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Virtually controlled high precision Robotic arm

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***Abstract*— This project is based on the implementation of virtually controlled high precision robotic arm. It addresses the critical environment where human presence is mandatory for the nature of demanding accuracy like bomb diffusion, Chemical and radiation etc., Due to the remote operation procedure of a ROBOT, it lags human precision and adaptability. In this module, it consists of camera, computer digital signal processing, system interface, arduino controller and robotic arm. It takes real time video of human hand and tracks it to get interface with robotic arm. The robotic arm is controlled by arduino controller. The main Arduino control board receives the voltage signal from the digital signal processing via its microcontroller pins and transforms them into angle and direction commands for the motion of each joint of the robotic arm. The pwm dc motor present in the arm will move according to the arduino instructions, which can be utilized in human endurance situations. Simulation of robotic arm is carried out using MAT lab simulink. The simulation results are presented to predict the output early. A hardware circuit for robotic arm is to be fabricated based on the results of simulation.**

Keywords—vedio image processing, robotic arm, arduino controller, interfacing.

I. INTRODUCTION

In today's world there is an increasing need to create artificial arms for different inhuman situations where human interaction is difficult or impossible. Robotic arms are becoming increasingly popular in several fields such as industrial automation, medical applications - remote key-hole surgeries and military applications because of its accuracy. In certain critical applications such as performing surgeries or diffusing a bomb, robotic arms could be of tremendous use to save lives. In such applications, controlling the robotic arm precisely is of at most importance. This requires a functional design specialised for a specific task with stiff joints. Modern robot arms are becoming more and more compact, light and stable, and are often designed to operate in human environments. Such robots must be capable of performing independent tasks in a human-like way, which means that its movements must be versatile, fast, accurate and energy efficient. In addition to that, the robot must be capable of reacting appropriately to external stimuli.

The Robotic arm used in industries and other sectors operates by executing the instructions stored in its processor. Hence Human-Robot interaction is less. As the technology improves there is a need to have greater interaction between Human and Robot so that the assigned work can be carried out as required by the user. At present, direct interaction between humans and robots is generally limited to physical guidance of assistive tools such as lift-assist devices. Most of the robotic devices used are controlled by wired communication. Hence separate communication cables have to be laid for each device which increases the cost and maintenance. This project introduces the technology used to track the arm and interface it to control the robotic arm for different activities. The motions can be controlled by the user by moving our hand in any direction. This project is very important since it gives an intuitive way to develop human centered forms of human machine interaction. At the same time it is difficult to control, since it needs different identification schemes of hands such as pattern recognition, tracking, etc. We have implemented virtually controlled robotic arm using Arduino controller and PWM dc motors. The wireless communication enables user to communicate with robotic arm from certain distance.

II. LITERATURE SURVEY

At present there is enormous amount of work is done in order to identify the motion of the hand. Lots of articles have been used in surveying the detection for the motion of hand. The different fields using this technique contain automatic hand language, automatic sketching, computer graphics and also industrial robots used to work instead of humans. This paper gives the most successful technique to use robotics.
In these area two types of techniques are used:
1) contact type
2) non-contact type
1) Contact type: Contact type of devices contain data gloves, electromagnetic tracking system, exoskeleton etc.

2) Non-contact type: This type contains vision based system, speech recognition, camera based etc.

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Our technique comes under non-contact type since it uses a camera to track the hand. Traditionally these systems were implemented using CCTV cameras, based on computer vision algorithm, using embedded system. These techniques mainly contain video analysis and are used for tracking the people. Some non-contact techniques involve skin color detection in which user will directly tracks the hand and detects the hand. Whereas some uses notation techniques for different positions of hand like as first finger denotes the motion in forward position, second will denotes the backward position etc.Tremendous amount of work is done by the use of single cameras. Nowadays different methods and techniques are using to detect the by the use filters, suppurating the background, using 3D cameras etc. For the extraction of features for Hand tracking we are using notation techniques for different positions of hand which is given on different positions of hand. Where the movement of hand will shows the different axis at different locations.

III. ALGORITHM

The sequence wise procedure of human hand tracking for controlling robotic arm is as shown in figure 1.Input is taken as a video signal of the human hand and analyses it to track the hand movement at different locations.

A. Tracking of Hand Movement

For conversion of image, normal image is converted into grey image. We have to convert the 3D image to 2D image. These grey images are converted in to black and white image. The image obtained must free of noise and edge reduced. Many frame will be generated so subtractions of frame required to detect the motion of hand. Finally direction of robotic arm is obtained.

B. Block Diagram Of A Robotic Arm

Block diagram consists of camera, computer digital signal processing, system interface, arduino controller and wireless robotic arm. Camera is used to capture the human hand movement, feed that captured movement to digital signal processing. The digital signal processing converts the analog (hand movement) to digital signals is called as video image processing.System interface is the cable, connecting the computer and arduino controller. Arduino controller contains set of microcontroller used to give the command to the wireless robotic arm peforms the analog function. These are basic function of the virtually controlled robotic arm.

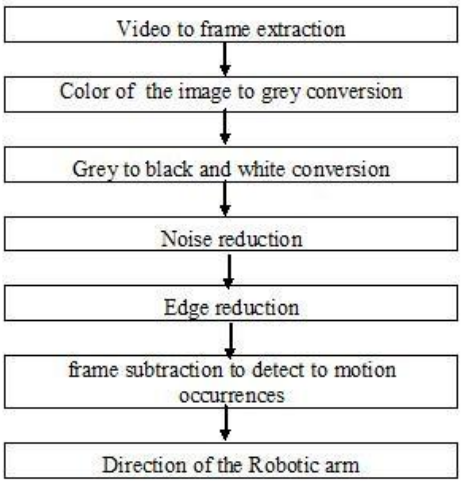

FIGURE 1: Sequence wise procedure of human hand tracking for controlling robotic arm.

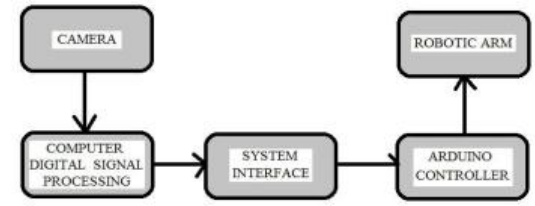

FIGURE 2(A):Block Diagram of Virtually Controlled High Precision Robotic Arm.

FIGURE 2(B): Detection of hand position for Down Movement.

Several methods has been used to trace the angles of human hand like gesture recognition in which a particular shape of palm or number of fingers has been shown to the camera, to track the angles and the voice recognition, whatever we speak will write in the MATLAB in the form of code and then it is interfaced with the robotic arm to trace the angle.

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Depending on the axis location the angle can be trace by the camera to give signal to robotic arm. For the movement of the robotic arm the angle signal is transmitted from MATLAB to the micro controller and process the signal. The processed signal is the transmitted to the robotic arm to perform various actions.

IV. RESULT AND OBSERVATION

Tracking of human hand gives the tracking of different axis at different location of human hand. As the axis location will going to change the angle between the each joint of hand will change. Depending upon these angles the robotic arm will move.

By serially interfacing the angles recorded by the axis of hand will be send to the Arduino and then it controls the robotic arm in the real time.

Here we may get error during the recording of video but it can be eliminated by taking white color background.

V. CONCLUSION

In this paper the implementation of human hand tracking using robotic arm is shown. The arm is controlled by the human hand and it will listen all the instructions of the human hand. This technique can be used even if the user is dumb or deaf that is it listen the instructions of hand only. This is a very easily implemented straight forward method to coupled man-machine interface. To control the robotic arm, the human hand must be recorded in the camera in proper lightning conditions, with a black color background. So that error will be less while recording the video. To control it I have used the angle measuring technique. The angles are measured by the use of simple trigonometric equations of sine, cosine, tan etc.

To detect the hand we should not need any database for this technique. Since this is a real time processing with this the memory required for the storage of database will not require. I have proposed a simple algorithm to track the human hand to detect the axis depending upon these axes, the angle between the joints of the hand can be recognized. Above figures shows the different algorithms to detect the hand and at the same time the robotic arm can be controlled.

VI. FUTURE SCOPE

This technique contain color detection technique, which need more filtering options such that no other colors should be present at the background of recording. This problem we have to eliminate. This method can be used for one degree of accuracy which can be improved up to 0.1degree or even less than that.

For the controlling of the robotic arm it is connected to the Arduino micro controller. Since it contain serial interfacing of the robotic arm and the camera or our laptop. We have to make serial interfacing program which will be interface the laptop camera and the robotic arm according to the movement of the human hand. Depending upon the angle we have taken from the axis location the interfacing program will interface the angle and the rotation of the PWM DC motor. This angle is send to the PWM dc motor by serial interfacing and the rotation of the PWM dc motor by same degree will takes place.

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