

# Student Project: Help control the Covid-pandemic

## Introduction

Students may feel helpless in stopping or controlling the current Covid-pandemic. Some may even feel anxious about it. Can all they really do is wear a mask, stay home and wait for a vaccine? This project can empower them to take part in keeping their local school or community safe, and may very well slow the Covid-pandemic spread.

As of November 2020, we know the virus is still spreading. But how? Despite mask wearing and social distancing it's likely due to particular social behavior in which some partaking. Not wearing a mask, being in close contact with others not wearing a mask, not social distancing, etc. We'll call this "Covid-unsafe" behavior.

## Learning Outcomes

- Electronic device assembly and operation
- Addressing a societal problem
- Contact tracing
- Cooperation in a larger goal

## Project Summary

In this project, students will build a simple electronic device (called the "token") using parts costing around \$20. The parts fit together with a single USB-micro cable; no soldering or major assembly is required. If they carry the token around with them, it will anonymously broadcast to others what their recent social behavior has been. How does the token know? Each participant will tell it before going out. The questions asked are something like this:

<b>Update your device</b>	
Check all that apply about your past 2-3 days	
<b>Going out</b>	<b>Social Distancing</b>
<input checked="" type="checkbox"/> I have not been out	<input type="checkbox"/> I did social distance (did not spend more than 15 minutes within 6 feet of anyone)
<input type="checkbox"/> I have been out	<input type="checkbox"/> I did not social distance (spent 15 minutes within 6 feet of others)
<b>Mask wearing</b>	<b>Were you inside or outside?</b>
<input type="checkbox"/> I was wearing a mask	<input type="checkbox"/> Inside
<input type="checkbox"/> I was not wearing a mask	<input type="checkbox"/> Outside
<b>How about others you were around?</b>	
<input type="checkbox"/> They were wearing masks	
<input type="checkbox"/> They were not wearing masks	
<input type="checkbox"/> They are in my Covid-safe "bubble"	

The token, which looks like this stores this information:



It's smaller than a credit card and when connected to a battery, looks like this:



The battery is a portable battery pack commonly used to give phones an emergency charge. The student is to take both with them when they go out (put in their pocket, bag, etc.),



after making a case for it, even out of cardboard, like this.



So, suppose everyone is carrying around their token, updated with their recent social behavior. Not only will a given token broadcast one's recent social interactions, but it will also log such received from other tokens. It does this via Bluetooth Low Energy provided by the token. No phones or apps are used at all for this project.

When they return home, they can check their token's log. It may look like this:

## Retrieve your device log

[Download Device Log](#) [Save device log](#)

Trouble connecting to device? Go to this URL: <chrome://bluetooth-internals/#devices>

```
45ef1367cb210d80 encountered 3 times, Has not been out
800599ae38a41a59 encountered 1 times, Has been out, wearing a mask, around others wearing masks, was outside
e1cdf53ea1ded20a encountered 6 times, Has been out, not wearing a mask, around others not wearing a mask, did not social distance
```

Looks like the first two were "Covid-safe," but the third was definitely "Covid-unsafe." This is a key moment now: the token owner may have been exposed to Covid. So, to prevent the spread, the owner should "lie low" for a couple of days (with their organization hopefully willing to accommodate them in doing so). They should see if symptoms develop or not, then go from there (get tested, go to a doctor, etc.)

That's this project. We call it the "Covid222" project, which is based at Covid222.org. The three twos mean:

- Covid-19 has a reproduction rate of **2** (meaning one person can infect 2 others).
- Someone who encounters another with "Covid-unsafe" behavior should lie low for **2** days.
- If a participant makes one of these, they should also make one for **2** others to equip them to participate as well.

## To Participate

### Parts

Everyone will need 2 items:

- An ESP32 [like this one](#), which is the token. (The ESP32 is like a small Arduino.) They cost around \$11, and go for less (\$8) on eBay, [like these](#).
- A portable "cell phone" battery charger, like [this one](#), which costs around \$11.

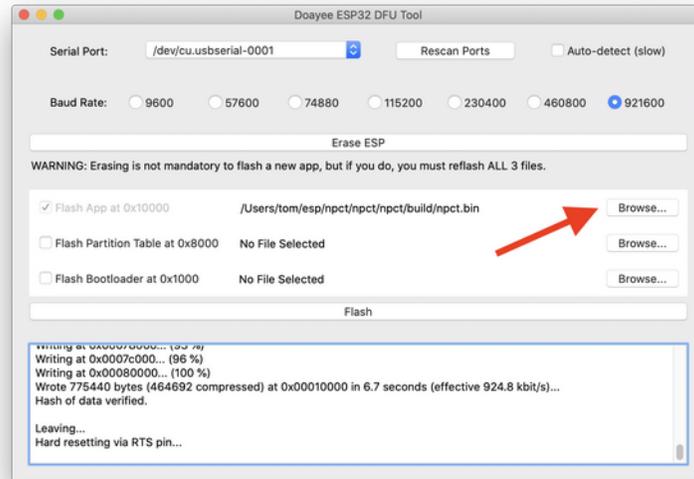
A USB-micro cable is needed to connect the battery to the token. The battery usually comes with one. (They can be purchased at most dollar-stores.)

### Flashing the token

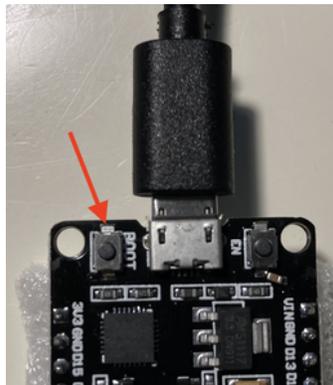
The token needs to have software put on it, to make it do the encounter broadcasting and receiving. This is called "flashing." Students could do this, but it might be easier if one person (like the teacher) pre-flashes the tokens. It is a matter of running some software on a PC/Mac, connecting each tokens to the PC/Mac one by one (via a USB cable) and clicking a few buttons. It works like this:

1. Download this [free flashing software](#).

2. Download the [encounter processing file](#).
3. Connect a token to the computer via a USB-micro cable.
4. Run the flashing software. It'll look like this:



Select the "Serial Port" the token is connected to (just try what's in the dropdown until it works). Click the "Browse..." button pointed to by the red arrow. Point to the encounter processing file you downloaded. Lastly, click the big "Flash" button. When the "Connecting..." message appears, press and hold this button on the token, until the message in the large text-box at the bottom shows progress (release the button when so).



That's it! When the flashing software says "Leaving..." the token is ready to go.

## Student work: Configuring and maintaining their token

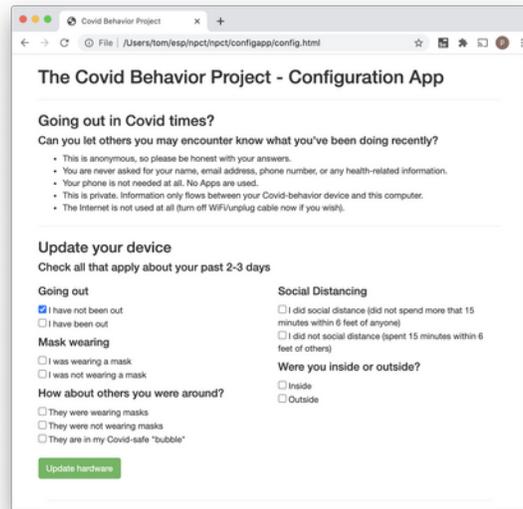
### Privacy

This project is fully anonymous. No emails, names, or medical information is ever used or asked for. The token or configuration page do not use the Internet at all. No GPS is used.

## Configuring the token

Armed with a flashed token, each student should do these steps, as they gain ownership of their token and participate in the project.

1. Be sure Bluetooth on a given computer is turned on. Download [this file](#) to their computer (click the "Raw" button, then do a File → Save As... in your browser).
2. Open the file in a Chrome web-browser. Do a File- → Open... on it in Chrome (and yes, it must be Chrome). The page should look like this.



3. Tick all areas that apply. When done, power up the token by connecting it to the battery. Click the "Update hardware" button. This will send the social behavior information to the token via Bluetooth. They are done!
4. Take the powered-on token and battery with them as they go about their day.

## The student token/project ownership plan

- Update the token as their social behavior changes, to always reflect the past 2-3 days.
- Check the token's log when they get home. Be sure not to unplug the token before downloading the log. It's OK to leave it plugged into the battery, which can power the token for 40+ hours.
- Keep the battery charged (any usual USB/phone charger will do it).
- Take appropriate action to stop the spread, if their log so reflects a need to do so.
- Even with the battery unplugged, the token will remember their last social encounter settings.

## Discussion Points

This project is an adaptation of "Contact Tracing." Johns Hopkins has a free online, self-paced course on it that your students can take. Contact tracing is a proven way of slowing pandemics. It is an intervention technique that works like this.

Suppose someone tests positive for some disease, for example Covid-19. As soon as possible, the person is asked who they were in contact with in recent days. These people are then contacted, and asked themselves to quarantine for two weeks. You can imagine all kinds of logistical difficulties with this, but it is a proven method for slowing disease spread, used long before the days of Covid-19.

Contact tracing is tied to the health status of people and the need to know truthful and potentially personal information that people may not be so willing to share. Contact tracing for Covid-19 has proven difficult to implement. Contact tracing by phones and Apps is also being worked on, but the privacy concerns are more severe. Your students could engage in some kind of learning project involving all of these issues.

This Covid222 project focuses not on health, but on social encounters and behavior. It makes the assumption that if a person encountered someone with unsafe Covid-behavior, that they should just isolate and see what happens.

## Resources

- Project website: [covid222.org](https://covid222.org)
- [Instructable page](#)
- [Github page](#)
- [Academic paper](#)