

[0071] The other key feature of the system according to the invention is the ability to determine which user is currently touching near the antennas. This is a very powerful feature that can be used many ways. For example, we generated a multi-player game where different colored objects appear on the surface, often simultaneously, and the player must quickly touch the objects that are a particular color. The first player to do this correctly for each object gets points credited to his or her score. Hitting the wrong color deletes points. This game is only possible via the identification feature of our invention.

[0072] The ability for simultaneous, identifying interaction opens some interesting possibilities. One of the more intriguing ideas is the ability to generate virtual personal work areas. Although the system is designed for group collaboration on a common surface, in practice, individuals may want to “break away” to briefly address some subset of the problem, and then wish to integrate their result into the whole. When these situations arise, the system can generate a virtual personal work area in front of the appropriate user that only responds to that user. The user can then manipulate objects in this space, without impacting the larger work effort of other users but for the loss of some screen space. Because these virtual personal work areas are software defined, they can be generated and destroyed on the fly, in any shape as desired.

[0073] The concept of virtual personal work areas can be extended to special “privileged objects.” A privileged object is an icon that allows only certain classes of users to perform certain operations with that object. For example, a plumber and an electrician may be viewing the same house plan, but only the plumber can modify the piping and only the electrician can modify the wiring.

[0074] Although the invention has been described by way of examples of preferred embodiments, it is to be understood that various other adaptations and modifications may be made within the spirit and scope of the invention. Therefore, it is the object of the appended claims to cover all such variations and modifications as come within the true spirit and scope of the invention.

We claim:

1. A multi-user touch system, comprising:
  - a surface including a plurality of antennas mounted thereon;
  - a transmitter configured to transmit uniquely identifiable signals to each antenna;
  - a plurality of receivers, each receiver capacitively coupled to a different user, the receivers configured to receive the uniquely identifiable signals;
  - means for associating a specific antenna with a particular users when multiple users simultaneously touch any of the plurality of antennas.
2. The system of claim 1 wherein the touch sensitive surface further comprises:
  - a plurality of conductive pads arranged in rows and columns.
3. The system of claim 1 wherein the plurality of conductive pads are arranged on a laminated substrate.

4. The system of claim 1 wherein each receiver further comprises:

- an amplifier connected to a synchronous demodulator;
- an analog-to-digital converter coupled an output of the synchronous demodulator; and

5. The system of claim 1 wherein the transmitter and each receiver are connected to a processor for associating the specific antenna with each particular users

6. The system of claim 1 wherein the surface is disposed on a table top.

7. The system of claim 1 wherein the surface is mounted on a wall.

8. The system of claim 1 wherein the surface conforms to an arbitrary shaped object.

9. The system of claim 1 wherein the antennas are arranged in a regular pattern.

10. The system of claim 1 wherein the antennas are arranged in an irregular pattern.

11. The system of claim 1 further comprising:

means for associating two antennas with the particular user when the particular user simultaneously touches two antennas.

12. The system of claim 11 wherein the two antennas define a bounding box.

13. The system of claim 1 wherein the particular user simultaneously couples multiple antennas, and further comprising:

means for estimating a centroid of the multiple antennas.

14. The system of claim 1 wherein the capacitive coupling uses near field coupling, and frequencies of the uniquely identifiable signals are substantially under 1 MHz to maximize a signal to noise ratio at the receivers.

15. The system of claim 1 wherein another user touches the particular user while the particular user touches any of the plurality of antennas, and further comprising:

means for associating the specific antenna with the particular user and the other user.

16. The system of claim 2 wherein the means for associating further comprises:

means for driving the uniquely identifiable signals to each antenna in turn; and

means for measuring times when the transmitted signals are present at the receivers to differentiate the antennas.

17. The system of claim 1 wherein the means for associating further comprises;

means for generating orthogonal spreading codes in the transmitter;

means for modifying the transmitted signals according to the spreading codes; and

means for separating the transmitted signals according by correlation with the spreading codes.

18. The system of claim 17 further comprising:

means for generating a pseudo random noise bit sequence using a polynomial function;

a shift register coupled to the means for generating; and

a plurality of taps coupled to the shift register to provide time delays of the pseudo random noise bit sequence and to modify the transmitted signals according to the time delayed pseudo random noise bit sequence.