Abstract Section

VIRUSafe: a personal airborne virus detector.

People currently have no way to detect the presence of COVID 19 in their surroundings and unknowingly spread the disease.

Worldwide, almost 103 million people have been infected, with over 2.2 million deaths in just over 1 year. In addition, over 1.6 billion jobs have been lost due to government required shutdowns of many businesses leading to economic struggles for the world.

Our vision is to make a personal device that will detect Coronavirus in the immediate area and alert the network of users so that they may take the appropriate actions to prevent exposure.

Present Technology

Current technology for viral testing is by studying samples collected from a humans. These samples can be from nasopharyngeal swab, blood, mucus, urine, or faeces. The methods of studying the sample to determine viral presence are polymerase chain reaction (PCR), sequencing, immunofluorescence, immunoperoxidase, and electron microscopy.

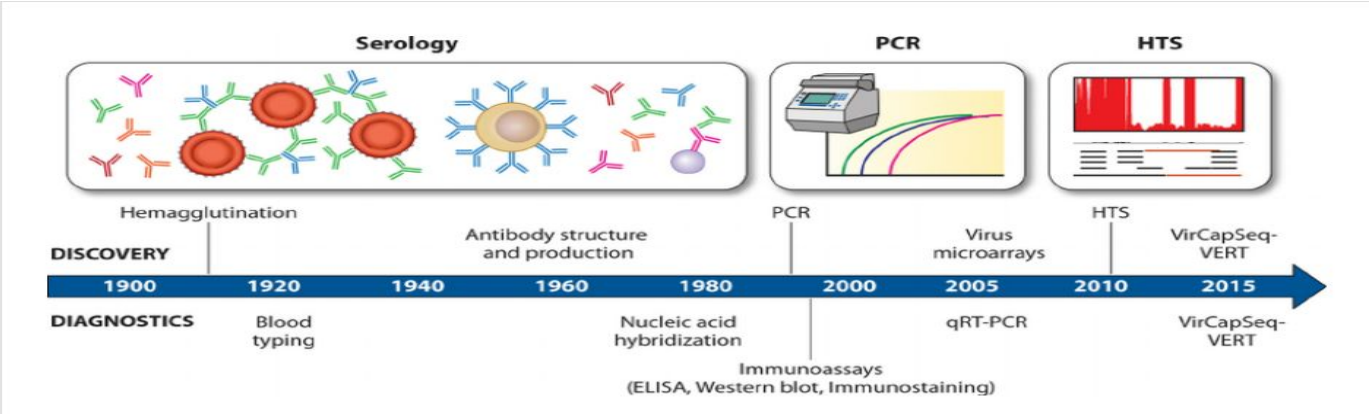
With the current pandemic, many people are being tested every day by PCR method for covid 19. In this testing, we use a swab from the back of a patient's throat by putting a swab in their nose/sinus area. That sample is taken to a lab, and they convert RNA into DNA.

Current virus testing technology is very limited because it takes a lot of time, and you need lots of people working in labs. There is also no present technology that would detect virus particles in the air. There is some new research in the experimental stage that seems to be able to detect various viruses from an air sample. This is the technology we are depending on, as it is useful and applies not only to covid, but any other virus.

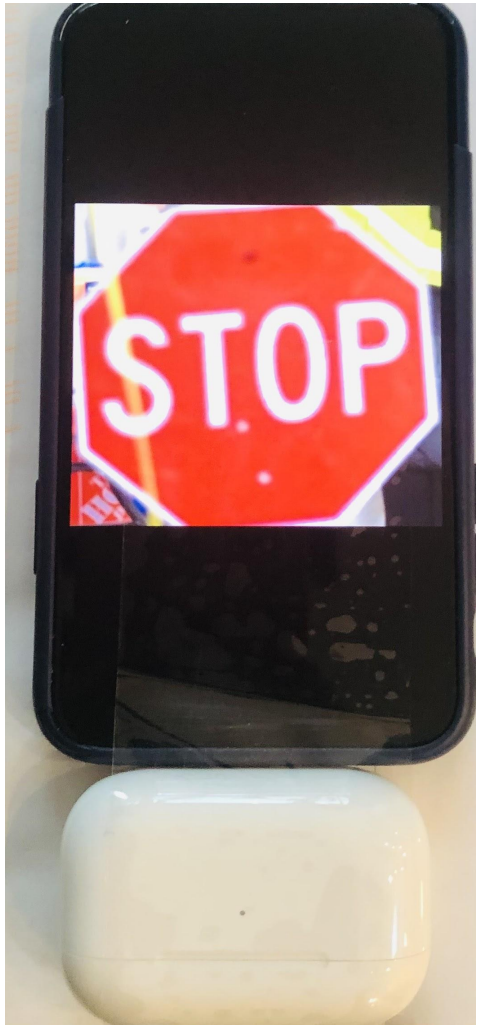
History

Viruses were first discovered in 1892 when Dmitri Ivanovsky found out that sap from a diseased tobacco plant infected other tobacco plants, even though it was filtered.

Virus detection in humans started in the 1900 by studying hemagglutination, which is the clumping of red blood cells when a virus is present. In the 1960's, scientist started to look for antibody production, which allows the body to naturally fight off infection. This can also be used on a larger scale by injecting antibodies to teach the body to fight of infections. In 1983, the PCR procedure was invented, where scientists take a single DNA sample and multiply it in a laboratory to study. High Throughput Sequencing or HTS was developed in 2010 where millions of DNA molecules can be sequenced to detect known and unknown viruses.



Future Technology – Slide 1

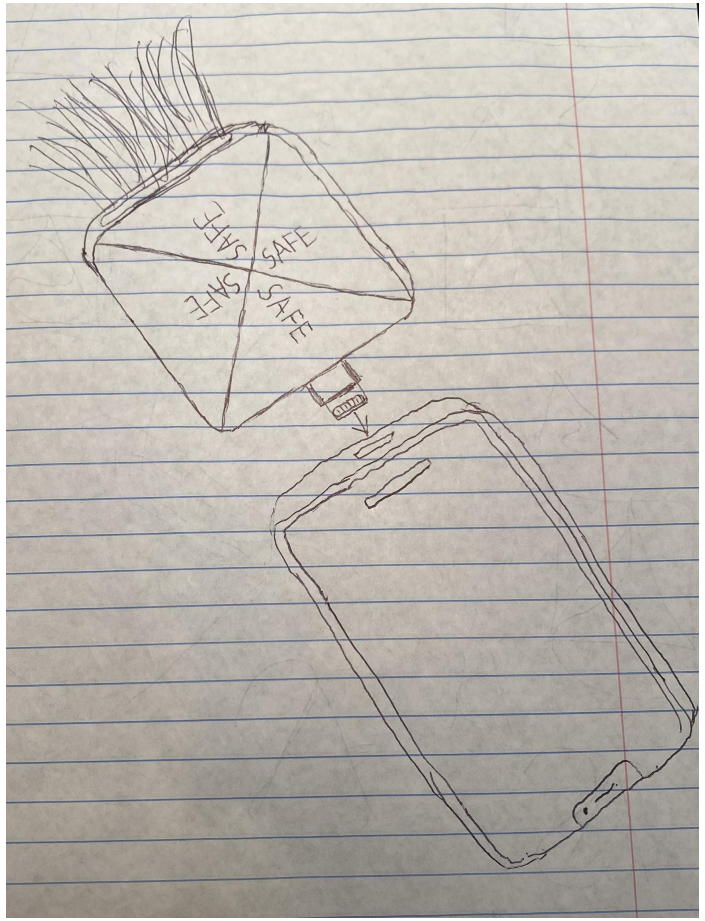


We will currently use ViruSafe for coronavirus detection, but we can use it for future virus outbreaks.

The device will be as close as possible to the size of a Square credit card reader and plugged in and be powered by a phone. It will use a vacuum to suck in the surrounding air particles including the virus if it's present and deposit them on a specialized chip. This chip will be customized to detect different types of airborne pathogens.

We intend to use the phone to transmit the information to a central location which will alert the sensor phone and any other mobile devices in the area that the virus is present in their general area.

Future Technology – Slide 2



Currently, our main focus for this technology is to detect coronavirus.

Because viruses are constantly mutating, this technology could be applied to future unknown viruses or other airborne pollutants.

We believe our technology could also be rolled out in larger scale in hopes that many of the affected industries that have suffered from covid shutdowns could operate safely and with public confidence.

Such places could include but not be limited to public transportation, hospitals, restaurants, stores, and sporting events where many people tend to congregate closely.

Future Technology- Slide 3

The travel industry can also utilize a version of our technology including airplanes, cruise lines, trains, resorts, and hotels. The larger effect of this will be that businesses which require travel will be more successful.

On a more individual level, this technology could be used in homes to detect air quality, pollutants, allergens, and airborne illnesses.

Breakthroughs – Slide 1

We believe that the most important breakthrough in order for our project to be successful is a small but powerful vacuum. The smallest one currently on the market is a portable handheld version which measures roughly 3 x 2.5 inches, and has a capacity of 1 lb.

The vacuum will consist of a fan to blow the surrounding air over the chip that will detect the virus within the small chip reader which is attached to the phone.

We also need a chip that can detect the virus and send a signal to the phone in order to analyze for matching characteristics.

VIRUSafe will then utilize existing technology to alert others in the area of a potential threat.

Breakthroughs – Slide 2

We will to complete some testing:

- The first thing that we will test is the vacuum to see how much air it can suck in and how big an area can be covered

- The second test we have to do is to get various chips with different coatings to see which one captures the coronavirus. This is possible because each virus has a unique shape.

- We will need to test our technology for compatibility with different phone types.

Breakthroughs – Slide 3

Some of the current problems to overcome are:

- Find the proper material for the chip that detects viruses.
- Develop a small enough vacuum to fit in the device.
- Make sure the phone will have enough power to run the device.
- Ensure that enough people are willing to participate in a network and allow for information exchange.

Design Process – Slide 1

Originally, we considered using a mini electron microscope to examine the air particles. We realized that microscopes are too large and probably couldn't be developed in a smaller version, even in the future.

We also considered using an x-ray to look for the virus, but that was also too big and the radiation would be a health risk.

We then realized that we could use a chip for detecting the virus.

One more idea that we had was that we could use an air filter to collect the air particles, but we were concerned about the integrity of the particles after they passed through the filter.

Design Process – Slide 2 (optional)

N/A

Design Process – Slide 3 (optional)

N/A

Consequences

Even though this device is designed to help the world, it will come with positive and negative consequences.

Positive Consequences:

- People will know when Covid 19 virus is in an area so they know to stay away. This will slow down the spread of the virus.
- More people will keep their job and go back to work, and there will be less government required shutdowns.Workplaces can be monitored and kept clean.
- New virus outbreaks could be contained earlier, before they turn into a pandemic.

Negative Consequences:

- Some could use this device as an excuse to be less careful around others.
- People might choose not take the vaccine because they think the device keeps them safe.
- Not everyone may have access to either a phone or this device, so those people will still be at risk.

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Image on slide 11:

Depositphotos, Inc. “Different Ways to Travel Icons. Vector Illustration.” *Depositphotos*, depositphotos.com/146788971/stock-illustration-different-ways-to-travel-icons.html.

VIRUSafe

Click here to watch our video!

There is no current way to detect airborne viruses, but this changes now! Introducing...

VIRUSafe

the new personal virus detection device!

VIRUSafe

Current technology for viral testing is by studying samples collected from a human. These samples can include:

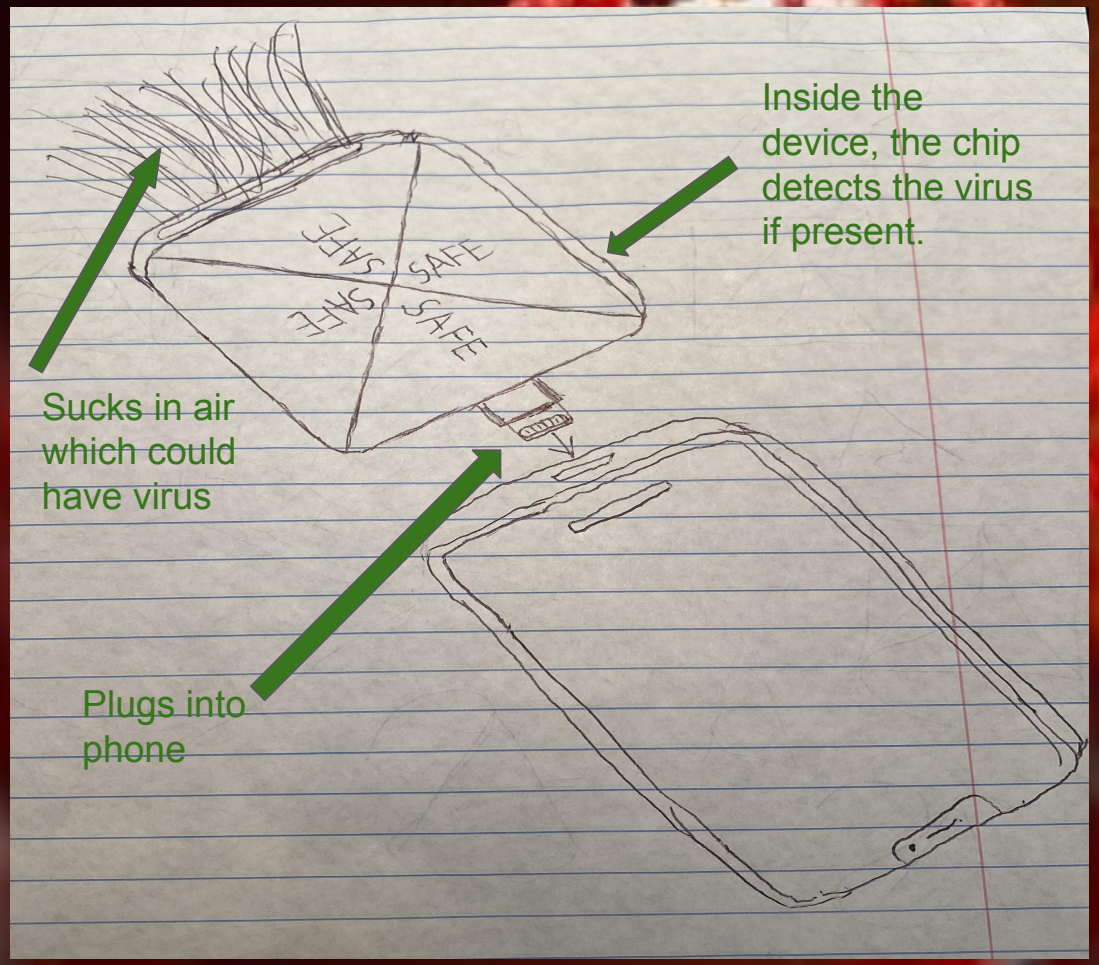
- nasopharyngeal swab
- blood
- mucus

The methods of studying the sample to determine viral presence can be:

- polymerase chain reaction (PCR)
- sequencing
- immunofluorescence

Current virus testing technology is very limited because it takes a lot of time, and you need lots of people working in labs. There is some new research that might be able to detect viruses from an air sample. This is the technology we are depending on, as it is useful and applies not only to covid, but any other virus.

VIRUSafe



The VIRUSafe will be used for coronavirus detection, but it can be used for future virus outbreaks. The device will use the following components for detecting the virus:

- A small vacuum to suck in the air that could possibly contain the virus.
- A chip with a special coating that the air particles will deposit on, and detect the virus if present.
- A central location where a signal will be sent from the device, and the location will alert the phone and other mobile devices in the area if the virus is present.

Our technology could be used to reopen places that have been shut down by the government including:

- restaurants
- public transportation
- stores
- sporting events

VIRUSafe

Click here to watch some of our testing!

Our most important breakthrough is a small vacuum that is powerful enough to suck in the air in a large radius. The smallest one in the market is 3 x 2.5 inches.

We also need a chip that can detect a virus when the particles land on it. It will also need to send a signal to the central location.

We will test these breakthroughs by seeing how far away the vacuum can detect the virus and by seeing if the chip works.

VIRUSafe

We considered three alternative ideas for this project:

#1. A microscope to inspect the air particles and look for the virus. We ended up not using this idea because even in a decade, there would be no microscope small enough that could see particles as small as viruses.

#2. An x-ray for finding the virus, but this is even bigger than a microscope, and the radiation would be a hazard.

#3. A filter where the air particles would pass through, but the viruses wouldn't. However, we ruled this out because we were concerned about the integrity of the air particles after they passed through.