TEAM 10173X

## (London, United Kingdom)

REVERSE ENGINEERING
CHALLENGE

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When we first heard of the Reverse Engineering Challenge, we all had various ideas of items we could use. We brainstormed and came up with many potential ideas that intrigued us to reverse engineer. We had ideas such as a CD player or a printer. However we couldn't come to an agreement on one of these since they didn't relate to us on a personal level.
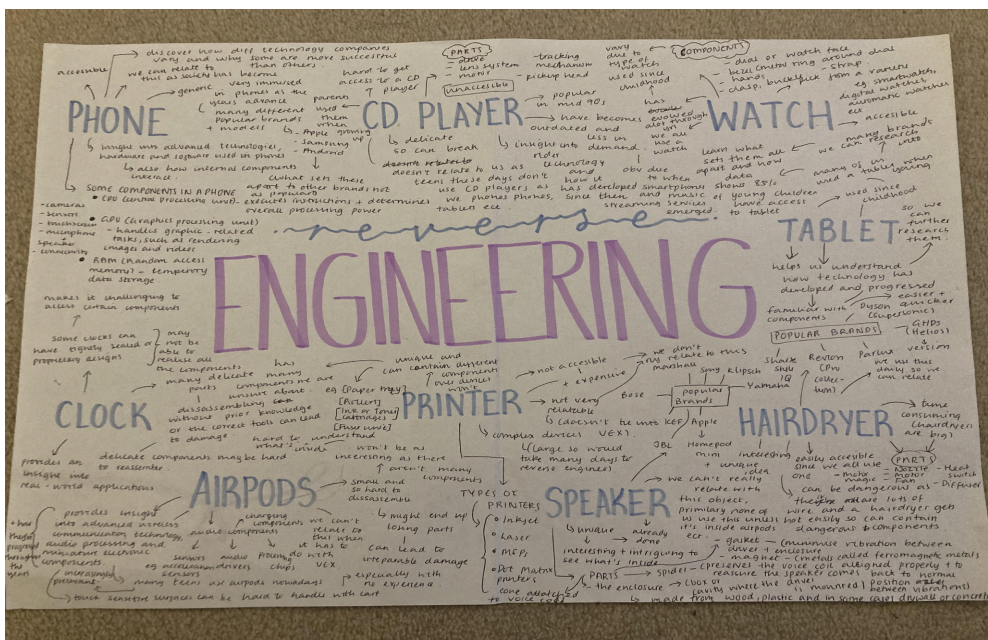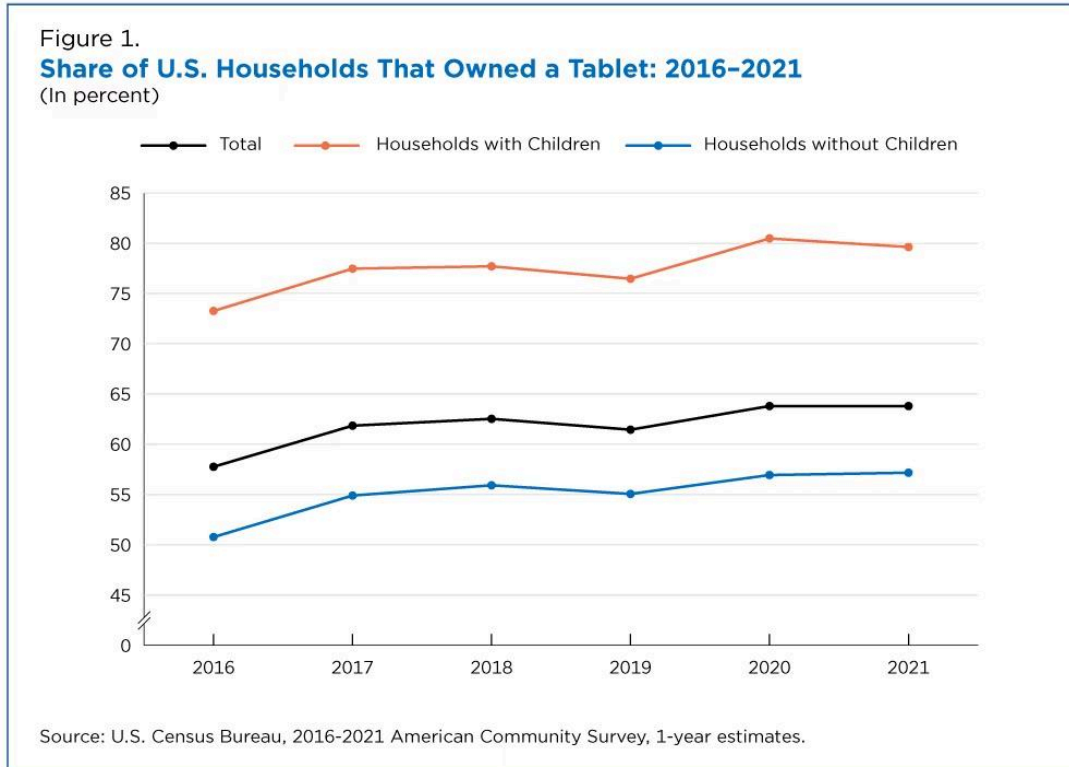
WHY A TABLET?

This generation is surrounded by technology, from phones to tablets to computers, making up an essential part of daily life. When discussing what object to use for our project, we concluded to take apart a popular device - a tablet, more specifically the Linx tablet Version8. It has been around for 12 years and 85% of children aged 6 already have access to a tablet. For something we use so often, we never stopped to think about the true inner workings of a device we are so dependent on.

What age are British kids given their own tablet?

Do you have access/ are you able to use any of the following devices? (% of 2,160 GB children aged between 6 and 17, answers for "tablets/iPads" shown)
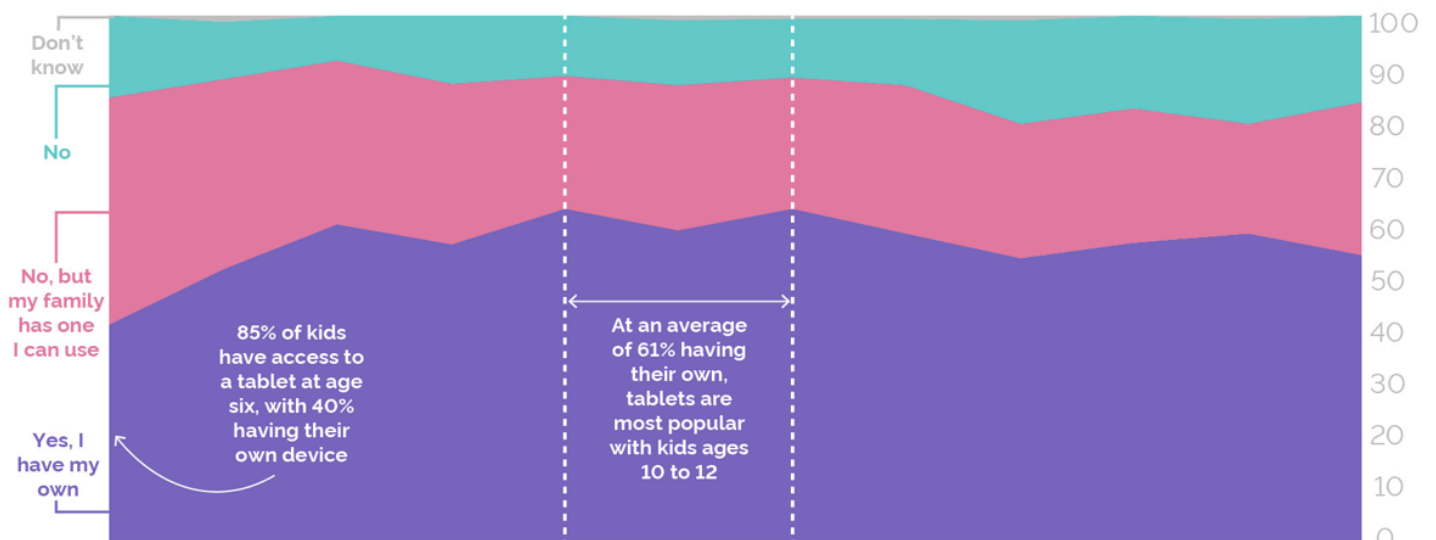
This figure predominantly shows how immersed our society has become in the idea of electronics and the prevalence of them especially among young children throughout the years.

Figure 1.
Share of U.S. Households That Owned a Tablet: 2016–2021
(In percent)

Source: U.S. Census Bureau, 2016-2021 American Community Survey, 1-year estimates.

This census proves that four out of five households with children owned tablets.

We decided to reverse engineer a tablet out of curiosity, passion for technology, and a desire to understand the complexities of modern devices. Tablets have become essential components of our daily lives since childhood as shown in the census, serving as versatile tools for communication, entertainment, and productivity. By delving into the reverse engineering process, we hope to uncover the underlying hardware and software components, gaining insights into the design principles and functionalities that allow these devices to function smoothly. This endeavour will allow us to broaden our knowledge of electronics, software development, and system architecture.

This Linx tablet version8 launched in 2012, and our aim was to see how much technology has evolved since the first tablet that was commercially successful appeared in 1989 and to see how much technology has progressed since the linx tablet was released. Using the Linx tablet will allow us to see both sides of the timeline of technology. Not only this, we also want to compare it to more renowned electronics companies (Apple and Samsung).

# RESEARCH

link of history of tablets - Google Slides
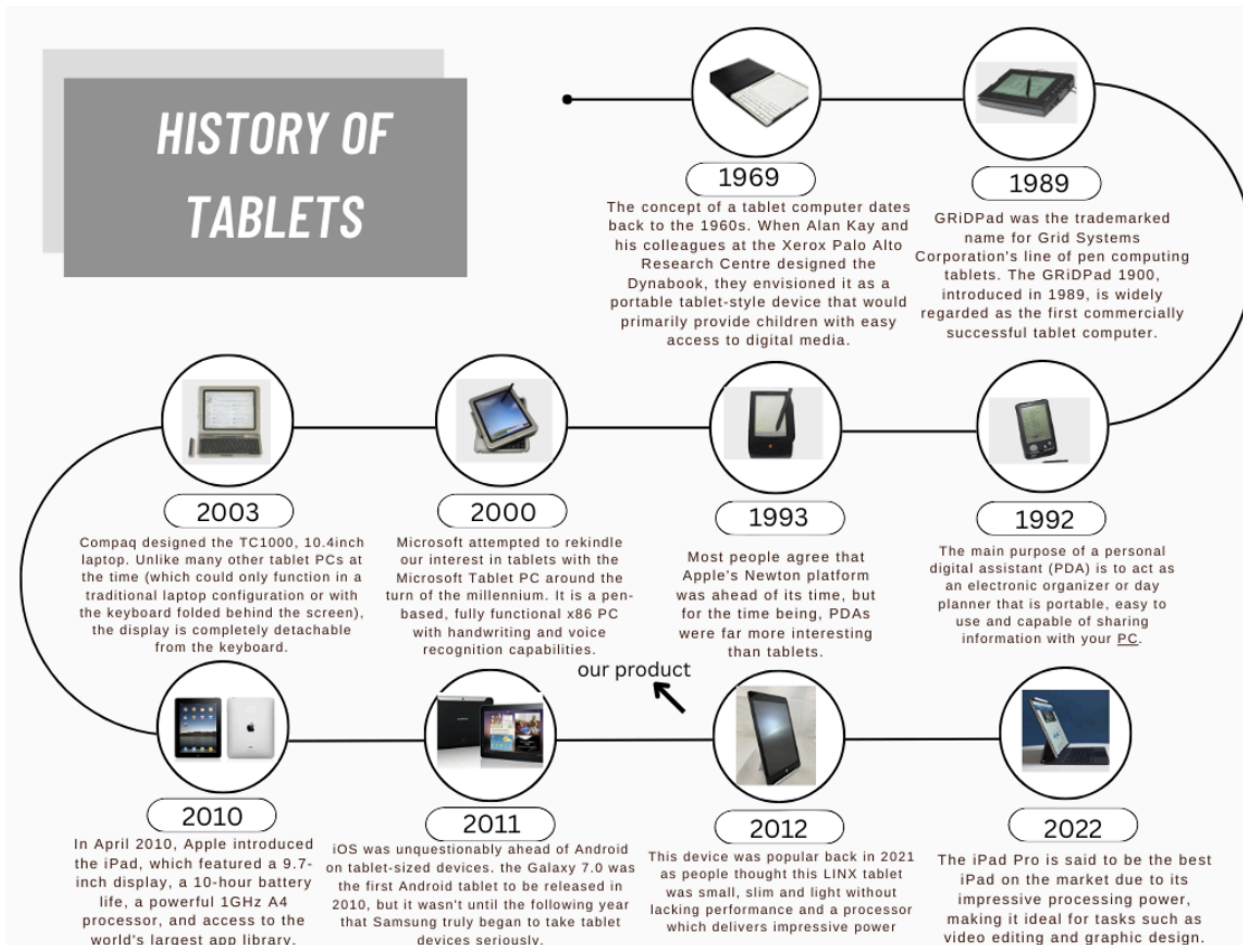
COMPARISON TO OTHER TABLETS

	Linx 8	Nexus 7 2013	iPad 2/mini	iPad 4	iPad Air	iPad Air 2	Shield Tablet	Surface Pro 2
Geekbench Single-Core	791	627	251	774	1465	1819	1123	2504
Geekbench Multi-Core	2196	2008	430	1408	2656	4510	3479	4762
3DMark Graphics	14696	10341	2625	11725	20001	31771	35433	47841
3DMark Physics	14607	11569	2870	8502	8368	10371	20250	30343
3DMark IceStorm Unlimited	14676	10558	2676	10814	15280	21776	30372	42324
GFXBench T-Rex	16.0FPS	15.0FPS	3.5FPS	16.5FPS	28.3FPS	70.5FPS	64.4FPS	63.0FPS

DISASSEMBLY PROCESS DIAGRAM
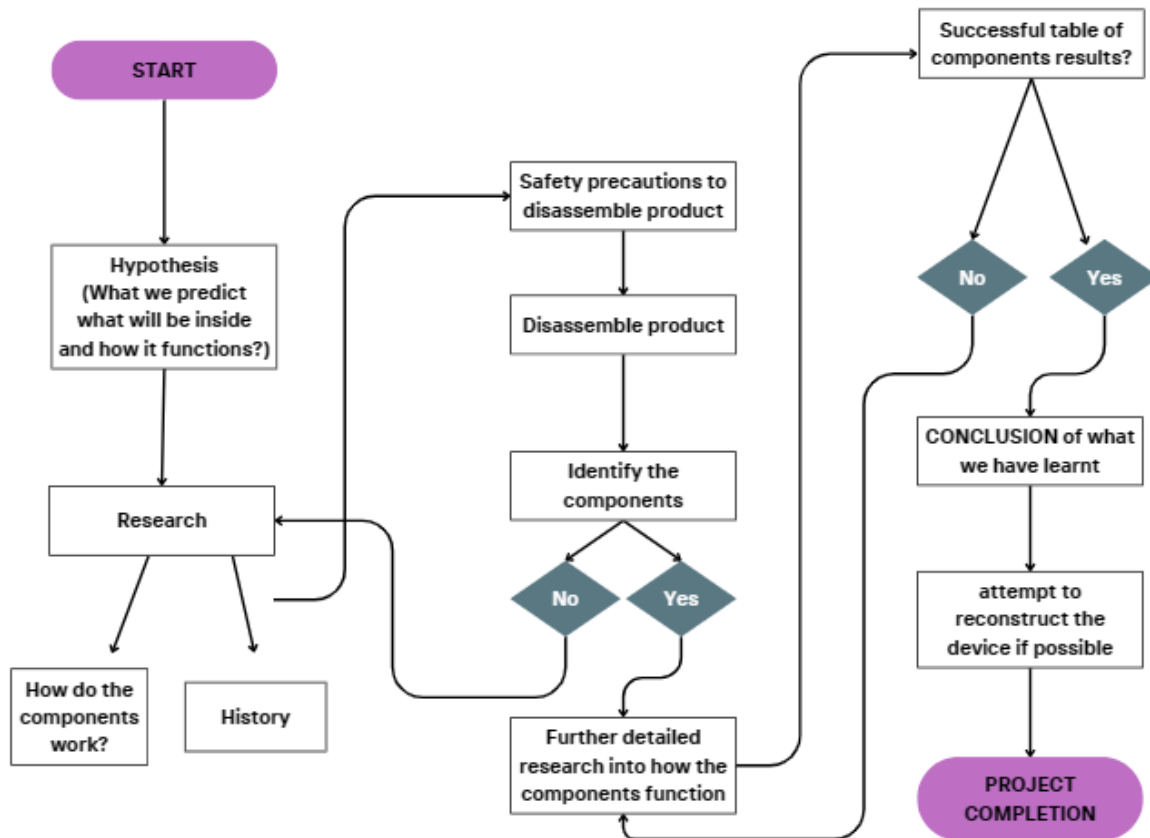
ARCHITECTURE DIAGRAM
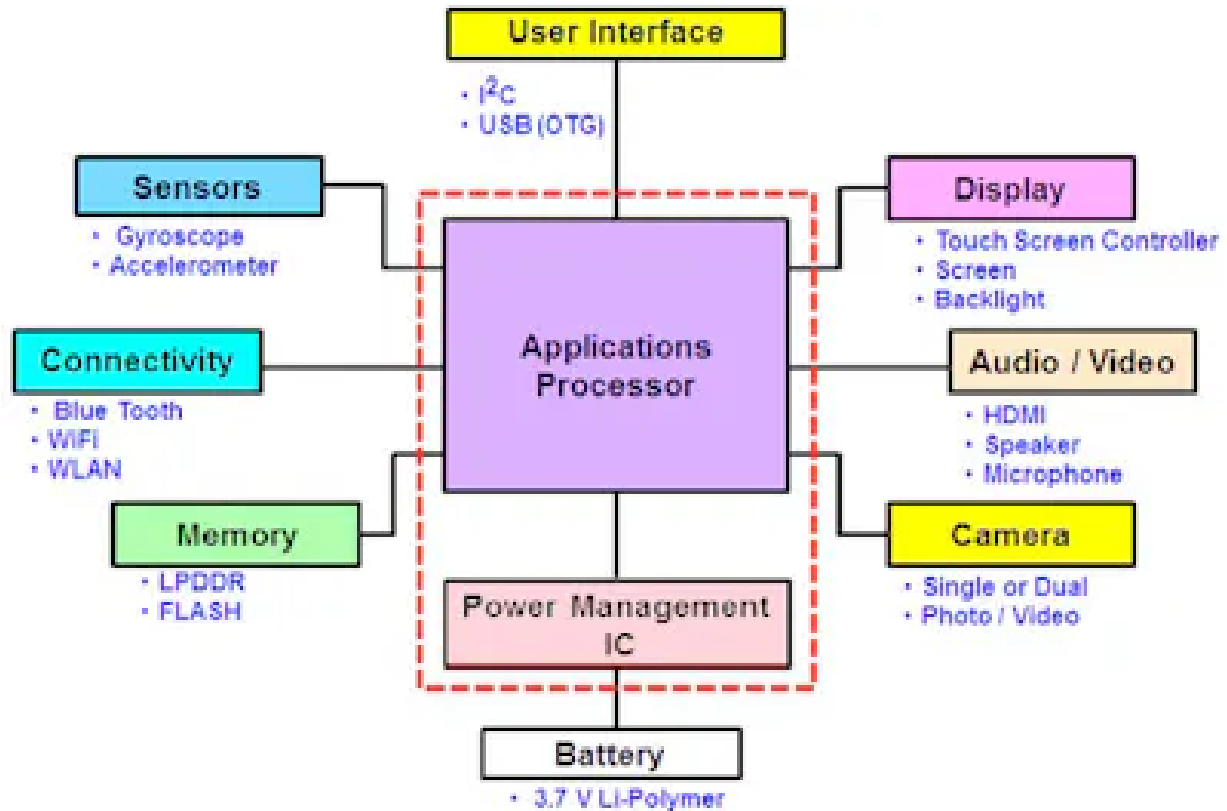
We used this architecture diagram to understand components in a tablet better and how they interact with each other to assist us when disassembling.

SAFETY PRECAUTIONS

HAZARD	SAFETY PRECAUTIONS
→ Getting electrocuted from certain components eg. wires	→ Ensure to disassemble the device by first disconnecting power sources. → Used insulating tools to prevent direct contact with live circuits
→ Chemical hazards eg. batteries, capacitors may contain hazardous chemicals	→ Wear protective gear such as gloves and goggles if required
→ Injuries from sharp bits of components	→ Take your time when disassembling and secure the workplace so that it is stationary and there are no sudden movements which can lead to injuries such as cuts.
→ Some devices can contain environmentally hazardous materials and toxic substances	→ Dispose these properly to avoid damage to the environment → Have an understanding of the device to see what toxic and dangerous things it could contain.

DIAGRAM OF EXTERIOR
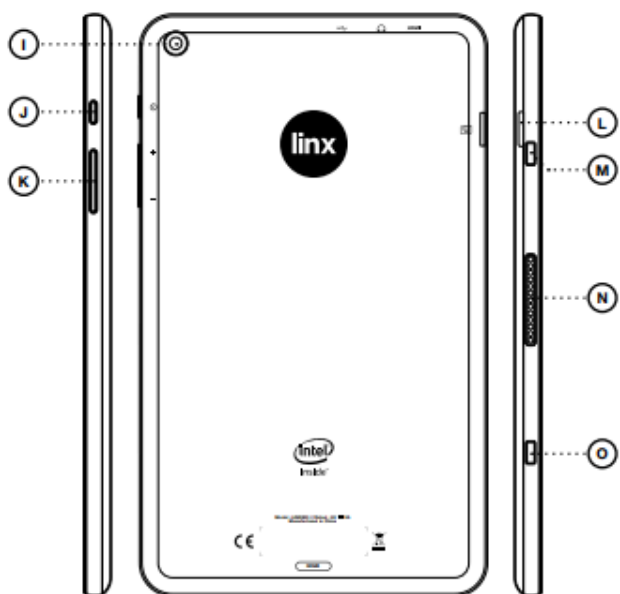
Specification.

I	2.0 Megapixel Rear Camera
J	Power / Sleep
K	Volume Up / Down
L	Micro SDHC / SDXC Slot
M	Accessory Mount Point

N	Linx Connector
O	Accessory Mount Point
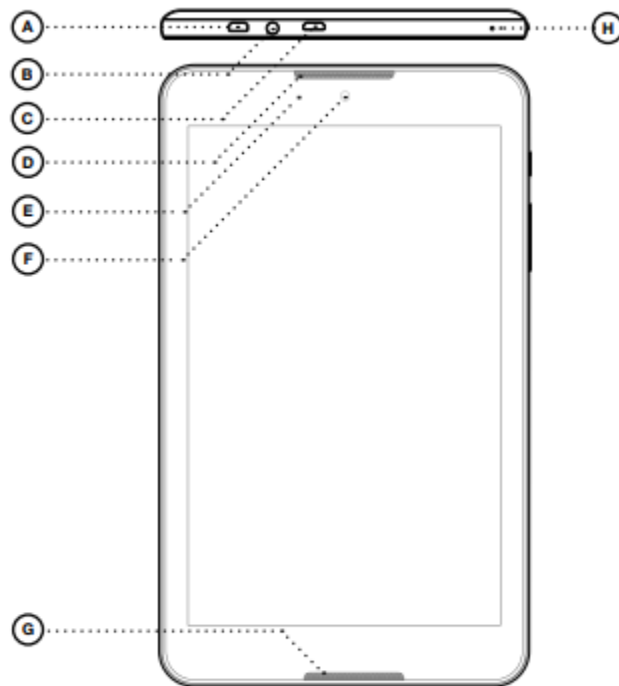
Specification.

A	Micro HDMI 1.4
B	3.5mm Headphone Port
C	Micro USB (Type-B)
D	Speaker

E	LED Indicator
F	2.0 Megapixel Front Camera
G	Speaker
H	Microphone

ANALYSIS OF EXTERIOR
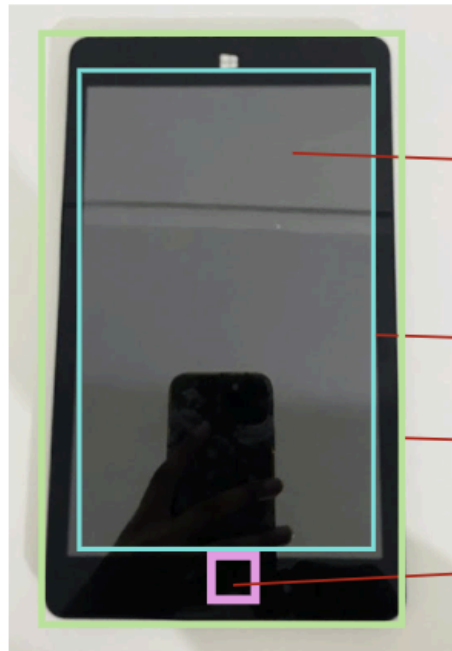
small, thin and lightweight

5-Point Capacitive Touch Panel

screen size = 8" diagonal

Primary Orientation = Portrait

no home button like you would expect in a Apple tablet
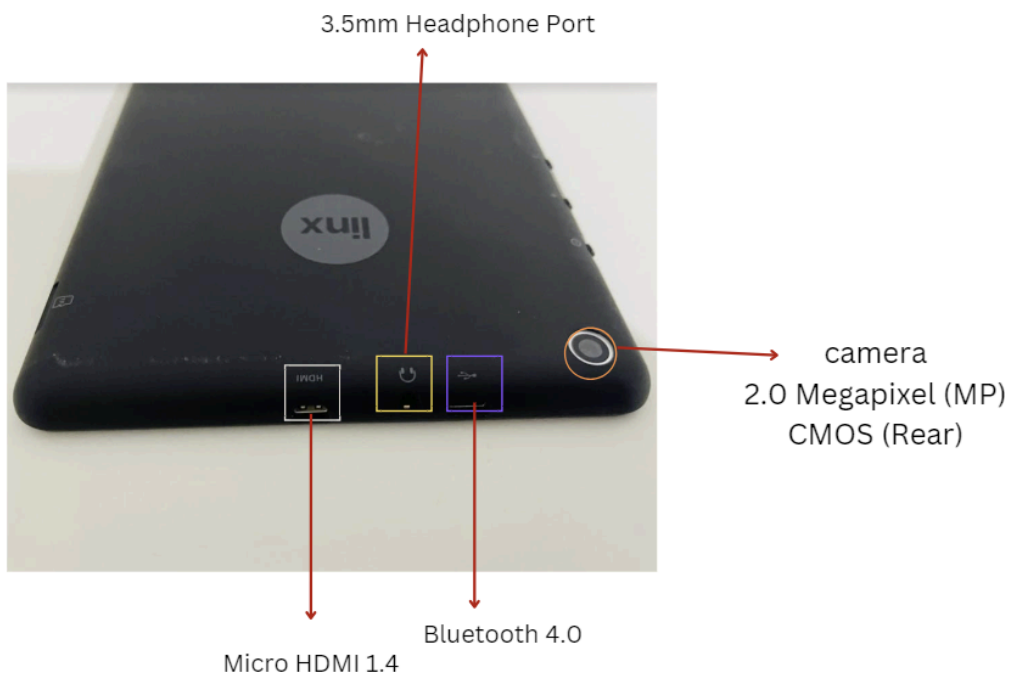
3.5mm Headphone Port

camera 2.0 Megapixel (MP) CMOS (Rear)

Bluetooth 4.0
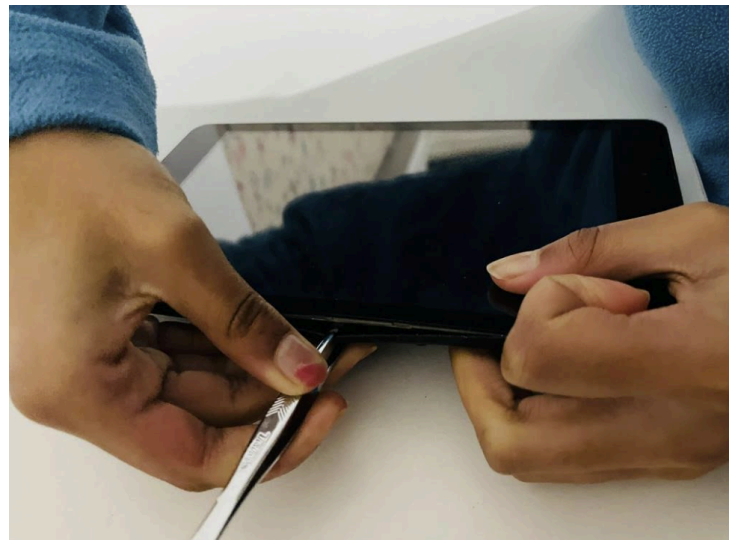
Micro HDMI 1.4

DISASSEMBLY PROCESS

DAY 1

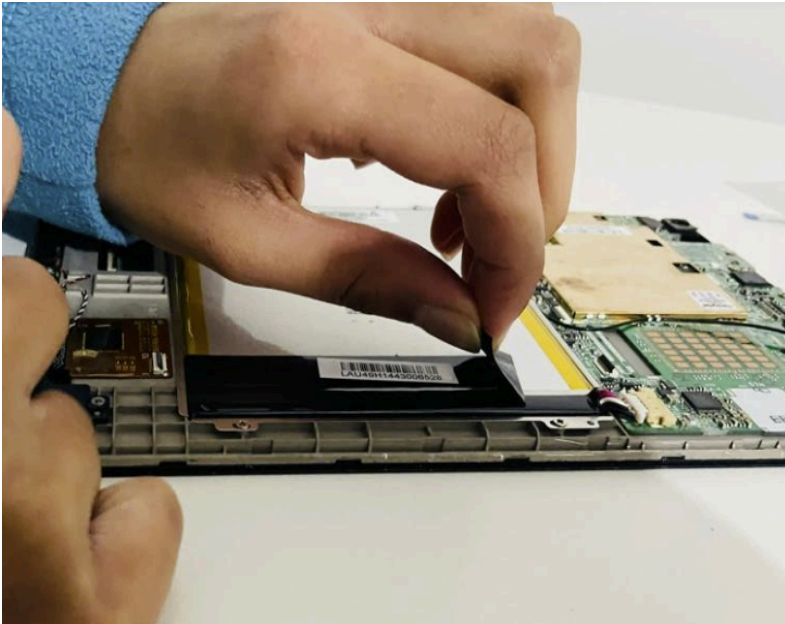**STEP 1** : Take measurements and remove the back cover

Tools used:
- Safety goggles
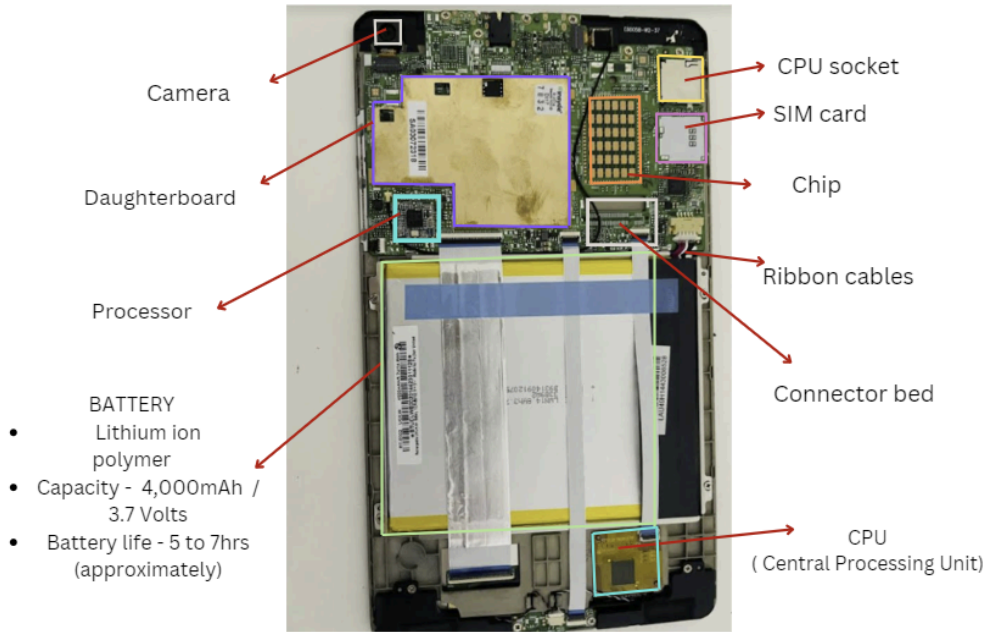- Tweezers
- Screwdrivers
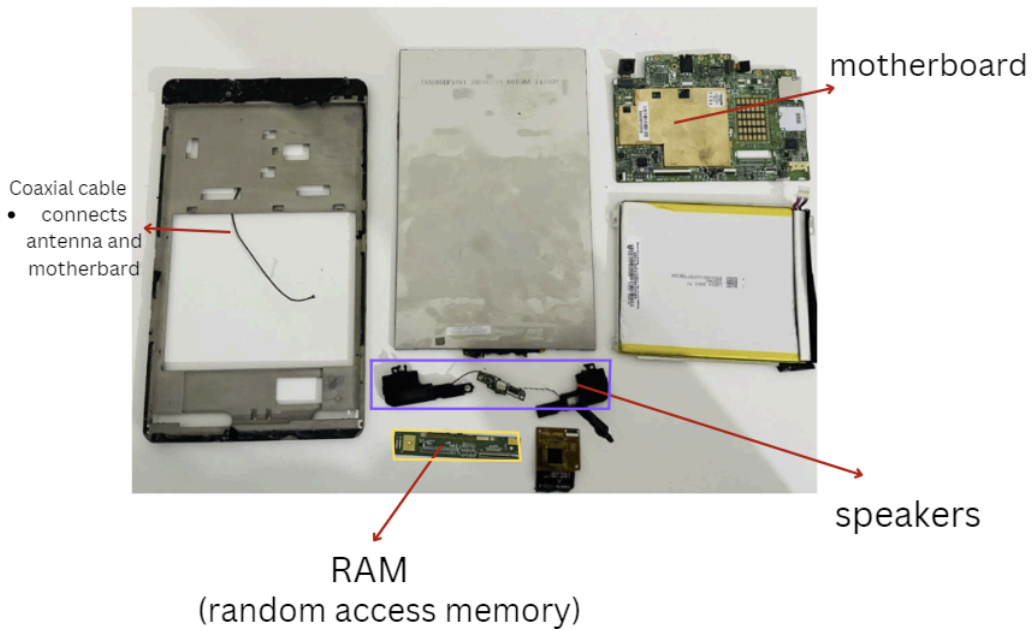
Weight : 460g
Dimensions : 215 mm x 126.7mm x 9.6mm

STEP 2: Ensure to remove components which can be hazardous (eg. battery)

STEP 3 : Label main components at the back

Camera

Daughterboard

Processor

BATTERY
- Lithium ion polymer
- Capacity - 4,000mAh / 3.7 Volts
- Battery life - 5 to 7hrs (approximately)

CPU socket

SIM card

Chip

Ribbon cables
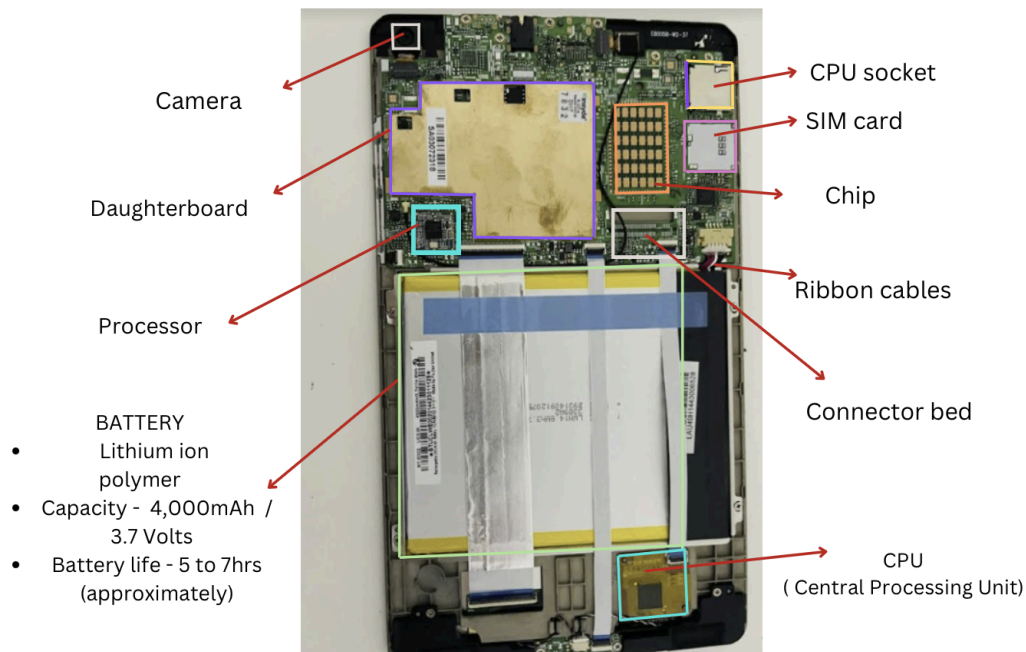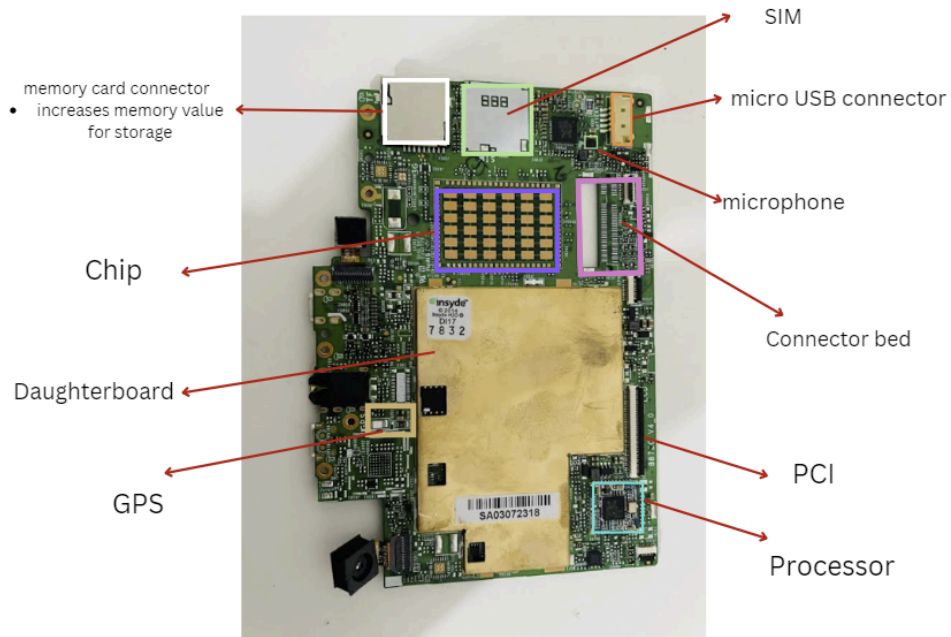
Connector bed

CPU
(Central Processing Unit)

STEP 4 : Separate all the components and label any new components

Coaxial cable
- connects antenna and motherbard

motherboard

speakers

RAM
(random access memory)
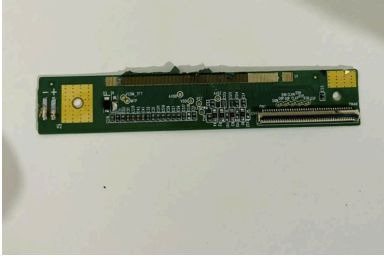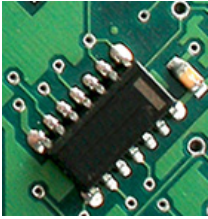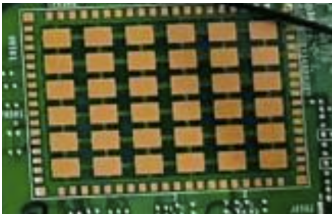
DAY 2
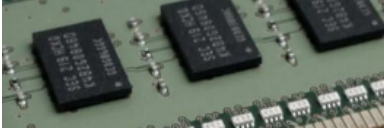
STEP 5: Inspect certain components in further detail to gain a stronger understanding.

SIM

memory card connector
- increases memory value for storage

micro USB connector

Chip

microphone

Daughterboard

Connector bed

GPS

PCI

Processor

Camera

CPU socket

SIM card

Daughterboard

Chip

Processor

Ribbon cables

BATTERY
- Lithium ion polymer
- Capacity - 4,000mAh / 3.7 Volts
- Battery life - 5 to 7hrs (approximately)

Connector bed

CPU
(Central Processing Unit)

ANALYSIS OF COMPONENTS

COMPONENT	IMAGE	DETAILS
Emf screen		Protects internals of motherboard from radiations
Internal connectors		Connects the inner layers
Battery		**5,800mAh / 3.7V made of Lithium-ion**
SIM card		Computer chips that hold information. It enables your device to connect to the internet if your phone's network signal is weak in a given area, and vice versa.

RAM		**2GB DDR3L-1600** RAM keeps data readily available, allowing your processor to complete immediate processing tasks without having to access long-term storage.
LEDs		Gives out light when an electric current passes through the LED screen.
Micro USB (Type-B)		**Micro HDMI port 1.4**
Chip		Process data to complete tasks
Motherboard		Distributes electricity and facilitates communication between and to the central processing unit, random access memory, and any other component of the device's hardware.

CPU		**Intel® Atom™ x5-Z8300** Responsible for executing instructions and processing data to complete tasks assigned by programs or applications.
Transistors		Used to create logic gates and memory cells, which process and store data.
Resistors		Helps to control the flow of electricity or dissipate excess energy in the device.
Ribbon cables		Used for data transmission and communications, commonly used as internal wiring.
Speakers		2 x Built-in 8Ω / 0.8W Speakers (Front Facing)

Further analysis of some components

RESISTORS

Resistive element
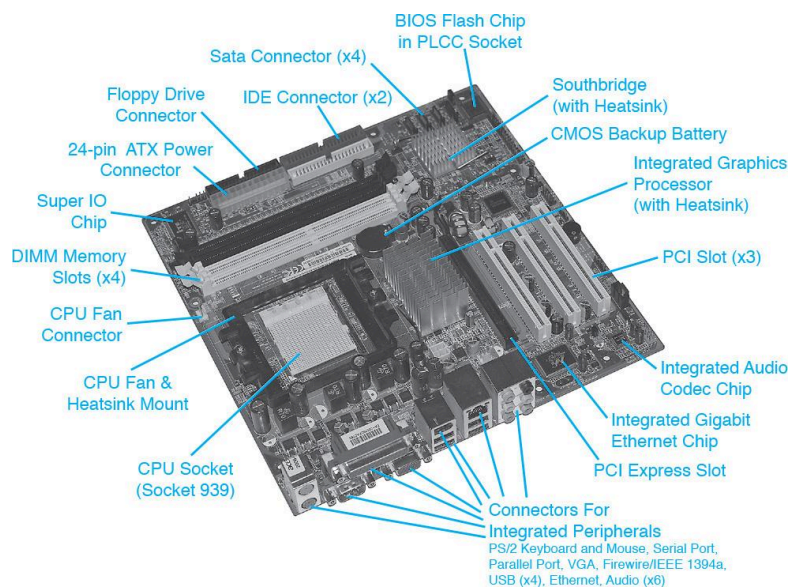
Insulating protective coating

Component contact

Ceramic body
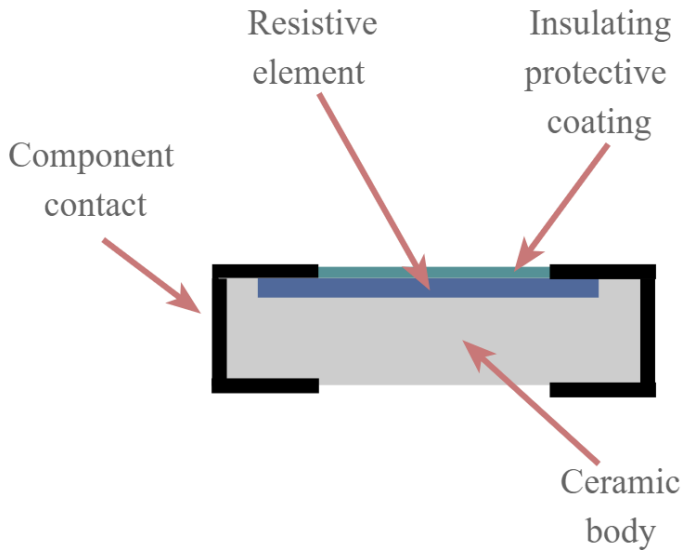
The type of resistor in the Linx Tablet are **chip SMD resistors**. They are manufactured using metal oxide or metal film and are coated with robust coating. allowing them to have a good temperature tolerance. The internal connection between the resistor element and the terminations is typically made of nickel, and the outer layer is made of tin to provide good solderability, which is essential for these components in a tablet.

MOTHERBOARD

MOTHERBOARD

BIOS Flash Chip in PLCC Socket

Sata Connector (x4)

Floppy Drive Connector

IDE Connector (x2)

Southbridge (with Heatsink)

CMOS Backup Battery

24-pin ATX Power Connector

Integrated Graphics Processor (with Heatsink)

Super IO Chip

PCI Slot (x3)

DIMM Memory Slots (x4)

CPU Fan Connector

Integrated Audio Codec Chip

CPU Fan & Heatsink Mount

Integrated Gigabit Ethernet Chip

PCI Express Slot

CPU Socket (Socket 939)

Connectors For Integrated Peripherals
PS/2 Keyboard and Mouse, Serial Port, Parallel Port, VGA, Firewire/IEEE 1394a, USB (x4), Ethernet, Audio (x6)

The Linx Tablet contains a **BTX motherboard.** is a strategy developed to fulfil the requirements of emerging technologies, which call for increased power consumption and, as a result, emanate more heat. During the middle of the 2000s, Intel ceased the future production of BTX boards to concentrate on low-power CPUs.

CPU
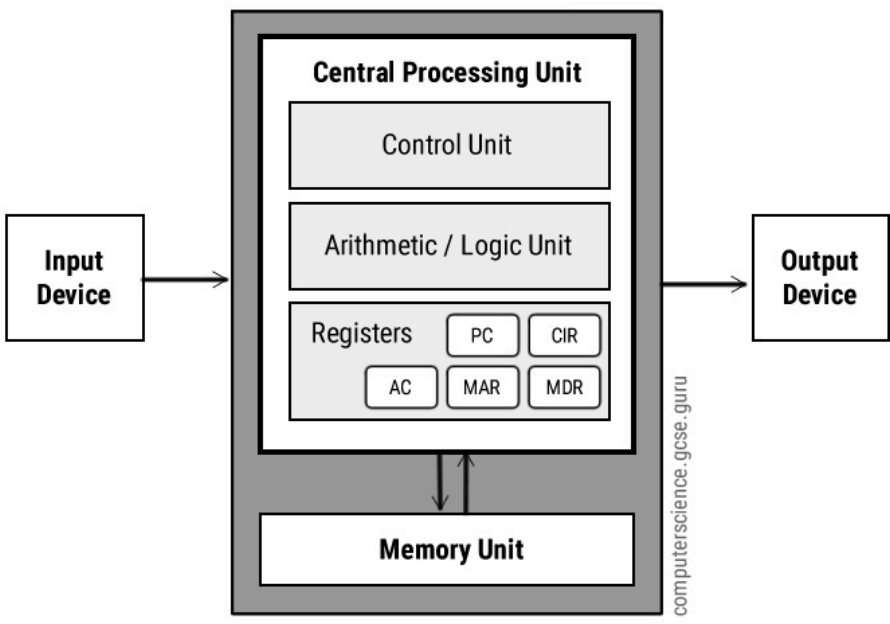
The Central Processing Unit used in the Linx tablet is Intel Atom® x5-Z8300 Processor which is responsible for executing instructions and processing data to complete tasks assigned by programs or applications. It contains 4 total cores and has 2 MB of cache and 2 W of scenario design power (SDP).

Intel Atom® x5-Z8300 Processor

CONCLUSION

Throughout this project, we learned how to safely take apart a tablet after assessing the electrical hazards. After successfully finishing this project, we have gained a profound and deeper understanding into the functionality of a tablet and the intricate technologies which has allowed our digital world to be shaped. The tablet was composed of many different systems and it was vital for us to thoroughly research and understand as many components as possible. The majority of this was through the internet, and we spent time after school analysing youtube videos and websites. This tablet is not that popular and we couldn't find much information therefore we weren't able to gain much insight on it, however this did not stop us as we decided to take our researching skills further by inspecting other tablets as well to see if there are similarities which could help us. Overall, we now have a deeper understanding of the components of a circuit board as well as how they work individually and collectively. We made effective use of our time by splitting jobs between team members and reporting our findings immediately to benefit the others. Through teamwork and perseverance, we completed this challenge.

SOURCES

- google
- http://support.linxtablets.com/Products/
- https://www.spiceworks.com/tech/hardware/articles/what-is-motherboard/
- https://en.wikipedia.org/wiki/Tablet_computer#:~:text=A%20tablet%20computer%2C%20commonly%20shortened,single%2C%20thin%20and%20flat%20package.
- https://all-spares.com/en/articles-and-video/what-s-inside-a-tablet-pc-and-other-mobile-devices/
- https://medium.com/@nithyaashreeg.ae19/whats-inside-an-electronic-tablet-98c37bc597ae
- https://www.google.com/url?sa=i&url=https%3A%2F%2Fm.youtube.com%2Fwatch%3Fv%3DWEbMrJMwE2g&psig=AOvVaw1ZzQPGXkpJENUSYD4mF5D-&ust=1706797070584000&source=images&cd=vfe&opi=89978449&ved=0CBMQjhxqFwoTCLDVttzoh4QDFQAAAAAdAAAAABAD