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Advancement of Natural Vision and Controller for a Surgical Robot System

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Abstract

This paper presents an innovative and price-effective development of a clinical/surgical robot device. The model and layout suggested are fairly useful in improving precision and we built a robotic surgical mechanism which is cost effective, compact and versatile framework to model and test the configuration of the tele-operation controller. The surgeon can perform tele surgery operations with real- time surgery site image which is produced from a 3D stereo vision tracking subsystem. So the proposed advancement in natural vision for a surgical robot system is more cost effective than the standard system. The controller which is designed can be used as standard tele surgery training system from the smoothly generated trajectories

Index Terms; *clinical robot device, 3D Stereo vision, Master console, Surgical Robot, Slave robot*

I. INTRODUCTION

Few areas where task involve the current product development includes numerous preferences, for instance say, decreased medical procedure time, quicker recuperation, less agony and lower danger of disease. Presentation of cutting edge automated systems has furnished the Minimal Invasive Surgery (MIS) with included advantages, for example, tremor decrease, complex finesse, movement scaling, telesurgery and stereoscopic representation [1].

In telesurgery activity the robot framework as a rule uses an ace slave engineering, which comprises of two sections: the specialist comfort (ace) and the careful robot (slave) as shown in fig.1 discoursed in the specialist support permits the specialist to enter his/her control directions and get a stereoscopic video of the medical procedure site. The careful robot then again, performs careful tasks, for example, cutting, suturing, and tying a bunch, heavily influenced by the ace specialist. Utilitarian square graph of the ace slave careful robot framework is appeared in literature. [2-4]

II. SYSTEM DESCRIPTION

The physical controls and the cautious tools integrate the final effect of the cautious system, which are limited by an integrated smaller scale control structure. The highly advanced scale device gets the guidance instructions from the professional service, translates the instructions, and controls the motion of the automatic controls and the cautious

2.1Mechanical Design

Fig.1 demonstrates structural design of the cautious robot. The serf human has 3 DOFs (yaw, pitch, interpretation) to deal with the situation at the end point of the cautious tool. This uses a triangular prism device at the port of procedure to achieve the remote central focus of motion (RCM). A workable diagram for machine operating system is shown in fig.2.

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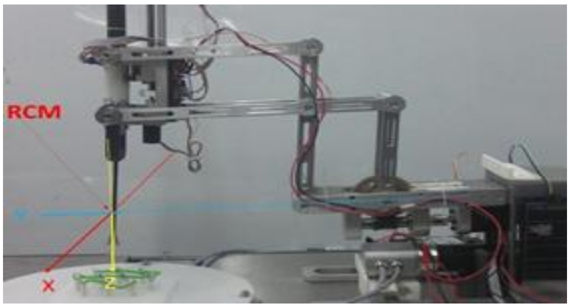

Figure 1. Architecture of virtual RCM surgical robot

2.2. Subsystem for 3-D stereo video

So as to monitor and control the robot precisely, the specialist requires a nitty gritty perspective on the medical procedure site which the system can be observed. Figure 3 shows the HD stereo view system block diagram and figure 4 shows the HD video cameras. Thus, one significant objective of our task is to furnish the specialist with a constant high-caliber (1920×1080) sound system video of the medical procedure site. The utilitarian square outline of the vision on every eye is divided computer, the display lines used individually**.**

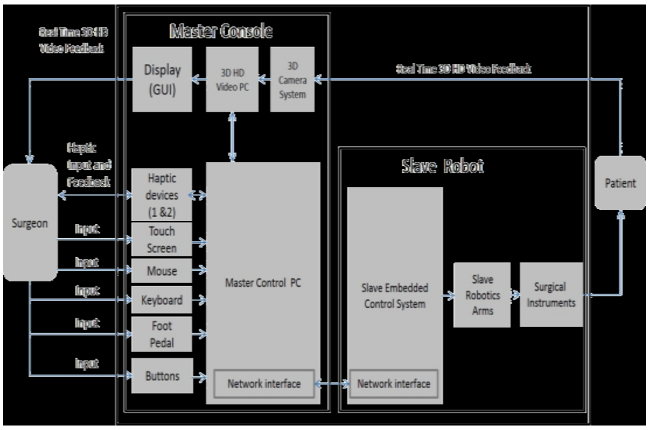

Figure 2. Workable diagram of machine operating system

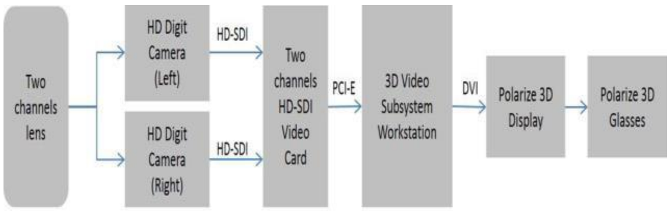

Fig. 3. HD Stereo View System Universal Block Diagram.

Fig. 4. HD Video cameras

2.3. Tele-operation Control Subsystem

The tele-medical procedure subsystem gets the specialist's direction sources of info and maps them to ideal developments of the robot and the careful systems.

2.4 Communication Protocol

Bundle of UDPs contains three sections: heading, content, and hash algorithm. The heading indicates the package classification amount and the data type and length. The nature of portion of information relies on the type of information obtained. For instance, if the information is rigid body order, the data should provide a description of DOF qualities for the machine's procedure. The last piece of the package is the bundle checksum for shipment approval and as a defense against errors in correspondence.

2.5 Master-Slave Mapping

The control unit, in the ace slave container, maps the Phantom Omni's movement to the robot and instrument Mapping are common where learning and working is simpler as seen from the published works. [5]

III. EXPERIMENTS

The master-slave system for the proof of concept as well as the monocular in real time was used to track the role of the tip of the clinical tool. The detector is sensitive to sub millimeter and post-degree. Two orbits were tested: the trajectory was rectangular and the trajectory was S-shaped. We followed the paths in ergonomically friendly mode, which is achieved

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by gripping the device and traveling along the path. Instead, in robot mode, we followed the predetermined route, using owner and slave command mode. [6]

The monitoring efficiency findings can be obtained through the path accuracy values as shown in table 1. The average of monitoring errors in sport mode is about 15 time bot mode in E l-shaped trajectory, which is 20 times in linear trajectory, as per the outcomes. Where n is the latest test percentage; the existing Omni end-point locations are x, y, z.

We may measure the respective positions of surgical tools in the frame of reference described and the new jobs of the surgical instruments. For the surgical automaton, the forward rigid body formula results in following equations are retrieved from available literature. [6].

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} r * cos\psi * sin\theta \\ r * sin\psi \\ r * \cos\psi * \cos\theta \end{bmatrix}$$

$$\begin{bmatrix} \theta \\ \psi \\ r \end{bmatrix} = \begin{bmatrix} \arctan(x/z) \\ arctan(y/\sqrt{x^2+z^2}) \\ \sqrt{x^2+y^2+z^2} \end{bmatrix}$$

Where x, y, z is the Cartesian location in the comparison frame of a robotic surgery. They are the surgical instrument's yaw they pitches angles while r is the representation around the broad medical tool axis. Fig. 5 and Fig.6 shows the 'S' shape and 'Rectangle' shape trajectory followed by the scribe [7].

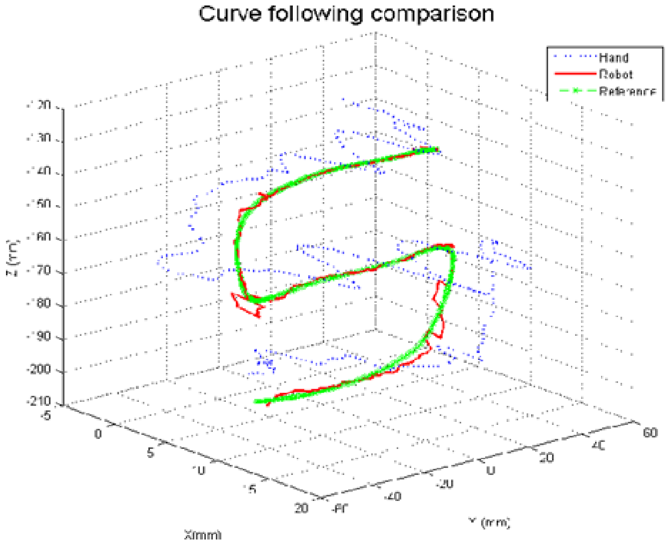

Fig.5 S-shape trajectory tracking

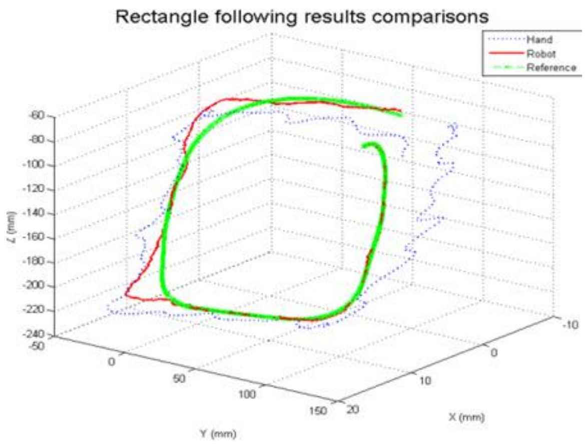

Fig.6 Rectangle shape trajectory tracking

Table.1. Accuracy of path

	S-Shaped	Rectangular
Manual Mode	19.07+5.25	39.23+7.26
	19.07-5.25	39.23-7.26
Robot Mode	1.21+0.87	1.74+0.73
	1.21-0.87	1.74-0.73

IV. CONCLUSION

In this document we created a lightweight, compact operational machine scheme. A 3D stereo vision and the lcd-operation modules were added for the vision monitoring surveillance system. The robot scenario described in this paper is a method that is developing and requires a great deal of development before it is prepared for operation. Table.1 shows the anatomical machine's motions were slow, and the route for cardiac machine mistakes is shorter than the non-robot (hand mode) activity.

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