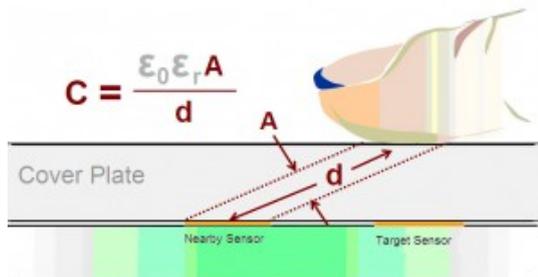


Discussing Capacitive Touch Sensors

Editor's Note: this informative series of posts was found on "[Notes From the Lab \[1\]](#)", a design engineering blog.

([Notes from the Lab \[1\]](#)) - This post answers the following question "How small can I create capacitive touch sensors, and how close together can the buttons be?"



This is a recurring question with capacitive touch; how small can I make the buttons be, and how closely together can I pack the buttons? Unfortunately, there is no simple answer here, the minimum size of the buttons, and the minimum spacing is really a function of the thickness of the cover material, its characteristics, and the resolution of the capacitance to digital conversion system used.

If the buttons are close together, and the insulating cover is thick, then you have the cross coupling problem discussed in question 2. If the buttons are too small, then your design won't create a significant amount of capacitance shift in response to a touch. Remember, the amount of capacitance shift generated by a touch is proportional to the area of the button, and inversely proportional to the thickness of the insulating cover; so large buttons, widely spaced, with a thin cover produce the greatest sensitivity. Small buttons, closely packed together under a thick insulating cover produce much less sensitivity, and they will cross couple, making an accurate touch detection more difficult.

This post answers the question "When I touch a capacitive touch sensor, why do adjacent touch sensors react?"

When you touch a sensor, you form a capacitance to ground that is a function of the area of the sensor, the characteristics of the insulating cover over the sensor, and the thickness of the insulating cover. You also form a capacitance to ground with any adjacent sensors, through the insulating cover. However, the effective area of the sensor is smaller because the path to the adjacent button is at an angle, and the distance between your finger and the adjacent button is greater as well.

This means that the amount of affect that a press will have, on an adjacent buttons,

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is determined the distance between the buttons, and the thickness of the insulating cover. To minimize this cross talk effect, separate the buttons as much as possible, and use the thinnest insulating cover possible.

(posted by Keith)

Water doesn't like capacitive touch

One of the factors that affect the amount of capacitance generated is the characteristics of the insulating material. This is quantified in the form of a material dependence constant known as Permittivity (ϵ); the higher the permittivity of the insulating material, the higher the capacitance of the resulting capacitor.

Permittivity is usually expressed as a function of the permittivity of free space (ϵ_0), and a relative permittivity number for the specific material (ϵ_r). Glass and plastic have relative permittivity values in the range of 3 - 8, so they create capacitances that are 3 - 8 times greater than capacitors that use air as an insulator. Water, on the other hand, has a relative permittivity of 78.

This means that if water is covering a capacitive touch panel, and the user touches a sensor covered by the water, then the user's finger will couple to every sensor covered by the water, almost as well as it couples to the sensor beneath the user's finger. In addition, if the water also covers a ground, then the parasitic capacitance of the sensor will also significantly increase and couple potentially cause a false touch trigger.

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<http://www.ecnmag.com/news/2009/07/discussing-capacitive-touch-sensors>

Links:

[1] <http://blog.notesfromthelab.com/>