

Team 95070E: Reverse Engineering Challenge

Exploring A Vintage
Apple Laptop



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Why We Chose This Item

The item we decided to take apart is a 2009 15 inch Apple A1278, more commonly known as a Macbook Pro. It is used to entertain (play videos, play games, etc.) and to work (edit documents, take meetings, etc.) ,but as technology has progressed, this model has been replaced with faster, more compact computers.

We chose this item because we wanted a device that reflected the iterations of the modern technology we use daily, whether it's to do homework or listen to music. Computers have many roles in different professions, like being used to 3D model products and communicating with clients.

In addition, while this Macbook wasn't as advanced as a modern computer, it still possesses a screen, keyboard, and trackpad that have a similar build to today's computers.

Team 95070E presents to you our reverse engineering project!



A Macbook Pro seen from the front

Daily Logs



Day 1-The Outside

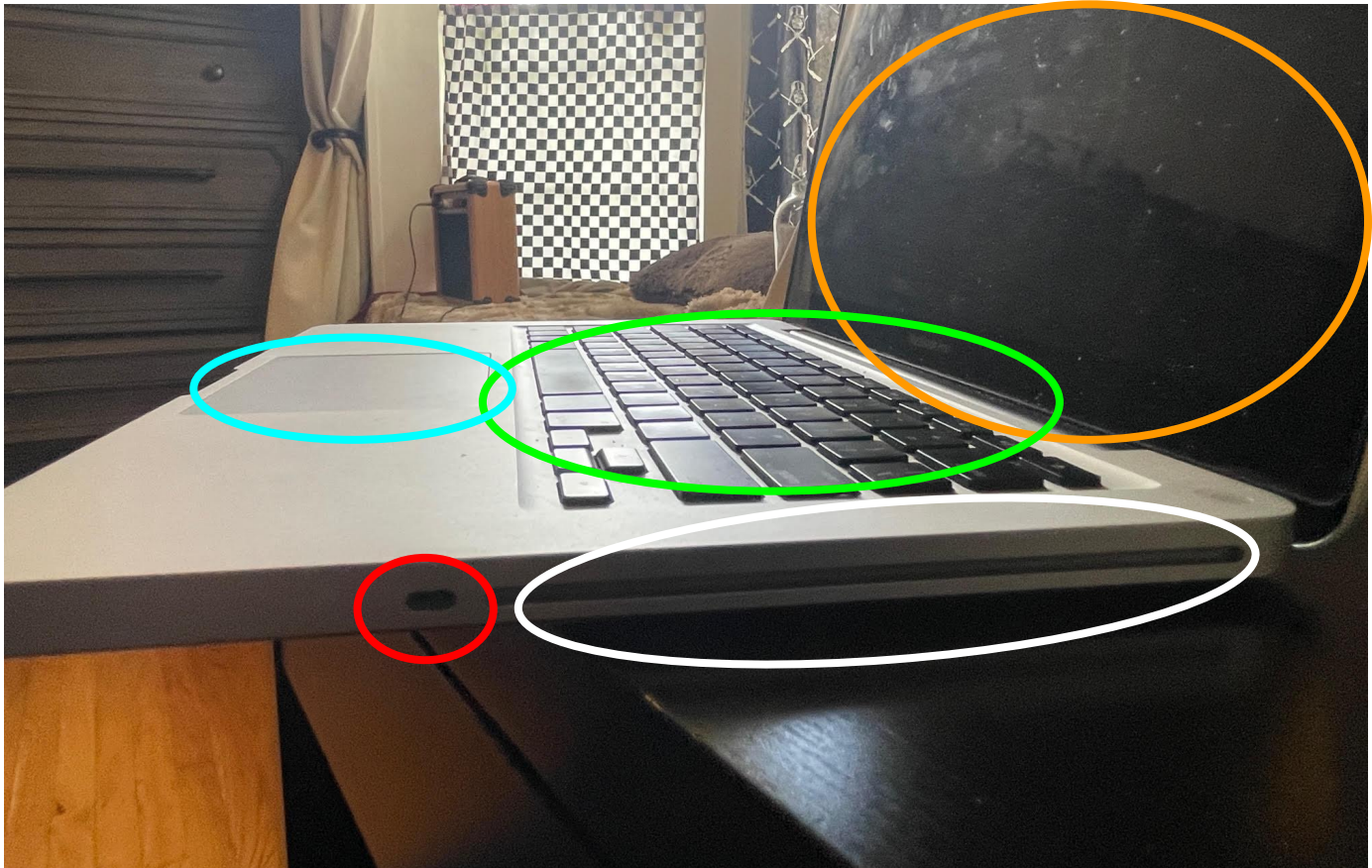


Before we could start taking it apart, we wanted to understand how the basic functions (typing, moving the mouse, memory storage) work. After finding out the model and what year it was from, we started studying the ports. We found several ports that we do not use widely today, such as the Ethernet port:

- SD Card Slot
- Headphone Jack
- USB Ports
- Mini Displayport
- FireWire 800 port
- Ethernet Port
- MagSafe Power Port

Day 1-The Outside

Opposite Side



Components:

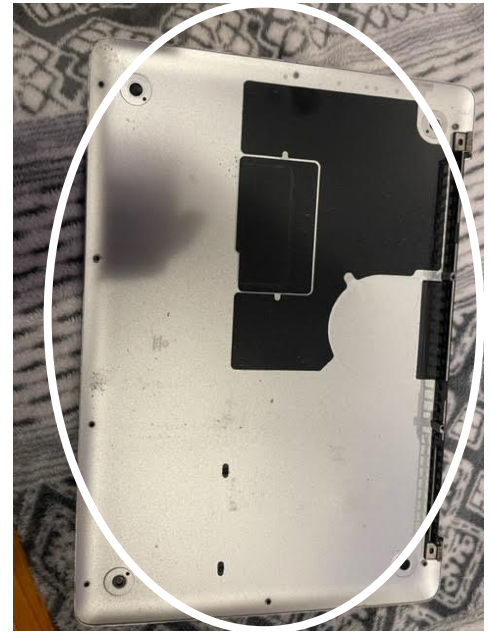
- Kensington Lock Slot
- DVD/Disc Player Slot
- Trackpad
- Keyboard
- Display Screen

The DVD slot is one of the most critical and interesting parts of the computer. This also contributes to the laptop's uniqueness and how it differs from today's laptops. It functions like a hard drive. When you put a disc in, all the media contained on said disc will be in the laptop's files to be watched or listened to. Today, we stream/distribute large files online rather than use DVDs.

Day 2-The Interior

Back Cover

Interior

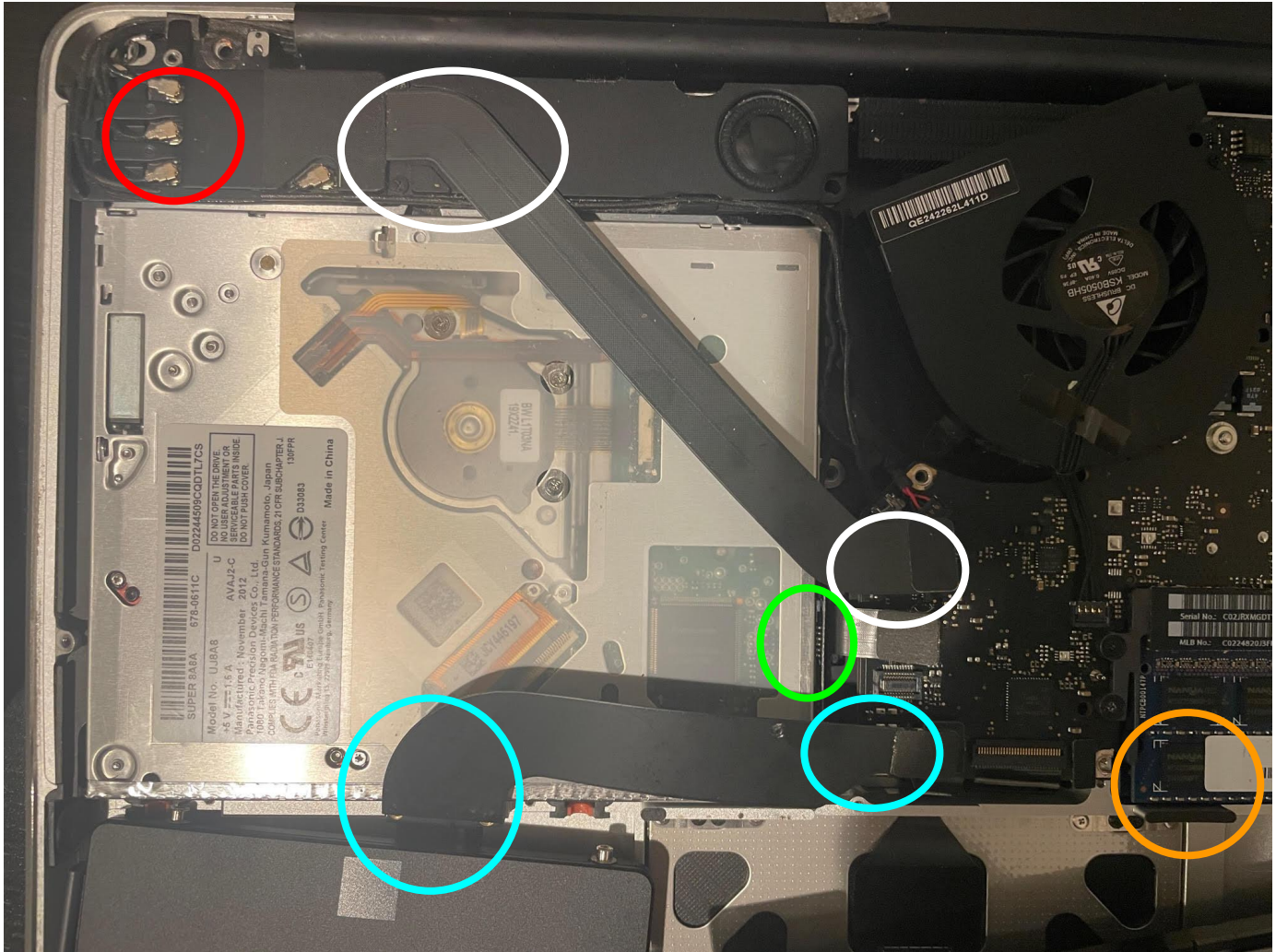


We decided to start with the back cover as it allows easy access to the interior. The screws were very unique so it took trial and error to find the right tools. These are system components that control all of the computer's functions like the motherboard. These are the components that allow the computer to function, like the battery and the fan:

- System Fan
- DVD Drive
- Lithium Polymer Battery
- Motherboard
- RAM (one original stick and one added)
- SSD Hard Drive (originally magnetic)
- Back Cover
- Screws and Connectors

Day 3 - Connectors

Left Side

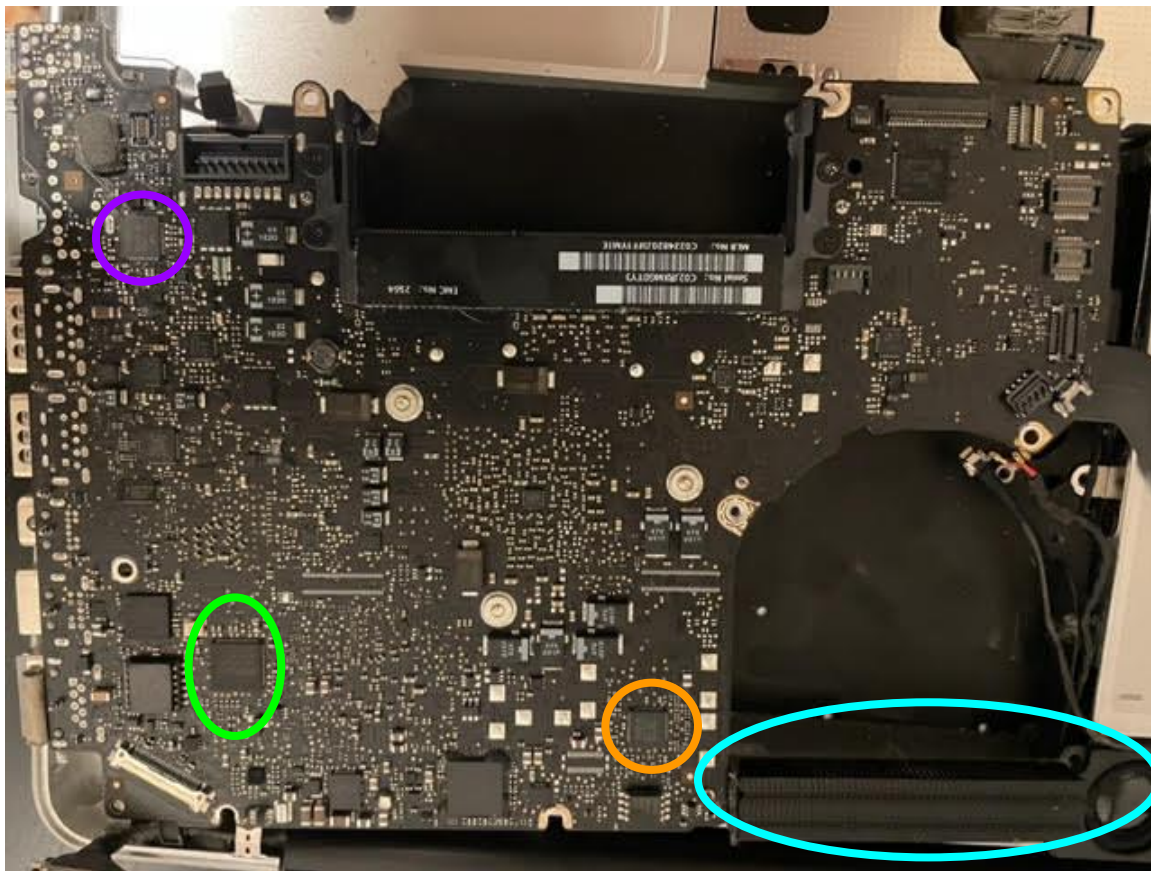


We then removed the major components and figured out how most of the wiring works and where it was connected to. These small, sometimes flexible, connectors allow the computer to relay data or information amongst all the necessary components:

- **Display Driver To Display**
- Display Driver To Motherboard
- **Hard Drive To Motherboard**
- **DVD Drive To Motherboard**
- **Keyboard Connector**

Day 4-The Motherboard

Top View



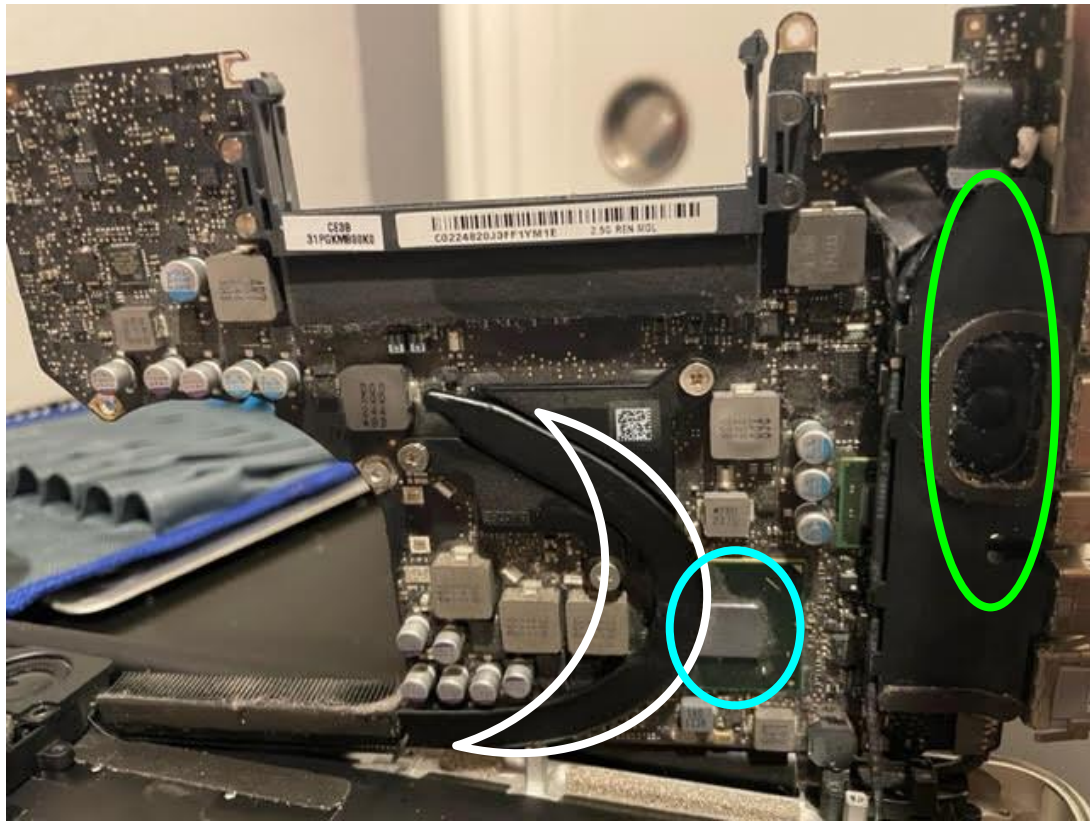
Although all components on a computer are very important, the motherboard is arguably the most important. It controls all of the computer's functioning. It was quite difficult to remove. The motherboard also has components that exist outside of the main board like the RAM which feeds directly into it:

- Added RAM Chip
- Original RAM Chip
- Display Driver
- WiFi Chip
- Audio Codec Chip
- Charge/Power Controller

Day 4-The Motherboard



Bottom View

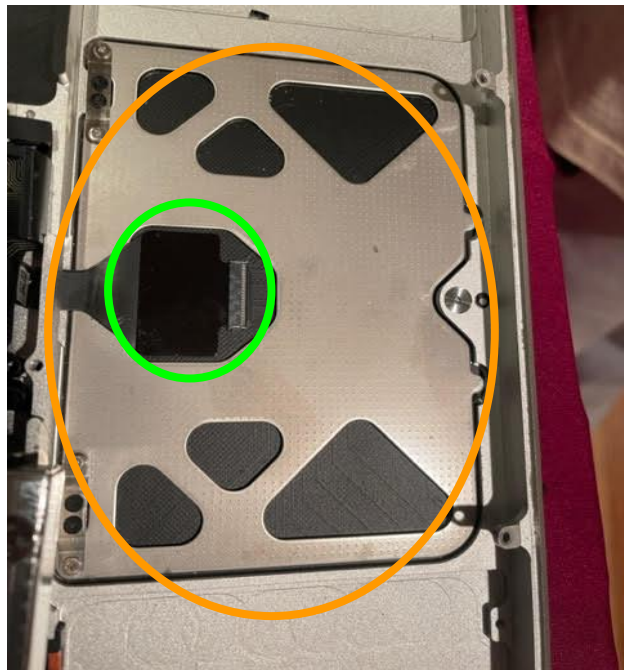
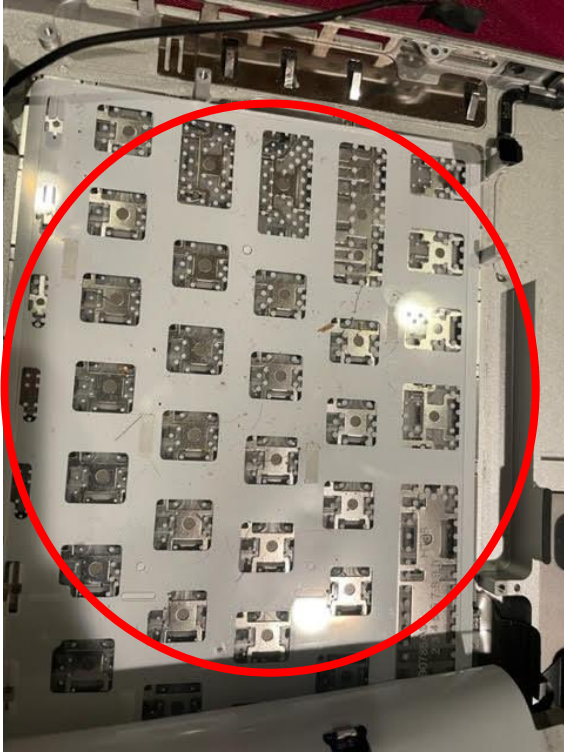


Components:

- Fan
- HeatSink For CPU
- GPU (Graphics Chip)
- Speaker
- CPU (Central Processing Unit)

However hard to take out, we felt it was necessary to expose the components underneath like the CPU. An important component here is fan. This is critical to the computers survival and stops the motherboard from overheating.

Day 5- Inputs & Keyboard



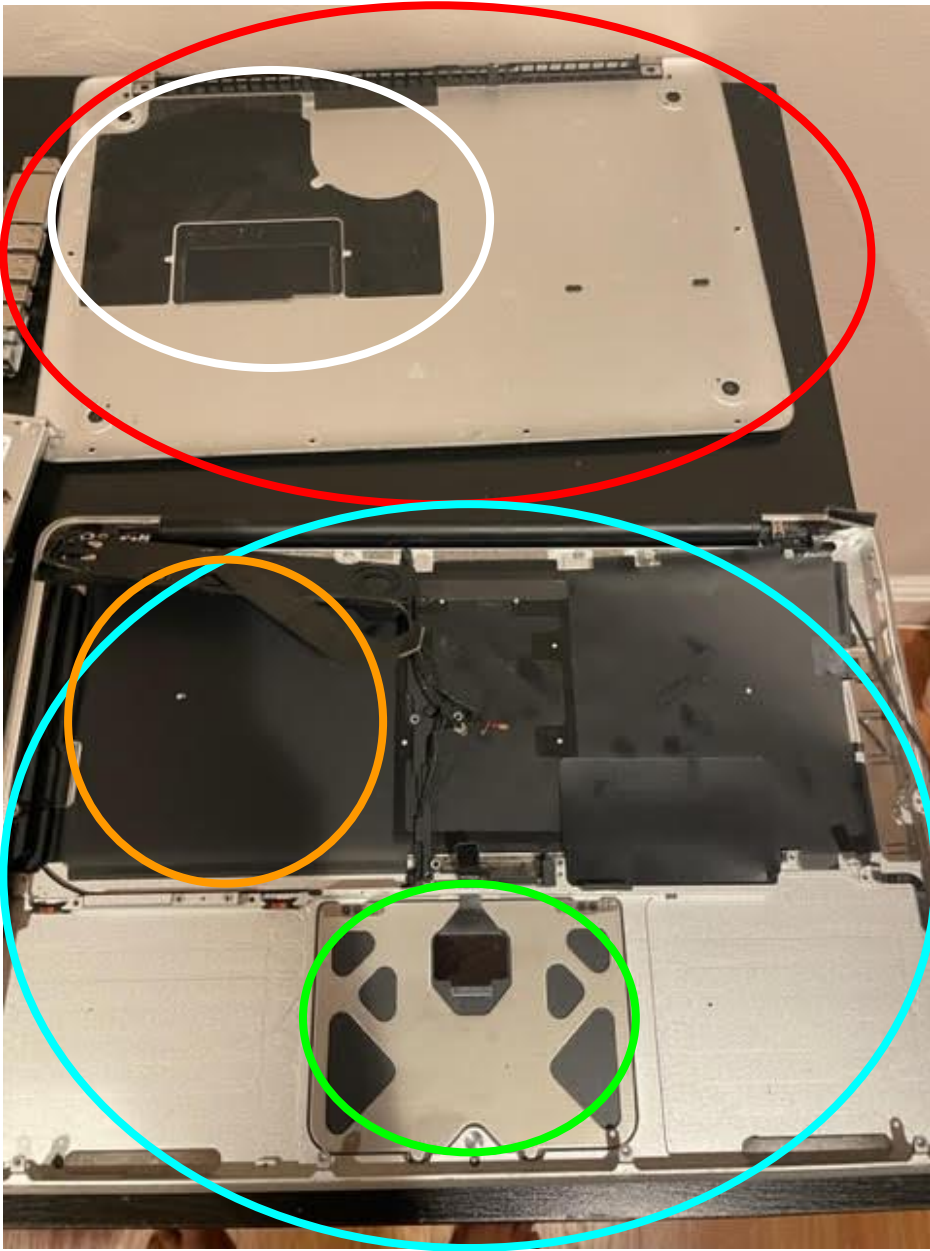
Keyboards are essential in making a computer usable. The keyboard and the trackpad are touch activated. When you click a key, the information gets sent directly to the motherboard. When you move your finger over the trackpad, information gets sent to the motherboard and then to the display:

- Keyboard Switches
- Keyboard Connector To Motherboard
- Trackpad Connector To Motherboard
- Trackpad Mechanism

Final Images



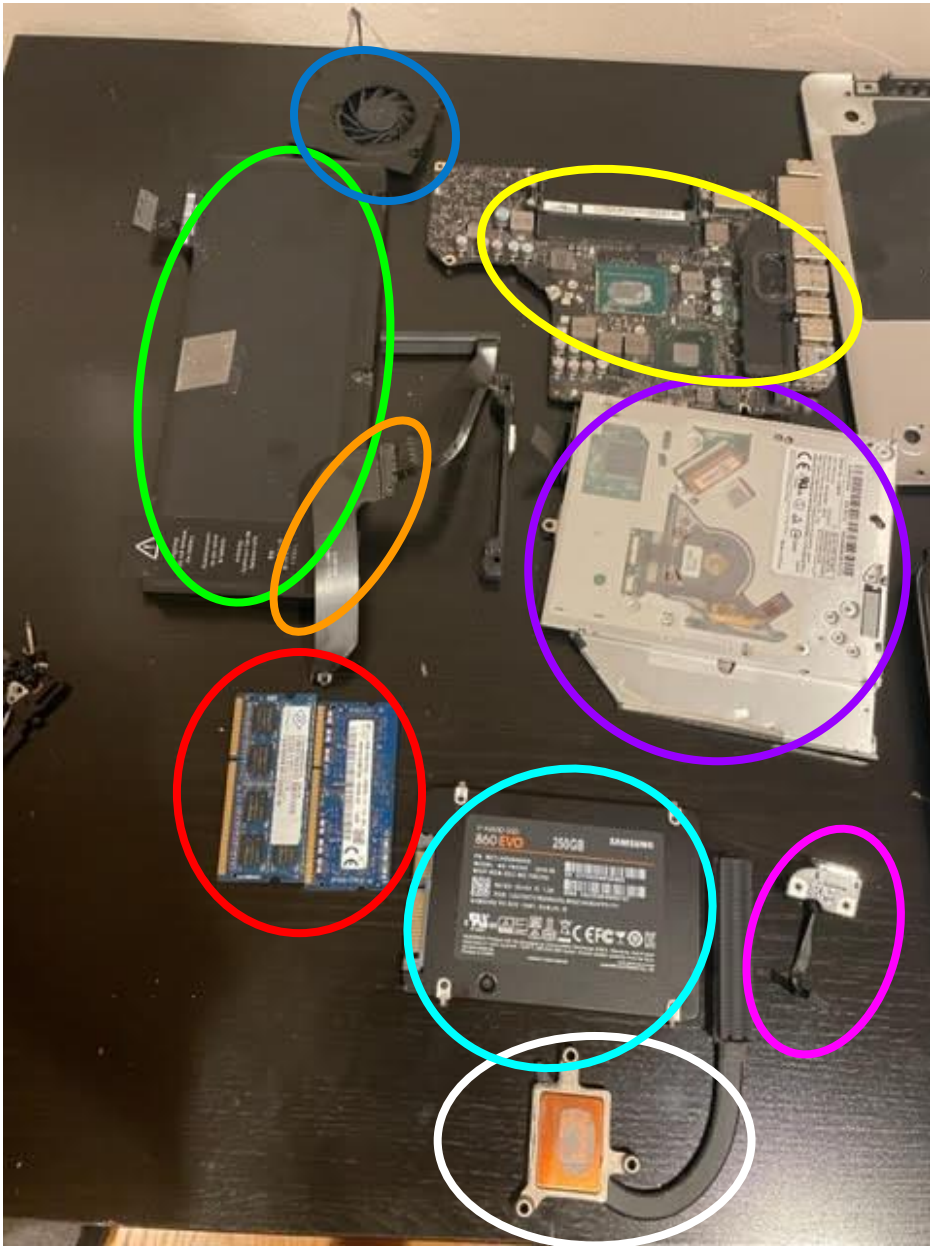
Final Images - Structure/Exterior



These parts are essential as they hold and protect all of the major components. The structure is mostly metallic on the outside and on the inside materials like plastic and foam are used to brace the components and allow them to connect and flow together in an organized way:

- Front Cover
- Motherboard Foam Bracing
- Back Cover & Component Holders
- Trackpad
- Plastic DVD Player Case

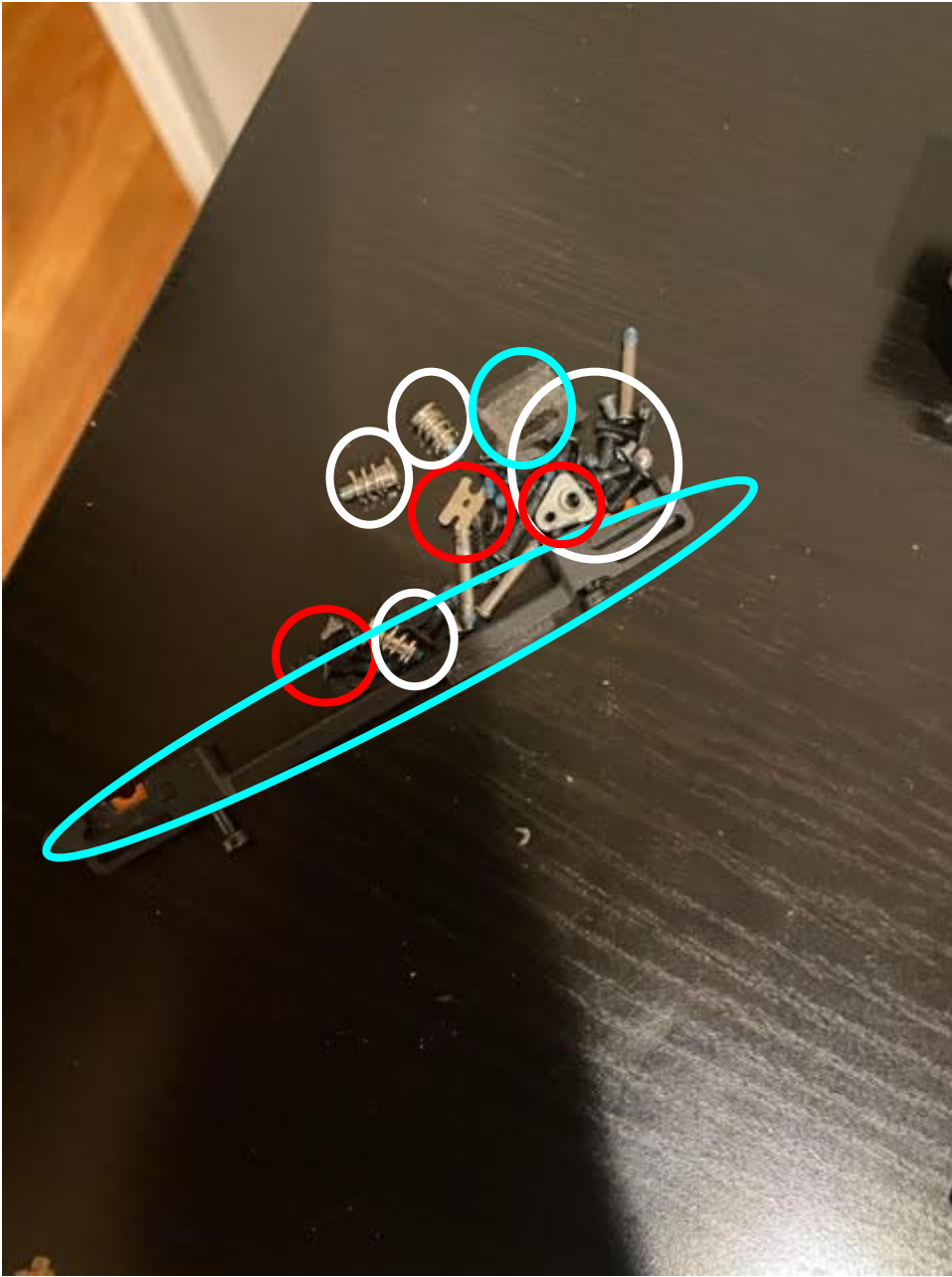
Final Images - System Components



These are the organs of the computer, it allows the laptop to function and carries out all of the commands the user puts in. These components provide and transfer electrical inputs to the motherboard which processes the information and carries out its function:

- RAM Chips
- HeatSink For CPU
- SSD Drive(Originally Hard Drive)
- Lithium Polymer Battery
- Main Driver Connector
- DVD Player
- MagSafe Port
- Motherboard & Ports
- Fan

Final Images - Fasteners



These mostly consist of screws, small structural components and fasteners, made from metal and plastic. These are very important as they secure all of the components as well as the structure into place. The screws themselves were very interesting and very specific to a computer like this, making them hard to take off:

- Metal Fasteners/Hinges
- Screws
- Plastic Fasteners/Hinges

Parts List



Parts List – Structure

Back Cover

- The back cover is mainly used to protect the most essential components, the cover is made of aluminum and has layers of padding to further protect electrical components



Trackpad Input

- This is the interior and the base of the trackpad, the touch sensor takes inputs from the outside of the trackpad and sends those signals to the motherboard in milliseconds, so you can see your cursor on the screen



DVD Player Brace

- The DVD player brace is one of the most interesting parts of the structure, being directly connected to the display, it is made of foam padding and special frames to hold in place securely



Parts List – Structure

Motherboard Frame

- The motherboard frame consists of sheets of plastic and rubber, these hold the frame in place. The motherboard is one of the most essential parts of the computer and needs the most protection



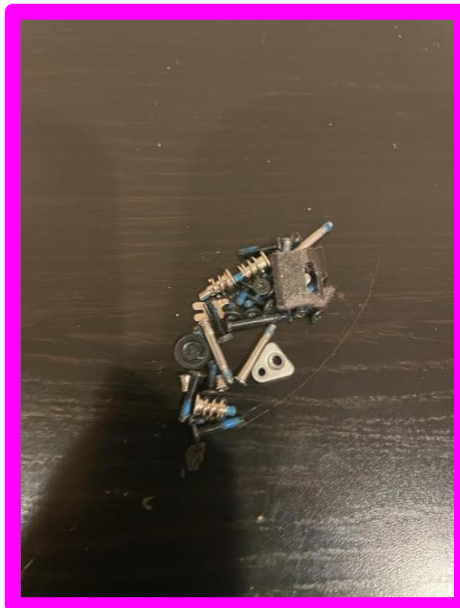
Plastic Braces

- These plastic braces are typically made of certain kinds of plastics and rubbers, they are mostly found connecting the frames for the components like the motherboard or the DVD player



Screws & Connectors

- To reduce modifications and tampering, all the screws and connectors you see were custom made and specific for this model of laptop



Parts List – System

Fan

- The fan is essential as it cools down the motherboard and other components so that the computer won't overheat and can function at full capacity



MagSafe Port

- This port is one of the most important ports. It allows the computer to connect to external power outlets and to keep the battery charged. This connects directly to the battery and the motherboard.



RAM Memory Chips

- RAM is random access memory used by the system to run, install and manage applications and programs. These extremely important chips enable the user's productivity via applications for browsing the internet, and for running the operating system. RAM is directly connected to the motherboard.



Parts List – System

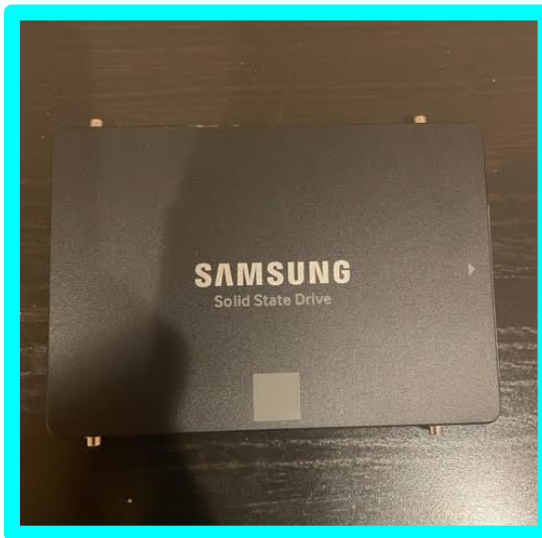
HeatSink

- The HeatSink removes heat from the CPU and this improves a component's performance and extends its life. These are typically paired with a fan to control the temperature of the CPU using airflow



Solid State Drive

- The Solid State Drive (SSD) is a mass storage device that stores all of the user's content as well the operating system and application files. This is connected to the motherboard, and unlike RAM, is permanent storage. This replaced an original magnetic hard drive.



DVD Player

- The DVD player is an important part of making the computer unique, it can play files stored on CDs and DVDs. It is connected to the motherboard.



Parts List – System

Motherboard

- The motherboard consists of many chips, ports, and connects to all of the computers components. All of the inputs that the user puts into the computer gets relayed to the motherboard and are processed. These functions and controls of the whole system make the motherboard the most important part of the laptop



Lithium Polymer Battery

- The battery is what supplies the computer with power and is the biggest component in the computer. This battery has 63.5 watts and is recharged using the magsafe port and is essential in allowing the computer to run.



Final Recap



Final Recap

Going into this project, we didn't know much about the different components of computers and what they do. It was enlightening to see all of these old components and see how technology was just a decade back. But not only was it amazing to see the components, it gave us a better understanding of how our modern computers work today.

We learned a lot from disassembling a older model laptop. Technology has changed much more than we thought it did over the years. We learned how components like the covers, frames and system components worked together in harmony. The **Frames and Back Cover** all worked together to support and protect important components like the motherboard and other system components.

The system components were all in some way connected to the motherboard. Parts like the **Touchpad, DVD Player, and Ports** take input from the user and that information is then sent to the motherboard for further processing, before it appears immediately on the screen. As all the components connect to the **Motherboard**, some parts protected and kept the motherboard alive. The **Fan and the HeatSink** are prime examples of this as both were used to keep the motherboard from overheating. Parts like the **Magsafe port and the Battery** are used to keep constant power running through the computer. These components are all connected using ribbon - like wires that span across the whole computer.

Connectors like the ones connecting the components to the motherboard are essential as the computer runs on power and information from all the different components. These typically consist of ribbon wires but the occasional regular black, red, and other intertwined wires used to connect all the components. The motherboard consists of many different parts like the **CPU, GPU, and Memory Chips** that are all connected using these wires. Parts like the **the SSD Drive** are also connected to the motherboard to store information.

Most of the **Frame** was just screwed in, in contrast components like the **Fasteners** were glued or soldered in for a more robust protection. We found it interesting how some parts were easier to take off than others. For example the **HeatSink** was soldered in, meanwhile the **Motherboard and DVD Player** were tightened using **unique screws that were hard to take off**.

We also learned how every single system component connected to the **Motherboard**, not only all of the peripherals but also the ports which feeds whatever the user puts in to the **Motherboard**. The **Motherboard** is **directly connected to the display**, which allows all of the users inputs to appear on the screen in front of them.

Another important thing we learned was that many small parts are put together to create a functional device. Every little piece plays a role in helping this Macbook work. Even the smallest of chips and wires can make a huge impact on the performance of the entire device, which is similar to how our robot and team works.

Thank You :)

