

REVERSE ENGINEERING

CLOVER ROVERS
83561A

CHESTER SPRINGS, PA



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Introduction

Our journey into reverse engineering began with a simple question: what makes things work? We thought about the tools we use every day, like laptops and phones, and then it hit us - printers play a crucial role too! With 60% of Americans relying on printers daily, we chose a color printer.

One day at school, the printer decided to take a break, leaving a bunch of frustrated students unable to print their assignments. That moment made us wonder: could we not only fix printers but also understand how they tick, so we could help others in similar printer pickles? That's when we stumbled upon the reverse engineering challenge, and we were all in!

Picking a color printer, the Epson Workforce 545, signaled the start of our adventure. We believe that by figuring out how things work, we're not just learning; we're solving real problems. Together, we're excited to dive into the challenge, hoping to make technology a little less mysterious and a lot more helpful for everyone. This is our story - where curiosity meets compassion, and learning takes us beyond the classroom!



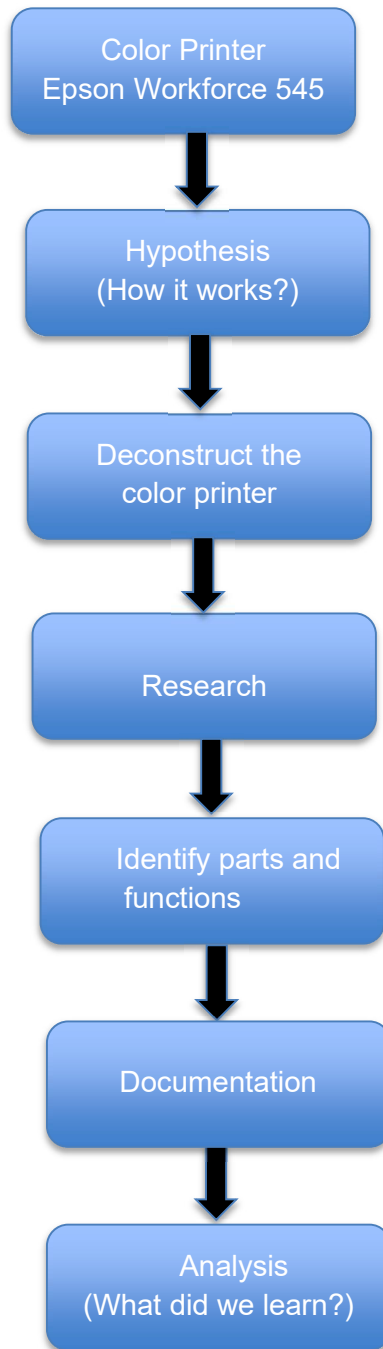
Clover Rovers – 83561A

What to Expect

Our decision to open up a printer promised a captivating hands-on journey filled with curiosity and discovery. Our research online provided insights into the printer's main tank, housing essential components like pressure-reducing valves, electrostatic sensors, deflecting electro plates, gutters, pumps, solvent tanks, and ink tanks. This revelation expanded our understanding of the printer's inner workings, revealing a complex interplay of mechanisms. We uncovered the role of ink pads, porous structures within the printer that collect and distribute ink, ensuring its efficient use during various printer functions, including initial setup, cleaning cycles, and printing borderless photographs. This unexpected journey not only fulfilled our expectations but also introduced us to a fascinating world of technology, where every element plays a crucial role in creating the printed pages we encounter daily.



Flow Chart



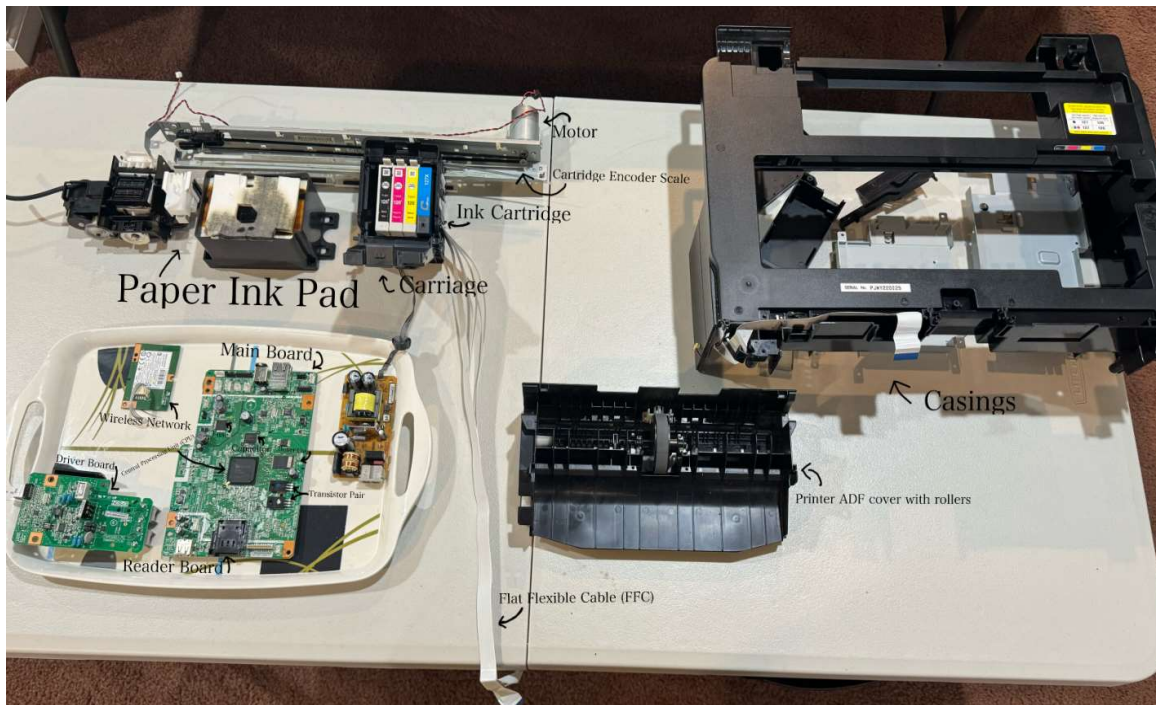
Approach

To make the complex assembly simple to understand we split the printer into three levels.



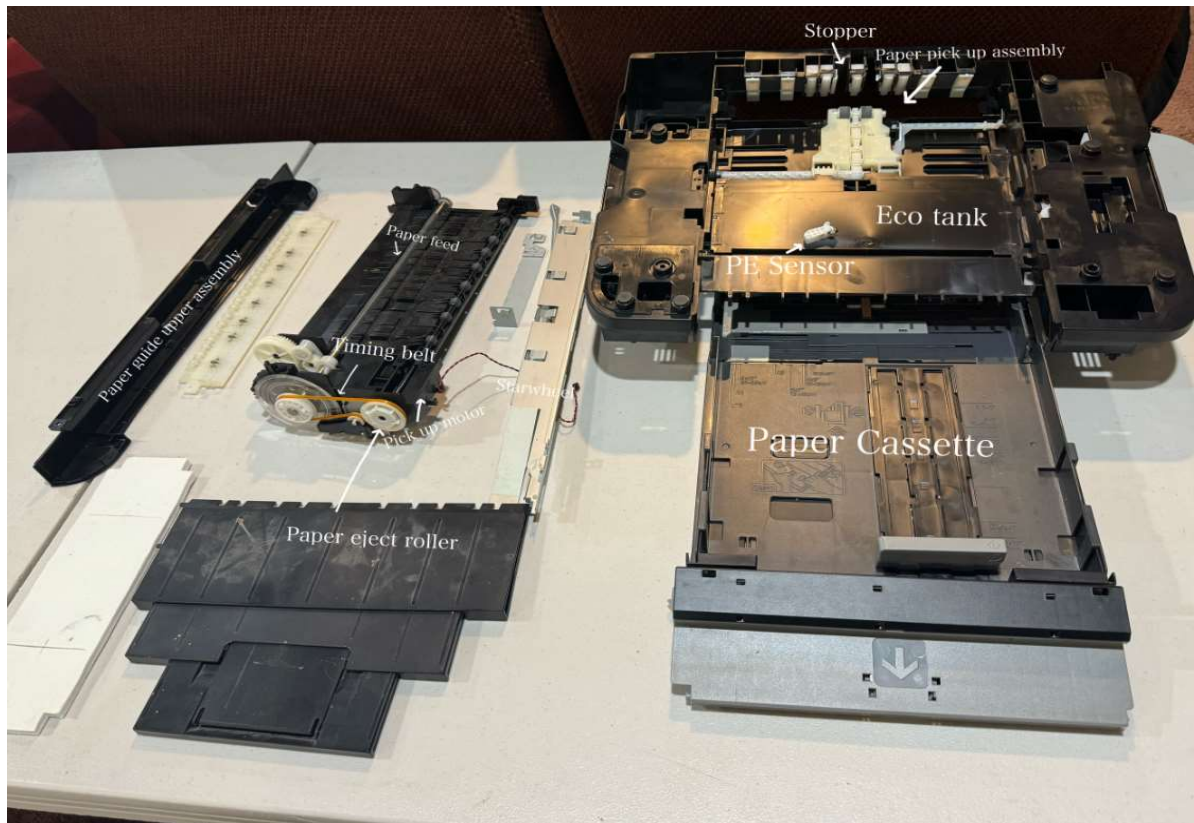
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Research

After taking apart the printer and trying to figure out its different parts, things got a bit confusing for us. We were specifically looking for parts related to color printers that we had read about. We managed to spot a few things like pulleys, the cartridge carrier, and circuit boards. Feeling a bit overwhelmed, we reached out to Ms. Archana Anand for help. Ms. Archana Anand guided us in understanding how information moves from the control panel to the print/scan head. She also taught us how to read the circuit board, pointing out components like capacitors, transistors, and chips. Each part has a special number, helping us find more information about them. (We have not detailed out the circuit boards due to the limitation of the word count).

Few of the online resources we used for our research are:

<https://www.digikey.com/>

<https://www.mouser.com/>

https://files.support.epson.com/pdf/wf545_wf545_ug.pdf

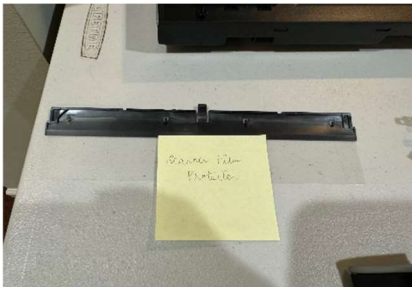
<https://computer.howstuffworks.com/inkjet-printer.htm>

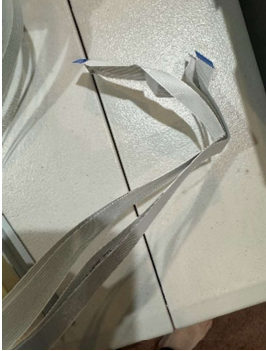


Former senior design engineer. She helps formulate and design mixed signal circuits for low-power custom ASICs for safety and security applications such as Smoke and CO Detectors.

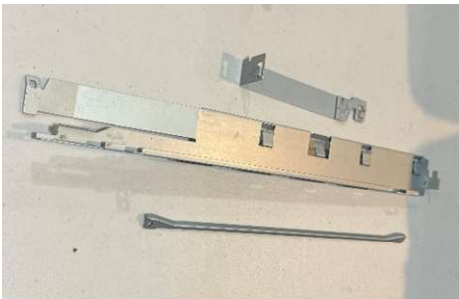
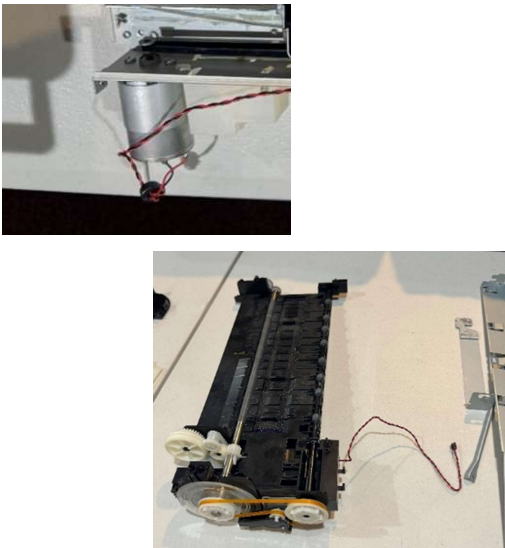
Archana Anand

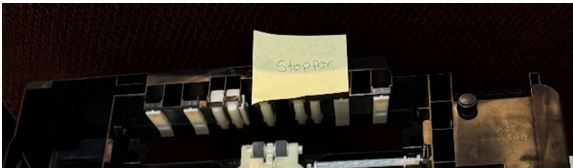
Parts List and Function

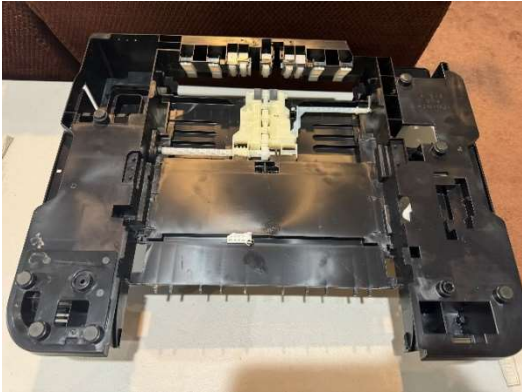
Top paper feed 	An extra input for manually loading paper into the printer.
Print head fits & Scan head 	The print head applies ink precisely, while the scan head captures and converts paper details into digital format.
Scanner film protector 	This safeguards the scanning glass, ensuring high-quality scans by preventing scratches or debris on the scanning surface.

Cables  Flat flexible Cable (everywhere) 	Cables establish essential electrical and data connections, ensuring seamless communication within the printer and external devices. Types include power, USB, ethernet cables, and FFC, facilitating efficient signal and data transmission in compact spaces.
Control board panel  	Known as the user interface, it acts as the command center for interacting with the printer, including user commands, settings adjustment, status display, and navigation.
1: Cartridge Driven Pulley 2: Cartridge Belt 3: Ink Cartridge 4: Cartridge Encoder Scale 	1: Guides ink cartridges in precise back-and-forth movements, facilitating accurate ink deposition on paper in a controlled manner. 2: Acts as a conveyor, moving cartridges to various positions. 3: Supplies ink (color /black) and is replaceable. 4: Works with sensors to track the ink cartridge's movement.

Mother Board or Main board 	Acts as the brain, managing data interpretation, print head movements, paper feed timing, and other tasks for cohesive operation and desired prints.
Printer ADF (Automatic Document Feeder) Cover with rollers  Paper pickup and paper guide assembly	Facilitates smooth page feeding, precise alignment during scanning or copying, and acts as a protective layer to prevent dust, debris, or damage, ensuring proper guidance and consistent feeds.
Wireless Network 	Enables cable-free connections, allowing users to send print jobs wirelessly.

Printer Casing 	This safeguards internal components for durability, safety compliance, and noise reduction by absorbing internal sounds.
Star wheel 	The star wheel guides paper, ensuring a straight path and preventing curling for consistent, issue-free printing.
Motors 	Motors convert electrical energy to mechanical motion, driving paper feed, printhead carriage, scanning, and gear functions. Types include Paper Feed, Carriage, Scanner Motors, and Gear Mechanisms.

Sensors ● Paper eject ● Paper width ● CRN encoder (Carriage encoder) ● Photo ink ● Pick up encoder	Sensors oversee paper, ink, and component status, detecting issues like jams or low ink levels to ensure safe and efficient printing operations.
Power Unit 	Distributes power to motors, heating elements, and control circuitry.
Gears, Screws and Misc. 	Printer gears transfer power, coordinating component movement. Screws secure vital components, ensuring stability.
Stopper 	Stoppers limit and control parts, ensuring precise alignment and coordination.
Paper cassette 	Stores and supplies paper, ensuring a steady print supply without frequent reloading.

Paper feed roller 	Advances sheets, ensures alignment, prevents multiple feeds, and reduces paper jam risk during printing.
Paper eject roller 	Guides printed paper smoothly out, reducing paper jam risk, and assists in stacking pages neatly in the output tray.

Conclusion

In concluding our exploration of the printer, we not only understood its workings but also felt a great sense of achievement. Disassembling it revealed interesting components, and our research showed that learning tech can be hands-on and exciting. This project was more than just printers; it was about teamwork, solving puzzles, and the thrill of discovering how things work in our tech-filled world.