

3D ENTITY DIGITAL MAGNIFYING GLASS SYSTEM HAVING 3D VISUAL INSTRUCTION FUNCTION

Technical Field

The present invention relates to a system for performing technical guidance by utilizing a communication network such as the internet. More specifically, it relates to a system for distributing a highly precision oriented special technical educational program in which a surgical operation or any other manual work is performed under direct observation, performing educational guidance of highly precision oriented techniques by which a surgical operation or any other work is performed by a specific customer (that is, such an operation or work is controlled through a visual instruction or an oral instruction by use of three-dimensional image composition based on information obtained while a visual field of a person with no technical knowledge assumed to be a robot from a remote location), or providing image information of an invisible region together with a direct surgical wound image to a visual perception visual field of an operation without a need for the practitioner to look away.

Background Art

Generally, in the case of instructing a surgical operation or any other special manual technique at a clinical field, a practitioner and an instructor have different visual field directions and postures, so that it is difficult to instruct manipulation such as accurate instrumentation, which not only increases operation time but also causes the instructor to block the practitioner's view so that the work may have to be interrupted temporarily; further, it may cause a patient to feel uneasy under a conscious operation environment and suffer from a psychogenic shock.

Conversely, in the case of instructing a student to perform a highly precision oriented technique such as a surgical operation by an instructor, if the technique and the operation on a closed site are to be observed from the same ideal visual field as the instructing practitioner (lecturer), to permit the plurality of students (customers) to sequentially observe an operating situation at each step of the operation, not only extremely much of time is required but also the number of those who can observe them simultaneously is limited by physical restrictions of facilities for operations, so that such a lecture has been performed for few people. In addition, if the instructing practitioner (lecturer) and the student (customer) speak different languages, an interpreter needs to come to the surgical wound, so that a fee per student (customer) for

participating in such an educational program has been expensive.

Moreover, both in the case of instructing a practitioner and the case of an instructor instructing a student, an operator needs to once look away from a surgical wound and closely watch and confirm information such as an X-ray picture, a CT picture, an MRI picture, or an electrocardiogram, so that it has been difficult to share the information with others especially at a remote location in real time.

Further, in the case of a surgical operation, it is difficult to transport a patient himself to a remote location for an educational program; also, in the case of other special techniques performed by hand which require large facilities or unmovable instruments, a visiting student used to coordinate his schedule so as to match an operating date and spend much transportation costs and time required by transportation. Also, in the case of distributing an educational program to a remote location by using various types of communication means, if a surgical operation on an individual is to be disclosed to a third party fundamentally, to obtain consent of a patient himself for responsibility of privacy protection, of course, the much the same responsibility is imposed on information so prevent it from being leaked along a communication path. Conversely, in the case of guidance on a surgical operation or a practical

training of highly precision oriented work which is performed at a remote location, instructors (group of lecturers) must go to a spot to require a lot of costs, so that various costs (transportation costs and time required by transportation) related to the guidance and, moreover, the remote area requiring much time to go there could not easily accommodate performing of an emergency surgical operation; especially in the case of guidance by a plurality of instructors (group of lecturers), the costs used to become even higher and an emergency surgical operation used to be even more difficult to conduct.

Furthermore, it is prohibited by medical licensing legal regulations to conduct medical work abroad, so that it is basically impossible to conduct a lecture of a live operation visiting educational program and practical training of an operation by which the instructors (group of lecturers) themselves perform the operation abroad.

Further, if a practitioner (customer) actually wishes to be guided in a surgical operation or any other highly precision oriented techniques conducted manually, it is essentially impossible to gather instructors (group of lecturers) and persons with excellent skills and knowledge who are scattered around to one place at the same date and time so that an operation may be edited or managed. Furthermore, there has been no system for discussing a shared

three-dimensional image while displaying a three-dimensional instruction image.

Patent Document 1 Japanese Patent Application No. 2556829

Disclosure of the Invention

However, as described above, in the case of instructing a surgical operation or any other specialized manual techniques at a clinical field, generally an instructor would share the same visual field as a practitioner to conduct accurate guidance, thereby preventing required surgery time from increasing. Furthermore, even in the case of conscious operation environments, what should be kept in mind is to avoid a patient from being worried about the existence of the instructor so that he may not feel uneasy unnecessarily.

Conversely, in the case of guiding students on highly precision oriented techniques such as a surgical operation which is conducted by an instructor, if the students are permitted to watch the techniques and the operation conducted on a closed site from the same ideal visual field as the instructing practitioners (lecturers), many people are enabled to view the field. In addition, if the instructing practitioner (lecturer) and the student (customer) speak different languages, a need is eliminated for causing an interpreter to attend the surgical wound all the way, thereby avoiding an increase in a fee per student (customer) for participating in such an educational program.

Moreover, also in the case of guiding a practitioner and the case of an instructor guiding a student, an operator is enabled to view and confirm the information such as an X-ray picture, a CT picture, an MRI picture, and an electrocardiogram without looking away from a surgical wound and also share said information even at a remote location in real time.

Further, in the case of a surgical operation, a patient need not go to a remote location to participate in an educational program, to instead reduce transportation fees of a visiting student (customer) and time required by the transportation. Also in the case of distributing the program to a remote location by using said various types of communication means, information about individuals are prevented from being leaked. Conversely, in the case of conducting practical training on highly precision oriented work or guidance on a surgical operation at a remote location, it is made possible to reduce various costs (transportation costs and time required by the transportation) of the instructors (group of lecturers) and accommodate performing of an emergency surgical operation at a remote location which requires much of time to go there and, additionally, conduct guidance by a plurality of instructors (group of lecturers). Besides, it is made possible to avoid medical licensing legal regulations and conduct a lecture of a live operation visiting educational

program and practical training of an operation by which the instructors (group of lecturers) themselves perform the operation abroad.

Further, if a practitioner (customer) actually wishes to be guided in a surgical operation or any other highly precision oriented techniques conducted manually, it is made possible to gather instructors (group of lecturers) and persons with excellent skills and knowledge who are scattered around to one place at the same date and time so that an operation may be edited or managed and, furthermore, discuss their shared three-dimensional images in real time.

The present invention provides a system that provides a three-dimensional digital entity mesoscope with a variety of functions, for performing an assistance and guidance/educational program for surgical operations and other highly precision oriented techniques which are performed under direct observation of a human being, by using the internet or an intranet as communication means, said system equipped with a three-dimensional visual instructing function for using an apparatus comprised of three-dimensional telescopic digital mesoscope which are constituted of a pair of LCDs which are set in front of the two eyes and have the same synchronized standards, as a minimum configuration, so as to be worn by a practitioner and a instructor when performing said assistance and guidance/educational program for surgical operations and

other highly precision oriented techniques and three-dimensional telescopic digital mesoscope constituted of an automatic focusing CCD camera equipped with a pair of zoom lenses which are set from a position that corresponds to a center between the right and left pupils of workers wearing said three-dimensional digital entity mesoscope constituted of the LCDs in front thereof in a direction toward a visual field of the naked eyes, to extract only a three-dimensional image of a three-dimensional pointing device or the same various types of instruments (dummy) as instruments used by the practitioner that can be held and freely moved within the visual field of the instructor and is operated by the instructor for giving a visual instruction as recognizing on an LCD monitor of a three-dimensional digital entity mesoscope apparatus in front of a background having a single color of red, green, and blue (red is preferable in the mouse cavity because it is complementary to a color of the blood vessel and the fresh) in consideration of a complementary color relationship corresponding to a background color of a visual field image among the R, G, and B colors which are set so as to cover an entire visual field in front of the CCD camera of the three-dimensional digital entity mesoscope apparatus worn by the instructor captured by the CCD camera of the three-dimensional digital entity mesoscope apparatus worn by the instructor with a floater-image processing apparatus on a three-dimensional

image of the visual field of the practitioner captured by the CCD camera of the three-dimensional digital entity mesoscope apparatus worn by the practitioner shared in display by the three-dimensional digital entity mesoscopes of both the practitioner and the instructor and, further, change a degree of transparency, between 0% and 100%, of three-dimensional visual instruction floater images due to an image chroma-key composite image processing apparatus or convert them so that their tint may be judged and display a resultant composite image on the LCDs of both the practitioner and the instructor. By this three-dimensional digital entity mesoscope system, the practitioner or the instructing practitioner can obtain an ideal camera angle when imaging and observing a surgical wound without looking away from the surgical wound and without the head of the practitioner blocking his view and, therefore, can concentrate on an operation without being worried about a camera position.

Of course, this action of instruction can be instructed by the instructor at a location away from an operating environment and so is performed without being perceived by a patient so that he may not be mentally influenced unnecessarily; moreover, the practitioner not only can be guided by the instructor through a simulation having a reality by expressing, in a working space over images of an entity (patient) on the LCD of the practitioner,

also a three-dimensional depth of a three-dimensional image of the same instrument as that actually used by the practitioner operated by the instructor in a practitioner's visual field image virtual space of the instructor's three-dimensional digital entity mesoscope for the entity before the eyes which is captured on the three-dimensional digital entity mesoscope visual field screen worn by the practitioner but also apparently can generate visually an operating situation in which he operates himself by using the same instrument, so that even poor verbal communication between the practitioner and the instructor can be sufficiently compensated for visually.

By conducting thus practical educational/guidance services involving visual instructions, time-wise expenses involved in transportation of one a plurality of instructors (group of lecturers) can be eliminated, thereby accommodating an emergency operation even at a remote location.

Further, in a surgical operation, a student (customer) can be guided across the border without transporting a patient from arbitrary operating facilities and without medical licensing regulations even if an instructing practitioner (lecturer) of an educational program and the student (customer). By further improving this three-dimensional digital entity mesoscope apparatus to compositely display three-dimensional image information

obtained through image processing/conversion by changing a three-dimensional anatomical image of the bone, the blood vessel, the nervous tissue, etc. created beforehand from information of a tomogram such as a CT picture or an MRI picture of an operation-subject patient or a surgical stent image into which said anatomical three-dimensional perspective image are three-dimensionally composed together with a dissection or bone cutting position similarly at a percentage between 0% and 100%, especially, changing a degree of transparency or a color tone of a site or a tissue indicative of an anatomical landmark or giving a visual difference to said practitioner's three-dimensional digital entity mesoscope CCD image information through wireframe display etc. so as to facilitate discrimination, the practitioner can visually watch shapes of the blood vessels and the bones as if by seeing through the skin or the soft tissues and further watch how the nerves run through the bones as if seeing through the bones and, therefore, can safely perform an operation accurately. However, it may be possible that both a practitioner wearing an HMD and a target of an operation always change in three-dimensional position. To solve this problem, it is necessary to superimpose said three-dimensional anatomical image or surgical stent image accurately on an image of a surgical wound displayed on the practitioner's HMD so that said three-dimensional anatomical image or surgical stent image may follow the image

of the surgical wound captured by the practitioner's CCD camera based on a change in position of the head of the practitioner and a change in posture of the patient. To make such a configuration applicable clinically, still images are taken out from a practitioner's visual field image picked up by the two mutually synchronized right and left CCD cameras of the practitioner's three-dimensional digital entity mesoscope and a reference point is set to three positions on an anatomically universal hard tissue such as the tooth or the bone on each of these images, position information of a total of six points, three points each, is recorded. By recording a three-dimensional positional relationship between a practitioner and a patient through three-point measurement by use of these two right and left CCD cameras and following positional movements of the three points that provide a reference in a practitioner's visual field image (moving image), it is possible to always grasp a three-dimensional positional change in the three-dimensional digital entity mesoscope and a posture of the patient. At the same time, by accurately plotting the same three points as those that provide a reference over an anatomically universal hard tissue on a three-dimensional anatomical image or a surgical stent image on three points of said hard tissue of still images taken out from information from the two CCD cameras of said practitioner's three-dimensional digital entity mesoscope and accurately

superimposing the three-dimensional anatomical image or the surgical stent image in an image of a surgical wound, a three-dimensional position, in a three-dimensional image of the surgical wound, of the three-dimensional anatomical image or the surgical stent image is recorded in a space of a space of the surgical wound captured by the practitioner's three-dimensional digital entity mesoscope. It is thus possible to three-dimensionally follow the three-dimensional anatomical image or the surgical stent image as three-dimensional positions move of the patient and the practitioner's three-dimensional digital entity mesoscope.

These three-dimensional anatomical image and surgical stent image can be managed and operated in a consolidated manner at a remote location. For example, in an emergency operation required in an area far away from a family doctor, a practitioner can transmit with various types of communication means information, of a patient just about to be operated, from the right and left CCD cameras captured through a three-dimensional digital entity mesoscope, take out an arbitrary still image from said information received at a remote location (information from the right and left CCD cameras captured through the practitioner's three-dimensional digital entity mesoscope), superimpose a three-dimensional anatomical image or a surgical stent image on this still image so as

to perform positional correction, perform computer processing on a positional change in information of an image of a surgical wound to follow, based on its three-dimensional movement, said three-dimensional anatomical image or surgical stent image, and then transmit a thus superimposed composite image and display it as a three-dimensional image on a three-dimensional digital entity mesoscope LCD mounted on the practitioner.

Further, in the present system, not only a face-to-face combination of a practitioner and an instructor but also a plurality of instructors can simultaneously display a three-dimensional anatomical image or a surgical stent image or participate in three-dimensional visual guidance. In such a guiding situation, the practitioner as well as the plurality of instructors can assume an image of a practitioner's visual field as one table to thereby exchange comments about various specialized categories on this table, in which case real rights to manage the table can be operated in accordance with predetermined priority order to easily manage and operate the shared table (display screen) without confusion.

Similarly, by transmitting three-dimensional image information captured by CCD cameras of the three-dimensional digital entity mesoscope CCD mounted on a practitioner through communication means such as the internet or an intranet and accumulating it in a server, a plurality of

persons on which mutually synchronized three-dimensional digital mesoscopes are mounted respectively can share that image information by using communication means such as the internet or the intranet. The relevant images, which have been accumulated moving images though, are of a visual field of a surgical wound obtained when a practitioner actually performed an operation and so can be such as to have an extremely high degree of reality with a feeling of sensation. Moreover, by permitting each of these multiple viewers to arbitrarily make switchover between a display mode and a non-display mode of images accumulated in the server together with surgical wound image information shared by these viewers such as three-dimensional anatomical images of the arbitrary bones, blood vessels, and nervous tissues produced on the basis of tomographic information such as CT or MRI of a patient to be operated, said anatomical three-dimensional perspective images, and surgical stent images obtained by accurately composing three-dimensionally a position of dissection and bone cutting by using an image position correcting/following apparatus, it is possible to demonstrate an operation with more information. In addition, by removing with a floater-image processing apparatus a background image from a viewer's visual field image obtained by utilizing the CCD cameras of said three-dimensional digital entity mesoscope to extract an image of only a three-dimensional pointing device operated

by the viewer or the same various types of instruments (dummy) as those used by the practitioner and change its degree of transparency at a percentage between 0% and 100% to provide a floating image whose tint has been changed for each of the viewers and chroma-key composing it on an accumulated image in an image due to the three-dimensional digital entity mesoscope mounted as viewing means for each of the viewers in condition where each of the viewers can switch between the display mode and the non-display mode arbitrarily, it is possible to carry out bidirectional discussion or operation simulation on a three-dimensional moving image or still image by utilizing a communication line such as the internet.

Further, in a case where a surgical operation is distributed and published to third parties at a remote location by using various types of communication means, as for a problem of privacy of a patient, his security can be realized by limiting access by using a password, performing different types of image scrambling (encryption) through two channels through which three-dimensional images are provided to subsequently performing software-wise decoding information in a personal computer used as this communication apparatus, mounting an integrated circuit having decoding functions in hardware of a three-dimensional digital entity mesoscope, or identifying a code number assigned to the three-dimensional digital entity mesoscope

(terminal). Furthermore, through publication of such information in accordance with certain restrictions, it is possible not only to contribute to developments of various technologies but also to find competent technicians (medical doctors) and instantaneously diffuse the latest excellent techniques worldwide.

Moreover, when an instructor or a helper is selected by using an extremely lot of information and a three-dimensional digital entity mesoscope capable of inspection, instruction, and recording and in virtual experiences of an operating situation of a practitioner, it is possible to provide a site of the network where information can be exchanged, without restrictions on an area and time. Besides, since skills can be assessed objectively, when a practitioner buys an assistance and guidance/educational program, it is possible to present highly authentic evaluation criteria by a third party institution as well as one-directional promos of the instructor (lecturer) or subjective evaluation by an acquaintance who participated in the program already; therefore, it is possible not only to easily give justification to evaluation and fees about technical guidance but also to, when selecting an instructor (helper), present monetary rewards as well as conditions such as skills and experiences for each technical field or a language spoken in guidance, thereby easily selecting a well-qualified

person most suitable for details of an operation to be performed.

When a monetary contract is signed with such a registered medical doctor or technician on the network and if breach of contract occurred on the side of a practitioner or an instructor in guidance of an operation or helping, such a system can be configured that resultant damages may be charged in accordance with contents of the contract already signed; accordingly, by this contract already established upon application, which has been signed by the practitioner and the instructor not acquainted with each other though, said well-qualified person (instructor) waiting at a remote location or the practitioner can accept a temporary staff at ease and, moreover, a manager of the network who promotes a procedure for this application can cause beforehand the practitioner to select second-choice and third-choice persons of the instructor (helper) so that essential damages on the side of the practitioner may be compensated for, thereby avoiding a trouble through discounting in accordance with skills of the instructor in some cases.

Further, if an unexpected situation such as an error in medical treatment occurred in an action of operating involving an instructor (helper) using a three-dimensional digital entity mesoscope system, it is of course possible to easily clarify an erroneous position based on a record of information by the three-dimensional digital entity

mesoscope and also to give variations in responsibility range and guide fee to contents of the contract beforehand in accordance with a degree of difficulty of each of operations or a degree of involvement corresponding to each of technical fields of the instructor or the helper and clarify the responsibility range corresponding to a guidance fee presented by the practitioner in accordance with the contents of the contract; it is thus possible not only to disperse risks of compensation for an error in medical treatment or a defect but also to add such factors as skills of the practitioner, which provide criteria for insurance fees of a typical term insurance and also a degree of difficulty of a case as well as skills of the instructor (helper) and an establishment (number of persons) for each operation so that more essentially streamlined setting of insurance fees may be performed, which basis for calculation of the insurance fees can be improved in terms of accuracy by accumulating experiences and achievements (success rate or time-wise survival rate) through use of the present system by the practitioner and the instructor (helper).

As described above, this three-dimensional digital entity mesoscope enables virtually experiencing an operating situation of a practitioner; the three-dimensional digital entity mesoscope system gives an extremely lot of information of skills of an instructor and so enables virtually observing an operating situation of the

instructor in real time and also with an extremely high degree of authenticity due to a system that can be communicated only with three-dimensional digital entity mesoscopes of the same standards and, further, can record the situation in a recording medium so that the skills may be evaluated objectively. Therefore, in the conventional case of auditing an action of medical treatment in a medical treatment field, conventional contents of auditing only matching between diagnosed contents and the action of treatment can be expanded further to objectively evaluate a surgical field (personal skills of medical doctor), thereby improving not only the skills of each of the medical doctors but also technical levels as a whole.

In an operation actually performed by a practitioner, of course, a three-dimensional anatomical image composed and displayed in a practitioner's visual field image, a surgical stent image, or an instructor image of a plurality of instructors interferes with a visual field image commonly owned by the practitioner and the instructor, so that by enabling a display mode operation and a non-display mode operation with switching that will not block operations of using the hand or the foot involved in an action of operating by the practitioner or the instructor through wishes of the practitioner or the instructor, it is possible to carry out a safe operation by utilizing features of the

three-dimensional digital entity mesoscope as a pure digital mesoscope without blocking a view of the practitioner.

Brief Description of the Drawings

FIG. 1 is an illustration showing a configuration of a three-dimensional digital entity mesoscope;

FIG. 2 is a conceptual illustration of performing of three-dimensional instruction by use of chroma-key composition of a floating image by utilizing three-dimensional digital entity mesoscopes of the same standards;

FIG. 3 is a conceptual illustration of performing communication by utilizing the internet with the digital entity mesoscope of FIG. 1;

FIG. 4 is a conceptual illustration of a plurality of instructors carrying out a configuration of FIG. 3;

FIG. 5 is a conceptual illustration of three-dimensional position measurement by use of a fixed base plane image;

FIG. 6 shows how anatomical images can be composed and displayed; and

FIG. 7 is a diagram showing a flow of image information in the present system.

Best Mode for Carrying out the Invention

An embodiment of the present invention will be described below together with illustrated examples.

Throughout the drawings, the same symbols indicate the same components. FIG. 1 is an illustration showing a basic configuration of a three-dimensional digital entity mesoscope 1. As shown in FIG. 1, a right-side LCD36R (monitor) and a left-side LCD36L installed in the three-dimensional digital entity mesoscope 1 have a spread that contains the respective right and left eyes of a practitioner 3, which may be an instructor or a person to be instructed and mounted on the head (face) by using a headgear 37. A right-side CCD camera 1c-R and a left-side CCD camera 1c-L are provided integrally with the three-dimensional digital entity mesoscope 1 to a position that nearly faces a midsection between the right and left pupils in condition where their three-dimensional digital entity mesoscope 1 is mounted on the face. It should be noted that image information from each of these two CCD cameras 1c is used to give synchronized individual images on right and left CDs, thereby providing a three-dimensional image with little uncomfortable feeling in much the same manner as in condition where an optical mesoscope is used.

Preferably the CCD camera 1c is an automatic focusing CCD camera equipped with a zoom lens. This type of camera is automatically adjusted to give appropriate focusing for

an arbitrary magnification setting irrespective of a distance between the head of a worker and a work site, so that a practitioner can minimize muscle fatigue of his neck owing to fixation of the headgear-mounted head.

In this configuration, as shown in FIG. 2, by utilizing a system of such a three-dimensional digital entity mesoscope 1 to project images due to image information of each of the right and left two CCD cameras 1c on the practitioner 3 to the respective LCDs of the three-dimensional digital entity mesoscopes having the same standards and mounted on the practitioner 3 and an instructor 12 so that they may share a three-dimensional visual field image (image of an inside of the mouth cavity of a patient 32). On this shared practitioner's visual field image, a virtual three-dimensional instruction mark (virtual image) 30a is chroma-key composed which is obtained by imaging a three-dimensional instruction mark 30 in front of a monochromatic background plate 31 by utilizing the right and left CCD cameras 1c of the three-dimensional digital entity mesoscope 1 mounted on the instructor 12 and floating it. This three-dimensional instruction mark 30 can be displayed as a line drawing in a visual field image of the practitioner 3 by showing a trajectory for a constant lapse of time or displayed as a still image.

Accordingly, the present system, which is comparatively simple but uses the CCDLCD monitors of the same

standards, permits the instructor 12 to accurately give a three-dimensional image instruction to the practitioner without performing complicated correction. That is, the practitioner 3 can give guidance with an extremely natural posture almost the same as that in a case where he actually performs an operation using his own hands, different from such movements as those for giving instructions on a computer monitor conventionally. Even in a case where this three-dimensional instruction mark 30 is replaced with an actual operating instrument, the instructor 12 can perform in a practitioner's visual field virtual space the same manipulations as those in the case of actually performing an operation to a surgical wound developed on an LCD screen of the three-dimensional digital entity mesoscope 1 mounted on himself. Similarly, the practitioner 3 can experience manipulations of an instrument having a three-dimensional depth in such a situation as if he himself were performing an operation. Furthermore, by changing a degree of transparency between 0% and 100% of three-dimensional visual instruction floating images of the instructor 12 which are composed and displayed in a visual field image of the practitioner 3 or, in addition to it, using a chroma-key composite image processing apparatus capable of tint conversion, it is possible to easily distinguish between a real image and a virtual image, thereby avoiding a confusion

on the monitor screen even in a case where the practitioner 3 and the instructor 12 use the same instruments.

Similar to this chroma-key composition of instruction images, three-dimensional anatomical images and surgical stent images saved in a personal computer 6 and personal computers 6a-1 through 6a-n or a server 8 shown in FIG. 4 can be chroma-key composed on a practitioner's visual field image and displayed. In this case, three-dimensional anatomical images and surgical stent images can also undergo image processing conversion at a percentage between 0% and 100%, alteration of a degree of transparency or a color tone, or wireframe processing to easily give visual differences to image information from the three-dimensional digital entity mesoscope CCDs on the practitioner. Three hard tissue reference points 34a - 34c on a tooth in a patient's tooth row 33 from a still image among image information from the practitioner's three-dimensional digital entity mesoscope CCDs such as shown in FIG. 5 and the same hard tissue reference point on a tooth in a tooth row 7 on said patient's three-dimensional anatomical image or the three-dimensional surgical stent image are selected and plotted using the personal computers 6 or 6a-1 through 6a-n or the server 8, to accurately superimpose such three-dimensional anatomical images and surgical stent image layers into the visual field image of the practitioner 3 in such a manner as to be equally scaled down on the LCDs of the three-dimensional digital

entity mesoscopes 1 mounted on the practitioner 3 and the instructor 12 shown in FIG. 1 as a transparent image such as shown in FIG. 6 and, at the same time, perform three-dimensional position correction in them. In such scaling correction and position correction, in a case where it is difficult to directly obtain a hard tissue reference point depending on a site, a point marker such as lead is stuck to three different fixed points on the skin which are visible from the CCD cameras of the three-dimensional digital entity mesoscope 1 at the time of performing an operation during taking a CT or MRI picture and displayed on a three-dimensional surgical stent so that the corresponding on-the-skin different three-point markers on the respective still images from the right-side CCD camera 1c-R and the left-side CCD camera 1c-L for displaying a surgical wound image of the three-dimensional digital entity mesoscope 1 may agree with each other, thereby accurately performing position correction. In this case, although it is difficult to perform position correction and equal-scaling correction simultaneously on the right and left LCDs, in the three-dimensional digital entity mesoscope 1 of the present invention, the right-side LCD monitor and the left-side and CCD camera are of the same standards, so that by performing equal-scaling work on either one of the right and left LCD screens and then conducting position correction (superimposition) on the one-side LCD monitor in

different two directions, it is possible to easily record position information. Further, if a site to be operated is the head, especially, covers the upper and lower jaws, three different reference points are obtained for each of the sites and two different surgical stents are prepared, to automatically follow the respective floating surgical stent images.

A three-dimensional anatomical image layer or a three-dimensional surgical stent layer image, if it has undergone scaling correction and position correction once, is composed into a practitioner's visual field image and displayed by capturing a displacement of a three-dimensional position measurement reference plane 35 made up of three hard tissue reference points 34a-34c on the tooth in the tooth row 33 as image information for the right and left two CCDs 1c of the three-dimensional digital entity mesoscope 1 on the practitioner 3, performing three-dimensional position measurement thereon by using the personal computers 6 and 6a-1 through 6a-n or the server 8, and following the point markers such as lead or the reference points on the image as the position of the practitioner's CCD camera and the posture of the patient change to automatically perform three-dimensional position correction thereon in real time. In this case, a change in posture of the patient may be captured by utilizing an image as described above or mounting a light emitter such as an LED to the three different points

attached on the universal tissue of the head of the patient in order to more clearly display the reference points on the image. Alternatively, a gyro mechanism may be mounted to each of a fixed point such as the patient's hard tissue or the three-dimensional digital entity mesoscope mounted on the practitioner to record a change in three-dimensional position of the patient and the practitioner's three-dimensional digital entity mesoscope with respect to the fixed point (reference point) and accurately align it with the reference point on a still image due to information from the right and left CCD cameras obtained from the practitioner's three-dimensional digital entity mesoscope so that an initially-corrected three-dimensional anatomical image or three-dimensional surgical stent image may be followed three-dimensionally as the patient's posture changes or the head of the practitioner moves.

By improving this system, it is possible to share practitioner's images among a plurality of instructors as shown in FIG. 4 so that medical specialists may give an appropriate advice. This advice is shared by the practitioner 3 and all of the instructors 12 by captioning a signal from a vital sign measuring instrument 5 at a peripheral of the LCD monitor of the three-dimensional digital entity mesoscope 1 in such a manner as not to damage an image of a surgical wound, so that it is possible for the instructors not only to give an instruction as grasping a

field situation more accurately but also for the practitioner 3 to concentrate on an operation without looking away from the surgical wound to the monitor etc.

Further, in the case of transmitting through a communication network such as the internet image information obtained by providing the same image as that on said three-dimensional digital entity mesoscope with advices and comments due to writing of a line drawings or a three-dimensional pointing instruction, to give an advice and a comment by use of pointing of the three-dimensional pointing mark 30, a moving image can be converted into a still image once and provided with said writing or pointing instruction as it is so that a resultant composite image of this still image may be distributed to terminals of a plurality of students to be instructed. Alternatively, conversely, in a case where a practitioner is helped with an operation by an instructor at a remote location as receiving a writing or a pointing instruction on his monitor, a moving image distributed to the side of the instructor is converted into a still image once and provided with a writing or a pointing instruction so that a resultant composite image thereof may be distributed to the monitor of that practitioner.

As permitted, such a wiring or a pointing instruction can be given also to a moving image, in which case a moving image is once converted into a still image and then

effectively returned to the moving image after dividing an LCD screen of the three-dimensional digital entity mesoscope 1 so that the still image may be separately displayed into a visual field image. It should be noted that if a practitioner etc. serves as an instructor, such a pointing instruction or writing is typically given by a third party live-broadcasting an operation by the practitioner or an instructor in charge in a service company of an educational system having the server 8 therein. Although a method for converting a moving image once into a still image and then returning it back to the moving image after carrying out a pointing instruction etc. as described above is known and so not detailed; in short, according to this method, an instantaneous data image from a CCD camera etc. is once accumulated in an image memory and then read and, simultaneously, an image of a pointing instruction etc. input from an input unit (which may be a moving one as well as a still one, but in some cases where a pointing instruction is moved during explanation and guidance, preferably the point image etc. is a moving one) is fetched so that these images may be composed using a known method such as layer processing or composition in a memory. It is thus possible to share information of a practitioner's three-dimensional image for a three-dimensional digital entity mesoscope accumulated in the server 8 and information of a surgical stent image for composing and displaying a

three-dimensionally accurate equal-scaled three-dimensional transparent image into a surgical wound image among viewers 7a-1 through 7a-n respectively mounted with a plurality of synchronized three-dimensional digital entity mesoscopes by utilizing a communication line such as the internet, thereby performing discussion on a three-dimensional moving image or a still image through bidirectional communication. In such communication by use of all of these images, from a viewpoint of patient's privacy protection, all of communication digital signal data is indicated on the three-dimensional digital entity mesoscope 1 through an audio/visual decoder 4; therefore, in the case of hacking by use of an ordinary personal computer terminal having a hardware decoding unit, a risk of information leakage is low.

With this, it is possible to transmit to the educational program distribution company server 8 from the terminal personal computer 6 connected to the internet image information obtained from this digital entity mesoscope 1, image information such as values and graphs of an illuminance, a temperature, a humidity, a pressure, and a speed that represent an environment of a situation of a vital sign of a patient in the case of a surgical operation and a situation of each technical operation in the case of the other precision techniques, voice information obtained from an audio microphone mounted on a practitioner, and visual

instruction information such as the three-dimensional instruction mark 30.

The information received by the educational program distribution company server 8 is either directly distributed to the terminal personal computer 6 via the internet 9 or distributed in condition where image processing or interpretation in accordance with each language is performed thereon by the educational program distribution company server 8. Similarly, it is possible to transmit to the educational program distribution company server 8 from the terminal personal computer 6 connected to the internet voice information obtained from an audio microphone 1b of the terminal personal computer 6 and visual instruction information such as the three-dimensional instruction mark 30.

The information received by the educational program distribution company server 8 is either directly distributed to the terminal personal computers 6a-1 through 6a-n via the internet 9 or distributed in condition where image processing or interpretation in accordance with each language is performed thereon by the educational program distribution company server 8.

Next, a method for distributing information in the above-described distribution system exemplified in FIG. 1 is described along the figures in divided cases of the practitioner 3 (instructor) guiding the auditing student 12

(customer) as shown in FIG. 3 and specialized instructors (group of lecturers) guiding the practitioner (customer) as shown in FIG. 4.

In this case where a practitioner (instructor) 3 performs a helping and guidance/educational program for a surgical operation and other precision techniques performed under direct observation on a student (customer) as shown in FIG. 3, data of the vital monitor 5 or the precision technique performing environment measurement instrument 5 and information from the audio/visual decoder 4 are composed with each other by the terminal personal computer 6 and superimposed through the audio/visual decoder 4 on a magnified image of a surgical wound which is obtained from the three-dimensional CCD camera 1c of the three-dimensional digital entity mesoscope 1 of FIG. 1 mounted on the practitioner 3 and which is projected on the eyeglass type LCD monitor 1d mounted on the head of the instructing practitioner (lecturer).

Image information which is projected to said LCD monitor 1d and oral instruction information for the microphone 1b are distributed by a specific contractant student (customer) to the terminal personal computers 7a-1 through 7a-N directly or to the technique-assisting and assisting-and guidance/educational distribution system distribution company server 8 from the terminal personal computer 6 by utilizing the internet 9. If the practitioner

(instructor) and the student (customer) speak different languages, in distribution of an educational program, this information is consecutively or simultaneously interpreted into the language spoken by the student (customer) 3 and transmitted to the student (customer) by the technique-assisting and assisting-and guidance/educational distribution system distribution company server 8. Accordingly, a lot of specific contractant students (customers) can get a virtual experience with such realistic sensations that he feels as if he were in a field of an operating situation about a surgical operation and other highly precision oriented techniques distributed to the terminal personal computers 7a-1 through 7a-N.

Since said communication configuration can be utilized in a bidirectional manner, questions etc. of a student (customer) are verbally input with the microphone 1b of the terminal personal computers 7a-1 through 7a-N so that they may be transmitted in a reverse direction to the server 8 via the internet 9 and organized to eliminate duplications and then similarly transmitted to the earphone 1a of the instructing practitioner (lecturer) from the technique-assisting and assisting-and guidance/educational distribution system distribution company server 8 by utilizing the internet 9.

An instructing practitioner (lecturer) 3a inputs his answer to a question of a specific student (customer) into

the terminal personal computer 6a by using the microphone 1b, to transmit it via the internet 9 to the technique-assisting and assisting-and guidance/educational distribution system distribution company server 8. Further, if the student (customer) and the practitioner (instructor) speak different languages, the educational program distribution company server 8 consecutively or simultaneously interprets the language spoken by the instructor into the language spoken by the student (customer) and distributes it via the internet 9 to the terminal personal computers 7a-1 through 7a-N of the students (customers).

Conversely, if specialized instructors (group of lecturers) at a remote location guide the practitioner (customer) 3b as shown in FIG. 4, magnified surgical wound image information A obtained from a two-dimensional or three-dimensional CCD camera 1c of the digital mesoscope of FIG. 1 mounted on the practitioner (customer) 3, vital sign data B superimposed on a magnified surgical wound image or image information B from a highly precision oriented technical operating environment measurement instrument, and a question C from the customer practitioner input through the microphone 1b are input through the audio/visual decoder 4 into the terminal personal computer 6 and then transmitted therefrom to the technique-assisting and assisting-and

guidance/educational distribution system distribution company server 8 via the internet 9.

If a practitioner (instructor) 3b and the specialized instructors (group of lecturers) 7 speak different languages, the educational program distribution company server 8 consecutively or simultaneously interprets the language spoken by the practitioner into that spoken by the specialized instructors (group of lecturers) and transmit it to the specialized instructors (group of lecturers) 7. In this case, it is transmitted via the internet 9 to terminal personal computers 7b-1 through 7b-N of one or, if technical contents cover multiple fields, a plurality of specialized instructors (group of lecturers).

As observing magnified surgical wound image information A of the practitioner (customer) 3 displayed on the terminal personal computers 7b-1 through 7b-N and vital sign data B superimposed on a magnified surgical wound image or image information B from the highly precision oriented technical operating environment measurement instrument, the specialized instructors (group of lecturers) 7 perform technical guidance and a question-and-answer session by inputting a visual instruction by using the three-dimensional instruction mark 30a and an oral instruction by using the microphone 1b by utilizing the terminal personal computers 7b-1 through 7b-N so that this input information may be transmitted in a reverse direction

to the technique-assisting and guidance/educational distribution system distribution company server 8 via the internet 9 and further to the practitioner (customer) 3 via the internet.

If the specialized instructors (group of lecturers) 12 and the practitioner (customer) 3 speak different languages, the educational program distribution company server 8 consecutively or simultaneously interprets the language spoken by the instructors into that spoken by the practitioner (customer) 3 and directly sends information of the three-dimensional instruction mark 30a onto the LCD monitor 36 of the three-dimensional digital entity mesoscope of FIG. 1 mounted on the practitioner (customer) and information of the oral instruction to the earphone 1a. It is thus possible to perform bidirectional communication on a specific contractant practitioner (customer) 3, thereby providing skill educational guidance services.

Further, in FIG. 1, the terminal personal computers 6 and 7 are connected to the internet 9 and, therefore, of course are equipped with a function to access a homepage of the educational program distribution company server 8.

In such a manner, when an auditing student (customer) buys technique-assisting and guidance/educational programs by utilizing the homepage of the educational program distribution company server 8, he can search this homepage of the educational program distribution company server 8 for

general advertisings such as histories of instructing practitioners (lecturers) of each of the programs, technical contents and technical fields, languages spoken by them, instruction time, and a tuition and also popularities and evaluations of students (customers) who have attended lectures already in real time, thereby obtaining unilateral promos of the instructing practitioners (lecturers) or objective criteria other than subjective evaluations of acquaintances who have participated in the same educational program already. Similarly, the students (customers) can apply for receiving lectures of the educational programs and pay tuition on the homepage of the educational program distribution company server 8.

Further, an instructing practitioner (lecturer) who teaches an educational program can utilize the homepage of the educational program distribution company server 8 to thereby give promos, accept an application for lecture reception, and confirm collection of the tuition for formal acceptance.

Conversely, in a case where a practitioner (customer) who wishes for receiving a lecture buys an individual technical/educational assistance and guidance/educational program by a plurality of field-specific expert instructors (group of lecturers), he can search a web site of the internet homepage of the educational program distribution company for publicized technical contents and technical fields of the

instructors (group of lecturers), languages spoken by them and instruction time, and various operation-unit costs for individual technical education/guidance, thereby reversely nominate any one of the instructors in accordance not only with unilateral promos of the instructors (group of lecturers) or evaluation criteria due to subjective evaluations of acquaintances who have already received a lecture of the educational program but also with objective criteria.

Moreover, tuitions are clearly published in the internet homepage web site of this educational program distribution company so that no one needs to directly negotiate about tuitions and, further, instructors (group of lecturers) for various technical fields are organized by the educational program distribution company into an appropriate team so that the customer can get a high degree of guidance. Also, a practitioner (customer) can pay for educational/guidance services at the internet homepage web site of this educational program distribution company.

Moreover, the instructors (group of lecturers) can automatically receive lecture fees determined by the education program distribution company in accordance with the number of the participant instructors (group of lecturers) for the skill educational/guidance service lectures charged in units of operating contents or time relating to a surgical operation or any other highly

precision oriented techniques, thereby keeping themselves free from troublesome office procedures.

Further, although the above description has been made on the assumption that the internet would be used, besides the internet the present invention can be applied also to communication means that connects a practitioner (or operator of precision work) and a party who receives information therefrom or receives it and transmits it bilaterally to each other by utilizing a closed network such as a intranet or any other dedicated line. Further, applicable communication method may use a communication satellite and any other means appropriately selected.

The present three-dimensional digital entity mesoscope system which can enable the third party to experience virtual operations has an extremely lot of information and safe and also completely records a practitioner's operating situation from his visual line; therefore, if a third party uses the present system to present an operation helper on the network with conditions such as skills, experiences, and languages spoken in instruction as well as monetary rewards for above-described various services so that a staff (instructor), such as a registered medical doctor or technician, at a remote location may sign a contract and be dispatched; in this configuration, if an unexpected situation such as an error in medical treatment during an operation occurs,

identification of the error can be made clear based on evaluations of information recorded in the present three-dimensional digital entity mesoscope and a responsible range is also clearly defined in accordance with contract contents determined beforehand based on a degree of involvement between contents of each operation and each technical field of the staff and an instruction fee presented by the practitioner based on the contract contents, thereby dispersing risks of compensations for errors in medical treatment and defects.

Moreover, the present system is of a real time configuration and, at the same time, enables communication only by means of three-dimensional digital entity mesoscopes having the same standards and, therefore, makes it very difficult to tamper data, has an extremely high degree of authenticity, and enables observing a practitioner's operating situation in virtual experience so that skills of the practitioner and existence of defects can be assessed objectively at a remote location.

An instruction image to be composed in a practitioner's visual field image and displayed or an anatomical three-dimensional image or surgical stent image to be composed in a practitioner's visual field image will not block manipulations by use of the hand or the foot involved in an action of a operation by a practitioner or an instructor if the practitioner in the case of his

leadership and the instructor in the case of his leadership will use an eye-contact switch or an audio command switch.

FIG. 7 is one example of a schematic diagram showing a situation of communication through the internet and by use of the above-described three-dimensional entity digital mesoscope 1. As shown in this figure, visual field image information 40 from a practitioner's CCD camera input to a practitioner's personal computer is transmitted using the internet and chroma-key image-composed (42) with an instructor's CCD camera's floating image 43 transmitted from an instructor's personal computer via the internet, to display chroma-key composite image information 42 on a practitioner's LCD.

Similarly, the instructor can provide, in the instructor's personal computer, chroma-key composite display obtained by composing the visual field image information 40 of the practitioner's CCD camera transmitted through the internet displayed on the instructor's LCD and a floater-image processed image obtained from instructor's CCD camera information 41, to thereby perform guidance and instruction on the instructor's LCD with such a reality that as if one were performing a surgical operation by using medical apparatuses actually used. In the present system utilizing the three-dimensional digital entity mesoscopes 1 of the same standards, by performing chroma-key composition processing on this instructor's CCD camera

floating image 43 in the practitioner's personal computer via the internet communication line, it is possible to reflect the same image as the instructor's LCD on the practitioner's LCD without correcting a position of the instructor's CCD camera's floating image 43 on the practitioner's CCD camera's visual field image information 40.

In addition, by taking information from the practitioner's CCD camera into a server computer, transmitting a surgical stent floating image 44 which has undergone position correction and automatic follow-up processing to the practitioner's personal computer and the instructor's personal computer, and performing chroma-key composite image processing on the visual field image information 40 of the practitioner's CCD camera, it is possible to reflect the surgical stent image on the LCDs of the practitioner and the instructor. Since those manipulations are all performed on the basis of the visual field image information 40 of the practitioner's CCD camera, the three parties can share the same images without performing position correction. As can be seen from this schematic diagram, the practitioner's three-dimensional digital entity mesoscope system and the instructor's three-dimensional digital entity mesoscope system have totally the same functions, so that the instructor and the practitioner can be switched with each other easily.

It is to be noted that a configuration and a communication subject of a three-dimensional digital entity mesoscope system of the present invention are not limited to the above-described embodiment and of course can be changed variously without deviating from the scope of the present invention.

Industrial Applicability

A three-dimensional digital entity mesoscope equipped with an image composition three-dimensional visual instruction function and a technical-assistance and guidance/educational distribution system of the present invention relate to a three-dimensional digital entity mesoscope apparatus for performing technique guidance by utilizing a communication network such as the internet. More specifically, the present invention relates to distribution of a highly precision oriented specialized technique educational program for a surgical operation performed under direct observation of a human being or any other manual work and a three-dimensional digital entity mesoscope for education/guidance for a surgical operation performed by a specific customer or any other manually-operated highly precision oriented specialized techniques (that is, such an operation or work is controlled through a visual instruction or an oral instruction by use of three-dimensional image composition based on information

obtained while a visual field of a person with no technical knowledge assumed to be a robot from a remote location) and, further, enables building up a stadium system that enables chroma-key composition without using large-scale facilities even at a remote location by a practitioner and an instructor using three-dimensional digital entity mesoscopes of the same standards and, at the same time, provides means for recruiting students and instructors for various kinds of educational programs and on-the-internet settlement of instruction fees for more inexpensive technique instruction and tuitions on the students.

Generally, in an educational program for live-demonstrating a surgical operation or any other manually operated specialized technique, in the case of instructing a student to perform a highly precision oriented technique such as a surgical operation by an instructor, if the technique and the operation on a closed site are to be observed from the same ideal visual field as the instructing practitioner (lecturer), to permit the plurality of students (customers) to sequentially observe an operating situation at each step of the operation, not only extremely much of time is required but also the number of those who can observe them simultaneously is limited by physical restrictions of facilities for operations, so that such a lecture has been performed for few people. In addition, if the instructing practitioner (lecturer) and the student (customer) speak

different languages, an interpreter needs to come to the surgical wound, so that a fee per student (customer) for participating in such an educational program has been expensive.

Further, in the case of a surgical operation, it is difficult to transport a patient himself to a remote location for an educational program; also, in the case of other special techniques performed by hand which require large facilities or unmovable instruments, a visiting student (customer) used to coordinate his schedule so as to match an operating date and spend much transportation costs and time required by transportation. Moreover, when a person who wishes to receive a lecture buys an educational program, he cannot but discuss whether to buy it based only on unilateral promos of an instructing practitioner (lecturer) or evaluation criteria due to subjective evaluations of his acquaintances who have already received the lecture of the same educational program and, further, must separately pay a tuition through payment medium specified by each of the lecturers. Conversely, the instructor (lecturer) who opens a course of the educational program used to provide promos by utilizing various kinds of media, accept application for reception of the lecture irrespective of whether the number of students (customers) is large or small, and confirm collection of the tuitions for formal acceptance again.

Conversely, in the case of guidance on a surgical operation or a practical training of highly precision oriented work which is performed at a remote location, instructors (group of lecturers) must go to a spot to require a lot of costs, so that various costs (transportation costs and time required by transportation) related to the guidance and, moreover, the remote area requiring much time to go there could not easily accommodate performing of an emergency surgical operation; especially in the case of guidance by a plurality of instructors (group of lecturers), the costs used to become even higher and an emergency surgical operation used to be even more difficult to conduct. Further, if the practitioner (customer) and the instructors (group of lecturers) speak different languages, it used to be necessary to take an interpreter to a field of an operation.

Besides, since conducting medical treatment overseas is prohibited by legal regulations on the medical licensing, so that it is basically impossible for the instructors (group of lecturers) to open a course of a live-operation visiting educational program in which the instructors (group of lecturers) themselves perform an operation and conduct skill guidance in the foreign country.

Furthermore, if a practitioner (customer) actually wishes to receive guidance of a surgical operation or any other highly precision oriented specialized techniques

which are performed by hand, he cannot but select his instructors (group of lecturers) within a limited human network and without clear criteria for calculating a tuition for each of the instructors (group of lecturers), and he has to directly negotiate with them; therefore, he used to not only worry himself in selection of the instructors (group of lecturers) but also have to pay the tuition through the respective payment means separately in accordance with guidance time and contents, thus resulting in troublesome office procedures.

Besides, when medical treatment is audited in the conventional medical fields, the present invention helps auditing consistencies between what is diagnosed and what is treated medically and is useful not only in decision of an error in medical treatment but also as criteria for calculating costs for medical treatment in a field of medical care insurances. Similarly, the present invention enables to objectively evaluate an academically surgical field (medical doctor's personal skills), so that a medical convention etc. can be held through real-time presentation on the internet, which is extremely useful in direct evaluation of competence of medical doctors, that is, establishment of criteria for selecting medical doctors accredited by the convention.

CLAIMS

1. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, the system used for performing assistance and training and education, relating to surgical operations and other highly precision oriented techniques performed, under direct observation, by a medical practitioner while an instructor is watching a medical practitioner's surgical field image shared by the medical practitioner and the instructor through communication secured by use of communication means such as the internet or an intranet by utilizing three-dimensional digital entity magnifying glasses, which are worn by both the medical practitioner and the instructor and constituted of a pair of LCDs positioned directly in front of the two eyes and by three-dimensional digital entity magnifying glasses of identical standards for indicating image information from a right-side CCD camera on the right-side LCD and image information from a left-side CCD camera on the left-side LCD of automatic focusing CCD cameras equipped with a pair of synchronized zoom lenses attached toward a visual field of the naked eye from a position that correspond to a central section between the right and left pupils of the worker wearing the magnifying glass in front of the three-dimensional digital entity magnifying glass, the system comprising:

a floater image-processing apparatus for removing a background image by extracting only images of a three-dimensional pointing device which is operated by the instructor to provide visual training, or various kinds

of instruments (dummies) identical to those used by the medical practitioner from a visual field image of the instructor captured by the instructor-side CCD camera on a front face of the visual field in front of the instructor-side three-dimensional digital entity magnifying glass; and

an image chroma-key composite image-processing apparatus for composing and displaying a three-dimensional visual training float image, on which no background output is performed by the image-processing apparatus on the medical practitioner's visual field image captured by the CCD camera of the medical practitioner's three-dimensional digital entity magnifying glass shared by the medical practitioner and the instructor,

wherein, in a minimum configuration, by utilizing the pair of synchronized three-dimensional digital entity magnifying glasses of identical standards worn by the medical practitioner and the instructor, the instructor provides visual training which is three-dimensional and produces a sense of reality in the medical practitioner's three-dimensional visual field by utilizing images of the three-dimensional pointing device operated by the instructor or various instruments (dummies) identical to those used by the medical practitioner which images are extracted by floating image processing from visual field images of the instructor captured by the instructor's CCD camera and chroma-key composed and displayed in the medical practitioner's visual field image (virtual three-dimensional image) captured by the medical practitioner's CCD camera projected onto an LCD monitor of the three-

dimensional digital entity magnifying glass worn by the instructor.

2. The three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, comprising the chroma-key composite image-processing apparatus according to claim 1 for purposes of varying a degree of transparency of a three-dimensional visual training image of the instructor by a percentage of between 0% and 100% or, additionally, for changing a color tone thereof and displaying it compositely, so that the medical practitioner can easily judge training image and in order to prevent the medical practitioner's visual field and an action of an surgical operation from being blocked visually as a result of overlapping of the worker's work situation visual field image and a three-dimensional visual training image of the instructor when the floater three-dimensional visual training image with no background, output from the image-processing apparatus, of the three-dimensional pointing device operated by the instructor or various instruments (dummies) identical to those used by the medical practitioner is chroma-key composed on medical practitioner's visual field image information in a CCD camera of the digital entity magnifying glass worn by the medical practitioner and displayed.

3. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, comprising an image position correction and follow-up apparatus for compositely

displaying three-dimensionally accurate equal-scaling three-dimensional perspective images into the medical practitioner's visual field image displayed on an LCD of a three-dimensional digital entity magnifying glass by automatically performing position correction always in respect of variations in a visual field angle of the medical practitioner with respect to a patient or to variations in postures of patients, by means of:

in an image obtained by varying a degree of transparency, by a percentage of between 0% and 100%, of image information from the medical practitioner's three-dimensional digital entity magnifying glass CCD displayed on LCDs of both the medical practitioner and the instructor according to claims 1 and 2:

three-dimensionally superimposing an item of three-dimensional image information obtained through image processing and conversion, by changing a three-dimensional anatomical image of an item such as an arbitrary bone, a blood vessel, or nervous tissue, created beforehand from information in a tomogram such as a CT picture or an MRI picture of a patient on whom an operation is to be performed or a surgical stent image into which the anatomical three-dimensional perspective images are three-dimensionally composed together with a dissection or bone cutting position similarly by a percentage of between 0% and 100%, especially, by varying a degree of transparency or a color tone of a site or a tissue indicative of an anatomical landmark, or by applying a visual difference to the medical practitioner's three-dimensional digital entity magnifying glass CCD image information through wireframe

display etc. so as to facilitate discrimination, and onto the medical practitioner's three-dimensional digital entity magnifying glass CCD image at an equal reduction rate by utilizing a reference triangular plane obtained through three-dimensional positional measurement by use of the right and left CCDs of the three-dimensional digital entity magnifying glass and by using, as reference points, three points on non-deformable hard tissue such as a tooth or a bone arbitrarily determined from among the medical practitioner's three-dimensional digital entity magnifying glass CCD image information; and by

enabling the anatomical three-dimensional image to automatically correct a change in position of, and follow, the reference point of the medical practitioner's three-dimensional digital entity magnifying glass CCD image information as the medical practitioner's CCD camera position changes or the patient's posture changes.

4. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein a three-dimensional anatomical image of an arbitrary item such as a bone, a blood vessel, or a nervous tissue, created beforehand from information in a tomogram such as a CT picture or an MRI picture of a patient on whom an operation is to be performed, owned at a remote location or a three-dimensional surgical stent image in which the medical practitioner or a third party (any other medical doctor) designed beforehand a position of a dissection or a bone cutting based on the anatomical three-dimensional

perspective image is composed into the medical practitioner's three-dimensional digital entity magnifying glass CCD's image information according to claims 1 through 3 at the remote location and accurately superimposed one on the other to provide the respective composite display images showing an apparently entity-see-through situation, positions of which images are automatically corrected by the image position-correction and follow-up apparatus in real time as the medical practitioner's CCD camera position changes and the patient's posture changes, to distribute the images compositely displayed to a three-dimensionally correct position always to the medical practitioner and the instructor by utilizing communication means such as the internet or an intranet.

5. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein by accumulating the medical practitioner's three-dimensional digital entity magnifying glass's medical practitioner three-dimensional image information according to claim 1 and surgical stent image information for compositely displaying three-dimensionally accurate equal-scaling three-dimensional perspective images into the medical practitioner's visual field image according to claim 3 in a server so that each of persons wearing a plurality of synchronized three-dimensional digital magnifying glasses and sharing the image information accumulated in the server can arbitrarily switch the surgical stent image information on the medical practitioner's three-dimensional digital

entity magnifying glass's three-dimensional image information between a display mode and a non-display mode and, further, can transmit to the server a three-dimensional visual training image obtained by utilizing the three-dimensional digital entity magnifying glass's CCD cameras worn by them according to claims 1 and 2, and compositely display it to the medical practitioner's three-dimensional image accumulated in the server, thereby making possible discussions through bidirectional communication on a three-dimensional moving image or a still image, by utilizing a communication line such as the internet.

6. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein by providing pluralities of synchronized three-dimensional digital entity magnifying glasses worn by the medical practitioner and the instructor and the floater image-processing apparatuses according to claims 1 through 4 so that the medical practitioner and the instructor may share the images, the plurality of instructors simultaneously guides one medical practitioner three-dimensionally by using the visual training image or switches and displays visual field images of the plurality of medical practitioners as occasion demands so that one instructor provides visual instruction and guidance to the plurality of medical practitioners three-dimensionally through various communication means such as the internet or an intranet.

7. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein when distributing and publishing a training situation by use of the three-dimensional visual training image according to claims 1 and 2 to a lot of students other than the medical practitioner and the instructor or to a third party institution by using live-broadcasting or video-recorded broadcasting via various kinds of communication means such as the internet, by encrypting output signals of two right and left channels output from one three-dimensional digital entity magnifying glass's CCD camera in hardware of the three-dimensional digital entity magnifying glass and by encoding it in hardware of the other three-dimensional digital entity magnifying glass, normal image display is disabled unless a terminal having a prescribed three-dimensional digital entity magnifying glass hardware configuration is used, to provide a higher degree of security, thereby making possible protection of the patient's privacy.

8. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein by presenting conditions such as skills, experiences, and languages spoken during the course of training as well as offering monetary rewards for above-described various services to an operation assistant on the network by using the three-dimensional digital entity magnifying glass system according to claims 1 through 5 having extremely large amount of information and capable of virtually experiencing of the

medical practitioner's operating situation, to sign a contract with a registered or technician to get the staff (instructor) dispatched thereto, so that if an unexpected situation such as an error in medical treatment during a surgical operation occurs, a location of the error can be clarified based on a record of information of the three-dimensional digital entity magnifying glass system and a responsible range is also clearly defined in accordance with contents of a contract determined beforehand based on a degree of involvement between contents of each operation and each technical field of the staff and an instruction fee presented by the medical practitioner based on the contents of a contract, thereby spreading a burden of risks for compensations for errors in medical treatment and defects.

9. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein it is made possible to objectively assess skills of the medical practitioner at a remote location by using the three-dimensional digital entity magnifying glass system that enables virtually experiencing an operating situation of a medical practitioner and has an extremely high degree of authenticity because this system according to claims 1 through 5 has extremely large amount of information and is of a real time type and also capable of communication only by simultaneously using three-dimensional digital entity magnifying glasses of identical standards.

10. A three-dimensional digital entity magnifying glass system incorporating three-dimensional visual training functions, wherein it is made possible to switch an instructing image compositely displayed in the medical practitioner's visual field according to claims 1 through 5, an anatomical three-dimensional image compositely displayed in the medical practitioner's visual field image, or a surgical stent image between the display mode and the non-display mode through switching that does not block operations of using the hand or foot involved in an action of operating by the medical practitioner in the case of his leadership or through wills of the instructor in the case of his leadership.

11. A method performed in a system incorporating three-dimensional digital entity magnifying glasses which are worn by both a medical practitioner and an instructor and constituted of a pair of LCDs installed directly in front of the two eyes and used for performing assistance, and training and education, relating to surgical operations and to other highly precision oriented techniques which are performed, under direct observation, by a medical practitioner while an instructor is watching a medical practitioner's surgical field image shared by the medical practitioner and the instructor through communication secured by use of communication means such as the internet or an intranet by utilizing three-dimensional digital entity magnifying glasses of identical standards for indicating image information from a right-side CCD camera on the right-side LCD and image information from a left-side CCD camera on the left-side

LCD of an automatic focusing CCD cameras equipped with a pair of synchronized zoom lenses which are attached toward a visual field of the naked eye from a position that nearly corresponds to a central section between the right and left pupils of the worker wearing the magnifying glass in front of the three-dimensional digital entity magnifying glass, the method comprising:

a step of floater image processing, by removing a background image by extracting only images of a three-dimensional pointing device which is operated by the instructor to provide visual instructions or various kinds of instruments (dummies) identical to those used by the medical practitioner from a visual field image of the instructor captured by the instructor-side CCD camera on a front face of the visual field in front of the instructor-side three-dimensional digital entity magnifying glass; and

a step of image chroma-key composite image processing, by composing a three-dimensional visual training float image with background output by the image-processing apparatus on the medical practitioner's visual field image captured by the CCD camera of the medical practitioner's three-dimensional digital entity magnifying glass shared by the medical practitioner and the instructor and displaying it,

wherein, in a minimum configuration, by utilizing the pair of synchronized three-dimensional digital entity magnifying glasses of identical standards worn by the medical practitioner and the instructor, the instructor provides visual instructions which is three-dimensional and has a sense of reality in the medical practitioner's

three-dimensional visual field by utilizing images of the three-dimensional pointing device operated by the instructor or various instruments (dummies) identical to those used by the medical practitioner which images are extracted by floating image processing from visual field images of the instructor captured by the instructor's CCD camera and chroma-key composed and displayed in the medical practitioner's visual field image (virtual three-dimensional images) captured by the medical practitioner's CCD camera projected onto an LCD monitor of the three-dimensional digital entity magnifying glass worn by the instructor.