SUMMARY

In accordance with a first aspect of the present invention there is provided a surgical training system comprising means for recording reference data representing a reference manipulation of a computer generated model of an object by a master user; a robotic device for moving along a recorded trajectory based on the recorded reference data to physically guide a trainee user during an assisted training manipulation of the model of the object by the trainee user; means for recording assessment data representing an assessment manipulation of the model of the object by the trainee user without guidance; and means for evaluating the assessment data based on the reference data.

The system as claimed may further comprise processing means for generating the model of the object.

Said processing means may be configured to generate a case specific model of the object based on patient data.

The processing means may comprise an image processing module for generating the model of the object based on images of a corresponding real object.

The images may comprise medical images for surgical training.

The means for recording the reference data and the means for recording the assessment data may together comprise one or more robotic devices.

The one or more robotic devices may be configured to be coupled to a tool used in the manipulation of the model of the object.

The one or more robotic devices may be configured to be coupled to the master user or the trainee user via the tool.

The system may further comprise means for evaluating the assessment data.

The means for evaluating may be configured to evaluate the assessment data based on the reference data.

The means for evaluating may be configured to evaluate the assessment data based on one or more motion parameters.

The motion parameters may comprise one or more of a group consisting of maneuver route, speed, force, and time.

The system may further comprise means for recording a training trajectory during an un-assisted training manipulation of the model of the object by the trainee user and correcting the training trajectory to the recorded trajectory when the training trajectory differs from the recorded trajectory by a predefined range.

In accordance with a second aspect of the present invention there is provided a robot assisted surgical training method comprising the steps of recording reference data representing a reference manipulation of a computer generated model of an object by a master user; physically guiding a trainee user using a robotic device, the robotic device moving along a recorded trajectory based on the recorded reference data during an assisted training manipulation of the model of the object by the trainee user; recording assessment data representing an assessment manipulation of the model of the object by the trainee user without guidance; and evaluating the assessment data based on the reference data.

The method may further comprise generating the model of the object.

Generating the model of the object may comprise generating a case specific model of the object based on patient data.

The method may comprise generating the model of the object based on images of a corresponding real object.

The images may comprise medical images for surgical training.

Recording the reference data, guiding the trainee user, and recording the assessment data may comprise using one or more robotic devices.

The one or more robotic devices may be configured to be coupled to a tool used in the manipulation of the model of the object.

The one or more robotic devices are configured to be coupled to the master user or the trainee user via the tool.

The method may further comprise evaluating the assessment data.

Evaluating the assessment data may be based on the reference data.

Evaluating the assessment data may be based on one or more motion parameters.

The motion parameters may comprise one or more of a group consisting of maneuver route, speed, force, and time.

The method may further comprising the step of recording a training trajectory during an un-assisted training manipulation of the model of the object by the trainee user and correcting the training trajectory to the recorded trajectory when the training trajectory differs from the recorded trajectory by a predefined range.

In accordance with a third aspect of the present invention there is provided a non-transitory data storage medium having computer code means for instructing a computer to implement a robot assisted surgical training method as defined in the second aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

Figure 1 illustrates an architecture of an Image-Guided Robot Assisted Surgical (IRAS) system, according to an embodiment.

Figure 2 shows a flowchart illustrating provisioning of a 3D model for surgical training, according to an example embodiment.

Figures 3a) and b) illustrate original CT images and the shape model built from CT data respectively, according to an embodiment.

Figure 4 shows a graph illustrating progress of suture timing of a surgical resident, student, and senior consultant, according to use of an example embodiment.

Figure 5 shows a flow chart illustrating a method for robot assisted surgical training, according to an embodiment.

Claims

1. A surgical training system comprising:

means for recording reference data representing a reference manipulation of a computer generated model of an object by a master user;

a robotic device for moving along a recorded trajectory based on the recorded reference data to physically guide a trainee user during an assisted training manipulation of the model of the object by the trainee user;

means for recording assessment data representing an assessment manipulation of the model of the object by the trainee user without guidance; and

means for evaluating the assessment data based on the reference data.

2. The system as claimed in claim 1, further comprising processing means for generating the model of the object.

3. The system as claimed in claim 2, wherein said processing means is configured to generate a case specific model of the object based on patient data.

4. The system as claimed in claim 2, wherein the processing means comprises an image processing module for generating the model of the object based on images of a corresponding real object.

5. The system as claimed in claim 4, wherein the images comprise medical images for surgical training.

6. The system as claimed in claim 2, wherein the means for recording the reference data and the means for recording the assessment data together comprise one or more robotic devices.

7. The system as claimed in claim 6, wherein the one or more robotic devices are configured to be coupled to a tool used in the manipulation of the model of the object.

8. The system as claimed in claim 6, wherein the one or more robotic devices are configured to be coupled to the master user or the trainee user via the tool.

9. The system as claimed in claim 1, wherein the means for evaluating is configured to evaluate the assessment data based on one or more motion parameters.

10. The system as claimed in claim 9, wherein the motion parameters comprise one or more of a group consisting of maneuver route, speed, force, and time.

11. The system as claimed in claim 1, further comprising means for recording a training trajectory during an un-assisted training manipulation of the model of the object by the trainee user and correcting the training trajectory to the recorded trajectory when the training trajectory differs from the recorded trajectory by a predefined range.

12. A robot assisted surgical training method comprising the steps of:

recording reference data representing a reference manipulation of a computer generated model of an object by a master user;

physically guiding a trainee user using a robotic device, the robotic device moving along a recorded trajectory based on the recorded reference data during an assisted training manipulation of the model of the object by the trainee user;

recording assessment data representing an assessment manipulation of the model of the object by the trainee user without guidance; and

evaluating the assessment data based on the reference data.

13. The method as claimed in claim 12, further comprising the step of generating the model of the object.

14. The method as claimed in claim 13, wherein generating the model of the object comprises generating a case specific model of the object based on patient data.

15. The method as claimed in claim 13, comprising generating the model of the object based on images of a corresponding real object.

16. The method as claimed in claim 15, wherein the images comprise medical images for surgical training.

17. The method as claimed in claim 12, wherein recording the reference data and recording the assessment data comprise using one or more robotic devices.

18. The method as claimed in claim 17, wherein the one or more robotic devices are configured to be coupled to a tool used in the manipulation of the model of the object.

19. The method as claimed in claim 17, wherein the one or more robotic devices are configured to be coupled to the master user or the trainee user via the tool.

20. The method as claimed in claim 12, wherein evaluating the assessment data is based on one or more motion parameters.

21. The method as claimed in claim 20, wherein the motion parameters comprise one or more of a group consisting of maneuver route, speed, force, and time.

22. A non-transitory data storage medium having computer code means for instructing a computer to implement a robot assisted surgical training method as claimed in claim 12.

23. The method as claimed in claim 12, further comprising the step of recording a training trajectory during an un-assisted training manipulation of the model of the object by the trainee user and correcting the training trajectory to the recorded trajectory when the training trajectory differs from the recorded trajectory by a predefined range.