

CLAIMS:

1. A mixed reality system, comprising:
a data acquisition device configured to acquire real-world data;
an output device for providing the real-world data to a user; and
5 a processing circuitry configured to:
obtain (a) data acquired by the data acquisition device, and (b)
information of one or more virtual entities having properties enabling
determination of simulated effects of the virtual entities on the data;
determine the simulated effects of the virtual entities on the data utilizing
10 the properties; and
provide the user with output on the output device being a manipulation
of the data reflecting the simulated effects.
2. The mixed reality system of claim 1, wherein the data acquisition device is a
15 sensor or a radio receiver.
3. The mixed reality system of claim 2, wherein the sensor is one of the following:
a camera, a radar, Night Vision Goggles (NVG), a proximity sensor, temperature sensor,
an infrared sensor, pressure sensor, light sensor, touch sensor, ultrasonic sensor, color
20 sensor, humidity sensor, tilt sensor, accelerometer, or an acoustic sensor.
4. The mixed reality system of claim 2, wherein the processing circuitry
determines the simulated effects also utilizing one or more parameters of the sensor or
the radio receiver.
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5. The mixed reality system of claim 1, wherein the data is acquired from a training
environment, and wherein the virtual entities are designed to simulate training
scenarios.
- 30 6. The mixed reality system of claim 1, wherein the simulated effect is one or more
of: virtual heat, virtual light, virtual touch, virtual shade, virtual sound, virtual
topography, virtual smoke, virtual hit, or virtual ice.

7. A method comprising:

obtaining, by a processing resource, (a) data acquired by a data acquisition device configured to acquire real-world data, and (b) information of one or more virtual entities having properties enabling determination of simulated effects of the virtual entities on the data;

determining, by the processing resource, the simulated effects of the virtual entities on the data utilizing the properties; and

providing, by the processing resource, a user of an output device, used for providing the real-world data to the user, with output on the output device being a manipulation of the data reflecting the simulated effects.

8. The method of claim 7, wherein the data acquisition device is a sensor or a radio receiver.

9. The method of claim 8, wherein the sensor is one of the following: a camera, a radar, Night Vision Goggles (NVG), a proximity sensor, temperature sensor, an infrared sensor, pressure sensor, light sensor, touch sensor, ultrasonic sensor, color sensor, humidity sensor, tilt sensor, accelerometer, or an acoustic sensor.

10. The method of claim 8, wherein the determining of the simulated effects also utilizes one or more parameters of the sensor or the radio receiver.

11. The method of claim 7, wherein the data is acquired from a training environment, and wherein the virtual entities are designed to simulate training scenarios.

12. The method of claim 7, wherein the simulated effect is one or more of: virtual heat, virtual light, virtual touch, virtual shade, virtual sound, virtual topography, virtual smoke, virtual hit, or virtual ice.

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13. A non-transitory computer readable storage medium having computer readable program code embodied therewith, the computer readable program code, executable by at least one processor of a computer to perform a method comprising:

obtaining, by a processing resource, (a) data acquired by a data acquisition
5 device configured to acquire real-world data, and (b) information of one or more virtual entities having properties enabling determination of simulated effects of the virtual entities on the data;

determining, by the processing resource, the simulated effects of the virtual entities on the data utilizing the properties; and

10 providing, by the processing resource, a user of an output device, used for providing the real-world data to the user, with output on the output device being a manipulation of the data reflecting the simulated effects.

14. A mixed reality system, comprising:

15 a sensor configured to acquire readings of real-world data, and display, on an output device, a real-world visualization of the real-world data based on the readings to a user, wherein the sensor has one or more parameters affecting the real-world visualization; and

a processing circuitry configured to:

20 obtain information of one or more virtual entities located within an area from which the readings are acquired, the information defining, for each of the virtual entities, one or more simulated physical properties;

determine, for at least one given virtual entity of the virtual entities, a virtual entity visualization of the given virtual entity, the virtual entity
25 visualization determined by manipulating a simulated reading of the simulated physical properties based on the parameters affecting the real-world visualization; and

display the virtual entity visualizations in combination with the real-world visualization, thereby enabling a user viewing the output device to view
30 the virtual entity visualizations and the real-world visualization.

15. The system of claim 1, wherein the display is performed by injecting the virtual entity visualizations into the output device.

16. The mixed reality system of claim 14, wherein the display is performed on a see-through output device overlaying the output device.

5 17. The mixed reality system of claim 14, wherein the display is performed by projecting the virtual entity visualizations on the real-world visualization.

18. The mixed reality system of claim 14, wherein the real-world visualization is provided to the output device via a first communication channel and the virtual entity
10 visualizations are injected into the output device via a second communication channel other than the first communication channel.

19. The mixed reality system of claim 18, wherein the parameters affect the real-world visualization by affecting the first communication channel.

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20. The mixed reality system of claim 19, wherein the manipulating of the simulated reading further includes simulating communication effects of the first communication channel on the virtual entity visualizations.

20 21. The mixed reality system of claim 14, wherein the virtual entity visualization of the given virtual entity is perceived closer to a third visualization of the given virtual entity had it been a real-world entity having physical properties identical to the simulated physical properties than an alternative visualization of the given virtual entity determined without manipulating the simulated reading of the simulated physical
25 properties based on the parameters affecting the readings of the sensor.

22. The mixed reality system of claim 14, wherein the manipulating of the simulated reading further includes employing one or more algorithms, employed on the readings of the real-world data, also on the simulated reading.

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23. The mixed reality system of claim 14, wherein the parameters affect the real-world visualization by affecting the readings.

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24. The mixed reality system of claim 23, wherein the parameters include one or more of:

- a. a noise model characterizing readings of the sensor;
- b. a spectral sensitivity of the sensor;
- 5 c. a spectral response of the sensor;
- d. a saturation of the sensor;
- e. a dynamic range of the sensor;
- f. a dark noise of the sensor;
- g. a signal-to-noise ratio of the sensor;
- 10 h. a detection limit of the sensor;
- i. a photo response non uniformity of the sensor;
- j. a penetration depth of the sensor;
- k. a lens distortion of the sensor;
- l. an optical deformation model of the sensor;
- 15 m. a vignetting model of the sensor;
- n. response to different exposure levels of the sensor; or
- o. a resolution map of the readings acquired by the sensor.

25. The mixed reality system of claim 14, wherein the processing circuitry is further
20 configured to:

obtain information of movement of the sensor during acquisition of the readings;
determine if the movement of the sensor generates an effect on the real-world
visualization, utilizing the information and the parameters;

wherein upon determining that the movement generates the effect, the
25 manipulating of the simulated reading further includes simulating the effect on the
simulated reading.

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26. The mixed reality system of claim 14, wherein the processing circuitry is further configured to:

obtain information of simulated movement of the given virtual entity during acquisition of the readings;

5 determine if the simulated movement of the given virtual entity is required to generate an effect on the simulated reading, utilizing the information and the parameters;

 wherein upon determining that the movement is required to generate the effect, the manipulating of the simulated reading further includes simulating the effect on the
10 simulated reading.

27. The mixed reality system of claim 14, wherein the processing circuitry is further configured to:

obtain information of environmental parameters of at least part of a region from
15 which the readings are acquired;

determine if the environmental parameters generate an effect on the real-world visualization, utilizing the information and the parameters;

 wherein upon determining that the environmental parameters generate the effect, the manipulating of the simulated reading further includes simulating the effect on the
20 simulated reading.

28. The mixed reality system of claim 14, wherein the processing circuitry is further configured to:

obtain values of one or more situational parameters indicative of a state of the
25 sensor during acquisition of the readings; and

 wherein the virtual entity visualization is determined also based on the values of the situational parameters.

29. The mixed reality system of claim 28, wherein the situational parameters include
30 one or more of:

- a. a temperature of the sensor;
- b. a vibration frequency of the sensor; or
- c. a type of platform the sensor is connected to.

30. A method comprising:

obtaining, by a processing circuitry, information of one or more virtual entities located within an area from which readings are acquired by a sensor configured to
5 acquire readings of real-world data, and display, on an output device, a real-world visualization of the real-world data based on the readings to a user, wherein the sensor has one or more parameters affecting the real-world visualization, and wherein the information defining, for each of the virtual entities, one or more simulated physical properties;
10 determining, by the processing circuitry, for at least one given virtual entity of the virtual entities, a virtual entity visualization of the given virtual entity, the virtual entity visualization determined by manipulating a simulated reading of the simulated physical properties based on the parameters affecting the real-world visualization; and
displaying, by the processing circuitry, the virtual entity visualizations in
15 combination with the real-world visualization, thereby enabling a user viewing the output device to view the virtual entity visualizations and the real-world visualization.

31. The method of claim 30, wherein the display is performed by injecting the virtual entity visualizations into the output device.
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32. The method of claim 30, wherein the display is performed on a see-through output device overlaying the output device.

33. The method of claim 30, wherein the display is performed by projecting the
25 virtual entity visualizations on the real-world visualization.

34. The method of claim 30, wherein the real-world visualization is provided to the output device via a first communication channel and the virtual entity visualizations are injected into the output device via a second communication channel other than the first
30 communication channel.

35. The method of claim 34, wherein the parameters affect the real-world visualization by affecting the first communication channel.

36. The method of claim 35, wherein the manipulating of the simulated reading further includes simulating communication effects of the first communication channel on the virtual entity visualizations.

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37. The method of claim 30, wherein the virtual entity visualization of the given virtual entity is perceived closer to a third visualization of the given virtual entity had it been a real-world entity having physical properties identical to the simulated physical properties than an alternative visualization of the given virtual entity determined
10 without manipulating the simulated reading of the simulated physical properties based on the parameters affecting the readings of the sensor.

38. The method of claim 30, wherein the manipulating of the simulated reading further includes employing one or more algorithms, employed on the readings of the
15 real-world data, also on the simulated reading.

39. The method of claim 30, wherein the parameters affect the real-world visualization by affecting the readings.

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40. The method of claim 39, wherein the parameters include one or more of:
- a. a noise model characterizing readings of the sensor;
 - b. a spectral sensitivity of the sensor;
 - c. a spectral response of the sensor;
 - 5 d. a saturation of the sensor;
 - e. a dynamic range of the sensor;
 - f. a dark noise of the sensor;
 - g. a signal-to-noise ratio of the sensor;
 - h. a detection limit of the sensor;
 - 10 i. a photo response non uniformity of the sensor;
 - j. a penetration depth of the sensor;
 - k. a lens distortion of the sensor;
 - l. an optical deformation model of the sensor;
 - m. a vignetting model of the sensor;
 - 15 n. response to different exposure levels of the sensor; or
 - o. a resolution map of the readings acquired by the sensor.
41. The method of claim 30, further comprising:
- obtaining, by the processing circuitry, information of movement of the sensor
 - 20 during acquisition of the readings;
 - determining, by the processing circuitry, if the movement of the sensor generates an effect on the real-world visualization, utilizing the information and the parameters;
 - wherein upon determining that the movement generates the effect, the manipulating of the simulated reading further includes simulating the effect on the
 - 25 simulated reading.

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42. The method of claim 30, further comprising:

obtaining, by the processing circuitry, information of simulated movement of the given virtual entity during acquisition of the readings;

determining, by the processing circuitry, if the simulated movement of the given
5 virtual entity is required to generate an effect on the simulated reading, utilizing the information and the parameters;

wherein upon determining that the movement is required to generate the effect, the manipulating of the simulated reading further includes simulating the effect on the simulated reading.

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43. The method of claim 30, further comprising:

obtaining, by the processing circuitry, information of environmental parameters of at least part of a region from which the readings are acquired;

determining, by the processing circuitry, if the environmental parameters
15 generate an effect on the real-world visualization, utilizing the information and the parameters;

wherein upon determining that the environmental parameters generate the effect, the manipulating of the simulated reading further includes simulating the effect on the simulated reading.

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44. The method of claim 30, further comprising:

obtaining, by the processing circuitry, values of one or more situational parameters indicative of a state of the sensor during acquisition of the readings; and

wherein the virtual entity visualization is determined also based on the values of
25 the situational parameters.

45. The method of claim 44, wherein the situational parameters include one or more of:

- a. a temperature of the sensor;
- 30 b. a vibration frequency of the sensor; or
- c. a type of platform the sensor is connected to.

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46. A non-transitory computer readable storage medium having computer readable program code embodied therewith, the computer readable program code, executable by at least one processor of a computer to perform a method comprising:

obtaining, by a processing circuitry, information of one or more virtual entities
5 located within an area from which readings are acquired by a sensor configured to acquire readings of real-world data, and display, on an output device, a real-world visualization of the real-world data based on the readings to a user, wherein the sensor has one or more parameters affecting the real-world visualization, and wherein the information defining, for each of the virtual entities, one or more simulated physical
10 properties;

determining, by the processing circuitry, for at least one given virtual entity of the virtual entities, a virtual entity visualization of the given virtual entity, the virtual entity visualization determined by manipulating a simulated reading of the simulated physical properties based on the parameters affecting the real-world visualization; and
15 displaying, by the processing circuitry, the virtual entity visualizations in combination with the real-world visualization, thereby enabling a user viewing the output device to view the virtual entity visualizations and the real-world visualization.