Operation Ultra Kirby (12223B)

VRC High School - Reverse Engineering a Lenovo Laptop

Information:

Students who participated: Stuart

Team Number: 12223B

Competition: VEX VRC High School

Location of Team: South Australia

Device deconstructed: Lenovo Yoga 730-13IKB

Word Count: 488 (Excl. front page and references)

Parts Explored:

Motherboard

Speaker

Fan

Trackpad

Keyboard

Fingerprint Scanner

Battery

Introduction

I chose to deconstruct a Lenovo Yoga Laptop as:

- laptops are designed to be taken apart easily, while still being designed intricately
- it was broken and was going to be recycled in e-waste.

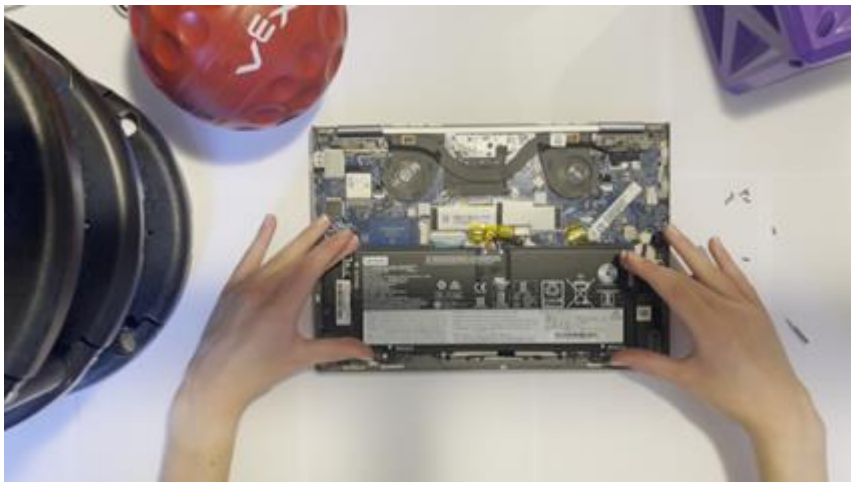
This computer is a complex electronic device that is only 4 years old, so is new enough for me to learn from.

Whilst not part of the requirements, I made a video of the deconstruction can be found here: https://youtu.be/4vd_6fDiqIw. Time stamps of the process can be found through the report.

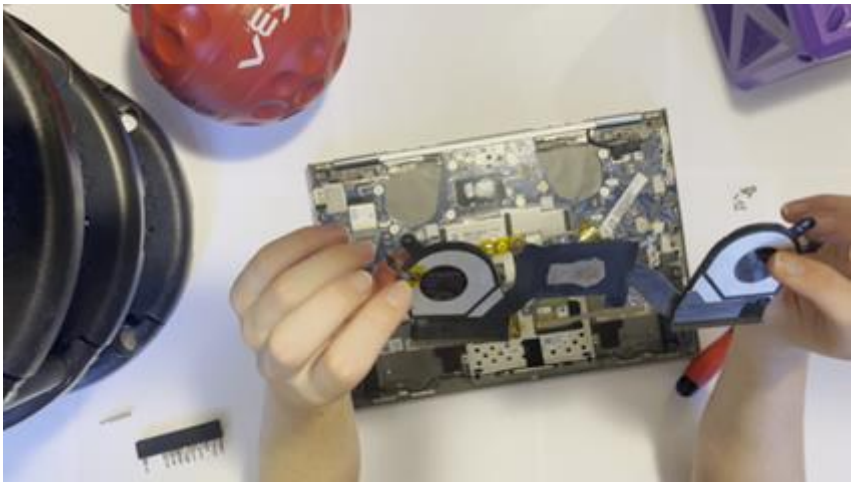
Throughout the video I referred to IFIXIT's Lenovo Yoga 730-13IKB Repair Page as an aid in identifying components.

Reverse Engineering

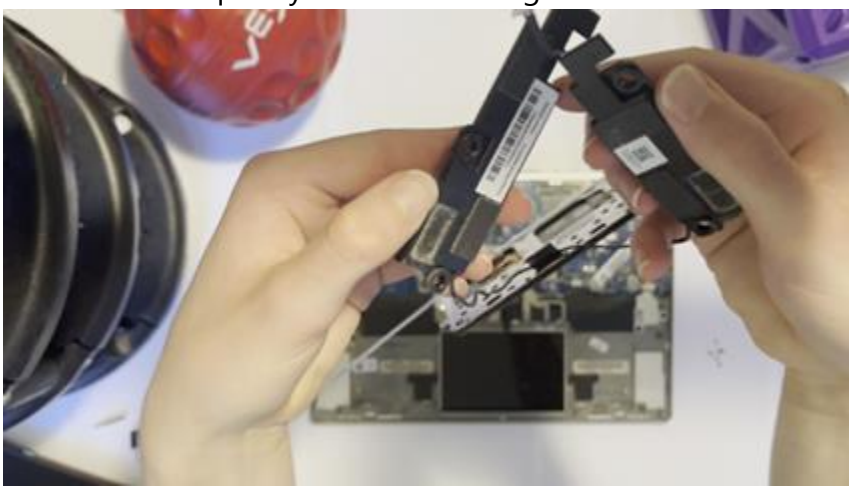
[1:00] Safety is important. After removing the back, I removed the battery. A damaged battery can be dangerous, or still powering the laptop and cause electrocution.



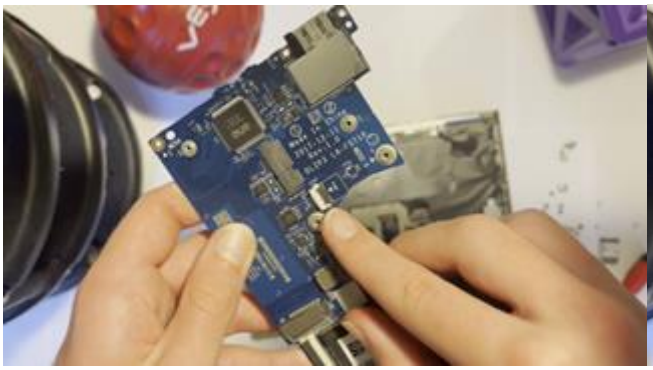
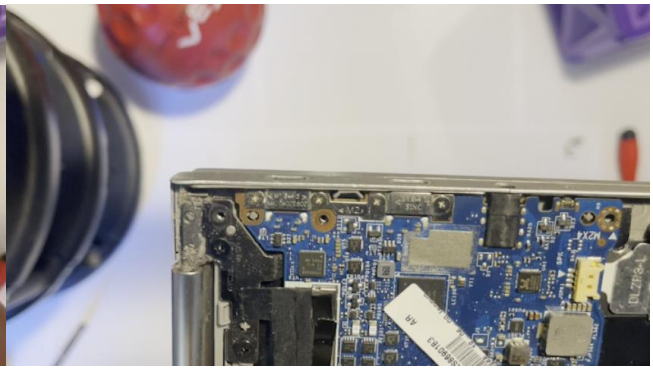
[1:46] I started on the top layer components; the first being the two fans. They were connected to the main processing board. Their shape helps air travel over the board to cool it. There was also cooling paste.



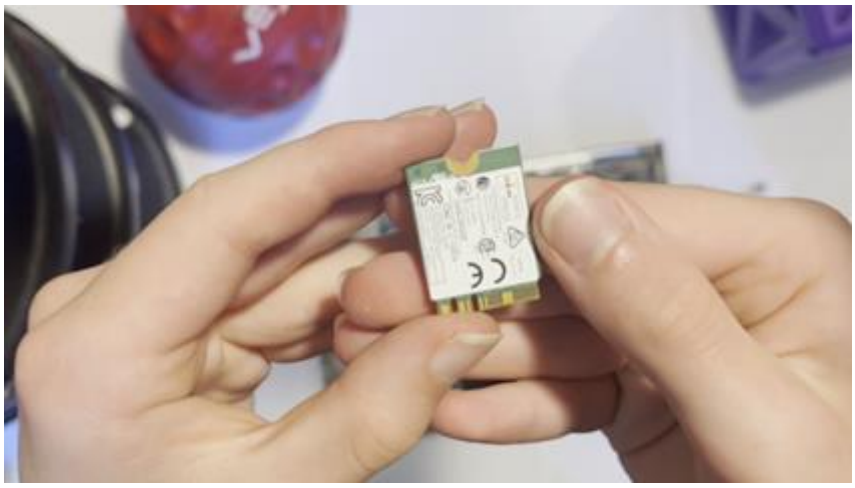
[2:55] Next the two speakers were connected by wire, but located on opposite sides (to support stereo sound). I noticed being magnetic they would repel and attract. Speakers use magnets to go back and forth quickly with electromagnetic waves to create sound waves.



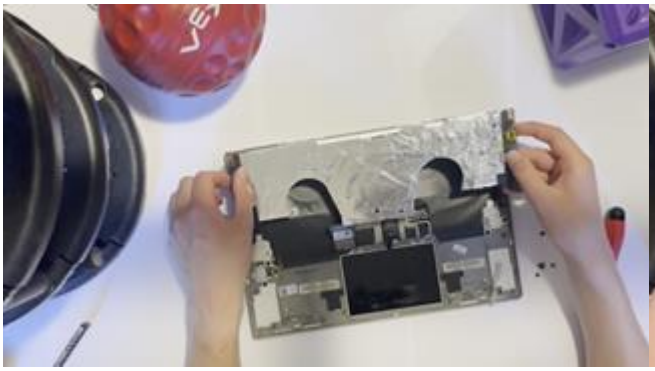
[4:02] As I was unscrewing the motherboard, I noticed labels next to each hole. I then noticed other labels on the circuit board, such as names of which parts connect to the ribbon cables.

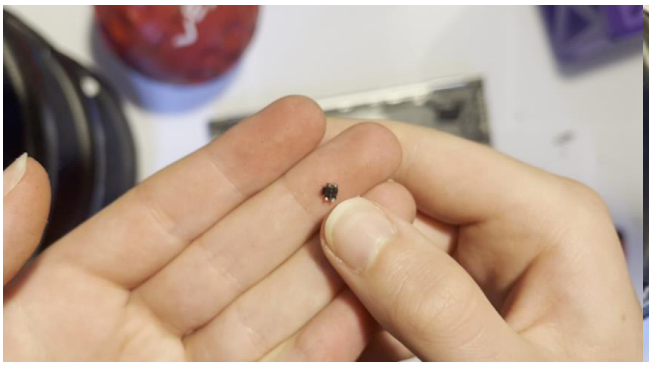
[6:15] Screwed onto the motherboard was a Local Area Network chip, which allows a device to connect to other devices locally. Underneath was the date the circuit board was made 11th December 2017.



[8:10] When removing the motherboard, I was trying to understand the purpose of the metal/plastic sheet underneath – possibly to stop inference with the keyboard.




[9:17] I found the little button for the power button. It was connected between the circuit board and the rubber power button. When power button is pressed, the rubbery plastic would force it to spring back into place.




[11:18] The keyboard remained, which took a while to remove due to many screws. Once off, I could see how the keys worked and removed all keys.


[14:10] I was hoping I could take apart the screen, but I could not find a way to open it safely without breaking the glass.

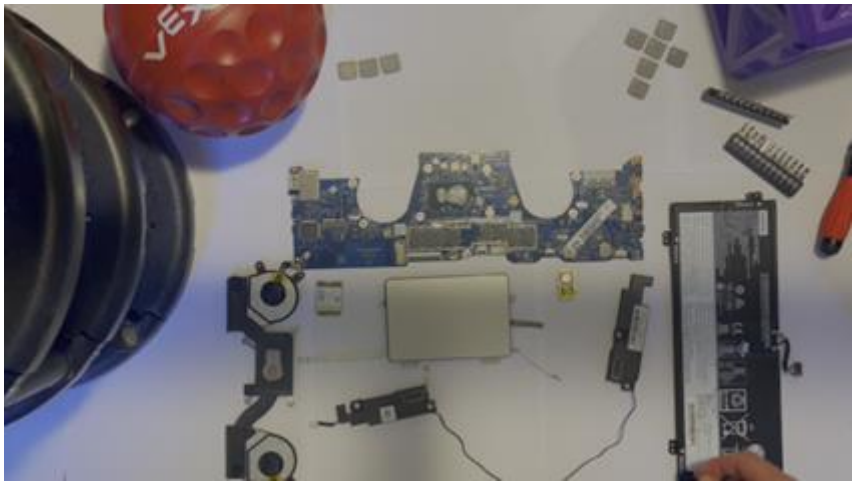
Conclusion

[14:34] Throughout this process I have learnt how compact a laptop is. Different components are right next to each other and are assembled like a complex puzzle.

That safety needs to be considered at all stages of the deconstruction, particularly with power sources and batteries.

I have also learnt that devices still take advantage of physical mechanisms, such as a bit of rubber in the power button to make it spring back into place.

I enjoyed exploring the innards of a complex electronic device and sharing my thoughts as a report and a video.



References

Lenovo Yoga 730-13IKB n.d., Photograph, IFIXIT, viewed 18 January 2022, <https://www.ifixit.com/Wiki/Lenovo_Yoga_730-13IKB_Troubleshooting>.

Stephens, J 2020, *Lenovo Yoga 730-13IKB Repair*, IFIXIT, viewed 6 January 2022, <https://www.ifixit.com/Device/Lenovo_Yoga_730-13IKB>.

VRC High School - Reverse Engineering Online Challenge sponsored by Texas Instrument 2021, REC Foundation, viewed 6 January 2022, <https://challenges.robotevents.com/challenge/169/vrc-high-school-reverse-engineering-online-challenge>.