DESCRIPTION

REMOTE PRE-VISUALIZATION SYSTEM AND PRE-VISUALIZATION METHOD USING VIRTUAL PRODUCTION VIRTUAL CAMERA AND LIGHTING

[FIELD OF THE INVENTION]

The present invention relates to a remote pre-visualization system and a pre-visualization method using virtual production virtual camera and lighting, and more particularly, to a remote pre-visualization system and method constructed to confirm in advance the effects of a camera moving shot before filming LED wall-based driving footage in a studio, and to thereby provide a more creative and efficient working environment during actual filming.

[BACKGROUND OF THE INVENTION]

In general, in order to film a scene such as a vehicle chase scene in a drama or movie, a camera is installed inside a vehicle and the surroundings are filmed therefrom, but because the interior of the vehicle is a confined space, the movement path of the camera and the positions of lighting devices are restricted, making it difficult to produce creative shots.

Accordingly, a chroma technique has been used, in which a vehicle is arranged on a set, a green chroma mat is installed around the vehicle so that the background and the interior scene of the vehicle can be separately recognized through a color contrast effect, and computer graphics (CG) are subsequently applied to the footage filmed on the set as a post-production correction process.

However, although such a chroma technique has the advantage of producing creative three-dimensional shots from various camera angles, it has the problem that an additional CG compositing process is required during post-production, thereby increasing the overall production budget, and in particular extending the production period in accordance with the amount of work.

Accordingly, in order to solve such problems, filming methods have recently been developed, as exemplified by the domestic film "Train to Busan" or the foreign film "Oblivion," in which a large-format LED wall, having a size that exceeds the angle of view

of the camera, is installed inside a set (studio), and a train, vehicle, or the like is positioned in front of the LED wall, and a background image of a particular location is reproduced at high resolution through the LED wall, thereby producing an effect as if the vehicle or train arranged on the set is actually moving through the location depicted in the background image.

However, such a method requires that the large-format source image (hereinafter referred to as the "background image") to be reproduced through the LED wall of the set (studio) be obtained in advance, and in particular, since the camera provided in the set (hereinafter referred to as the "studio") must simultaneously film the vehicle or the like together with the background image being reproduced through the LED wall, the space in which the camera is placed and the viewing direction thereof must be taken into consideration.

Furthermore, since driving footage must be filmed in a state in which real and virtual elements are mixed so as to appear as if a vehicle is traveling on a road, unexpected results may occur, or the footage may differ from what the director envisioned, thereby causing delays due to re-shooting.

Accordingly, there has been a need for a system and method capable of previewing camera moving shot effects in advance, prior to filming LED wall-based driving footage in the on-site studio, and capable of providing a more creative and efficient production environment during actual filming.

[SUMMARY OF THE INVENTION]

Technical Problem

Accordingly, an object of the present invention is to provide a system and method which, prior to filming of LED wall-based driving footage, are capable of confirming in advance the effects of a camera moving shot, and which thereby provide a more creative and efficient filming and working environment during actual filming.

Technical Solution

To this end, the present invention provides a remote pre-visualization system using virtual production virtual camera and lighting, comprising: a service server configured to LiDAR-scan an on-site studio having an LED wall to determine a scale thereof and, based on the determined scale, to generate a mesh-converted virtual studio, while modeling

cameras, lighting devices, and vehicles used at the filming site and storing the same in a database such that they can be selectively used in the virtual studio, and further storing in the database large-format background images reproducible through the LED wall provided in the on-site studio such that the background images can be reproduced through an LED wall provided in the virtual studio; and a user terminal configured to access the service server and to arrange a camera, a lighting device, and a vehicle in the virtual studio, to set positional values and setting values thereof, and to set a background image to be reproduced through the LED wall provided in the virtual studio, the user terminal being further configured such that, when the service server reproduces the background image through the LED wall provided in the virtual studio, the user terminal can view driving footage of the vehicle while a viewpoint is changed to a viewpoint of a camera currently filming, based on the reproduction, wherein the user terminal is configured such that, through the service server, various driving footage is pre-shot in the virtual studio, and based thereon, driving footage is filmed stably and rapidly in the on-site studio having the LED wall.

In the present invention, the service server is further configured to generate a web page that is stably accessible through the Internet based on W3C and HTML web standards, and to display, on the web page, the virtual studio having the LED wall, such that a user is enabled to perform pre-visualization without installing a separate program and regardless of location and time, and to provide a service such that driving footage being pre-shot through the virtual studio provided on the web page is simultaneously confirmable by a connected production company, staff, or actors.

Furthermore, in the present invention, when a plurality of users are connected to the service server and confirm driving footage being pre-shot, a user or an account administrator is configured to grant control priority to any one user among the connected users, and the user granted such control priority is enabled to adjust a position of a camera or lighting device arranged in the virtual studio, or to reset a setting value of the camera or the lighting device, so as to re-shoot or correct various driving footage.

In the present invention, the service server comprises an access unit configured to authenticate the user by receiving an ID and a password through an access window of the web page; a project generation unit configured to form a project window on the web page and to display the virtual studio having an LED wall and a ceiling panel on a stage so as to be viewable; a DCSS arrangement unit configured to support arrangement

of a camera, a lighting device, and a vehicle in the virtual studio, and to support selection of a background image to be reproduced through the LED wall; a DCSS setting unit configured to support setting of positional values or setting values of the lighting device, the camera, and the vehicle, and to support viewing of a changed appearance of the virtual studio; a play unit configured to reproduce the background image through the LED wall, to switch a screen to a viewpoint of the camera, and to cause driving footage to be filmed by the camera arranged in the studio with the LED wall as a background; and a correction unit configured, during viewing of the driving footage, to support screen correction by changing an angle or a characteristic value of the camera, wherein the correction unit is further configured to adjust a brightness of the ceiling panel provided above the LED wall, or to vertically raise and lower the ceiling panel which displays a background image above the traveling vehicle in synchronization with the background image.

Furthermore, the present invention provides a pre-visualization method comprising: an access step in which, when a user terminal accesses a service server, a web page is opened, and a user is authenticated by inputting an ID and a password into an access window of the web page; a project generation step in which, when the connected user is authenticated as an authorized user, a virtual studio including an LED wall and a ceiling panel is displayed on the web page, and an authority to use the virtual studio is granted; an arrangement step in which a camera, a lighting device, and a vehicle are arranged in the virtual studio so as to be position-adjustable, and a background image to be reproduced through the LED wall is selected accordingly; a setting step in which positions and setting values of the camera, the lighting device, and the vehicle are respectively adjusted to enable filming, and a changed appearance of the virtual studio is viewed accordingly; a filming and playback step in which, when the LED wall reproduces the background image, the screen is switched to a viewpoint of the camera, and driving footage is filmed with the LED wall as a background and the same is viewed; and a correction and monitoring step in which a position or a setting value of the camera filming in the virtual studio is adjusted, and the resulting footage is monitored.

Furthermore, the present invention provides a pre-visualization method which, after completion of the correction and monitoring, is terminated when there is no further correction matter, and which, when a plurality of users are connected to the service server, further comprises collaborating by communicating, through voice or text, with the plurality of connected users regarding the filmed driving footage, or granting control priority to any one user among the plurality of users and re-shooting by the user having

the control priority while changing a positional value or a setting value of a camera or lighting device arranged in the virtual studio.

In addition, the present invention enables pre-visualization to be carried out anywhere through web access without installation of any separate program, and enables a plurality of remotely connected users to collaboratively review the previsualized footage in real time, thereby providing a flexible and efficient working environment.

Advantageous Effects

Accordingly, the present invention is configured such that, prior to filming driving footage based on a background image reproduced through the LED wall provided inside the studio, various camera tests are first completed in the virtual studio, and thereafter the footage can be filmed more stably and rapidly in the on-site studio.

Furthermore, the present invention enables a plurality of users to perform pre-visualization regardless of location, by accessing the system through the web at any time and from any place, and in particular, enables the plurality of connected users (for example, directors, staff, production companies, actors, and the like) to communicate with one another and thereby pre-shoot various footage in a more creative and efficient manner.

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a diagram schematically illustrating the overall configuration of a system according to an embodiment of the present invention.

FIG. 2 is a block diagram schematically illustrating the configuration of a service server in the system according to an embodiment of the present invention.

FIG. 3 is a flowchart illustrating the operating process of the system according to an embodiment of the present invention.

FIGS. 4 to 9 are diagrams schematically illustrating, by way of example, screen configurations of the system according to embodiments of the present invention.

FIG. 5 (further detail) is a diagram illustrating a side window through which a vehicle, a camera, and a lighting device are arranged in the virtual studio according to an embodiment of the present invention.

[DESCRIPTION OF THE PREFERRED EMBODIMENTS]

The best mode for carrying out the present invention is a remote pre-visualization system using virtual production virtual camera and lighting, comprising a service server configured to LiDAR-scan an on-site studio having an LED wall to determine a scale thereof and, based on the determined scale, to generate a mesh-converted virtual studio, while modeling cameras, lighting devices, and vehicles used at a filming site and storing the same in a database such that they can be selectively used in the virtual studio, and further storing in the database large-format background images reproducible through the LED wall provided in the on-site studio such that the background images can be reproduced through an LED wall provided in the virtual studio; and a user terminal configured to access the service server and to arrange a camera, a lighting device, and a vehicle in the virtual studio, to set positional values and setting values thereof, and to set a background image to be reproduced through the LED wall provided in the virtual studio, the user terminal being further configured such that, when the service server reproduces the background image through the LED wall provided in the virtual studio, the user terminal can view driving footage of the vehicle based thereon while a viewpoint is changed to a viewpoint of a camera currently filming.

First, the terms used in the description and claims of the present invention are not to be construed as having their dictionary meanings, but rather, in accordance with the principle that an inventor may appropriately define the concepts of terms in order to best describe his or her invention, should be interpreted with meanings and concepts consistent with the technical idea of the present invention.

Accordingly, the embodiments described in the present specification and the configurations illustrated in the accompanying drawings are merely preferred embodiments of the present invention and do not represent the entirety of the technical idea of the present invention; it should therefore be understood that, at the time of filing of the present application, various equivalents and modifications capable of substituting therefor may exist.

The present invention will now be described in detail with reference to the accompanying drawings.

As illustrated in FIG. 1, the remote pre-visualization system using virtual production virtual camera and lighting according to an embodiment of the present invention comprises a service server (10) configured to be accessible through the Internet, and one

or more user terminals (1) capable of accessing the service server (10), wherein the service server (10) stores in a database the relevant data such that an on-site studio having an LED wall can be LiDAR-scanned, the scale thereof can be determined, and, based thereon, a mesh-converted virtual studio can be generated, and wherein the virtual studio includes, in the same manner as the on-site studio, an operating space, a stage, a lobby, and an LED wall, and, when a default 180-degree view is displayed in accordance with the monitor after access of the user terminal, the stage and the LED wall are displayed such that the entirety thereof can be confirmed from the operating space.

Furthermore, the service server (10) is configured such that cameras, lighting accessories, and vehicles used at the filming site are modeled and provided in a manner that allows them to be selectively used in the virtual studio, and in particular, large-format background images reproducible through the LED wall provided in the on-site studio are stored in the database such that the background images can also be reproduced through the LED wall provided in the virtual studio, and the service server (10) operates a web page in a cross-browsing-capable manner based on W3C and HTML web standards so as to allow stable web access, wherein the virtual studio is displayed in a viewable manner on the web page through Unreal Engine, based on the data stored in the database.

The user terminal (1) is an Internet-accessible PC or notebook computer used by a director of photography, staff, an actor, or a production company, and is configured such that, after logging into the web page operated through the service server (10), a camera, a lighting device, and a vehicle can be arranged in the virtual studio, setting values and positional values thereof can be set, a background image to be reproduced through the LED wall provided in the virtual studio can be selected, and the driving footage filmed by the camera with the background image as a background can be viewed.

In addition, a plurality of user terminals (1) may be provided and may access the service server, and the users may communicate with one another by voice/video or by text upon web access, or through a separate communication terminal, and may collaborate with a plurality of users in order to film a more effective shot, or may, through exchange of control priority, allow another user to take over filming in the virtual studio or to adjust setting values or correction values of the camera or lighting device, wherein, for reference, the on-site studio is provided with a stage of the same or similar scale as the virtual studio, into and out of which a vehicle for filming driving footage can enter and exit, and a large curved LED wall for reproducing a background

image is provided around the vehicle, such that driving footage can be filmed based on the background image reproduced through the LED wall, and a ceiling panel that is movable forward and rearward and is also movable upward and downward is provided on the ceiling, the ceiling panel being an LED panel capable of displaying a background image above the traveling vehicle (for example, a sky, a tunnel ceiling, or a parking lot ceiling) in synchronization with the background image, the brightness of which is adjustable so as to express daytime or nighttime.

As illustrated in FIG. 2, the service server (10) of the present invention comprises an access unit (11), a project generation unit (12), a DCSS (Driving Comp Stage System) arrangement unit (13), a DCSS setting unit (14), a play unit (15), and a correction unit (16), and may further comprise a collaboration unit (17), wherein the access unit (11) is configured such that, when the user terminal (1) accesses the service server (10) through the Internet (for example, by IP access), a web page operated by the service server (10) is displayed on the screen of the user terminal, and an ID and password are received from the user terminal (1) through an access window of the web page so as to authenticate whether the user is an authorized user.

The project generation unit (12) is configured to form a project window on the web page and to display, through the project window, the virtual studio including the LED wall, the ceiling panel, and the studio in a viewable manner, wherein the project window provides by default a 180-degree default viewing screen through which the stage and the LED wall can be confirmed as a whole from the operating space, and is configured to be freely rotated in upward, downward, leftward, and rightward directions in accordance with control of an input device (for example, a mouse or keyboard), such that the operating space, the lobby ceiling, and the like in which a director, staff, and the like will be located can be confirmed.

Furthermore, the DCSS arrangement unit (13) is configured to arrange a camera and a lighting device, respectively, in the virtual studio based on the data stored in the database, and is further configured to selectively and position-adjustably arrange a background image to be reproduced through the LED wall provided in the virtual studio and a vehicle for filming driving footage based on the background image, and the DCSS setting unit (14) is configured to support setting and adjustment of setting values and positional values of the cameras, the lighting devices, and the like arranged through the DCSS arrangement unit (13), and to support viewing of the appearance of the virtual studio that has been changed in accordance with the set setting values and positional

values.

The play unit (15) is configured such that a large-format background image is reproduced through the LED wall provided in the virtual studio, and the screen is switched to a viewpoint of the camera, and driving footage is filmed by the camera arranged in the studio with the LED wall as a background, and may be mode-switched so that only the footage filmed through the camera is enlarged and viewed, and the correction unit (16) is configured such that, similar to adjusting the focus or distance during on-site camera shooting, characteristic values of the camera filming in the virtual studio can be changed so as to perform zoom-in shooting or correction while viewing the driving footage being filmed therethrough, and the height of the ceiling panel can be adjusted in accordance with the driving footage, or the brightness of the ceiling panel can be adjusted in accordance with daytime or nighttime conditions.

In addition, the collaboration unit (17) is configured such that, when a plurality of users access the web page of the service server, the camera footage being filmed by the current user through the virtual studio can be simultaneously confirmed by a production company, staff, and the like, and the connected users can communicate with one another by voice or text through a WebRTC or VoIP module, or through a separate communication terminal, wherein control priority held by the user or an administrator can be granted to any one user among the plurality of users, and the user granted such control priority can adjust the position of a camera or lighting device, or correct a characteristic value of a configured camera, so as to effectively film various driving footage while communicating therewith.

As illustrated in FIG. 3, the present invention comprises an access step (S110), a project generation step (S120), an arrangement step (S130), a setting step (S140), a filming and playback step (S150), and a correction and monitoring step (S160), and may further comprise a collaboration step (S170) and a re-shooting step (S180), wherein, in the access step (S110), when the user terminal (1) accesses the service server (10), a web page is opened, and an ID and password are input into the access window of the web page to authenticate whether the user is an authorized user, and in the project generation step (S120), when the connected user is authenticated as an authorized user, the virtual studio including the LED wall (21) and the ceiling panel (22) is displayed on the web page, and an authority to use the virtual studio is granted, and as illustrated in FIG. 4, after login access, a project window (31) having a plurality of menu buttons (32) and a play button (33) is displayed on the web page (30), and in the project window

(31), a default 180-degree screen through which the stage (20) and the LED wall (21) can be viewed as a whole is displayed.

In the arrangement step (S130), as illustrated in FIG. 5, a camera, a lighting device, and a vehicle are respectively arranged, in a position-adjustable manner, in the virtual studio based on the data stored in the database of the service server (10), and a background image to be reproduced through the LED wall is selected accordingly, wherein, when a vehicle button (32c) among a plurality of menu buttons (32) provided at the upper end of the project window (31) is selected, a side window (34) is displayed at the left end of the project window (31), and when any one of a plurality of vehicle icons displayed in the side window (34) is selected with a mouse and dragged into the virtual studio, the corresponding vehicle is arranged on the stage (20) provided with the LED wall (21), and the camera (23), the lighting device (24), and the background image of the LED wall (21) are also respectively selected and arranged in the same manner.

In the setting step (S140), the positions of the camera (23), the lighting device (24), and the vehicle (25) arranged in the virtual studio are adjusted to enable filming, wherein a setting window (35) is displayed at the right end of the project window (31), and through the setting window (35), positional values (Position, Rotation, Scale) and setting values (for example, Intensity, Color, Temperature, Shadow Hardness, Soft Source Radius, Inner Angle, and the like) are set and adjusted, such that the states of the camera (23), the lighting device (24), and the vehicle (25) are respectively set, and in the filming and playback step (S150), as illustrated in FIG. 6, after the arrangement and detailed setting have been completed, when the play button (33) provided at the upper right of the project window (31) is clicked, the viewpoint is switched, as illustrated in FIG. 7, from a viewpoint of viewing the virtual studio from the operating space to a viewpoint of looking at the virtual studio from the camera, and a pop-up window (36) is opened in the virtual studio, such that the driving footage being filmed by the camera (23) can be simultaneously confirmed through the pop-up window (36), and when a view button (38) of the pop-up window (36) is clicked, the pop-up window (36) is switched to a full screen, such that the driving footage being filmed through the camera (23) can be viewed, and in the correction and monitoring step (S160), as illustrated in FIG. 7, when the play button (33) for reproducing the background image of the LED wall (21) is clicked, a correction window (39) is displayed at the right end of the project window (31), and through the option items of the correction window (39), the position and characteristic values of the camera (23) filming in the virtual studio (for example, Position, Rotation, Scale, Focal Length, F-Stop, ISO, Focus Distance, and the like) are changed,

such that the driving footage being filmed can be monitored, and as illustrated in FIG. 8, a slide bar (37) is provided at the left end of the project window (31), and when the slide bar (37) is moved downward, the ceiling panel (22) is lowered, or, conversely, when moved upward, the ceiling panel (22) is raised, such that the ambient brightness can be adjusted in accordance with the background image being reproduced through the LED wall, or the sky outside the vehicle, the tunnel ceiling, and the like can be filmed in accordance with the traveling vehicle, and in the collaboration step (S170), after the correction and monitoring have been completed, the process is terminated if there is no further correction matter, and when a plurality of users are connected, additional matters or correction matters are confirmed by communicating, through voice or text, with the plurality of users (for example, a production company, staff, actors, and the like) regarding the filmed driving footage, wherein, when a collaboration button (32e) is clicked, a side window is displayed at one side of the project window (31), and in the re-shooting step (S180), if it is determined that re-shooting is not necessary, the process is terminated, and if additional matters or correction matters are to be confirmed, the positional values and setting values of the camera or lighting device may be changed, or the project may be saved, and the process may return to the project generation step (S120) and the steps may be repeated up to the collaboration step (S170), wherein the user (for example, a director) or an administrator may grant control priority to any one user (for example, a staff member) among the plurality of users, and the user granted such control priority may adjust the position of a camera or lighting device, correct a characteristic value thereof, or save the project and proceed with a new project, thereby pre-shooting various driving footage and reflecting the same when filming in the on-site studio at a later time. Accordingly, the present invention is configured such that, before driving footage is filmed using the LED wall in the on-site studio, various camera tests are first performed in the virtual studio, and thereafter, vehicle driving footage can be filmed more stably, rapidly, and effectively in the on-site studio.

What is claimed is :

1. A remote pre-visualization system using virtual production virtual camera and lighting, comprising: a service server configured to LiDAR-scan an on-site studio having an LED wall to determine a scale thereof, and to generate, based on the determined scale, a mesh-converted virtual studio, the service server being further configured to model cameras, lighting devices, and vehicles used at a filming site and to store the same in a database such that they can be selectively used in the virtual studio, and to further store, in the database, large-format background images reproducible through the LED wall provided in the on-site studio such that the background images can be reproduced through an LED wall provided in the virtual studio; and a user terminal configured to access the service server and to arrange a camera, a lighting device, and a vehicle in the virtual studio, to set positional values and setting values thereof, and to set a background image to be reproduced through the LED wall provided in the virtual studio, the user terminal being further configured such that, when the service server reproduces the background image through the LED wall provided in the virtual studio, the user terminal views driving footage of the vehicle while a viewpoint is changed to a viewpoint of a camera currently filming, based on the reproduction, wherein the user terminal is further configured such that, through the service server, various driving footage is pre-shot in the virtual studio, and based thereon, driving footage is filmed stably and rapidly in the on-site studio having the LED wall.
2. The remote pre-visualization system of claim 1, wherein the service server is further configured to generate a web page that is stably accessible through the Internet based on W3C and HTML web standards, and to display, on the web page, the virtual studio having the LED wall, such that a user is enabled to perform pre-visualization without installing a separate program and regardless of location and time.
3. The remote pre-visualization system of claim 2, wherein the service server is further configured to provide a service such that driving footage being pre-shot through the virtual studio provided on the web page is confirmable by a plurality of connected users.
4. The remote pre-visualization system of claim 3, wherein, when the plurality of users are connected to the service server and confirm the driving footage being pre-shot, an account administrator or a user is configured to grant control priority to any one user among the plurality of connected users, and the user granted such

control priority is enabled to adjust a position of a camera or lighting device arranged in the virtual studio, or to reset a setting value of the camera or the lighting device, so as to re-shoot or correct various driving footage.

5. The remote pre-visualization system of claim 2, wherein the service server comprises: an access unit configured to display, on the user terminal, a web page operated by the service server when the user terminal accesses the service server through the Internet, and to authenticate the user by receiving ID and password information through an access window of the web page; a project generation unit configured to form a project window on the web page and to display the virtual studio having an LED wall and a ceiling panel on a stage so as to be viewable; a DCSS arrangement unit configured to support arrangement of a camera, a lighting device, and a vehicle in the virtual studio generated through the project generation unit, and to support selection of a background image to be reproduced through the LED wall; a DCSS setting unit configured to support setting of positional values or setting values thereof and to support viewing of a changed appearance of the virtual studio; a play unit configured, after the arrangement and setting have been completed through the DCSS arrangement unit and the DCSS setting unit, to reproduce the background image through the LED wall, to switch a screen to a viewpoint of the camera, and to cause driving footage to be filmed by the camera arranged in the studio with the LED wall as a background; and a correction unit configured, during viewing of the driving footage, to support screen correction by changing an angle or a characteristic value of the camera arranged in the virtual studio.
6. The remote pre-visualization system of claim 5, wherein the correction unit is further configured to adjust a brightness of the ceiling panel provided above the LED wall, or to vertically move the ceiling panel which displays a background image above the traveling vehicle in synchronization with the background image.
7. A pre-visualization method for a remote pre-visualization system using virtual production virtual camera and lighting, the method comprising: an access step in which, when a user terminal accesses a service server, a web page is opened, and a user is authenticated by inputting an ID and a password into an access window of the web page; a project generation step in which, when the connected user is authenticated as an authorized user, a virtual studio including an LED wall and a ceiling panel is displayed on the web page, and an authority to use the virtual studio is granted; an arrangement step in which a camera, a lighting device, and a vehicle

are arranged in the virtual studio so as to be position-adjustable, based on data stored in a database of the service server, and a background image to be reproduced through the LED wall is selected accordingly; a setting step in which positions and setting values of the camera, the lighting device, and the vehicle arranged in the virtual studio are respectively adjusted to enable filming, while a changed appearance of the virtual studio is viewed accordingly; a filming and playback step in which, when the LED wall reproduces the background image, the screen is switched to a viewpoint of the camera arranged in the virtual studio, and driving footage is filmed with the LED wall as a background and the same is viewed; and a correction and monitoring step in which a position or a setting value of the camera filming in the virtual studio is adjusted, and the resulting footage is monitored.

8. The pre-visualization method of claim 7, further comprising: terminating the method when, after the correction and monitoring have been completed, there is no further correction matter; and when a plurality of users are connected to the service server, collaborating with the plurality of users by communicating, through voice or text, regarding the filmed driving footage, or granting, by the user, control priority to any one user among the plurality of users, and re-shooting by the user granted such control priority while changing a positional value or a setting value of a camera or lighting device arranged in the virtual studio.