METHODS AND SYSTEMS FOR IMAGING A SCENE, SUCH AS A MEDICAL SCENE, AND TRACKING OBJECTS WITHIN THE SCENE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Patent Application No. 15/930,305, filed May 12, 2020, and titled "METHODS AND SYSTEMS FOR IMAGING A SCENE, SUCH AS A MEDICAL SCENE, AND TRACKING OBJECTS WITHIN THE SCENE," which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present technology generally relates to a camera array, and more specifically, to a camera array for (i) generating a virtual perspective of a scene for a mediated-reality viewer and (ii) tracking objects within the scene.

BACKGROUND

[0003] In a mediated reality system, an image processing system adds, subtracts, and/or modifies visual information representing an environment. For surgical applications, a mediated reality system may enable a surgeon to view a surgical site from a desired perspective together with contextual information that assists the surgeon in more efficiently and precisely performing surgical tasks. Such contextual information may include the position of objects within the scene, such as surgical tools. However, it can be difficult to precisely track objects while maintaining low system latency. Moreover, such mediated reality systems rely on multiple camera angles to reconstruct an image of the environment. However, even small relative movements and/or misalignments between the multiple cameras can cause unwanted distortions in the reconstructed image.

SUMMARY

[0003a] In a first aspect, the present disclosure provides a support structure having a center; a depth sensor mounted to the support structure proximate to the center; a plurality of cameras mounted to the support structure radially outward from the depth sensor, wherein the cameras are configured to capture image data of a scene; and a plurality of trackers mounted to the support structure radially outward from the cameras, wherein the trackers are configured to capture positional data of a tool within the scene.

[0003b] In a second aspect, the present disclosure provides a mediated-reality system, comprising a camera array including a support structure having a center; a depth sensor mounted to the support structure proximate to the center; a plurality of cameras mounted to the support structure radially outward from the depth sensor, wherein the cameras are configured to capture image data of a scene; and a plurality of trackers mounted to the support structure radially outward from the cameras, wherein the trackers are configured to capture positional data of a tool within the scene; an input controller configured to control a position and orientation of a virtual perspective of the scene; a processing device communicatively coupled to the camera array and the input controller, wherein the processing device is configured to synthesize a virtual image corresponding to the virtual perspective based on the image data from at least two of the cameras; and determine a position of the tool based on the positional data from at least two of the trackers; and a display device communicatively coupled to the processing device, wherein the display device is configured to display a graphical representation of the tool at the determined position in the virtual image.

[0003c] In a third aspect, the present disclosure provides a method of imaging a subject within a scene, the method comprising: aligning a depth sensor of a camera array with a portion of interest of the subject such that the portion of interest is positioned proximate a focal depth of the depth sensor; capturing, with a plurality of cameras of the camera array, image data of the scene including the portion of interest of the subject; capturing, with a plurality of trackers of the camera array, positional data of a tool within the scene; receiving input regarding a selected position and orientation of a virtual perspective of the scene; synthesizing a virtual image corresponding to the virtual perspective of the scene based on the image data; determining a position of the tool based on the positional data; and displaying, at a display device, a graphical representation of the tool at the determined position in the virtual image.

[0003d] In a fourth aspect, the present disclosure provides a method for determining the position of a tip of a tool within a scene, the method comprising: receiving positional data of the tool from at least two trackers; estimating a three-dimensional (3D) position of the tip of the tool based on the positional data; receiving an image of the scene from each of one or more cameras; for the image from each of the one or more cameras defining a region of interest in the image based on the estimated 3D position of the tip of the tool; and processing the image in the region of interest to determine a position of the tip of the tool in the region of interest; and determining

an updated 3D position of the tip of the tool based on the determined position of the tool in the region of interest of the one or more images.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Many aspects of the present disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale. Instead, emphasis is placed on clearly illustrating the principles of the present disclosure.

[0005] Figure 1 is a schematic view of an imaging system in accordance with embodiments of the present technology.