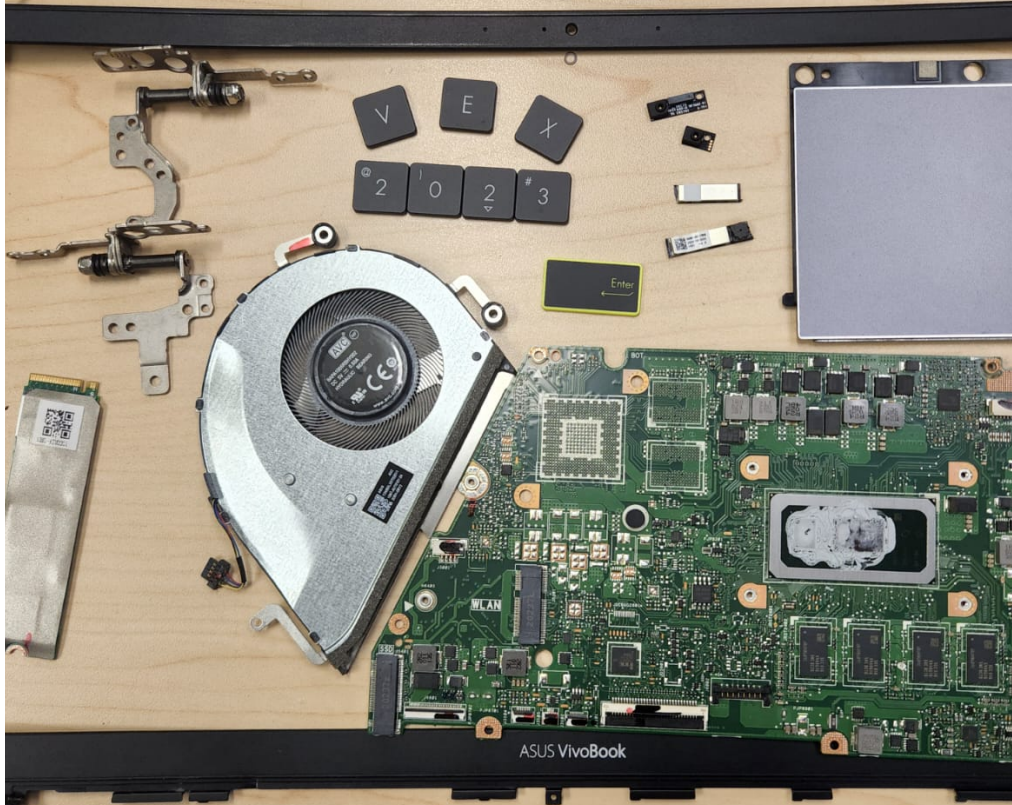


## A Look Inside of a Laptop



### Team 5225a - The πlons Burlington, Ontario

By: Jackson, Sarah, Avi, & Avery

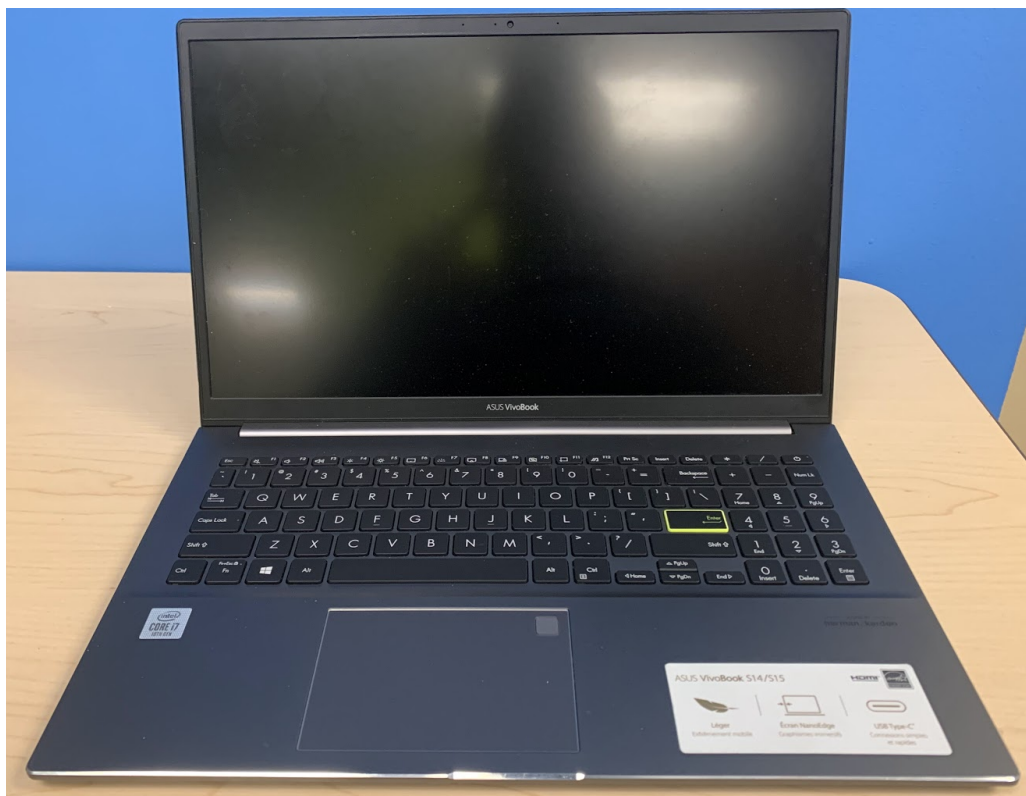
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# Introduction

In June, 1981, something incredible happened. A computer, known as the Osborne 1, was released to the public. However, this was not like any other computers available. This one wasn't forever stuck on a desk—it was portable, and quite cheap, as it came with bundled software that was worth the price alone! This would be one of the first laptops ever. Present day, on our VEX team, we use these machines a lot. From the start of the season, when we CAD our robot ideas, to the end, when we finish our last line of code, to even now, typing this intro... Laptops are a part of our everyday lives, and yet many people never stop to think about how they work. So, when our teammate's laptop broke, we took the opportunity to take it apart in order to see what amazing machinery makes a laptop work!

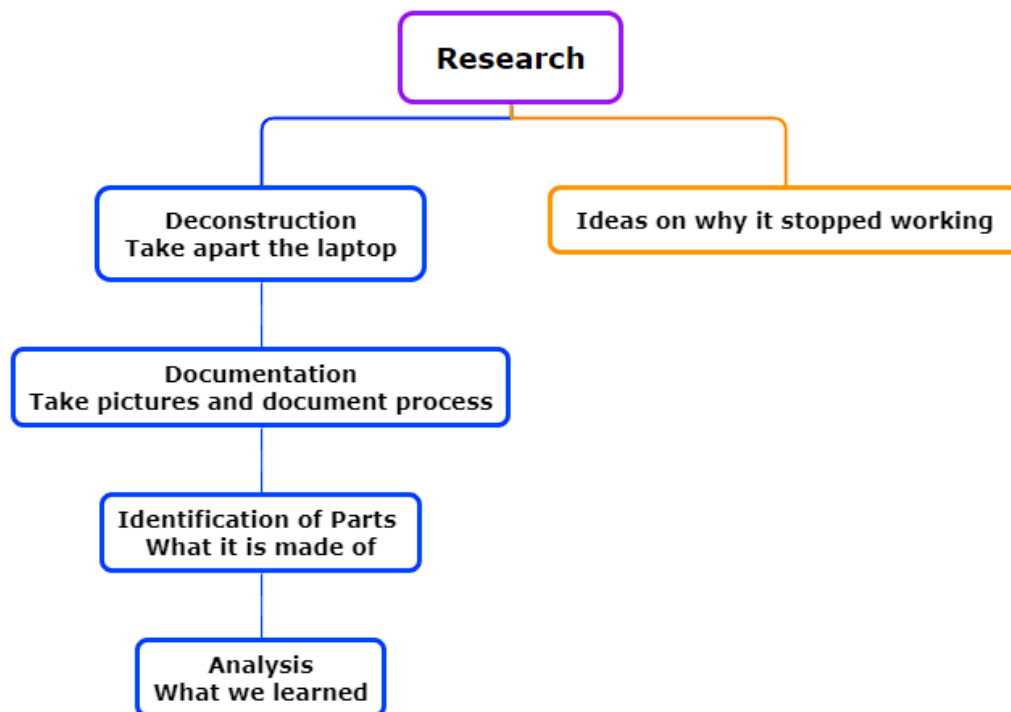


Our Teammate's Broken Asus Vivobook S533F Model

# Our Process

As a team, we researched the laptop's model to find out as much information about it before we got started. During this process, we came up with theories on what exactly led to the laptop's demise. Then, we watched and read through several tutorials on how to safely disassemble a laptop. Only after we were confident in our knowledge did we get started on the actual machine. With our coach's permission, and help to disconnect the power, we started on our journey.

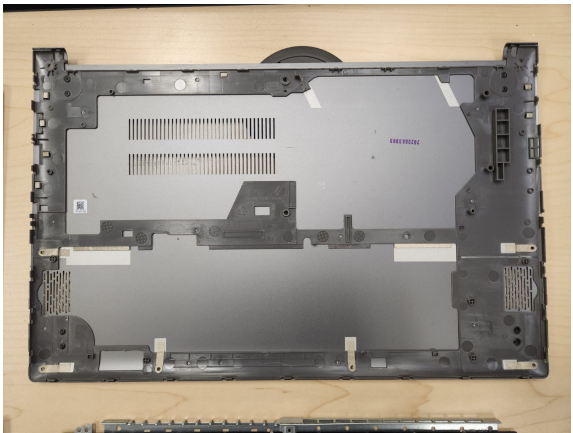

For the deconstruction, we required a few tools: safety goggles, a container to store parts, and a large table we could use to properly dismantle the laptop. Screwdrivers were also necessary—the tiny, star-headed screws needed a Torx screwdriver, while the ones that looked like plus signs used Philips screwdrivers. In order to not lose any screws, we kept them close by in the small bin as we worked.



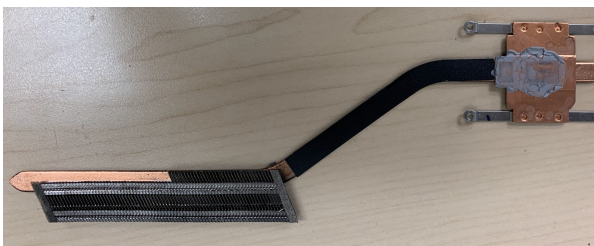




# Device Summary

## Non-Electronic Components:

Name & Purpose	Photo
<b>Bottom Plate</b>  This is found on the bottom of the laptop, and was the first thing we removed. Its purpose is to provide protection to the internals as shielding, as well as provide vents for the fan to expel air.	
<b>Screen Bezel</b>  This is the area around the edges of the screen, its purpose is to provide the screen with protection. Note the small amount of bezel, which was an interesting selling point of this laptop. It allowed for the laptop to keep its small size while including the full screen size.	

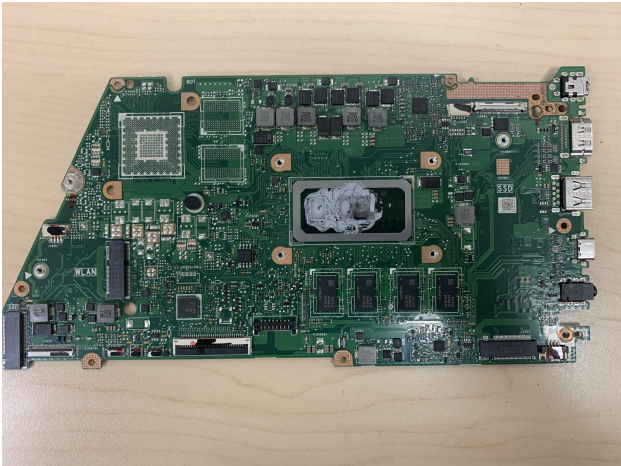
<p><b>Top Cover</b></p> <p>The top cover is used to shield the back of the screen. This is the black model, but it comes in a variety of colours.</p>	 <p>A black, rectangular top cover for a laptop, lying flat on a light-colored wooden surface. The text "ASUS VivoBook" is printed in white on the lower right side.</p>
<p><b>Keyboard Cover</b></p> <p>This part of the laptop covers the keyboard and touchpad. It also has several stickers with the laptop's details.</p>	 <p>A black keyboard cover with a grid of rectangular cutouts for the keys. It features several stickers: an Intel Core i7 sticker on the left, a "ASUS VivoBook 15" sticker in the center, and a "HARMAN" sticker on the right. There are also smaller stickers for "ASUS", "Core i7", and "USB Type-C".</p>
<p><b>Brace plate</b></p> <p>This plate is used to brace the motherboard and components by providing inserts for the components as well.</p>	 <p>A silver-colored metal brace plate with various cutouts and mounting points, lying flat on a light-colored wooden surface.</p>
<p><b>Cooling Chassis</b></p> <p>This piece is located inside of the computer and is used to take heat off of the central processing unit via heat sink. A heat sink is an array of metal spaced out to cool things down. The chassis works in tandem with a fan to expel the air. Note the orange colour. This is because it is copper, a great conductor of heat.</p>	 <p>A copper-colored cooling chassis with a black fan attached to it, lying flat on a light-colored wooden surface.</p>

## Hinges

The hinges are located on the sides of the laptop inside, and require quite a bit of force to move on their own. The hinges allow the user to open and close the lid of the laptop.



## Electronic Components:

Name & Purpose	Photo
<p><b>Motherboard</b></p> <p>The motherboard is the central hub of the computer, housing most of the circuitry, Input/Output (IO) ports, and connections.</p>	 A photograph of a laptop motherboard lying flat on a light-colored wooden surface. The motherboard is green and populated with various electronic components, including a large central processor, several memory modules, and various connectors and ports along the edges.

### Central Processing Unit (CPU)

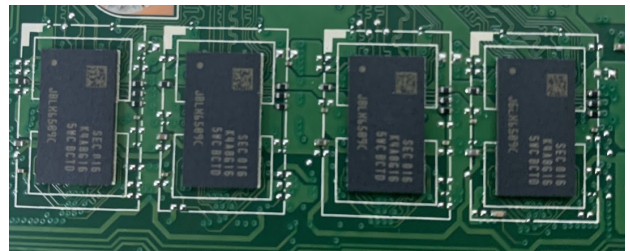
The CPU is the main processing hub of the computer, located on the motherboard. Its purpose is computing simple commands and performing simple logic using the Arithmetic Logic Unit (ALU). Note the grey glue on top, this is thermal paste. It's used to transfer heat to the cooling chassis and eventually the fan, because while processing, the CPU gets very hot. The computer has a clock speed of 1.8 GHZ, meaning that at least 1.8 billion operations get carried out in the span of a second. This particular one is an Intel i7-10510U Processor.

[Information Sheet](#)



### Random Access Memory (RAM)

RAM is located on the motherboard as well, and it works in tandem with the CPU. It holds a small amount of total memory stored in the SSD. The RAM gives the CPU its instructions to carry out. This computer has 16GB of DDR4, which is a type of RAM that was released in 2014.



### Fan

The fan is used to expel all of the hot air funnelled along by the copper cooling chassis. It has a 4-wire port that connects to the motherboard, and the wires are used for power in, power out, and we believe the other two are used for a temperature sensor located inside the fan.





### Wifi Card & Antenna

The wifi card is used to connect to wireless networks, and is connected to the motherboard via a specially designed port. Attached to the card are two long wires, these are the antenna, a main and an auxiliary. They snake through to the top of the screen, with some copper pads for better connection. This module is built by Intel and is the AX201NGW model. Unfortunately, due to a flaw in the website the datasheet was not available from Intel, so we had to use a mirror (alternate source).

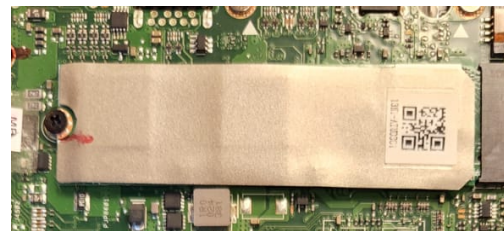
[Datasheet Mirror](#)



### Solid State Drive (SSD)

We acknowledge that this is the millionth acronym but just bear with us. The SSD is the storage of the computer, all of the files, the operating system, absolutely everything is stored on the SSD. It has a multitude of transistors, which flip on and off to store the data. The SSD is connected with its own connector to the motherboard, and there is one expansion slot for another SSD. This SSD was made by Intel as part of the SSD6 series. Again, the Datasheet was unavailable because of deprecation.

[Datasheet Mirror](#)



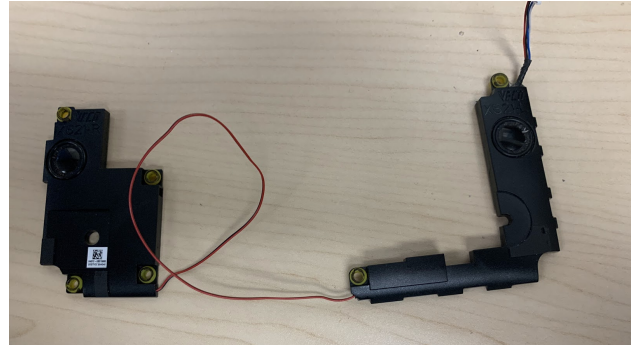
### IO Board (BOT Board) & Connector

While looking at this board, we were unable to deduce the name of it. We decided to call it BOT because of the three letters on the board. Little did we know on the other side of the board it said TOP! This board provides access to ports located on the right side of the laptop. 2 USB 2.0 ports, one microSD card slot, and two LED indicator lights. A 29 length ribbon cable connects the board to the motherboard. The board is manufactured by P&Q specifically for Asus, so no Datasheets are available.



### Speakers

The laptop speakers are downward facing towards the front of the laptop, offering a left and right side speaker. The speakers create magnetic vibrations, which allow a user to hear sound. The speakers connect to the motherboard via a four pin connector, which we are guessing is a positive and negative, for left and right speakers.



### Touchpad and Fingerprint Reader

The touchpad and fingerprint reader is used to allow the user to navigate a mouse as well as verify their identity using fingerprint recognition technology. When you move your finger across the touchpad, it picks up on the gesture and moves the mouse. When you put your finger on the reader, it scans your finger for identifiable indents and compares them with those on file. Interestingly enough, when you click on the touchpad, it is only a button on the rear that reads it, not the touchpad itself.



### Battery

The battery is a 50 watt-hour 11.5 volt DC, lithium ion battery, with 3 cells. The battery connects directly to the motherboard through an 8 prong connection, though it looks like only 7 wires are used. The battery's job is to power the entire computer. It is rechargeable.



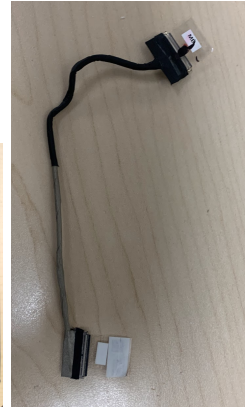
### Keyboard & Power Button

The keyboard is a 98-key keyboard connected to the motherboard. It is used for inputting characters into the computer. The power button is connected via a separate wire. During this deconstruction we managed to pop some keys out for a very cool-looking title picture!



### Screen & Connecting Cable

The screen's purpose is to provide visuals for the user to see and interact with. The screen is connected to the motherboard via its own cable.



### Camera and Microphone

The camera and microphone is used to capture the surroundings of the user. They sit just above the display, and are connected to the motherboard via cable.

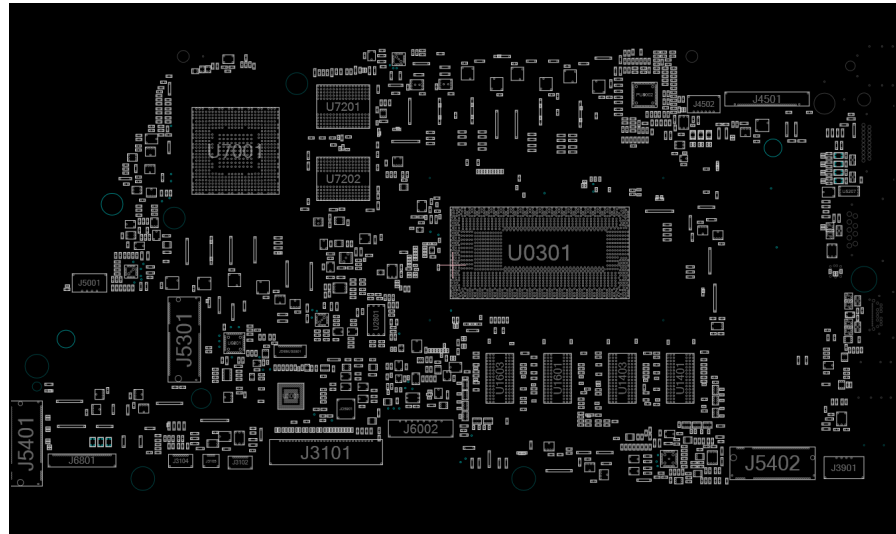




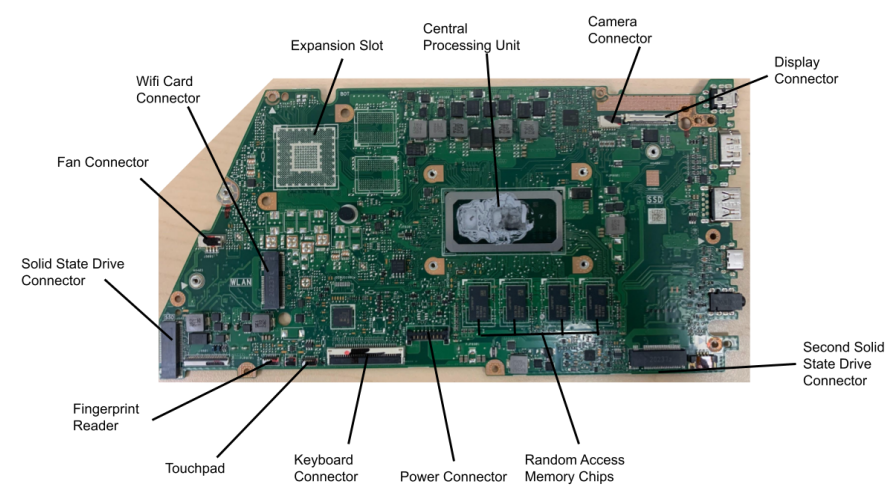
# Photo Gallery

Caption	Photo
Asus Connection Block Diagram detailing the outputs and inputs of the device.	<p><b>X421 SCHEMATIC Revision 1.0</b> (FA : UBA) (FL : DGPU = MX250)</p> <p>The diagram illustrates the internal connections of the X421 device. Key components include the CPU, RAM, Storage (SSD, HDD), Audio Codec, and various I/O ports (USB, HDMI, etc.). The schematic shows the flow of data and power between these components, with labels for specific pins and connectors.</p>
Team schematic detailing the inputs and outputs of the device. Note the direction of the arrows.	<p>This schematic diagram shows the Motherboard as the central hub, connected to various components. The components are arranged around the Motherboard, with arrows indicating the direction of data flow. The components include:</p> <ul style="list-style-type: none"> <li>Antenna</li> <li>Wi-Fi Card</li> <li>Screen</li> <li>USB-C</li> <li>Microphone</li> <li>Audio Jack</li> <li>IO Board</li> <li>2 USB 2.0 Ports</li> <li>MicroSD Card Slot</li> <li>2 LED Indicator Lights</li> <li>Camera</li> <li>Fingerprint Sensor</li> <li>Charging Port</li> <li>Power Button</li> <li>IC Expansion Slot</li> <li>SSD Expansion Slot</li> <li>HDMI</li> <li>Speakers</li> <li>RAM</li> <li>SSD</li> <li>CPU</li> <li>Fan</li> <li>Battery</li> <li>Keyboard</li> <li>Touchpad</li> </ul>

An X-ray image of the motherboard.



A team diagram using a photo of the real motherboard.



What we believe made the laptop stop working. This is a spot on the motherboard that looks to have "fried". The exact hardware piece number is unreadable because of the damage.



Unscrewing the motherboard.



A very fancy way of laying everything out!

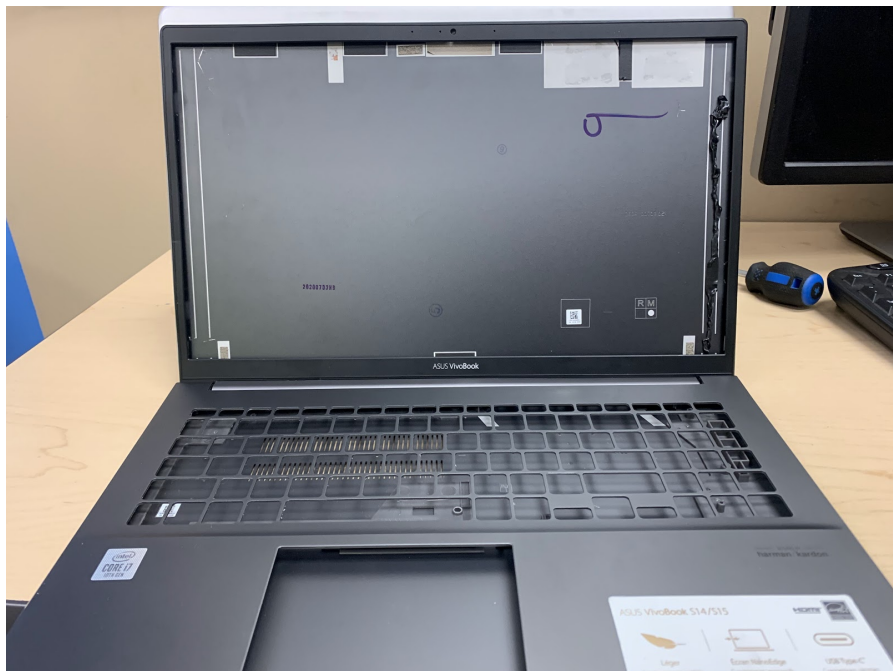


We're trapped in a computer screen but we're happy! 😊.



Together again!

(Just kidding.)



# Conclusions and Lessons Learned

During this challenge we learned a variety of valuable lessons. We practiced researching a specific item, preparing as a team to deconstruct it, planning out the process and documentation, *and* we learned what machinery goes into a laptop to make it work!

We also concluded that a hardware item ending in “413” was the piece that caused the laptop to stop working. It appears as if it received more power than it could handle, and since the copper inside of it is a great conductor of heat, the surrounding motherboard covering subsequently burnt. This may have been due to its placement, right around the screw that kept the battery in place. A charger with a higher voltage could have caused a power surge, which then caused the motherboard harm.

Overall...

- We learned how to plan
- We learned how a computer works
- We learned how a CPU functions in relation to RAM and the motherboard
- We learned the purpose of all of the components in the computer
- We learned what may have caused the laptop to stop working
- We learned that teamwork and a variety of views helps to gain a common understanding of a difficult concept

## Sources:

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3. [🔧 ASUS VivoBook S15 S533 - disassembly and upgrade options](#)
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