect the entire driver available on the system. This function will return name of driver and the ID of driver.

C. *Capturing view:* After getting the list of driver we need to use specific driver in the project to start the capturing of the camera view in the picture box. There is a function named "capCreateCaptureWindow" which can be used to get the camera window object.Then to actually start the camera view

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we use “sendmessage” function to the window object and send message connect this function to start the camera view in picture box.

D. *Extracting frame:* To get the current view as image we used a function “hdcToPicture”. This function will convert the view into image format which will be processed by our project. Next we used a variable which can hold entire image in memory so by using “Dim bm as bitmap” statement we declare a image object which will hold entire image in memory as a variable and to load current view in this “bm” variable we used a function “getobject” this function will load a picture form picture box to bm variable.

E. *Extracting pixel:* By using “getBitmapBits” function we can get the pixel RGB value detail which in range of 0 to 255.Once this process complete live cam view displayed in supportable control like picture box but this is real time live view so it is not possible to process it directly so we need to get the current frame out of live streaming for processing. This is what we called it frame extraction and we load this frame in memory for fast processing.

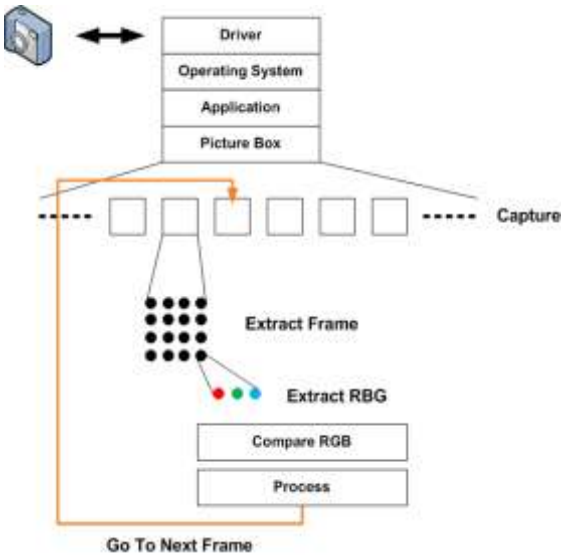
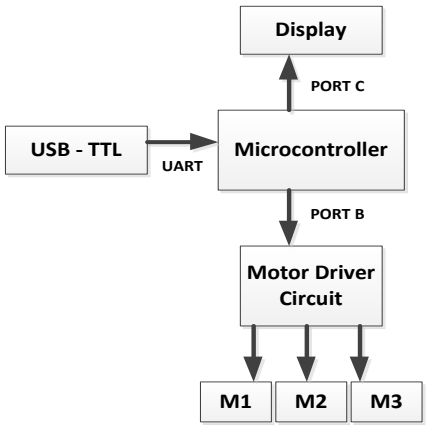


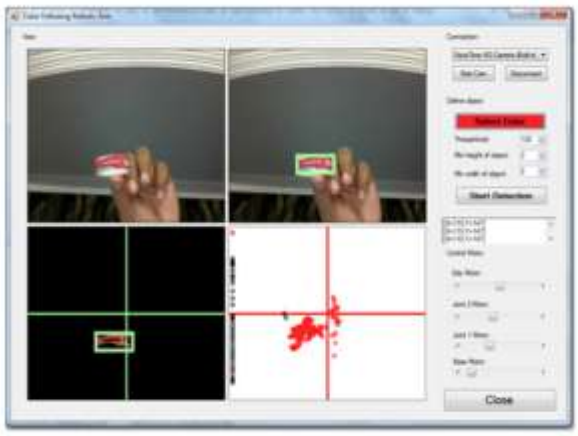
Fig.-Process of image capturing and frame processing

Overall execution sequence for video processing

- Capturing camera view
- Extracting current frame from video stream
- Creating memory image of current frame
- Finding skin color cluster
- Calculating input on the basis of finger gestures
- Finding current co-ordinates
- Detecting Click event
- Action (User interaction).



V. RESULT



Initially we take a colourful object then select area which have to be plotted,then we have to select a color the system selects the mentioned color and it blanks the other color.

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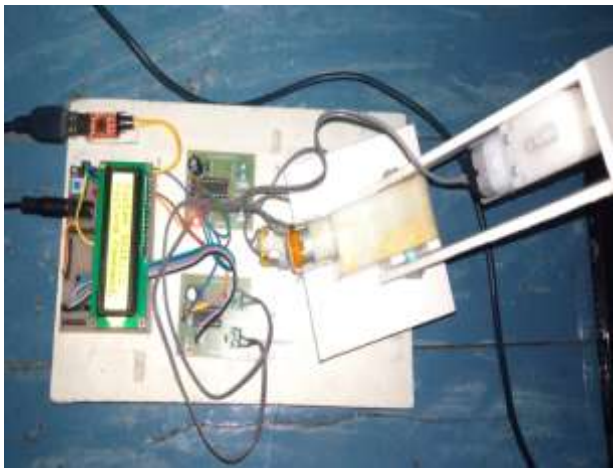

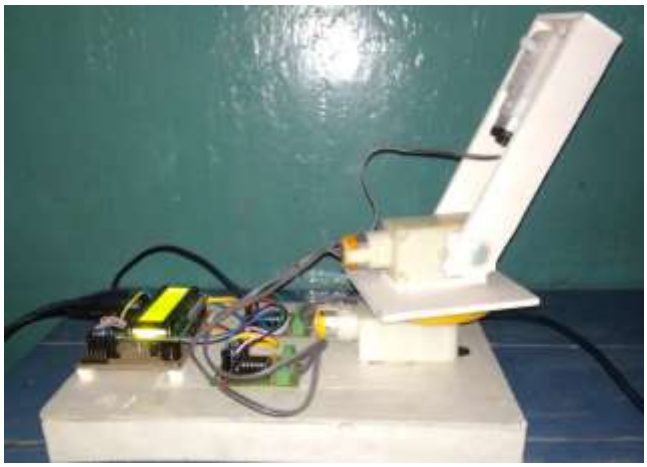

VI.APPLICATIONS

This prototype model can be implemented in large scale in industry based application such as-

1.In extreme high temperature industrial area such as cast iron manufacturing/boilers the human operations can control machines such as jcp arm by this gesture control sitting in control remote location.

2.In military war fronts machineries can be controlling by this gesture based technique where soldiers can operate from far distances.

3.Medical application such as remote key hole surgeries.

VII. FUTURE SCOPE

1.New technology is enabling automobile manufactures to integrate gesture recognition features in their cars to let driver manage the control system of the car.Ex.-A 3D gesture control system in their top end cars that will let a driver to control the audio system with just a wave of the hand.

2.Surgeons routinely need to review medical images and teppirecords during surgery,but stepping away from the operating table and touching a keyboard and mouse can delay the surgery and increase the risk of spreading infection causing bacteria.

The new approach is a system that uses a camera and specialised algorithms to recognise hand gestures as command to instruct a computer or robot.

VIII. CONCLUSION

This project introduces new and effective approach for object tracking system.A new technique has been proposed to control robotic arm and implement a system using real time camera.This method improves the accuracy.The goal of this project is to create a system that will recognizing the gestures and control the arm according to those gestures. The developed system uniquely integrates vision and image processing techniques for object recognition and perception with camera actuation system through the designed computer control programs. The advantage of this system is that it does not require camera calibration and manipulates will all measurable parameters only in pixel values.

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