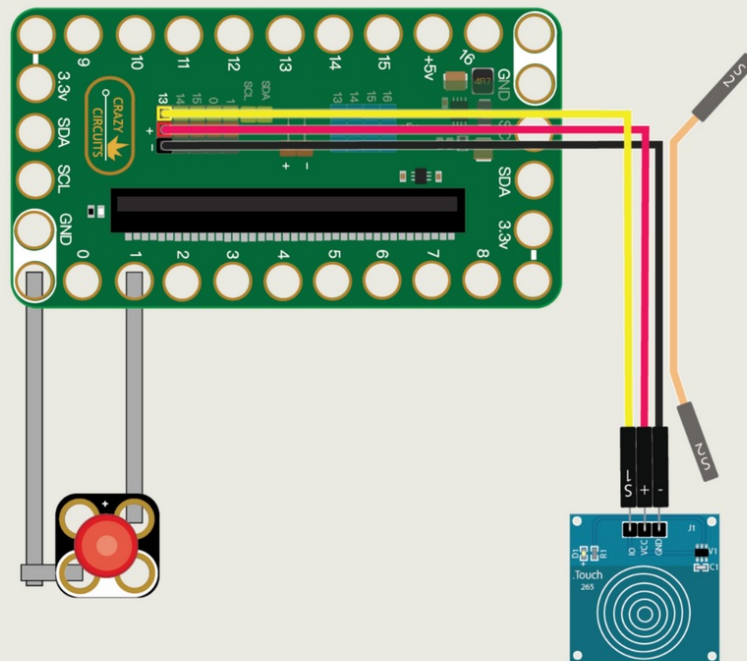




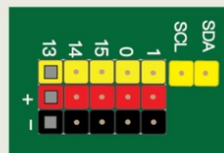
CH33-D - Capacitive Touch Toggle Better

Connect a Capacitive Touch Sensor to a Bit Board and control it with code.

Written By: Pete Prodoehl



CAPT	Bit Board
IO	-> Pin 13
VCC	-> + (Positive) Pin
GND	-> - (Negative) Pin



INTRODUCTION

Connect a Capacitive Touch Sensor to a Bit Board and control it with code. A "Cap Touch" sensor is a type of switch, but instead of closing a contact it looks for a change in capacitance, which happens when you place your finger near the sensor.



TOOLS:

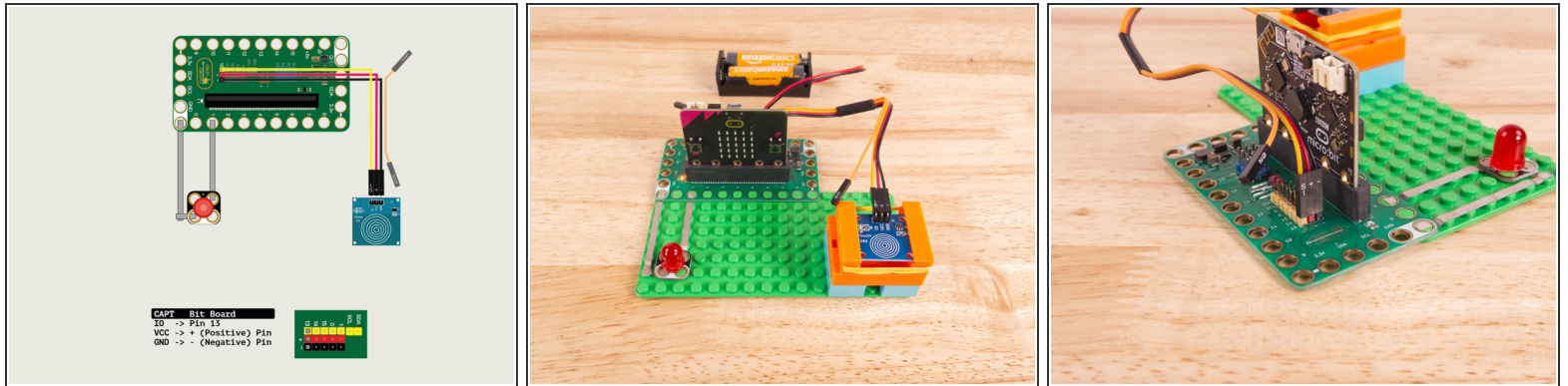
- [Computer](#) (1)
- [Scissors](#) (1)



PARTS:

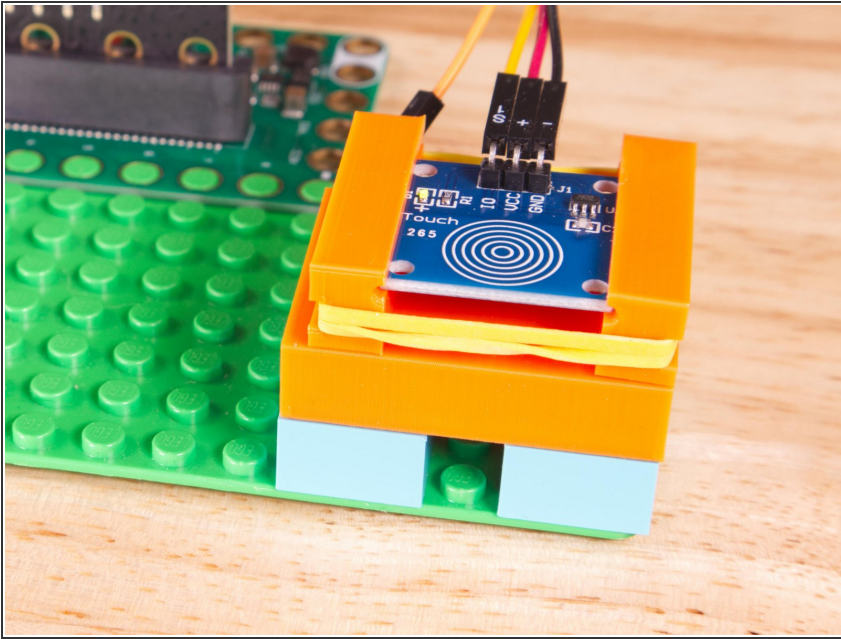
- [Crazy Circuits Bit Board](#) (1)
- [micro:bit](#) (1)
- [Crazy Circuits Ribbon Cable](#) (1)
- [Capacitive Touch Sensor](#) (1)

Step 1 — Connect the Capacitive Touch Sensor and LED



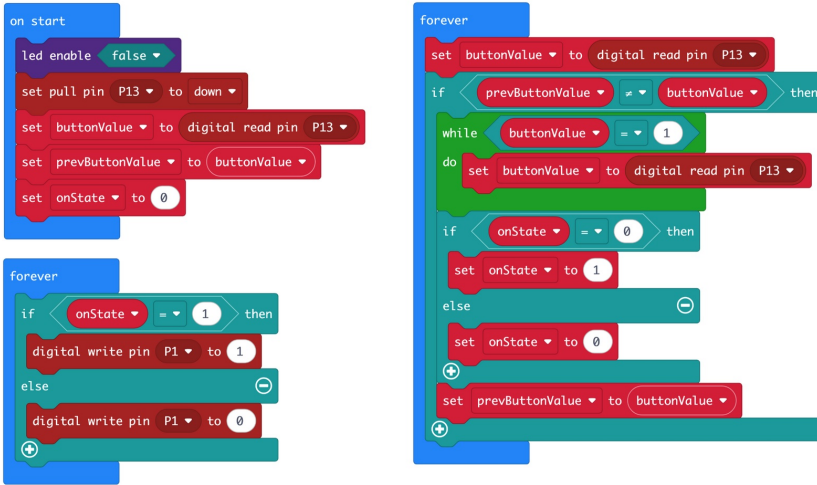
- We'll connect the **Capacitive Touch Sensor** with a **Crazy Circuits Ribbon Cable** using just three of the wires.
- Start by plugging the connector with the three wires in it (Black, Red, Yellow) into the **Pin 13** row of the Bit Board. (Make sure the Black wire is in - and the Yellow wire labeled **S1** is closest to the number **13** on the Bit Board.) The Orange wire (labeled **S2**) does not get plugged in and can hang loose.
- Now we'll connect the other end of the Ribbon Cable to the **Capacitive Touch Sensor**. **S1** (Yellow) goes to **IO**, and then + (Positive) goes to **VCC** and - (Ground or Negative) goes to **GND**.
- We'll use **Maker Tape** to connect the LED to the Bit Board on a LEGO baseplate.
- Connect the **Negative** (-) side of the LED to a **Ground** (GND) hole on the Bit Board and then connect the **Positive** (+) side of the LED to **Pin 1** on the Bit Board.

Step 2 — Mounting the Sensor



- We used a 3D printed holder we designed to hold the Cap Touch Sensor in place on the LEGO baseplate.
- (We don't have a specific holder for the Cap Touch Sensor but the [7 Segment Display Holder](#) should work just fine.)
- Alternately you can use some LEGO bricks and a rubber band or tape to hold the sensor in place. *(But don't use anything conductive!)*
- And be sure to check out the [3D Printed Component Holder Guide](#) if you want to design & print your own at any size.

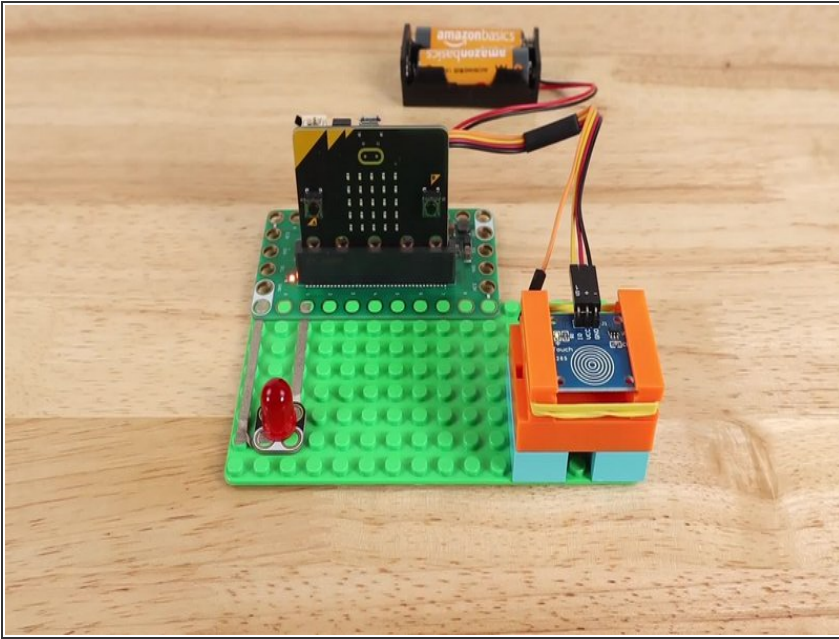
Step 3 — Load the Code



- We're going to load the following code for our **Cap Touch Toggle Better** program:
https://makecode.microbit.org/_H337vxCgi...
- In the on start block we'll set **Pin 13** to **down** for the Capacitive Touch Sensor, which is the *opposite* of what we usually do with a standard pushbutton.
- We'll also set a few variables; **buttonValue**, **prevButtonValue**, and **onState**. (These will be used to keep track of things in our code.)
- In the larger forever block we'll read the value of **Pin 13** which has the sensor connected to it. We then check if **prevButtonValue** and **buttonValue** are **not equal** to each other. The loop continues on and *does nothing* until the two variables are **not equal** to each other.
- Remember that we set **buttonValue** in the on start block, and then set **prevButtonValue** to **buttonValue** so they would start *with the same value*. They will be **unequal** only when the sensor is triggered.

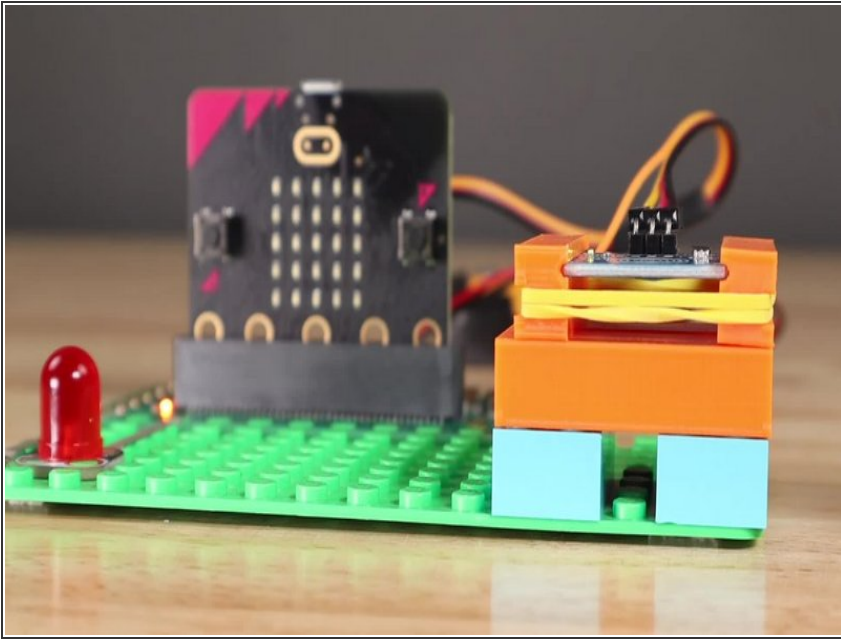
- Once we enter the while loop (because **buttonValue** is now **1**) we keep checking the sensor and setting it to the variable **buttonValue**. The while loop continues as long as it is **true**, which means when the **buttonValue** becomes **0** (when the sensor is no longer triggered) we *break out* of the while loop.
- After we exit the while loop we check the **onState** value and flip it to the opposite value. If it's **0** we set it to **1**, and if it's **1** we set it to **0**.
- In our second forever loop we will test the **buttonValue** to see if it is **1** or not so we can turn on the LED. (If it is *not*, we do the **else** part of our **if/else** statement and turn off the LED.)

Step 4 — Test it Out!



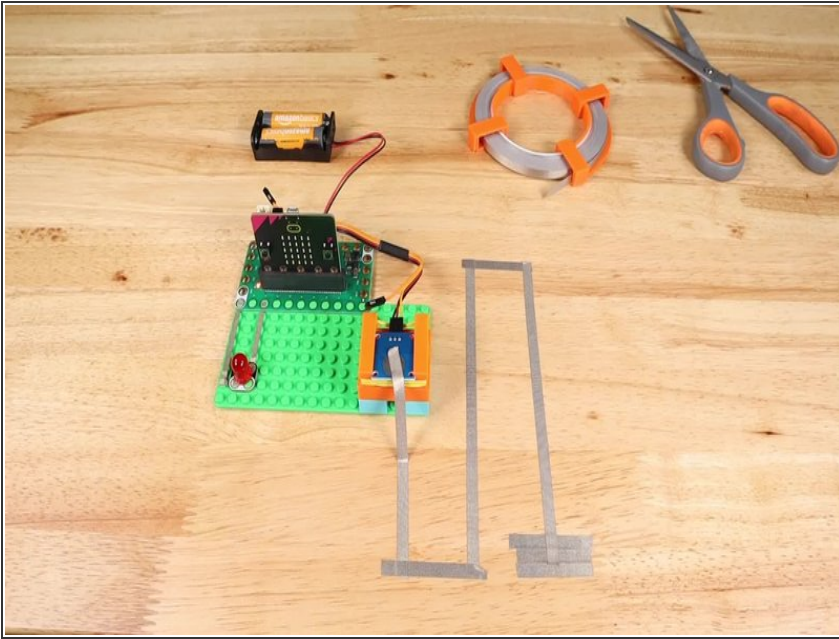
- Once the code is loaded it should start running immediately.
- ❗ You can power the micro:bit via the USB cable you used to load the code or you can use a battery pack plugged into the Bit Board.
- Touch the sensor with your finger *and then remove your finger* and the LED should light up. Press it again *and then remove your finger* and the LED will turn off.
- Note this this time the action of *pulling your finger away* from the sensor is what triggers the action. This is because our code is looking for the change of state from **1** to **0** (or from **on** to **off**.)
- If you try to tap the sensor rapidly it works fine, and you can press and release as fast as you want.

Step 5 — No Touching!



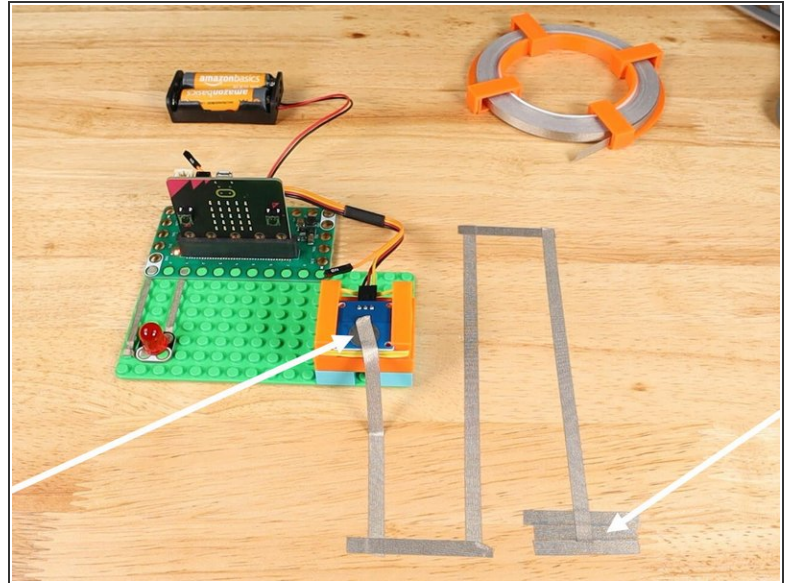
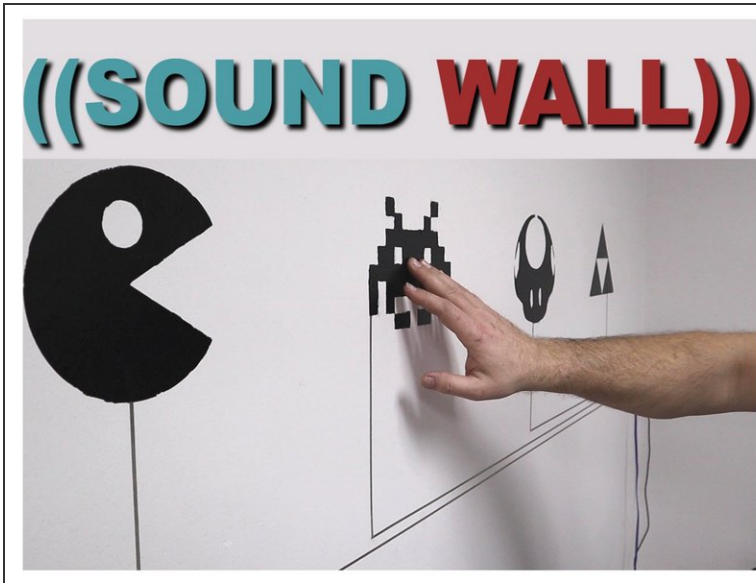
- As mentioned the **Capacitive Touch Sensor** can detect when a finger (or other conductive object being held) touches **or comes close** to the pad of the sensor.
- In this video you can see how the sensor gets triggered by just putting a finger close to (but not touching) it, and that you can even put an object (in this case, a piece of paper) in front of the sensor.
- Here's an excerpt from a post about capacitive sensors:
 - *"The sensor works by measuring changes in an electrical property called **capacitance**. Capacitance describes how two conductive objects with a space between them respond to a voltage difference applied to them. When your finger, a conductive object, touches the device (screen), it changes the capacitance of the sensor."*
 - For a more in-depth study [read the full post about capacitive touch sensors](#).

Step 6 — Long Distance / Antenna



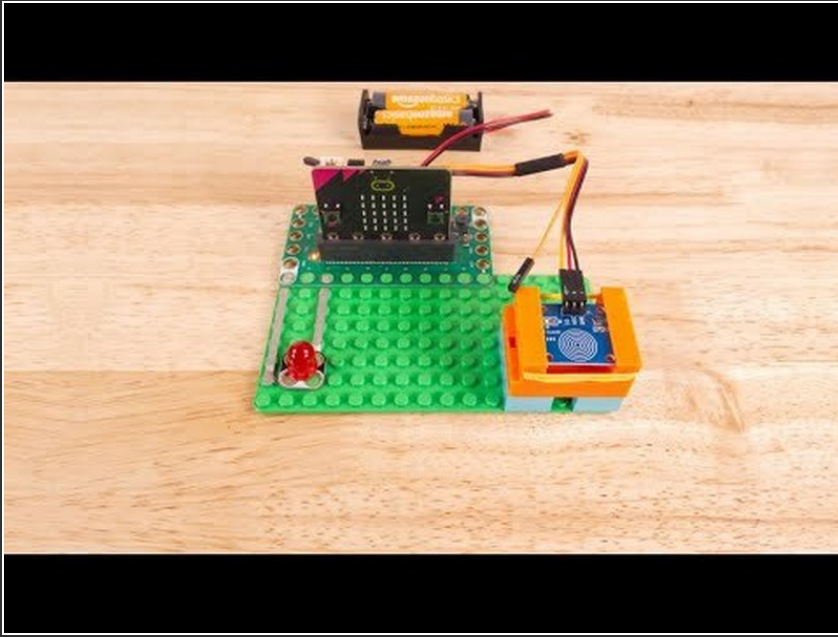
- We've got one more trick with the Capacitive Touch Sensor. If you flip it over you'll see a **silver pad** on the PCB (Printed Circuit Board) and we can use that to extend our reach.
- Connect a piece of **Maker Tape** to the silver pad and run it far from the sensor. You can see in the video we made a little zig-zag pattern, but we've also successfully ran a piece of Maker Tape across a room!
- In the video you'll see that we were able to trigger the sensor by just waving a hand above the Maker Tape. The tape sort of acts like an antenna to amplify the sensors reach.
- One thing worth noting is that **not everyone is the same!** You might be able to trigger the sensor from afar while someone else needs to reach closer.
- Capacitive Touch Sensors can be affected by then environment, and things like humidity, as well as from the differences between people's bodies.

Step 7 — Take it Further



- Our [Sound Wall project](#) (from 2020) used a different microcontroller but could be built using a micro:bit along with a few of the Capacitive Touch Sensors and an MP3 Player.
- We have a guide on using the [MP3 Player with the micro:bit](#) so it would mainly be a matter of replacing the buttons with Cap Touch sensors.
- By connecting Maker Tape to the back side of the Cap Touch Sensor we can build touch points far from the micro:bit and build bigger projects with unique touch trigger capabilities.

Step 8 — Follow Along



- Follow along with our recorded Live Stream!
- ① You can watch the full video of us walking through this project, along with explaining and exploring the code:
<https://www.youtube.com/live/tgQ9Y5K9t2I>