CLAIMS

1. An ultrasonic-based person detection method, comprising the steps of:

(a) emitting, from an emitter, an ultrasonic signal, the ultrasonic signal including a component at a first frequency, f_0;

(b) receiving reflections of the ultrasonic signal, the received signal including components at frequencies greater than and less than the first frequency;

(c) determining a difference between an upper portion of the received signal containing a frequency higher than the first frequency, and a lower portion of the received signal containing a frequency lower than the first frequency; and

(d) determining, based on the difference between the upper portion and the lower portion, whether a person is present;

wherein the method includes dividing the received signal into a plurality of bins, each bin representing a range of frequencies in the received signal, and wherein the upper portion is an upper frequency bin, containing portions of the received signal which are higher in frequency than the first frequency, and the lower portion is a lower frequency bin, containing portions of the received signal which are lower in frequency than the first frequency; and

wherein determining the presence of a person includes determining a logit function of a normalised power of the upper frequency bin.

2. The method of any preceding claim, wherein the upper portion of the received signal contains higher frequencies immediately adjacent to the first frequency, and the lower portion of the received signal contains lower frequencies immediately adjacent to the first frequency.

3. The method of claim 1, wherein the determination in step (d) is performed based on a difference between a normalised power estimate of the upper frequency bin and a normalised power estimate of the lower frequency bin.

4. The method of claim 3, wherein a normalisation factor is a sum of a power estimates of the upper frequency bin and the lower frequency bin.

5. The method of claim 1, wherein the logit function takes the form:

$$L(t) = \text{logit}\left(\frac{|X(t, f_0 + 1)|^2}{|X(t, f_0 - 1)|^2 + |X(t, f_0 + 1)|^2}\right)$$

where $X(t, f_0 + 1)$ is a coefficient representing the upper frequency bin at time t, and $X(t, f_0 - 1)$ is a coefficient representing the lower frequency bin at time t.

6. The method of any preceding claim, wherein steps (b) – (d) are repeated at a predetermined rate.

7. The method of any preceding claim, further comprising a step, after it has been determined that a person is present, of determining whether the person is moving towards or away from a receiver.

8. The method of claim 7, wherein determining whether the person is moving towards or away from the receiver is further based on a first likelihood ratio test, for determining whether the person is moving towards the receiver; and a second likelihood ratio test, for determining whether the person is moving away from the receiver.

9. The method of claim 8, wherein a log-likelihood ratio is derived for each likelihood ratio, and is computed recursively from a previous value of the respective log-likelihood ratio.

10. The method of any preceding claim, wherein when it has been determined that a person is present, the method includes taking a video conferencing device out of standby mode.

11. A system for detecting a person, the system including:

an emitter, configured to emit an ultrasonic signal including a component at a first frequency, f_0;

one or more receivers, configured to receive reflections of the ultrasonic signal; and

one or more processors, configured, in response to the receiver receiving a received signal including components at frequencies greater than and less than the first frequency, to:

(a) determine a difference between an upper portion of the received signal containing a frequency higher than the first frequency, and a lower portion of the received signal containing a frequency lower than the first frequency; and

(b) determine, based on the difference between the upper portion and the lower portion, whether a person is present,

wherein the method includes dividing the received signal into a plurality of bins, each bin representing a range of frequencies in the received signal, and wherein the upper portion is an upper frequency bin, containing portions of the received signal which are higher in frequency than the first frequency, and the lower portion is a lower frequency bin, containing

portions of the received signal which are lower in frequency than the first frequency; and

wherein determining the presence of a person includes determining a logit function of a normalised power of the upper frequency bin.

12. The system of claim 11, wherein the upper portion of the received signal contains higher frequencies immediately adjacent to the first frequency, and the lower portion of the received signal contains lower frequencies immediately adjacent to the first frequency.

13. The system of claim 11, wherein the determination in step (d) is performed based on a difference between a normalised power estimate of the upper frequency bin and a normalised power estimate of the lower frequency bin.

14. The system of claim 13, wherein a normalisation factor is a sum of the power estimates of the upper frequency bin and the lower frequency bin.

15. The system of claim 11, wherein the logit function takes the form:

$$L(t) = \text{logit}\left(\frac{|X(t, f_0 + 1)|^2}{|X(t, f_0 - 1)|^2 + |X(t, f_0 + 1)|^2}\right)$$

where $X(t, f_0 + 1)$ is a coefficient representing the upper frequency bin at time t, and $X(t, f_0 - 1)$ is a coefficient representing the lower frequency bin at time t.

16. The system of any of claims 11 to 15, wherein the processor is configured to repeat steps (a) – (b) at a predetermined rate.

17. The system of any of claims 11 to 16, wherein the processor is further configured to determine, after it has been determined that a person is present, whether the person is moving towards or away from a receiver.

18. The system of claim 17, wherein determining whether the person is moving towards or away from the receiver is further based on a first likelihood ratio test, for determining whether the person is moving towards the receiver; and a second likelihood ratio test, for determining whether the person is moving away from the receiver.

19. The system of any of claims 11 to 18, wherein when it has been determined that a user is present, the processor is configured to take a video conferencing device out of standby mode.