Name: _____ Date: _____

How a Screen Knows Where Your Finger Is

Circle group

When you tap a phone screen, you feel only a soft touch. But in a tiny blink, the phone knows just where your finger is. Most phone screens use a design called capacitive sensing. It works because the human body carries a little electricity.

Under the top glass is a thin grid of clear electrodes. They are set in rows and columns, like the lines on graph paper. They are so thin and clear that you cannot see them. The phone sends a weak electric charge into the grid. This makes a faint electric field above the screen at each crossing in the grid.

When your fingertip comes near, it upsets that field. Your finger is a conductor, and it pulls a tiny bit of charge from the spot below it. Circuits measure the change at each crossing. The crossing with the biggest change shows where you touched. The phone can check many crossings at once, so it can follow more than one finger.

This explains some puzzles. A plain wool glove usually does not work. The glove is a poor conductor, so your finger cannot upset the field. Gloves with special threads in the fingertips fix this. So does a stylus with a conductive tip. A fingernail or a plastic pen fails for the same reason as the glove.

Old touchscreens often worked by pressure. Two bendy layers pressed together. Capacitive screens need almost no force, so a light swipe is enough.

Questions

1. What fact about the human body does capacitive sensing use?

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_____

2. How are the electrodes in the grid set out?

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3. What does your fingertip do to the electric field?

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4. How can the phone follow more than one finger?

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5. Why does a plain wool glove usually not work?

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6. Why is a light swipe enough on a capacitive screen?

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Words to know

capacitive: working by sensing tiny changes in stored electric charge
electrode: a small piece of metal that carries electricity
conductor: a material that lets electricity flow through it
stylus: a pen-shaped tool used to touch a screen

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

How a Screen Knows Where Your Finger Is

Triangle group

When you tap a phone screen, nothing seems to happen except a gentle touch. Yet within a tiny fraction of a second, the phone knows exactly where your finger is. Most phone screens use a design called capacitive sensing, and it depends on the fact that the human body conducts a small amount of electricity.

Under the top layer of glass lies a thin grid of transparent electrodes, arranged in rows and columns like the lines on graph paper. The electrodes are so fine and so clear that you cannot see them. The phone sends a weak electric charge into the grid, and this creates a faint electric field above the screen at every crossing point of the grid.

When your fingertip comes close, it disturbs that field. Your finger is a conductor, and it draws away a tiny amount of charge from the spot beneath it. Circuits connected to the grid measure the change at each crossing. The crossing with the biggest change tells the phone where you touched, and the phone can compare many crossings at once to follow several fingers.

This explains some everyday puzzles. A plain leather or woolen glove usually will not work, because the glove is a poor conductor and keeps your finger from disturbing the field. Gloves with conductive threads in the fingertips solve the problem. So does a stylus made with a conductive tip. A fingernail or a plastic pen fails for the same reason as the glove.

Older touchscreens often worked by pressure, with two flexible layers that pressed together. Capacitive screens need almost no force, which is why a light swipe is enough.

Questions

1. What fact about the human body does capacitive sensing use?

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2. How is the grid of electrodes arranged?

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3. What does your fingertip do to the electric field?

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4. How does the phone follow several fingers at once?

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5. Why does a plain woolen glove usually fail on a touchscreen?

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_____

6. Why does a light swipe work on a capacitive screen?

_____

_____

Words to know

capacitive: working by sensing tiny changes in stored electric charge
electrode: a small piece of metal that carries electricity
conductor: a material that lets electricity flow through it
transparent: clear enough to see through
stylus: a pen-shaped tool used to touch a screen

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

How a Screen Knows Where Your Finger Is

Square group

When you tap a phone screen, nothing seems to happen except a gentle touch against the glass. Yet within a tiny fraction of a second, the phone has determined precisely where your finger is. Most phone screens rely on a design called capacitive sensing, which depends on the fact that the human body is capable of conducting a small amount of electricity.

Beneath the top layer of glass lies a thin grid of transparent electrodes, arranged in rows and columns like the lines on graph paper. The electrodes are so fine and so clear that they are completely invisible to the eye. The phone sends a weak electric charge into the grid, and this creates a faint electric field above the screen at every crossing point of the grid.

When your fingertip approaches, it disturbs that field. Your finger is a conductor, and it draws away a tiny amount of charge from the spot directly beneath it. Circuits connected to the grid measure the change at each crossing. The crossing with the largest change tells the phone where you touched, and by comparing many crossings simultaneously, the phone can follow several fingers at once.

This explains some everyday puzzles. A plain leather or woolen glove usually will not work, because the glove is a poor conductor and prevents your finger from disturbing the field. Gloves with conductive threads woven into the fingertips solve the problem, as does a stylus with a conductive tip. A fingernail or a plastic pen fails for the same reason as the ordinary glove.

Older touchscreens often worked by pressure, with two flexible layers that were pressed together. Capacitive screens need almost no force, which is why a feather-light swipe is enough to register.

Questions

1. What fact about the human body does capacitive sensing depend on?

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_____

2. How is the grid of transparent electrodes arranged?

_____

_____

3. What does your fingertip do to the electric field?

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4. How does the phone follow several fingers at once?

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5. Why does a plain woolen glove usually fail on a touchscreen?

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_____

6. Why is a feather-light swipe enough on a capacitive screen?

_____

_____

Words to know

capacitive: working by sensing tiny changes in stored electric charge
electrode: a small piece of metal that carries electricity
conductor: a material that lets electricity flow through it
transparent: clear enough to see through
stylus: a pen-shaped tool used to touch a screen

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: How a Screen Knows Where Your Finger Is

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: How a Screen Knows Where Your Finger Is

Easier · 243 words · Flesch-Kincaid grade 4.2

1. The body carries a little electricity.
2. In rows and columns, like the lines on graph paper.
3. It upsets the field by pulling away a tiny bit of charge.
4. It checks the changes at many crossings at once.
5. The glove is a poor conductor, so the finger cannot upset the field.
6. The screen senses electricity and not pressure, so it needs almost no force.

Triangle: How a Screen Knows Where Your Finger Is

This passage · 273 words · Flesch-Kincaid grade 7.3

1. The body conducts a small amount of electricity.
2. In rows and columns, like the lines on graph paper.
3. It disturbs the field by drawing away a tiny amount of charge.
4. It compares the changes at many crossings of the grid at the same time.
5. The glove is a poor conductor, so the finger cannot disturb the field.
6. The screen senses electricity, not pressure, so it needs almost no force.

Square: How a Screen Knows Where Your Finger Is

Harder · 289 words · Flesch-Kincaid grade 9.1

1. The body is capable of conducting a small amount of electricity.
2. In rows and columns, like the lines on graph paper.
3. It disturbs the field by drawing away a tiny amount of charge.
4. It compares the changes at many crossings of the grid simultaneously.
5. The glove is a poor conductor and prevents the finger from disturbing the field.
6. The screen senses electricity rather than pressure, so it needs almost no force.