REVERSE ENGINEERING CHALLENG

The Lighting Stallions!

Home of Somerset Academe Silver Palms

The Reverse Engineering Challenge:

VEX Robotics competitors design and create complex machines and elaborate code, but don't usually get to see the technology and components inside the electronics they use in the classroom and competitions. Entries for this challenge will explore the inner workings of an electronic device at a part-by-part level.

Choose an electronic device, carefully deconstruct it, and catalog the parts you find inside. As you go, document your process and findings with text and images. Conduct online research on the components you discover, and try to identify their roles within the electronic system. Your submission will tell us what you learned by taking a closer look inside and reverse engineering a complex electronic device.

The electronic device we have chosen to use is a laptop, specifically a DELL laptop our teacher's, Mr. Seifans, son had in middle school in the late 2000's, which unfortunately is too old to work anymore. When we took it apart, we found parts such as the:

- Motherboard
- Keyboard
- LCD Computer Screen
- Computer Casing
- Computer Casing Hinges
- Cable
- Wi-Fi Adapter
- Memory
- USB
- Speakers
- Hard Drive
- Hard Drive Connecter

- Battery
- CPU
- CPU Heatsink
- CPU Fan

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Components

Motherboard – The motherboard is one of the most crucial parts of a computer. It contains 14 layers of fiberglass and copper, and is the biggest unit in a computer. It connects the CPU, memory (RAM), hard drive, video card, sound card, external peripherals (Wi-Fi, GPU, etc.) and other components. Through the motherboard, different pieces can talk and interact with each other. Without it the computer wouldn't function properly.

Keyboard – The keyboard is probably the most known part of a computer. It is an input device with letters, numbers, and symbols. While you can press them individually to input a certain character or a certain thing, you can press multiple to do more complex functions. For example, clicking Ctrl + C to copy and Ctrl + V to paste. When a key is pushed an electrical circuit is closed, because the circuit got closed it sends a signal to the CPU, which tells it what character to show on screen. The keyboard is mainly arranged using QWERTY due its predecessor, the typewriter using it, but also uses AZERTY and, or DVORAK. The keyboard is the main way we can input commands into the computer and interact with it.

LCD Computer Screen – The computer screen is how yours and the CPUs inputs are shown. The screen helps display information to you, such as programs, pictures, and videos. In between two pieces of glass, there are dots that are three different colors, blue, red, and green. Every other color on the color wheel can be made from just these three. The CPU has a memory, which has the picture it wants to show. In the screen there is a panel of light, that controls transistors, in which control liquid crystals placed in front of the dots. The liquid crystals line up with an electric field produced by those transistors that changes the color of the dots using different displays of brightness. Those dots turn into over 2 million tiny little pixels. When done the full image with all the colors is shown.

Computer Casing – Since a computer has a lot of delicate, fragile, and extremely expensive parts, it's very important to protect it. Which is why there is a casing that covers the entire computer, expect for plugs/sockets. It protects prominent parts such as the CPU, motherboard, memory (RAM), and other parts inside and insures everything stays and in its place if the computer were to ever get damaged.

Computer Casing Hinges – Casing hinges are used to connect the top casing and bottom casing together. Most modern computers don't use casing hinges anymore.

Cable – There are a lot of different types of cables that do different things in and around a computer. The two main types of cables are power cables and data cables. Power cables help power the computer and are plugged in through a socket, while data cables help transmit data from one part to another and connect other devices to the computer, such as mice, keyboards, and printers. Transmitting data is very important as helps the computer do certain tasks.

Wi-Fi Adapter – A Wi-Fi adapter helps convert a computer from needing a network cable into being wireless. While modern computers have an adapter built inside, older computers can still connect an adapter via an ethereal port. To work the adapter must connect to a wireless router.

Memory – Memory is a place that holds instructions and commands for quick use. Doing basic things such as opening applications, going to different websites, and playing games requires memory. The more memory you have, the easier it will be for the computer to do certain tasks. Without memory the computer would be much slower and complicated.

USB – A USB is used to connect the computer and peripheral objects and devices. It can also upload data like photos, videos, and documents

Sound Card – A sound card helps transform digital audio signals into analog ones for a person to hear from speakers or headphones and vice versa. It is either connected to the motherboard directly or from a PCI card slot. While a computer can function without it, hearing sound is important in a lot of activities.

 Speakers – A speaker is a peripheral device that outputs sound from the sound card. Speakers mainly use a cone and an iron coil, when sound is output, the coil moves back and forth, hitting the cone and causing sound to come out.

Hard Drive – The hard drive is where everything is stored, such as software, apps, documents, files, pictures, and videos. It is similar to memory; expect it long-term. Old hard drives used to be magnetic disks that would be magnetized or demagnetized. Like a vinyl, it writes and reads tiny Os and Is on the disk to gather information.
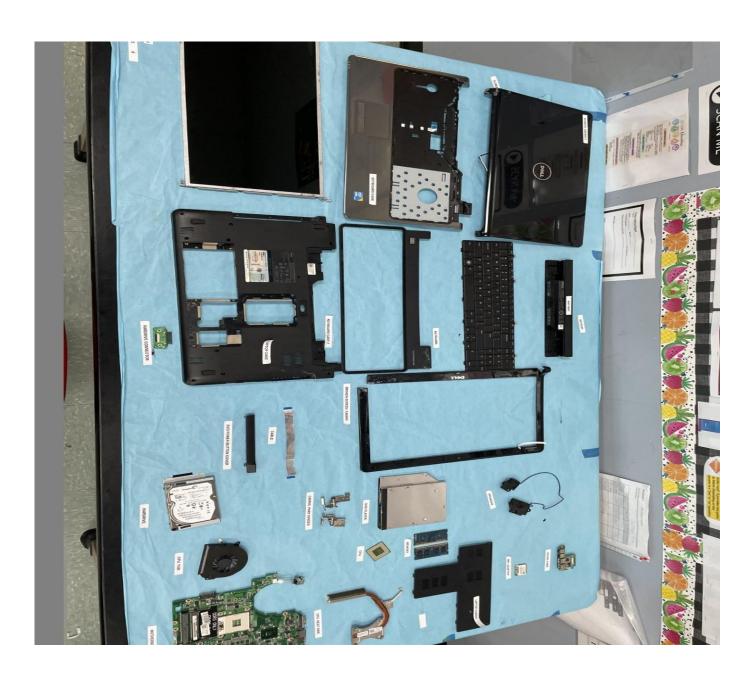
Hard Drive Connecter – Hard drives have two connecters, one a power cable and other a data cable. The power cable connects to a PCB (printed circuit board), with connects to a battery, while the data cable connects directly with the computer's motherboard.

Battery – Laptops use batteries to power their components. A battery is a device that stores chemical energy and converts it to electricity. A battery has two ends, a positive cathode, and a negative anode. When these two are connected they form a circuit. Electrolytes will flow throughout the circuit and make electricity. This works until a chemical reaction between cathodes, anodes, and electrolytes renders it dead.

CPU – The CPU or central processing unit is the main part of the computer. It takes inputs from different parts of the computer, and fetches information from the memory, then it does mathematics and basic operations to execute instructions. Without a computer would not work one bit.

CPU Heatsink – CPUs can very easily overheat, which can cause them to melt or fry, because of that a CPU heatsink is placed on the top to disperse the heat away and protect the CPU. They are usually made of aluminum or copper and have a large surface area with little fins that are used to make conduction possible. By using heat diffusion and convection, the heatsink can use the surrounding cooler air to drive the hotter air into the environment. This is called thermal gradient. There are mainly three types of heatsinks, passive ones, active ones, and hybrid ones. Passive heatsinks work like described, but active ones have a fan or blower added to make conduction better. Hybrid ones are less common and are a mix of both, utilizing both aspects of a passive and active heatsink.

CPU Fan – The fan is very similar to the heatsink, as it is there to help cool the CPU down when it works a lot. It's made up of aluminum and connects to the top of the heatsink. It sucks hotter air through its fins and brings it into the heatsink.

Conclusion

In conclusion, doing all of this has taught all of us a lot about our computers and how different components and parts interact and work together to make it fully functioning. It is very useful to know all of this, so if something were to ever happen to your computer, you know what's wrong with it. Taking apart and analyzing all those pieces was very enjoyable and educational.

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