

750W South Brunswick, New Jersey

Members - Gyan, Prisha, Rahi, Arav, Raghav,
Anirudh, Shreyas, Samyutha, Ved, Akshay,
Ishaan and Aashika

TI Reverse Engineering



Insignia NS-CSPBTHOL

We chose this Speaker to dissect for this challenge. Speakers are embedded into our daily lives like in our cars or in our smart phones and we've never really understood how it works and intricate it is.





Components



Insignia Speaker Components

- ◆ Motherboard
- ◆ Battery
- ◆ Buttons
- ◆ Speakers





Motherboard

Motherboard's Function

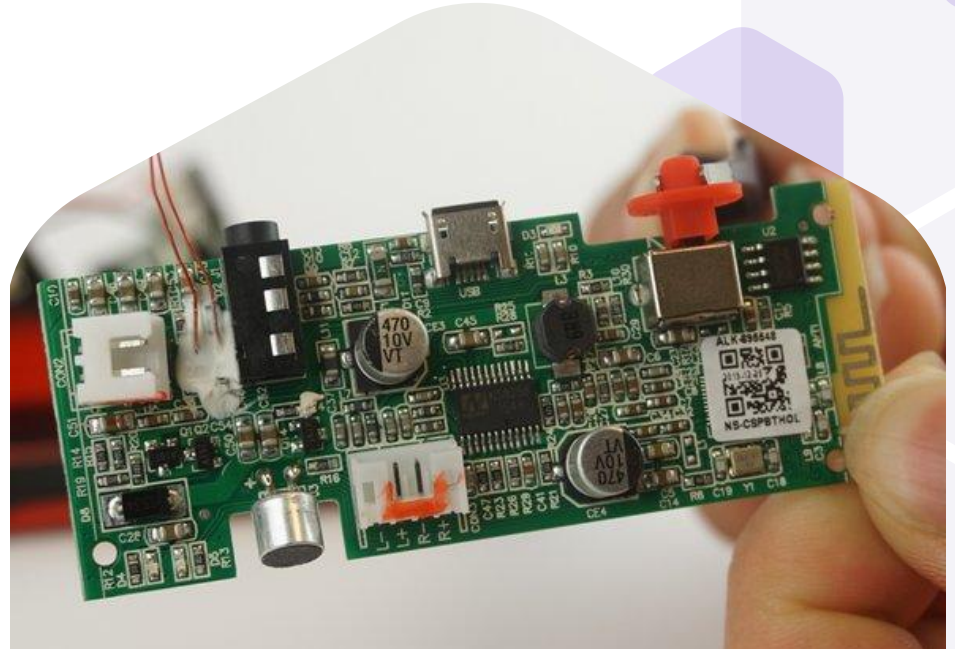
- The main printed circuit board, holding and allowing communication between all the main components of the system.

Function in relation to the Speaker

- Handles all of the functions of the speaker
- Manages the flow of current throughout the speaker and is the “brain” behind the system.

Components Purpose and the role it plays in the system

- Broken up into sections for battery charging, voltage reduction, audio amplification, and Bluetooth
- Also on the back are the buttons to control the volume of the speaker, make phone calls, and change the source
- Redirects current, power, and other vital components to keep a system running to the appropriate parts that need it.



Battery

Function in relation to speaker

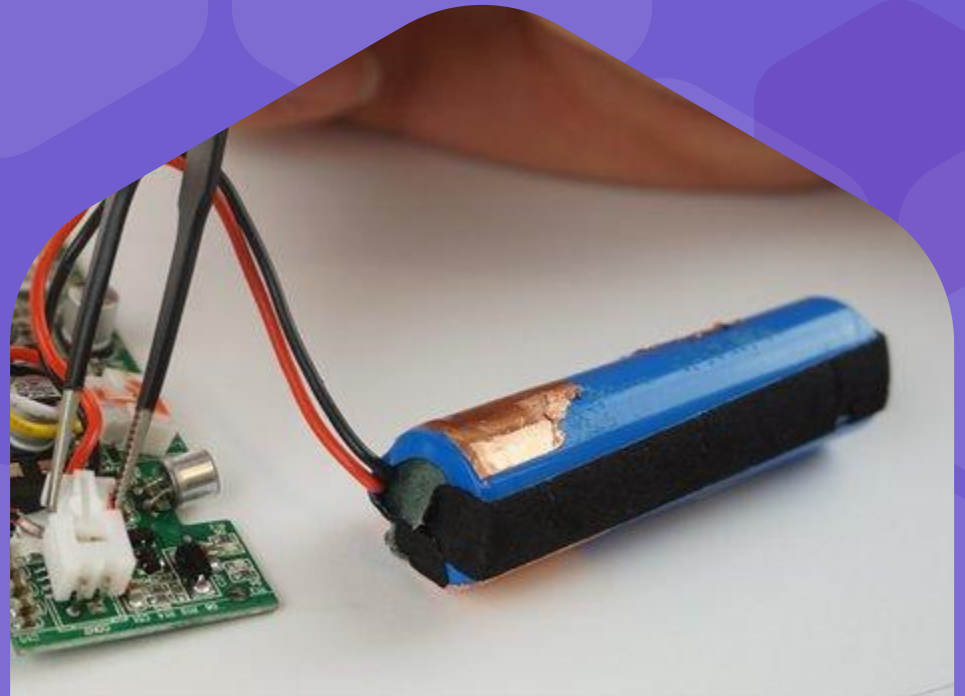
- Lithium-ion batteries are most commonly used in speakers
- Provides the speaker the ability to allow the product's consumer to use it for multiple long hours without recharging

Components Purpose and the role it plays in the system

- When the current can flow through the circuit the speaker can operate.
- Since it is rechargeable, the speaker does not need battery replacement, but rather just a simple plug in.

Battery's Function

- Supplies power through a positive and negative charge
- The flow of electrons creates an electric current to do work
- The chemical reactions in a battery take place in an external circuit





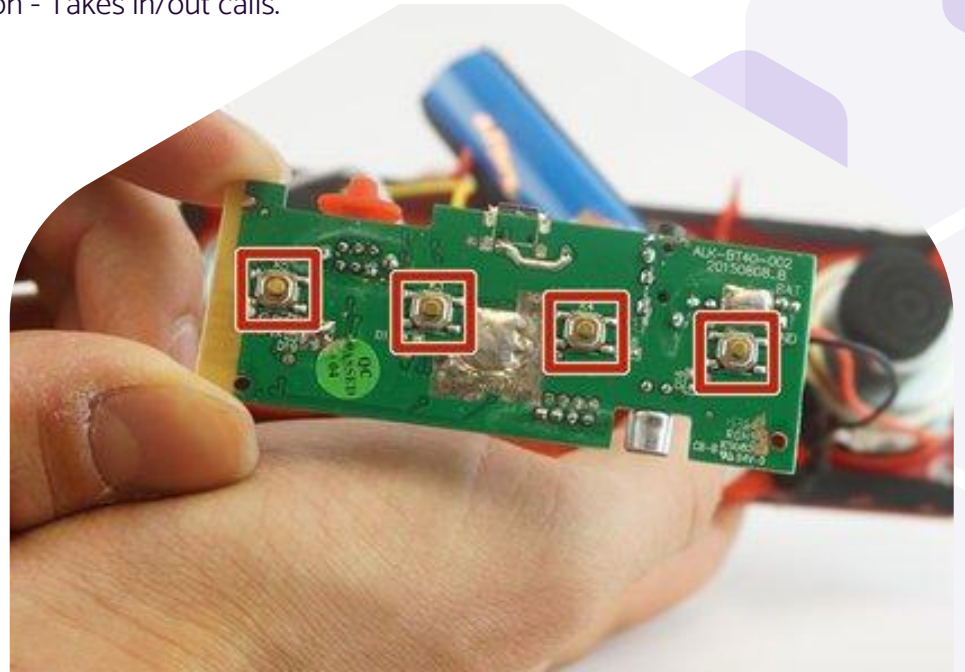
Buttons

Button's Function

- Source Buttons - Its function is regulating currents to connect with Bluetooth. Also has the function to music when Bluetooth is connected.
- Source Buttons - Can also be used to Connect an external sound source, such as an MP3 player, by plugging a 3.5 mm audio cable into the AUX IN jack on your speaker.
- Volume Down/ Volume Up Button - Reduces volume, Increases volume by regulating currents inside the speaker.
- Phone Button - Takes in/out calls.

Function in relation to the Speaker

- Volume buttons control the sound waves the speaker creates and the phone, AUX and source buttons play a role in (wireless) communication.
- Volume Buttons - On a speaker are typically wirewound potentiometers that serve as something that increases the object's resistance to the speaker system in the context of handling volume.
- Amplifier - Volume on an amplifier can be a divider but only in the signal stage of the amplifier, not the speaker circuit.





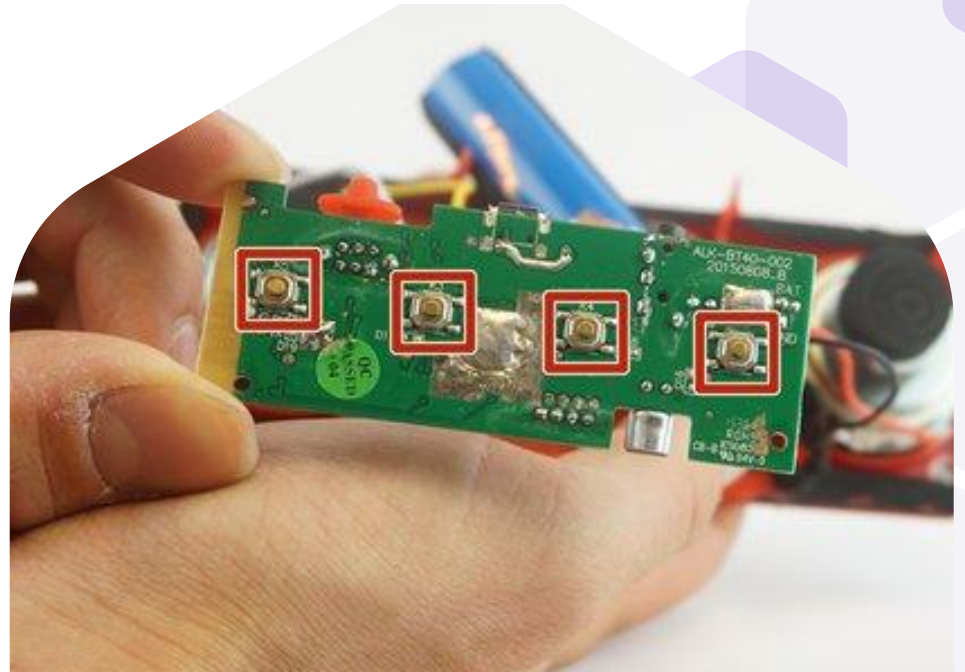
Buttons Continued

Function in relation to the Speaker continued

- Power Buttons - This obtains a cable that connects to 2 pins on the motherboard, controls power supply.

Components Purpose and the role it plays in the system

- It is a small, sealed mechanism that completes an electric circuit when you press on it. When it's on, a small metal spring inside makes contact with two wires, allowing electricity to flow.



Speakers

Function in relation to the whole Speaker

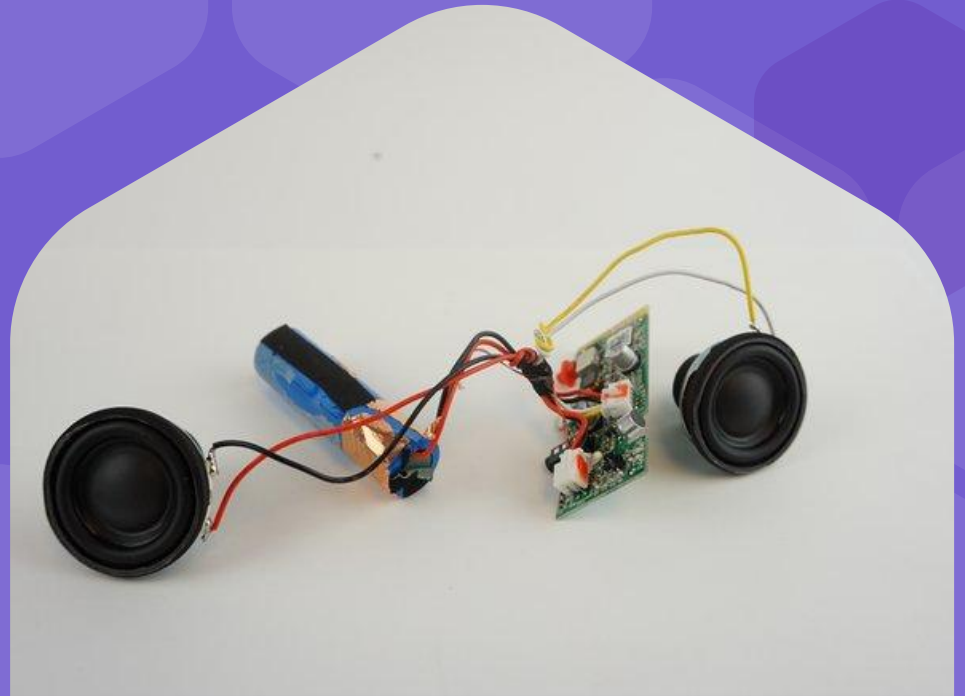
- Speaker converts mechanical energy into electrical energy by compressing the air, converting it into sound energy
- The speaker converts the electrical signal into rapid motion of the diaphragm, which creates the sound

Components Purpose and the role it plays in the system

- When an electrical current passes through a speaker, it induces a magnetic field
- Current passing through a voice coil produces a similar electrical field, which repels and attracts the magnetic field
- As this audio signal passes through the voice coil, the coil attracts the magnetic field, causing the back-and-forth motion of the diaphragm

Speaker's Function

- To create and project noises - the noise that is heard by the vibrating of the diaphragm which is the part
- The faster the diaphragm vibrates, the higher the pitch heard, and vice versa



Conclusion

As members of our robotics team, we have always revolved around the idea of designing first via CAD before attempting to build anything. We were allowed to explore a different, unorthodox way to engineer something through this challenge: by reverse engineering it! From this experience, we have learned so much about such a tiny speaker to the point where we could put it back together if we were given the same parts. We walk away from facing this challenge with not only ideas about a speaker but with the bigger idea that sometimes, to understand complicated systems, all it takes is a little bit of hands-on tinkering through reverse engineering!

