CLAIMS

WHAT IS CLAIMED IS:

1. A method of ranging a target object, the method comprising:

transmitting a plurality of signals with different frequencies towards the target object;

receiving the plurality of signals as a result of the plurality of signals being reflected back from the target object;

estimating a phase of a basis carrier frequency signal of the plurality of signals and a number of periods traveled by the plurality of signals; and

determining a distance to the target object based on the phase of the basis carrier frequency signal and the number of periods traveled by the plurality of signals; wherein an accuracy of the determined distance is independent of a bandwidth of the plurality of signals and a sampling rate of the plurality of signals.

2. The method of claim 1, wherein the phase of the basis carrier frequency signal and the number of periods traveled by the plurality of signals are estimated separated.

3. The method of claim 1, further comprising:

estimating a moving speed of the target object or vital sign frequency of the target object through monitoring a changing of the distance over time.

4. The method of claim 3, wherein a detection sensitivity for the changing of the distance increases when carrier frequency of the plurality of signals increases, wherein a detection range for the changing of the distance narrows when the carrier frequency of the plurality of signals increases.

5. The method of claim 1, the plurality of received signals being a plurality of analog signals, wherein the method further comprises:

removing high frequency components from the plurality of analog signals before converting the plurality of analog signals into a plurality of digital signals for further processing.

6. The method of claim 1, wherein the plurality of signals has a sequence of frequencies changing along time in a period.

7. The method of claim 1, wherein the plurality of signals has different frequencies and is simultaneously emitted.

8. The method of claim 1, wherein the plurality of signals corresponds to a plurality of stages with ascending frequencies in a period, wherein the basis carrier frequency signal has a lowest frequency among the plurality of signals, wherein the basis carrier frequency signal has a same phase in each period.

9. The method of claim 1, wherein the target object is an active reflector that resends the plurality of signals back after a fixed delay subsequent to receiving the plurality of signals at the target object.

10. An apparatus for ranging a target object, the apparatus comprising:

a memory; and

at least one processor coupled to the memory and configured to:

transmit a plurality of signals with different frequencies towards the target object;

receive the plurality of signals as a result of the plurality of signals being reflected back from the target object;

estimate a phase of a basis carrier frequency signal of the plurality of signals and a number of periods traveled by the plurality of signals; and

determine a distance to the target object based on the phase of the basis carrier frequency signal and the number of periods traveled by the plurality of signals; wherein an accuracy of the determined distance is independent of a bandwidth of the plurality of signals and a sampling rate of the plurality of signals.

11. The apparatus of claim 10, wherein the phase of the basis carrier frequency signal and the number of periods traveled by the plurality of signals are estimated separated.

12. The apparatus of claim 10, wherein the at least one processor is further configured to:

estimate a moving speed of the target object or vital sign frequency of the target object through monitoring a changing of the distance over time.

13. The apparatus of claim 12, wherein a detection sensitivity for the changing of the distance increases when carrier frequency of the plurality of signals increases, wherein a detection range for the changing of the distance narrows when the carrier frequency of the plurality of signals increases.

14. The apparatus of claim 10, the plurality of received signals being a plurality of analog signals, wherein the at least one processor is further configured to:

remove high frequency components from the plurality of analog signals before converting the plurality of analog signals into a plurality of digital signals for further processing.

15. The apparatus of claim 10, wherein the plurality of signals has a sequence of frequencies changing along time in a period.

16. The apparatus of claim 10, wherein the plurality of signals has different frequencies and is simultaneously emitted.

17. The apparatus of claim 10, wherein the plurality of signals corresponds to a plurality of stages with ascending frequencies in a period, wherein the basis carrier frequency signal has a lowest frequency among the plurality of signals, wherein the basis carrier frequency signal has a same phase in each period.

18. The apparatus of claim 10, wherein the target object is an active reflector that resends the plurality of signals back after a fixed delay subsequent to receiving the plurality of signals at the target object.