A MASTER SLAVE TELE-OPERATED SURGICAL ROBOTIC SYSTEM FOR ROBOTIC SURGERY TRAINING

IITM Technology Available for Licensing

Problem Statement

- Robotic assisted laparoscopic surgery employs tele-operated robot systems which are very expensive and a new surgeon may need the actual system to get trained on using them
- Further, in 3D simulation based robotic surgery training platforms, surgeons find it difficult acquiring necessary competent skills

Key Features / Value Proposition

❖ ***Technical perspective***

- The invention discloses novel **tele-operated robotic surgical system that is aimed at training surgeons those are new to robotic surgery.**
- The system consists of a pair of master and slave arms and controller performs identical to actual robotic surgical system in scaling of movement, gravity compensated mechanisms for safety, and inertia and reduces fatigue of surgeon.

❖ ***User Perspective***

- **The System enables use of phantom or real tissue instead of relying on virtual models for training surgeons**
- **User friendly to surgeons and cost effective**

TRL (Technology Readiness Level)

TRL-3; Experimental Proof of Concept

Intellectual Property

- **IITM IDF Ref. 1575**
- **IN 476858-Granted**

Technology Category/ Market

Category – Medical and Surgical devices
Applications -Surgical training, Robotics **Industry – Healthcare, Manufacturing**
Market -Robotic surgical systems market value is projected to reach $3.3bn in 2023 and up to $7.2bn in 2033, **with a compound annual growth rate (CAGR) of 15.7%**

Technology

❖ A pair of ***master arm assemblies*** is configured to generate commands based on a user's hand movement.

❖ The said ***Slave arm assembly*** is an adjustable passive arm assembly comprising:

- **A parallelogram based remote center of motion (RCM) module**
- **An L-arm mounting the parallelogram based RCM module**
- **A surgical tool placed in a first face of the RCM module and attached at a distal end thereof**

❖ The said ***central controller*** electronically tethers the master arm and slave arm assemblies.

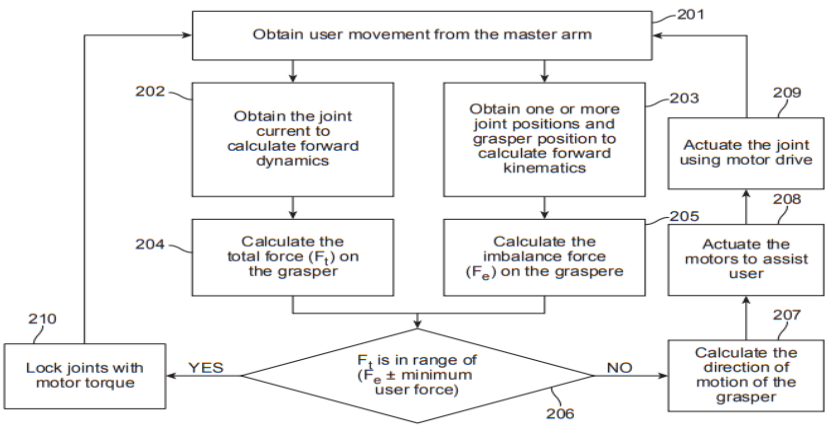

Fig. 1 shows the method of maintaining equilibrium in a master arm of the robotic training system.

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The system includes:

Master Arm comprises:

- ✓ Support members connected by joints with motors.
- ✓ Grasper assembly capturing the user's hand movement.

Capstan Drive Transmission

Motors connected to the parallelogram-based RCM module via capstan drive transmission

Passive Arm Assembly :

Comprises support members connected by at least three joints

Brake Mechanism for Joints

Taper roller bearings, brake disc, and brake lever with a screw for joint clamping.

Surgical Tool : Translates along RCM mechanism links and Comprises a drive mechanism that includes a linear motion guide, a preloaded capstan drive ,a constant tension spring for gravity compensation

Master Arm Degrees of Freedom

Master arm comprises 7 degrees of freedom (DOF).

Tool Axis and Roll Motor

Surgical tool axis coincides with the roll axis at the RCM point.

Roll motor counterbalances the surgical tool along the roll axis.

Counter Balancing and Control

Master arm includes counterbalancing masses.

Feed-forward control loop for inertia and gravity compensation.

The system further includes a camera assembly comprising:

Camera Arm Assembly

- ✓ C arm-based RCM mechanism
- ✓ Endoscopic camera movable and clamped along pitch and roll axes.
- ✓ Motor drive for camera movement.
- ✓ Position encoder to track camera positioning.

Camera Joint

Each joint includes a D-shaped interrupting disc with a photoelectric sensor for finding a reference point

Research Lab

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Images

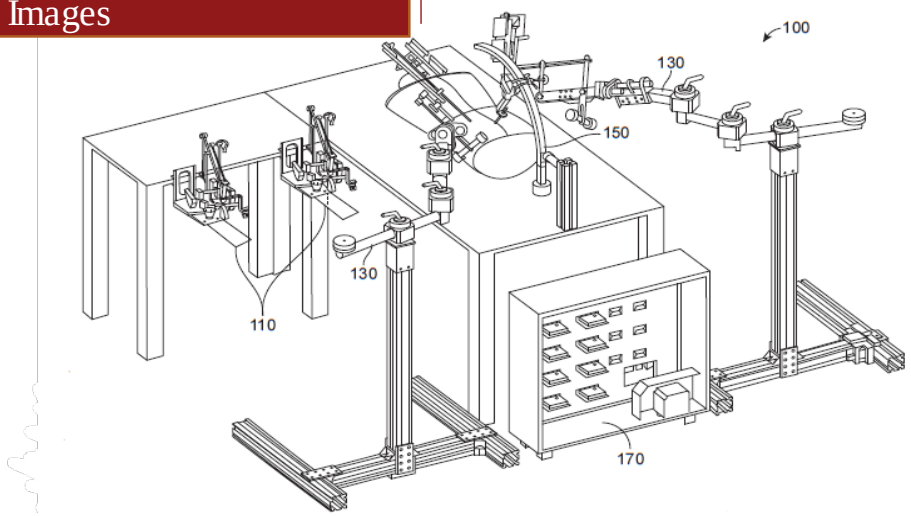

Fig. 2 illustrates tele-operated robotic setup having a pair of master arm assembly, a central controller and a pair of slave arm assembly

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