CLAIMS

1. A device, comprising:

a light projector configured to:

project first light onto a scene in a first distribution including a flood projection when the device operates in a first mode; and

project second light onto the scene in a second distribution including a pattern projection when the device operates in a second mode;

a receiver configured to detect reflections of light projected by the light projector;

a memory storing instructions; and

a processor, connected to the memory, configured to:

determine first depth information based on an amount of time for the first projected light to be reflected back to the receiver when the device operates in the first mode;

determine second depth information based on distortion of at least one pattern of the second projected light by one or more objects in a scene as detected by the receiver when the device operates in the second mode; and

compensate for multipath interference (MPI) errors in the first depth information at least in part by using the second depth information as a reference for removing the MPI errors from the first depth information.

2. The device of claim 1, wherein the processor is further configured to:

determine the first depth information using time-of-flight (ToF) techniques; and

determine the second depth information using structured light (SL) techniques.

3. The device of claim 1, wherein the light projector comprises a switchable diffuser and is further configured to:

activate the switchable diffuser to project the flood projection.

4. The device of claim 3, wherein the pattern projection is created by a diffractive optical element (DOE) disposed between the switchable diffuser and a light source of the light projector.

5. The device of claim 4, wherein the light projector comprises a birefringent material disposed between the DOE and the switchable diffuser, and wherein deactivating the switchable diffuser comprises:

applying a voltage across a refractive material.

6. The device of claim 5, wherein the switchable diffuser has a first refractive index and the birefringent material is a liquid crystal material having a second refractive index, wherein the first refractive index and the second refractive index are different when the light projector does not apply the voltage across the refractive material, and wherein the first refractive index and the second refractive index are the same when the light projector does apply the voltage across the refractive material.

7. The device of claim 6, wherein the light projector does not apply the voltage across the refractive material when the device operates in the first mode, and wherein the light projector does apply the voltage across the refractive material when the device operates in the second mode.

8. The device of claim 3, wherein the light projector is further configured to:

deactivate the switchable diffuser to project the pattern projection.

9. The device of claim 1, wherein the receiver is further configured to:

detect reflections of the first distribution when the device operates in the first mode; and

detect reflections of the second distribution when the device operates in the second mode.

10. The device of claim 1, wherein to the processor is further configured to:

generate a depth map using the second depth information and the first depth information with at least mitigated MPI.

11. The device of claim 1, wherein the receiver comprises a monolithic pixel sensor including at least one global shutter (GS) pixel cell and at least one lock-in pixel cell, and wherein the processor is further configured to:

determine at least one phase difference between the first projected light and reflections detected by the monolithic pixel sensor when the device operates in the first mode.

12. The device of claim 11, wherein the receiver is further configured to:

detect, via the at least one GS pixel cell, near infrared (NIR) light based on the reflections detected by the receiver when the device operates in the second mode.

13. The device of claim 11, wherein the lock-in pixel cell includes two time-of-flight (ToF) gates for operating in a two-phase mode.

14. The device of claim 11, wherein the at least one GS pixel cell is electrically isolated from the at least one lock-in pixel cell, and wherein the lock-in pixel cell includes four time-of-flight (ToF) gates for operating in a four-phase mode.

15. The device of claim 1, wherein the receiver comprises at least one of a complementary metal-oxide semiconductor (CMOS) device and a charge-coupled device (CCD), and wherein the receiver is further configured to:

alternate between detecting reflections of the first distribution and detecting reflections of the second distribution using time-division multiplexed read (TDMR).

16. The device of claim 1, wherein the device is a wireless communication device.

17. A method for depth sensing using a device, comprising:

projecting first light onto a scene in a first distribution including a flood projection when the device operates in a first mode;

projecting second light onto the scene in a second distribution including a pattern projection when the device operates in a second mode;

detecting, by a receiver, reflections of the first projected light and the second projected light;

determining first depth information based on an amount of time for the first projected light to be reflected back to the receiver when the device operates in the first mode;

determining second depth information based on distortion of at least one pattern of the second projected light by one or more objects in a scene as detected by the receiver when the device operates in the second mode; and

compensating for multipath interference (MPI) errors in the first depth information at least in part by using the second depth information as a reference for removing the MPI errors from the first depth information.

18. The method of claim 17, further comprising:

determining the first depth information using time-of-flight (ToF) techniques; and

determining the second depth information using structured light (SL) techniques.

19. The method of claim 17, wherein the device includes a switchable diffuser, and the method further comprises:

activating the switchable diffuser to project the flood projection.

20. The method of claim 19, further comprising:

deactivating the switchable diffuser to project the pattern projection.

21. The method of claim 17, further comprising:

detecting reflections of the first distribution when the device operates in the first mode; and

detecting reflections of the second distribution when the device operates in the second mode.

22. The method of claim 21, further comprising:

determining at least one phase difference between the projected first light and reflections detected by the receiver when the device operates in the first mode.

23. The method of claim 17, further comprising:

generating a depth map using the second depth information and the first depth information with at least mitigated MPI.

24. The method of claim 17, further comprising:

alternating between detecting reflections of the first distribution and detecting reflections of the second distribution using time-division multiplexed read (TDMR).

25. The method of claim 17, wherein the device is a wireless communication device.

26. A non-transitory computer-readable medium storing instructions that, when executed by one or more processors of an apparatus, causes the apparatus to perform operations comprising:

projecting first light onto a scene in a first distribution including a flood projection when the apparatus operates in a first mode;

projecting second light onto the scene in a second distribution including a pattern projection when the apparatus operates in a second mode;

detecting reflections of the first projected light and the second projected light;

determining first depth information based on an amount of time for the first projected light to be reflected back to the receiver when the apparatus operates in the first mode;

determining second depth information based on distortion of at least one pattern of the second projected light by one or more objects in a scene as detected by the receiver when the apparatus operates in the second mode; and

compensate for multipath interference (MPI) errors in the first depth information at least in part by using the second depth information as a reference for removing the MPI errors from the first depth information.