

31213T Tectonic Tsunami **REVERSE ENGINEERING CHALLANGE SUMMARY REPORT** ihal Thakkar. 2023-2024

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TABLE OF CONTENTS

Page 1: Introduction Page 2: Approach and Planning Page 3: Research Page 4: Dissambly Page 6: Non-Electronic Components Page 7: Electronic Components Page 9: Roles of the Components Page 10: Conclusion/Learnings Page 11: Work Cited



INTRODUCTION

Our team is passionate about robotics, engineering, and music. During long meetings, we love listening to music. We were fascinated by how a simple voice command plays music on the Amazon Echo Plus. So, we took the opportunity of the reverse engineering challenge to learn how our favorite speaker/personal assistant, Amazon Echo Plus works. We also considered a broken dishwasher and a damaged VEX V5 controller for this challenge but the voice commands converting to action was far more interesting.



APPROACH AND PLANNING



RESEARCH

Devices such as Alexa have become universal and are revolutionizing the way we interact with technology, making our lives more connected and convenient. Alexa utilizes voice commands by applying advanced natural language processing algorithms to interpret instructions. This allows users to interact seamlessly with the device. Voice-enabled IoT devices have evolved significantly, from basic home assistants to advanced devices that can control entire homes. To do this, Amazon utilized a variety of sensors ranging from microphones to pressure sensors.

DISASSEMBLY

Tools needed:

- Safety Glasses Screwdriver set
- Pry tool

NON-ELECTRONIC Components

Description	Photo
Small speaker Housing	
Mesh and plastic Outer Housing	
Bottom grip pad	
Buttons for volume and mute	

ELECTRONIC COMPONENTS

Description	Image	Location
Charging Ports : Connect to power.		
Speaker and Subwoofer : Amplify sound		Spaker Designed Desig
Capacitors : Enhance performance		Speaker Charging Port Charging Charging Charging Description Charging Description Charging Description Charging

Pressure Sensor: Detects the clicking of the volume buttons and the mute button

Heat sink: Dissipates heat

CPU: Processes and executes instructions

ROLES OF THE COMPONENTS

The Amazon Echo integrates several components to make it function smoothly and flawlessly. Capacitors provide a stable power supply, preventing voltage changes and protecting sensitive components. The CPU acts as the device's brain, processing voice commands, data processing, and managing operations. The heat sink dissipates heat generated by the CPU and prevents overheating. Pressure sensors enable touch or physical interactions through buttons. The speaker produces clear audio responses, such as Alexa's voice. Lastly, the power port connects the device to a power source, supplying the necessary energy for its operation. Together, these components collaborate to create an efficient and responsive smart personal assistant.

CONCLUSION/LEARNINGS

Throughout this project, we learned how to disassemble a machine and put it back together safely. We learned how to pay attention to details as it was important to understand all aspects of the device.

Lessons Learned:

- How electrical currents work
- What are the components of a circuit board and their role
- Importance of knowing details of a machine in and out.
- How to read patents to understand the motherboard and other components.
- Teamwork and effective communication are important to take on big tasks.

WORK CITED

- Patents for Alexa
- <u>Transfomative loT</u>
- How Alexa Works Guide
- <u>Amazon IoT Solutions</u>