Vex IQ Reverse Engineering Online Challenge

TEAM 3383E

CELESTIAL
IRVINE, CA

Our Team

We are team 3383E, and our team, name is Celestial. Our names are Ethan, Aahana, Aria, Caleb, Aiden, and Zilin. Aiden, Aahana, Zilin and Caleb are in 6th grade, and Aria and Ethan are in 7th grade. We are all robohawks from the Orchard Hills School, in Irvine CA. Our main goal is to flourish in competitions and gain knowledge and experience. Our most ambitious goal is to go to VEX IQ Worlds. Ethan and Aiden are our qualification and Robot Skills Challenge drivers. Aria is our backup driver. Aahana and Caleb are our main programmers, and sometimes Zilin does programming as well. And everyone on the team helps with building and notebooking..

Our Team Photo

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What is Reverse Engineering?

Reverse Engineering is a VEX IQ online challenge in which you take apart an electronic device to see the internal pieces and to record what we find. In robotics, we work with motors, batteries, and computers very often and most are very familiar with them. Unfortunately, many people don’t know what is inside of them so we decided to find out and share our results. Our version incudes us using an IBM thinkpad and we are using assorted screwdrivers to carefully disassemble each part of the device.

The computer we are reverse engineering

This is the computer we will be reverse engineering for this online challenge. It is about 10 years old. It is a IBM thinkpad. We chose this specific device because we were curious what was inside of the computer and also because no one would have any use of it.

Teammates participating in this online challenge: Aiden, Aahana, Aria, Caleb, Ethan, Zilin.

Why we chose a computer

We are reverse engineering a computer because we use computers
everyday and they are extremely common. We wanted to better understand the mechanics and functions of a computer so we could better understand the computer as a whole and use them better.

Tools we used during our Reverse Engineering

FLATHEAD SCREWDRIVER

A flat-head screwdriver is a screwdriver with a wedge-shaped flat tip, used to tighten or loosen screws that have a straight, linear notch in their heads.

PHILLIPS SCREWDRIVER

The Phillips screwdriver is mostly used in the automotive industry and it has a cross (X) shape at the tip. This type of tool is used to turn screws with more torque to achieve the desired fit and is less prone to slippage.

The 3 Main Steps

STEP 1

Unscrew the nails on the bottom side of the laptop

STEP 2

Take apart the keyboard, and take off all the keys

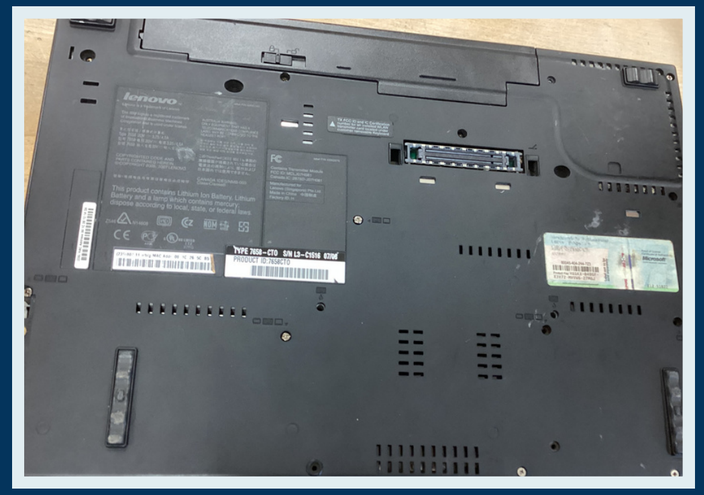
STEP 3

Remove the bottom of the computer and the computer screen

STEP ONE

UNSCREW THE NAILS ON THE BOTTOM SIDE OF THE LAPTOP

THE LAPTOP WHEN WE STARTED.

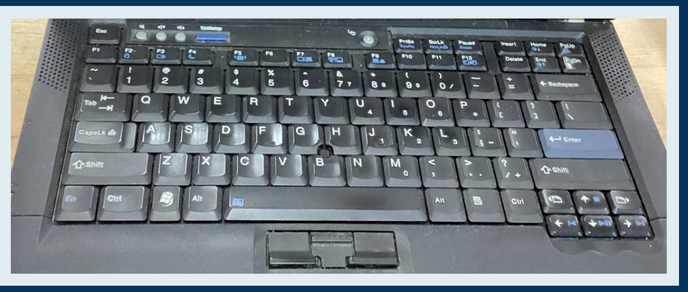


THE BOTTOM SIDE OF THE LAPTOP AFTER WE UNSCREWED MOST OF THE NAILS.

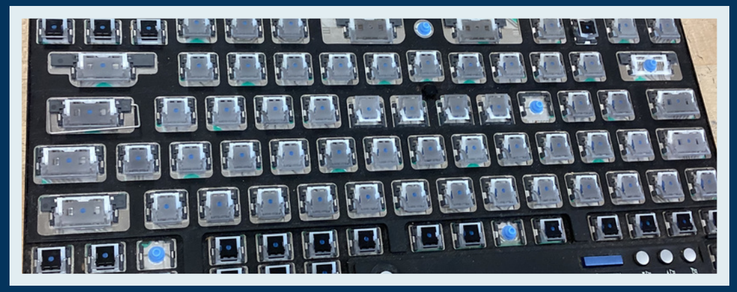
The first step that we did was to unscrew the bottom of the computer. This is so we could access the circuitry inside of the computer. We had issues with actually getting the computer open but we managed to do so by getting the keyboard off. We mainly had trouble getting all of the screws off due to the fact that there were many different types of screws and screwdrivers and it was difficult to identify which screwdriver to use sometimes. Other than that, this step was relatively easy.

Step Two

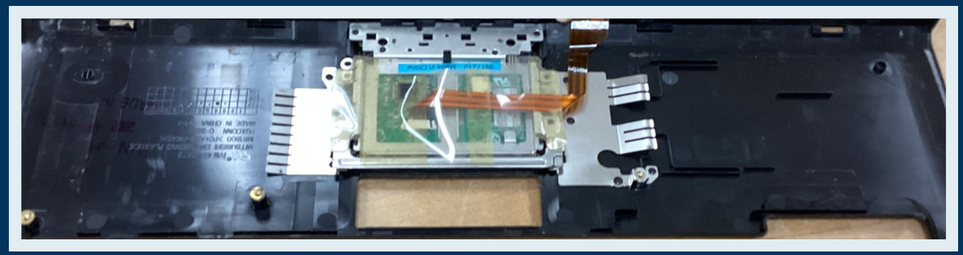
Take apart the keyboard, and take off all the keys



THE KEYBOARD BEFORE WE STARTED.



THE KEYBOARD WHEN WE REMOVED ALL OF THE KEYS.



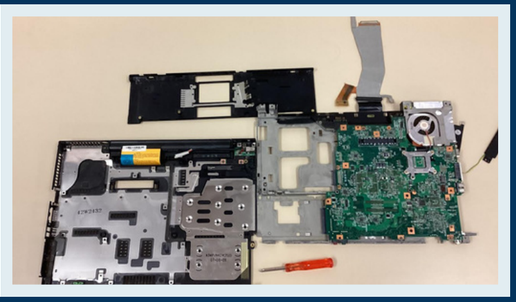
THE CIRCUITRY OF THE KEY BOARD.

We took the keyboard off to access the inner circuitry, as well as to get to see the keyboard without the keys in it. We removed the screws securing it to remove the keyboard and to remove the keys, we simply just pried them off with a tool. We also took off the top plastic covering off of the computer and took the trackpad off along with it. A small issue that we had with this step was figuring out how to detach the keyboard away from the main circuitry once the keyboard was unscrewed, due to the fact that it was attached by wires. We managed to get it done however, by removing the wires.

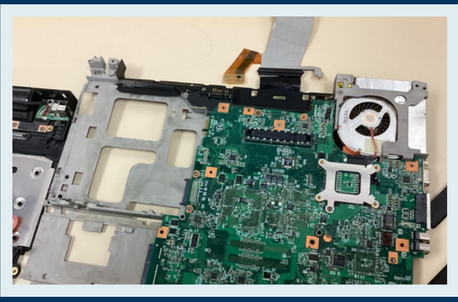
Step Three

Remove the bottom of the computer and the computer screen

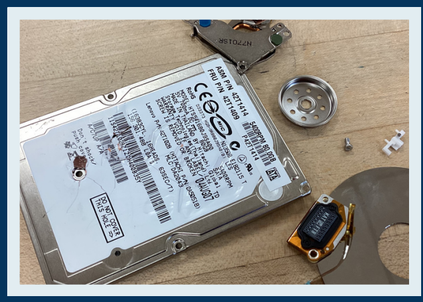
THE BOTTOM OF THE LAPTOP AFTER WE REMOVED ALL CIRCUITRY.



THE LAPTOP CIRCUITRY.



THE HARD DRIVE OF THE LAPTOP.



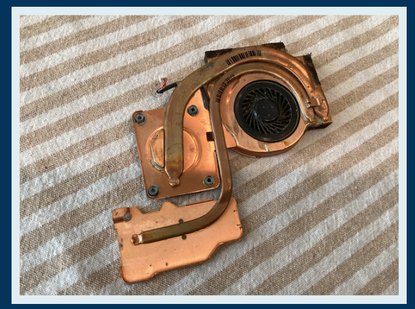
THIS IS A PART OF THE COMPUTER THAT MAKES THE SCREEN WORK.

This is the step once we got to the actual innards of the computer. We saw many things on the inside of the computer. This is the stage in which we spent the most time in, and had to be the most careful at, due to the delicate circutry inside of the computer. We had to also carefully work around the wires as they could get in the way of things and they made the placement of things limeted for us. After we removed the fan, we got to remove the motherboard, or the main circuitry, from the computer. It was at this point where we had seperated the computer into all of the large parts that we could without getting too complex.

MAIN THINGS WE IDENTIFIED

Internal Cooling System/ Air Vent

The Internal Cooling System keeps the computer from overheating.

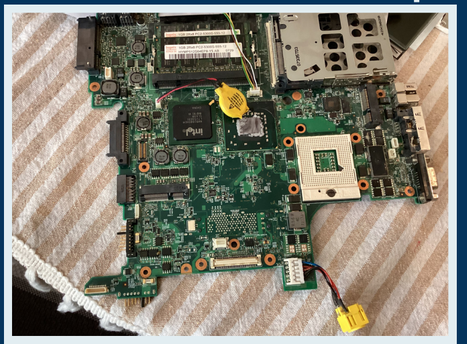


The Screen

The screen’s purpose was to transfer the data from the hard drive into a visual. The screen was cracked in multiple places when we started.

The Mother Board

The Motherboard is the main circuit board the allows the computer to work.



The Hard Drive

The hard drive basically stores all the data and the code.

SMALLER THINGS WE IDENTIFIED

The Keyboard Plungers

These are small blue rubber plungers that allow the keys to go up and down when you press them. This object also helps the plastic pieces that interlock

The Keys

The keys each represent a certain number, letter or symbol, they go up and down as you click on them on them to type. This due to the interlocking plastic pieces and the plungers.

The Smaller Circuit Boards

Along with the motherboard there are also other key boards that serve smaller functions. This includes some of the smaller programs or functions.

The Screws

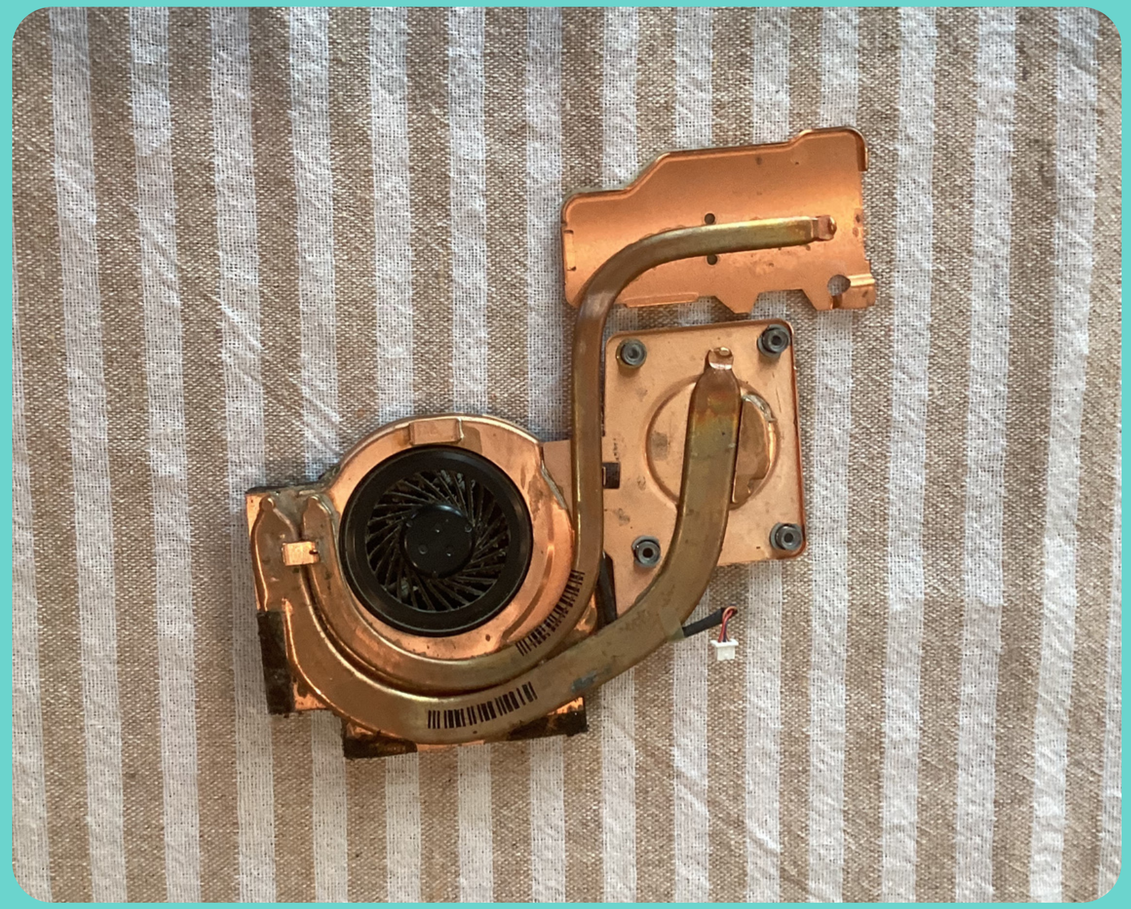
The screws are small, and some are longer than others. They hold the different sides of the computer together. They are usually made of steel.

THE HARD DRIVE (PT.1)
FUNCTIONALITY AND PURPOSE

THIS PARTICULAR HARD DRIVE WAS MADE BY HITACHI FLOBAL STORAGE TECHNOLOGIES.

The hard drive contains the storage memory information, but not just regarding the things such as computer applications, pictures, or documents that you download, but the code necessary to run the operating functions, such as the ability to use an usb cable or the function that you use to log in to a computer. It does this by reading off information off of a rapidly rotating magnetic metal disc, similarly like how a record player does so off of a music disc. This discs' information can be overwritten and can have more informaition added to it, which makes it a very reliable and efficient way to store data. This particular hard drive was made by Hitachi Global Storage Technologies, as said so on the label on the hard drive.

LAPTOP INTERNAL COOLING FAN



INTERNAL COOLING FAN TO PREVENT FROM THE OVER HEATING OF THE DEVICE

The laptop internal cooling fan's sole purpose is to keep the computer from overheating a lot to the point where it doesn't work. It works by expelling the hot air generated within the computer and intaking cooler air from the exterior of the computers with a series of vents and strategicaly placed fans to distribute the cold air evenly within the computer's internal structure. This is especially important in cases in such a laptop gets used in a large amount and a lot of memory and battery is getting used. The internal fan will automatically turn on and will help cool the computer down. This helps preserve the long term performance of the computer and prevents crashing and malfunctions.

LAPTOP INTERNAL DVD CD PLAYER

THE DVD AND CD PLAYER FOR THE LAPTOP

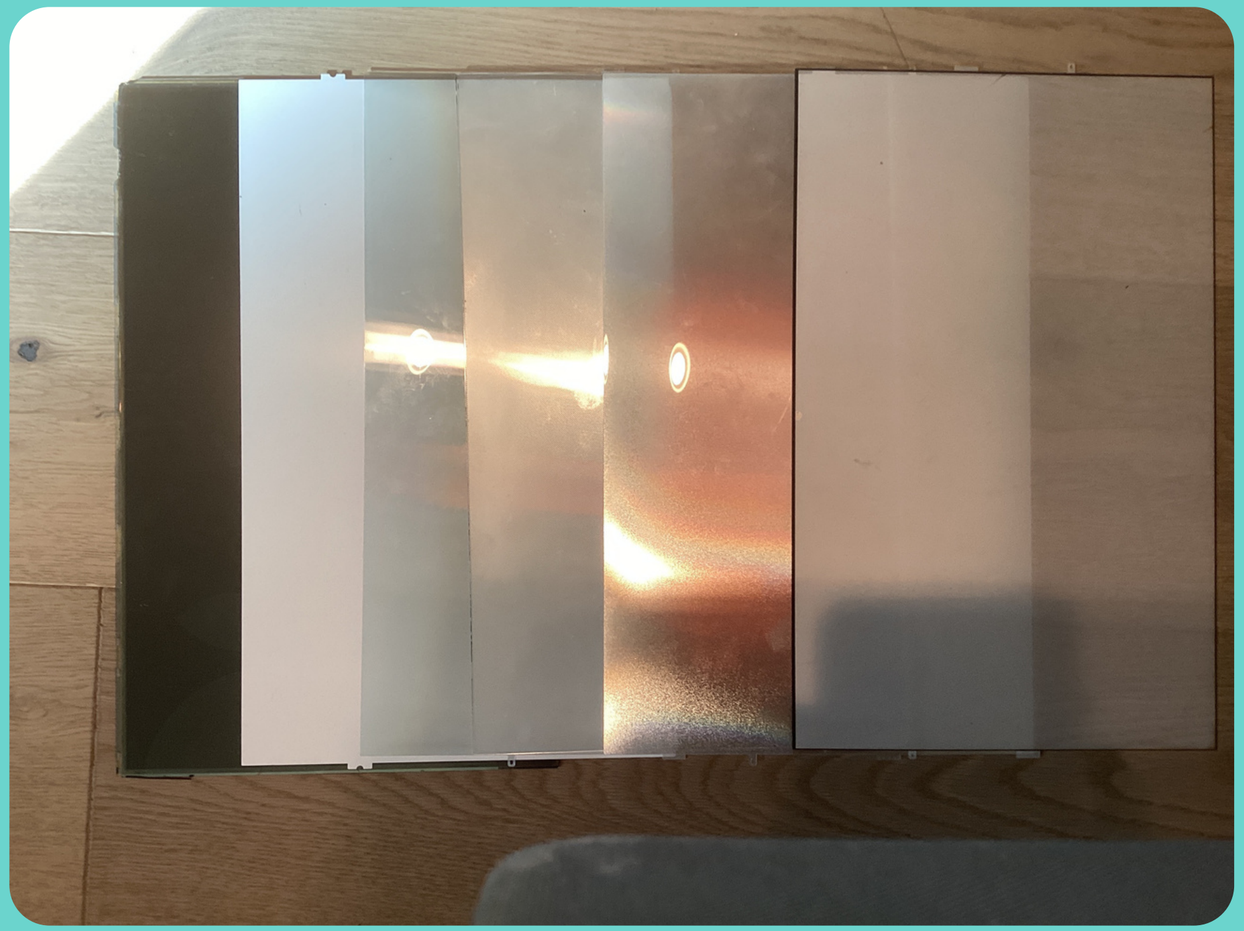
The laptop internal DVD CD player is a storage slot within the computer that runs DVD and CD programs. DVD is the abbreviated form of Digital Video Disk or Digital Versatile Disk, and CD stands for Compact Disc. Both are extremely popular and are used to run pieces of code on a computer to do something such as play a movie or to run a game or to listen to some music. A laptop internal DVD CD player works by having a laser pointed at the CD, which is spinning at high speeds. The CD is made out of polycarbonate, aluminum, plastic, and lacquer, and has many bumps on it. If the laser beam lands on a bump, it gets scattered. Once the laser beam hits a flat area with no bumps, it reflects the laser back to a photocell, which can detect energy, which sends an electric current to a circuit board, which then in turn continues to send a signal of “1” . If no laser beam is detected, it sends a signal of “0”. With enough ones and 0s, it can write out a code for the computer to follow.

THE KEYBOARD

Scissor Switch keyboard

The keyboard is the part of the computer in which controls typing and many different adjustible screen functions such as the power button and keyboard shortcuts. This particular keyboard is a scissor switch keyboard. A scissor switch keyboard has two interlocking plastic pieces on a joint that can fold like scissors over a small plastic dome that presses inwards when the key is pressed down, opening the two interlocking plastic pieces similarly to a pair of scissors, which activates to circuits. It works by having circuit switches in each key that trigger a series of electrical signals to represent each letter.

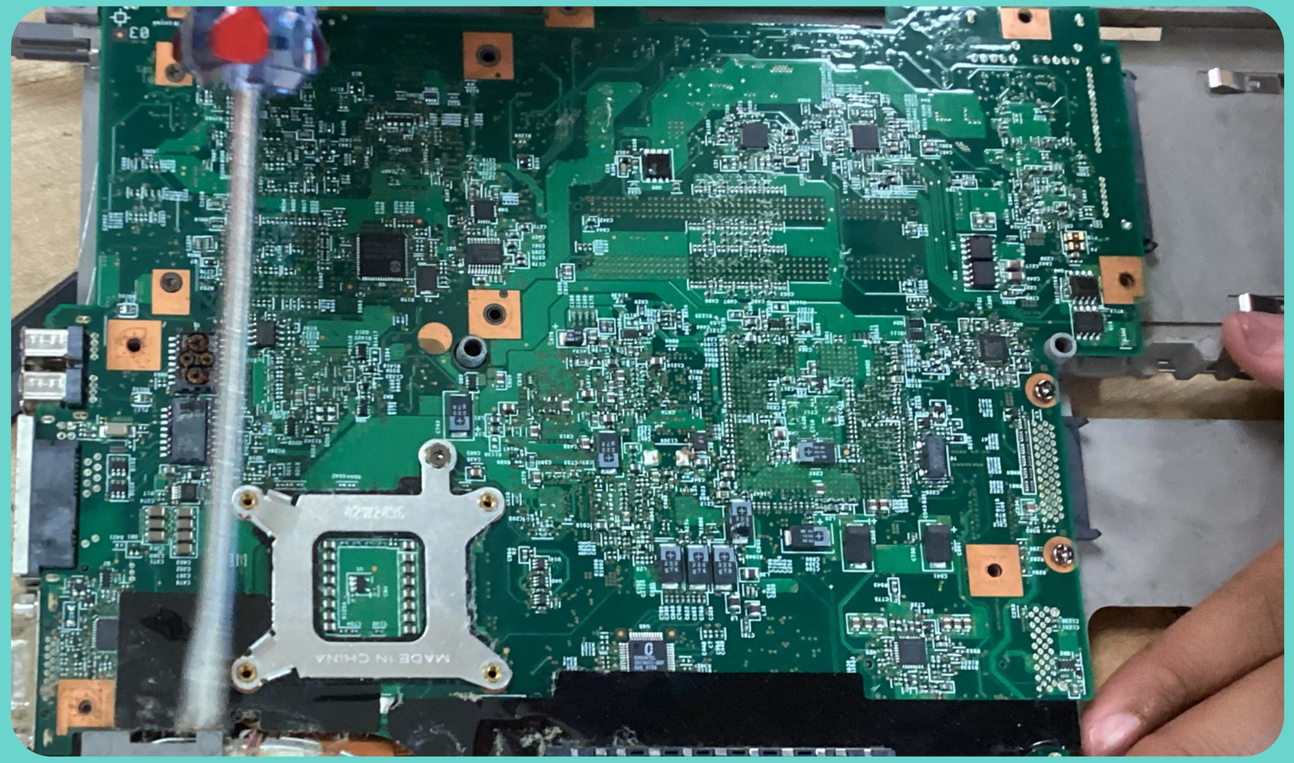
THE LAPTOP SCREEN



THE 6 LAYERS FOR THE SCREEN

In this step, we took the screen off to look at the layers in and behind the screen. There were 5 different thin layers and one thick dark layer, which was the first layer as the screen. The other layers were the layers placed behind it. The screen has 6 layers and they all have a different purpose and role for being there. For example, the layers all in order is the polarizer, the first layer that applies voltage to the crystal, the liquid crystal, the second layer that applies voltage to the crystal, the polarizer, and finally, the backlight. These layers all provide different purposes for the laptop screen.

THE MOTHERBOARD



OUR TEAM WORKING TO SEPARATE THE MOTHERBOARD

The motherboard is a key component of the computer that distributes electricity and makes communicating easier between the CPU, RAM, and other components that contribute to this process. The motherboard is basically like a main center that distributes electricity from your power supply, and bonds all of your hardware to the processor. It also carries most of the program that used by the laptop. Finally, the motherboard also includes interesting and different parts, including the CPU, memory, storage, and cooling fans. These are some of the typical parts in a motherboard, although there are more parts.

PARTS OF THE MOTHERBOARD

The CPU (Central processing unit)

The CPU (Central Processing Unit), is responsible for fetching, decoding, and then executing vairious commands within the programming. It also responsible for doing mathematical and logical calculations.

The RAM (Random access Memory)

The RAM (Random access Memory), is a series of computer chips that temporiarily store pieces of coded information so the operating system doesn't have to fetch it all the way from the hard drive.

The BIOS (Basic Input/ Output System)

The BIOS (Basic Input/Output System), otherwise known as the Driver or Device Driver, is responsible for many different functions, such as the screen and the keyboard.

The CMOS RAM (Complimentary Metal Oxide Semiconductor Random Access Memory)

The CMOS RAM contains all of the information that is a nessesity of the computer's functionality, such as turning on and off, charging functionalities, an d the Date and time. It is powered by a small battery that is running 24/7

PARTS OF THE MOTHERBOARD CONTINUED

Serial Port

Old Macs used the serial port for printers. Also known as an RS-232 port, serial ports provide very slow speeds and have been superseded by USB on desktop computers. USB-to-serial adapters are available for old peripherals.

CMOS Battery

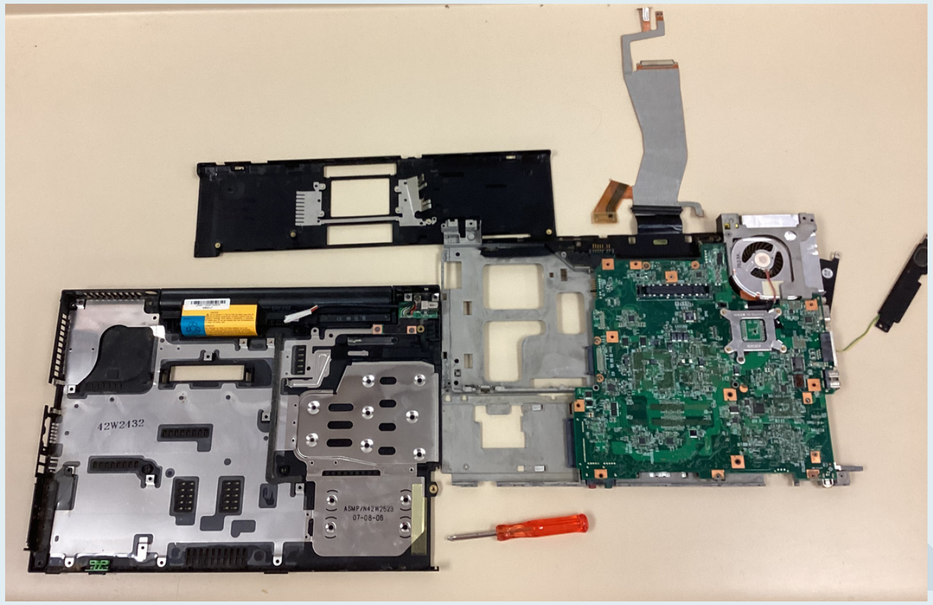
The CMOS battery powers your laptop's BIOS firmware, which is responsible for booting up your computer and configuring data flow. You can tell if your CMOS battery has died if your laptop has difficult booting up, if drivers disappear, and if your laptop's date and time are incorrect.

USB Port

The USB port USB ports allow USB devices to be connected to each other with and transfer digital data over USB cables. They can also supply electric power across the cable to devices that need it. Both wired and wireless versions of the USB standard exist, although only the wired version involves USB ports and cables.

Before

This is before we removed anything of the thinkpad not even a single screw.

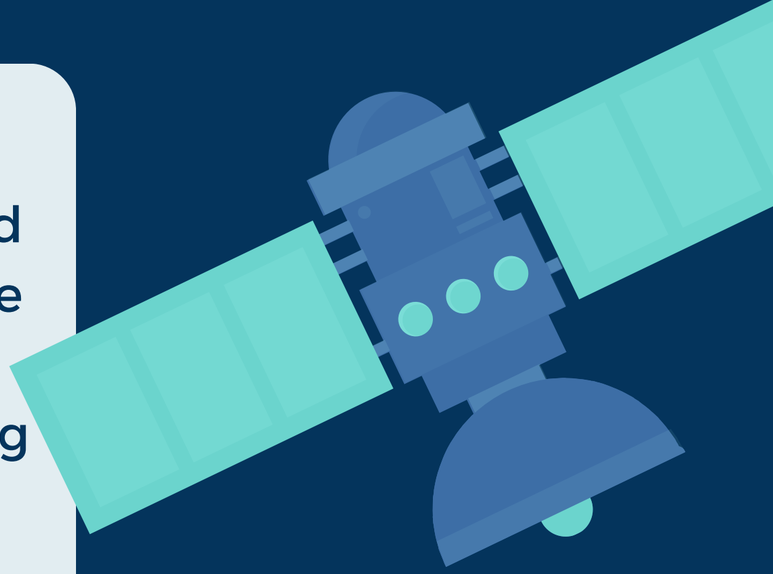


After

This is after 3 days of detaching parts and unscrewing each and everything we can.

Overview

After we dissected the laptop, saw the internal components, and did research on the parts that we did not know about. We learned all we wanted to know and even more. We all learned together and cooperated to make this possible with the teamwork of investigating the different parts and functions of the laptop.



What we Learned

We learned about the different functions in the different parts of the computer, such as the hard drive, the mother board, or the internal cooling fan. We learned how each component of the laptop works together to make the laptop work properly. We had a lot of fun reverse engineering this laptop. As a result we now know more about the circuitry of eletronics, such as a computer, than we knew before completing this challenge. We all helped a lot in the diferent parts of the reverse engineering challenge, such as taking apart the robot, sorting the parts we recovered, and designing this presentation.

Bibliography

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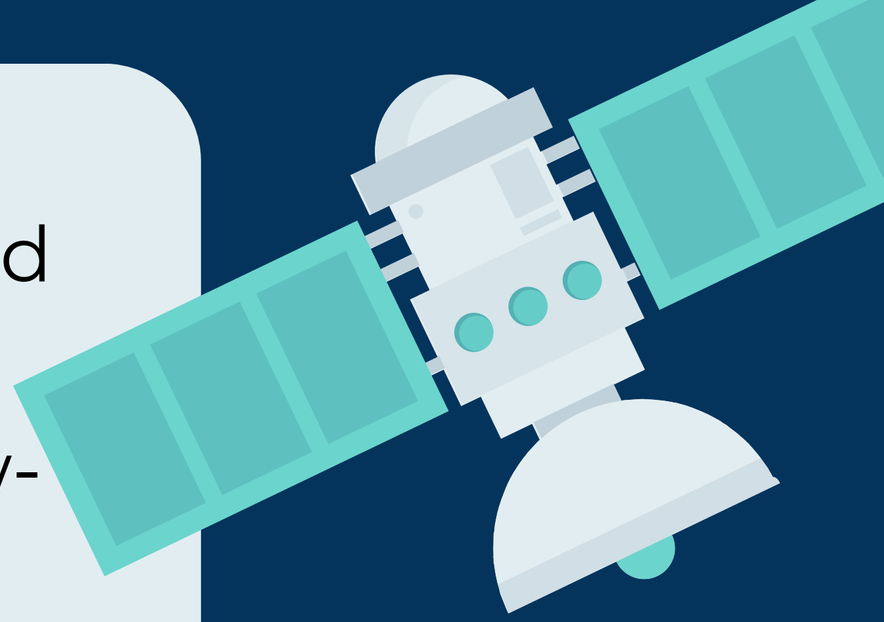

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