Annex 1

Amendment 1 (conditional)

1. A system for digitally overlaying an image with another image, comprising
   a storage (4) for storing a model of a real world space, wherein the model includes an overlay surface to be overlaid with an overlay image, wherein the overlay surface in the model represents a display device in the real world, wherein the display device is a LED board configured to display a moving image on the display device in the real world by emitting radiation in one or more predetermined frequency ranges;
   a camera parameter interface (2) for receiving camera parameters, which calibrate at least one camera with respect to coordinates of the model;
   a camera image interface (3) for receiving at least one image captured with respective said at least one camera substantially at the same time, said at least one captured image comprising a detection image, wherein the camera used to capture the detection image is configured to detect radiation having a frequency outside all of the one or more predetermined frequency ranges and distinguish the detected radiation outside all of the one or more predetermined frequency ranges from radiation inside the one or more predetermined frequency ranges;
   a positioner (8) for determining a position of the overlay surface within said at least one captured image based on the model and the camera parameters;
   a detector (9) for detecting an occluding object at least partially occluding the overlay surface in a selected captured image of said at least one captured image based on an image property of the occluding object and the detection image;
   an overlayer (10) for overlaying a non-occluded portion of the overlay surface in the selected captured image with the overlay image to obtain an output image, wherein the overlayer is configured to overlay the moving image displayed on the display device in the real world with the overlay image in the selected captured image;
   and an output interface (11) for outputting the output image;
   wherein
   the camera used to capture the detection image is equipped with a spectral bandpass filter that only allows light at a small controlled frequency spectrum and wherein the small controlled frequency spectrum is not within the spectral responses of the LED board;
   the detection image is not influenced by any changes displayed on the LED screen;
   the LED screen has a uniform, monotone distribution as if it was not active on the captured detection image;
   the occluding object is a real world object; and
   the image property of the occluding object is its very complex frequency response curve such that the occluding object is still visible in the captured detection image.

2. The system of claim 1, wherein the image property of the occluding object relates to a descriptor of a neighbourhood of a pixel, wherein the descriptor comprises a spatial frequency, and wherein the detector is configured to compare a descriptor of a pixel of the detection image to the descriptor of the occluding object.

3. The system of claim 1, further comprising a model updater (16) for updating a model of a background based on the detection image;
   wherein the detector is configured to detect the occluding object further based on the model of the background.

4. The system of claim 3, wherein the model of the background comprises a model of a characteristic of a texture of the background;
   and wherein the model updater is configured to ad- just the model of the characteristic of the texture around the pixel based on the detection image.

5. The system of claim 1, wherein the detector is configured to detect the occluding object by detecting a change in a current detection image compared to an earlier captured detection image.

6. The system of claim 1, wherein the detection image is different from the selected captured image, and the camera interface is configured to receive the detection image and the selected captured image from different cameras.

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7. The system of claim 6, wherein the camera used to capture the detection image and the camera used to capture the selected captured image are mounted at a distance from each other so that the selected captured image and the detection image form a pair of stereo images, and wherein the image property of the occluding object relates to a disparity between the two stereo images.

8. The system of claim 6, wherein the camera used to capture the detection image is configured to detect radiation other than visible light.

9. The system of claim 6, wherein the camera used to capture the detection image and the camera used to capture the selected captured image are configured to receive radiation through the same objective or two different objectives.

10. The system of claim 1, wherein the camera used to capture the detection image is configured   to detect visible light outside all of the one or more predetermined frequency ranges and to distinguish the detected visible light outside all of the one or more predetermined frequency ranges from visible light inside the one or more pre-determined frequency ranges.

11. The system of claim 1, wherein the overlay surface is represented in the model by an indication of at least a shape, position, and orientation of the overlay surface in the real world space.

12. A method of digitally overlaying an image with another image, comprising creating (200) a model of a real world space, wherein the model includes an overlay surface to be overlaid with an overlay image, wherein the overlay surface in the model represents a display device in the real world, wherein the display device is a LED board configured to display a moving image on the display device in the real world by emitting radiation in one or more predetermined frequency ranges;
identifying (201) camera parameters, which calibrate at least one camera with respect to coordinates of the model;
capturing (202) at least one image with respective said at least one camera substantially at the same time, said at least one captured image comprising a detection image, wherein the camera used to capture the detection image is configured to detect radiation having a frequency outside all of the one or more pre-determined frequency ranges and distinguish the detected radiation outside all of the one or more predetermined frequency ranges from radiation inside the one or more pre-determined frequency ranges;
positioning (203) the overlay surface within said at least one captured image based on the model and the camera parameters;
detecting (204) an occluding object at least partially occluding the overlay surface in a selected captured image of said at least one captured image based on an image property of the occluding object and the detection image;
overlaying (205) a non-occluded portion of the overlay surface in the selected captured image with the overlay image, by overlaying the moving image displayed on the display device in the real world with the overlay image in the selected captured image;
wherein
the camera used to capture the detection image is equipped with a spectral bandpass filter that only allows light at a small controlled frequency spectrum and wherein the small controlled frequency spectrum is not within the spectral responses of the LED board;
the detection image is not influenced by any changes displayed on the LED screen;
the LED screen has a uniform, monotone distribution as if it was not active on the captured detection image;
the occluding object is a real world object; and
the image property of the occluding object is its very complex frequency response curve such that the occluding object is still visible in the captured detection image.

13. A computer program product comprising instructions for causing a computer to perform the steps of storing (500) a model of a real world space, wherein the model includes an overlay surface to be overlaid with an overlay image, wherein the overlay surface in the model represents a display device in the real world, wherein the display device is a LED board configured to display a moving image on the display device in the real world by emitting radiation in one or more predetermined frequency ranges;
receiving (501) camera parameters, which calibrate at least one camera with respect to coordinates of the model;
receiving (502) at least one image captured with respective said at least one camera substantially at the same time, said at least one captured image comprising a detection image, wherein the

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camera used to capture the detection image is configured to detect radiation having a frequency outside all of the one or more predetermined frequency ranges and distinguish the detected radiation outside all of the one or more predetermined frequency ranges from radiation inside the one or more pre-determined frequency ranges;

determining (503) a position of the overlay surface within said at least one captured image based on the model and the camera parameters; detecting (504) an occluding object at least partially occluding the overlay surface in a selected captured image of said at least one captured image based on an image property of the occluding object and the detection image;

overlaying (505) a non-occluded portion of the overlay surface in the selected captured image with the overlay image to obtain an output image by overlaying the moving image displayed on the display device in the real world with the overlay image in the selected captured image;

and outputting (506) the output image;

wherein

the camera used to capture the detection image is equipped with a spectral bandpass filter that only allows light at a small controlled frequency spectrum and wherein the small controlled frequency spectrum is not within the spectral responses of the LED board;

the detection image is not influenced by any changes displayed on the LED screen;

the LED screen has a uniform, monotone distribution as if it was not active on the captured detection image;

the occluding object is a real world object; and

the image property of the occluding object is its very complex frequency response curve such that the occluding object is still visible in the captured detection image.

Annex 2

Amendment 2 (conditional)

1. A system for digitally overlaying an image with another image, comprising
a storage (4) for storing a model of a real world space, wherein the model includes an overlay surface to be overlaid with an overlay image, wherein the overlay surface in the model represents a display device in the real world, wherein the display device is a LED board configured to display a moving image on the display device in the real world by emitting radiation in one or more predetermined frequency ranges;
a camera parameter interface (2) for receiving camera parameters, which calibrate at least one camera with respect to coordinates of the model;
a camera image interface (3) for receiving at least one image captured with respective said at least one camera substantially at the same time, said at least one captured image comprising a detection image, wherein the camera used to capture the detection image is configured to detect radiation having a frequency outside all of the one or more predetermined frequency ranges and distinguish the detected radiation outside all of the one or more predetermined frequency ranges from radiation inside the one or more predetermined frequency ranges;
a positioner (8) for determining a position of the overlay surface within said at least one captured image based on the model and the camera parameters;
a detector (9) for detecting an occluding object at least partially occluding the overlay surface in a selected captured image of said at least one captured image based on an image property of the occluding object and the detection image;
an overlayer (10) for overlaying a non-occluded portion of the overlay surface in the selected captured image with the overlay image to obtain an output image, wherein the overlayer is configured to overlay the moving image displayed on the display device in the real world with the overlay image in the selected captured image;
and an output interface (11) for outputting the output image;
wherein
the camera used to capture the detection image is equipped with a spectral bandpass filter that only allows light at a small controlled frequency spectrum;
the detection image is not influenced by any changes displayed on the LED screen;
the LED screen has a uniform, monotone distribution as if it was not active on the captured detection image;
the occluding object is a real world object; and
the image property of the occluding object is its very complex frequency response curve such that the occluding object is still visible in the captured detection image.

2. The system of claim 1, wherein the image property of the occluding object relates to a descriptor of a neighbourhood of a pixel, wherein the descriptor comprises a spatial frequency, and wherein the detector is configured to compare a descriptor of a pixel of the detection image to the descriptor of the occluding object.

3. The system of claim 1, further comprising a model updater (16) for updating a model of a background based on the detection image;
wherein the detector is configured to detect the occluding object further based on the model of the background.

4. The system of claim 3, wherein the model of the background comprises a model of a characteristic of a texture of the background;
and wherein the model updater is configured to ad- just the model of the characteristic of the texture around the pixel based on the detection image.

5. The system of claim 1, wherein the detector is configured to detect the occluding object by detecting a change in a current detection image compared to an earlier captured detection image.

6. The system of claim 1, wherein the detection image is different from the selected captured image, and the camera interface is configured to receive the detection image and the selected captured image from different cameras.

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7. The system of claim 6, wherein the camera used to capture the detection image and the camera used to capture the selected captured image are mounted at a distance from each other so that the selected captured image and the detection image form a pair of stereo images, and wherein the image property of the occluding object relates to a disparity between the two stereo images.

8. The system of claim 6, wherein the camera used to capture the detection image is configured to detect radiation other than visible light.

9. The system of claim 6, wherein the camera used to capture the detection image and the camera used to capture the selected captured image are configured to receive radiation through the same objective or two different objectives.

10. The system of claim 1, wherein the camera used to capture the detection image is configured to detect visible light outside all of the one or more predetermined frequency ranges and to distinguish the detected visible light outside all of the one or more predetermined frequency ranges from visible light inside the one or more pre-determined frequency ranges.

11. The system of claim 1, wherein the overlay surface is represented in the model by an indication of at least a shape, position, and orientation of the overlay surface in the real world space.

12. A method of digitally overlaying an image with another image, comprising creating (200) a model of a real world space, wherein the model includes an overlay surface to be overlaid with an overlay image, wherein the overlay surface in the model represents a display device in the real world, wherein the display device is a LED board configured to display a moving image on the display device in the real world by emitting radiation in one or more predetermined frequency ranges;
identifying (201) camera parameters, which calibrate at least one camera with respect to coordinates of the model;
capturing (202) at least one image with respective said at least one camera substantially at the same time, said at least one captured image comprising a detection image, wherein the camera used to capture the detection image is configured to detect radiation having a frequency outside all of the one or more pre-determined frequency ranges and distinguish the detected radiation outside all of the one or more predetermined frequency ranges from radiation inside the one or more pre-determined frequency ranges;
positioning (203) the overlay surface within said at least one captured image based on the model and the camera parameters;
detecting (204) an occluding object at least partially occluding the overlay surface in a selected captured image of said at least one captured image based on an image property of the occluding object and the detection image;
overlaying (205) a non-occluded portion of the overlay surface in the selected captured image with the overlay image, by overlaying the moving image displayed on the display device in the real world with the overlay image in the selected captured image;
wherein
the camera used to capture the detection image is equipped with a spectral bandpass filter that only allows light at a small controlled frequency spectrum;
the detection image is not influenced by any changes displayed on the LED screen;
the LED screen has a uniform, monotone distribution as if it was not active on the captured detection image;
the occluding object is a real world object; and
the image property of the occluding object is its very complex frequency response curve such that the occluding object is still visible in the captured detection image.

13. A computer program product comprising instructions for causing a computer to perform the steps of storing (500) a model of a real world space, wherein the model includes an overlay surface to be overlaid with an overlay image, wherein the overlay surface in the model represents a display device in the real world, wherein the display device is a LED board configured to display a moving image on the display device in the real world by emitting radiation in one or more predetermined frequency ranges;
receiving (501) camera parameters, which calibrate at least one camera with respect to coordinates of the model;
receiving (502) at least one image captured with respective said at least one camera substantially at the same time, said at least one captured image comprising a detection image, wherein the

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camera used to capture the detection image is configured to detect radiation having a frequency outside all of the one or more predetermined frequency ranges and distinguish the detected radiation outside all of the one or more predetermined frequency ranges from radiation inside the one or more pre-determined frequency ranges;

determining (503) a position of the overlay surface within said at least one captured image based on the model and the camera parameters; detecting (504) an occluding object at least partially occluding the overlay surface in a selected captured image of said at least one captured image based on an image property of the occluding object and the detection image;

overlaying (505) a non-occluded portion of the overlay surface in the selected captured image with the overlay image to obtain an output image by overlaying the moving image displayed on the display device in the real world with the overlay image in the selected captured image;

and outputting (506) the output image;

wherein

the camera used to capture the detection image is equipped with a spectral bandpass filter that only allows light at a small controlled frequency spectrum;

the detection image is not influenced by any changes displayed on the LED screen;

the LED screen has a uniform, monotone distribution as if it was not active on the captured detection image;

the occluding object is a real world object; and

the image property of the occluding object is its very complex frequency response curve such that the occluding object is still visible in the captured detection image.

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