

FPAAs

- FPAAs (Field-programmable Analog Arrays) provide a platform for programmable mixed-signal computing
- FPAAs have a lower power consumption rate compared to other programmable computing platforms (i.e. FPGAs)
- Useful technology for low power headphones

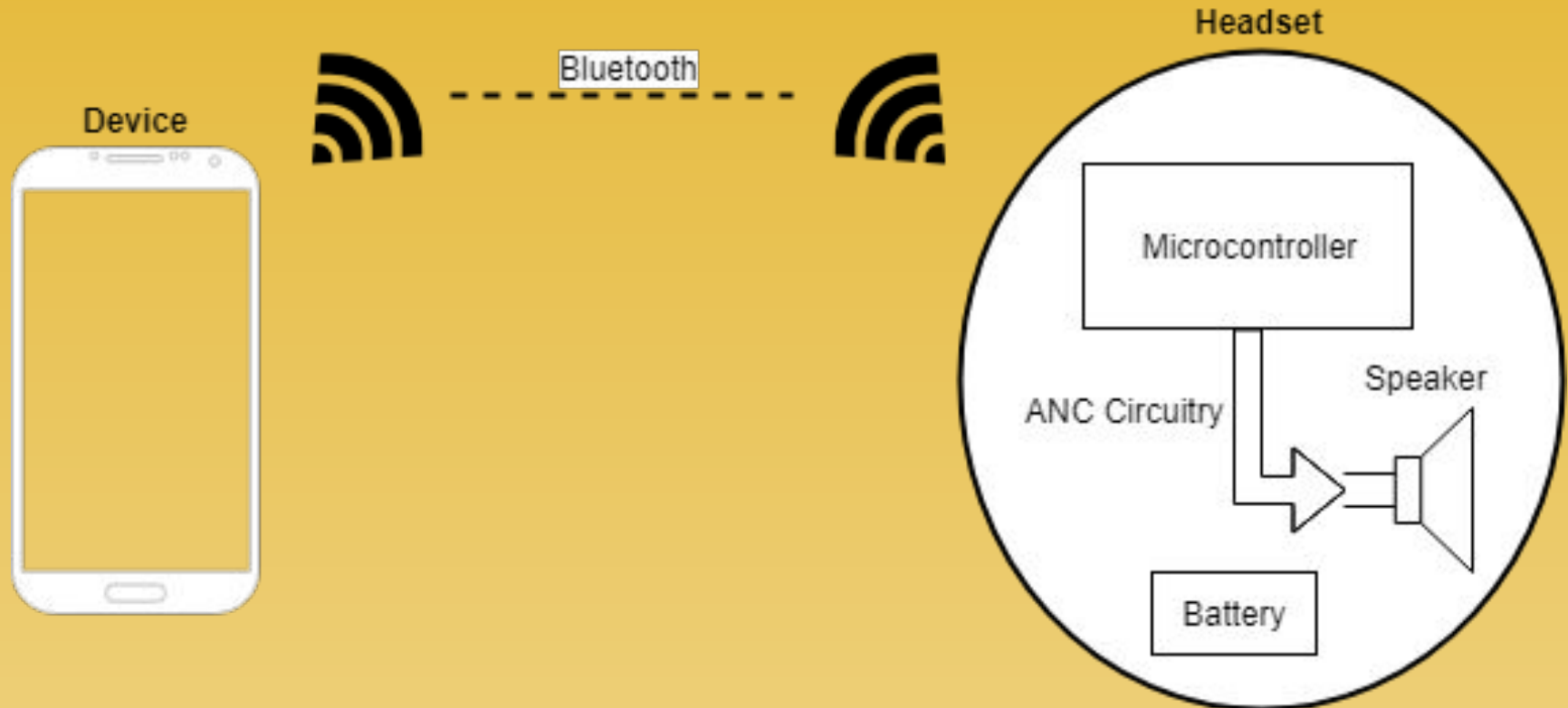
Vision



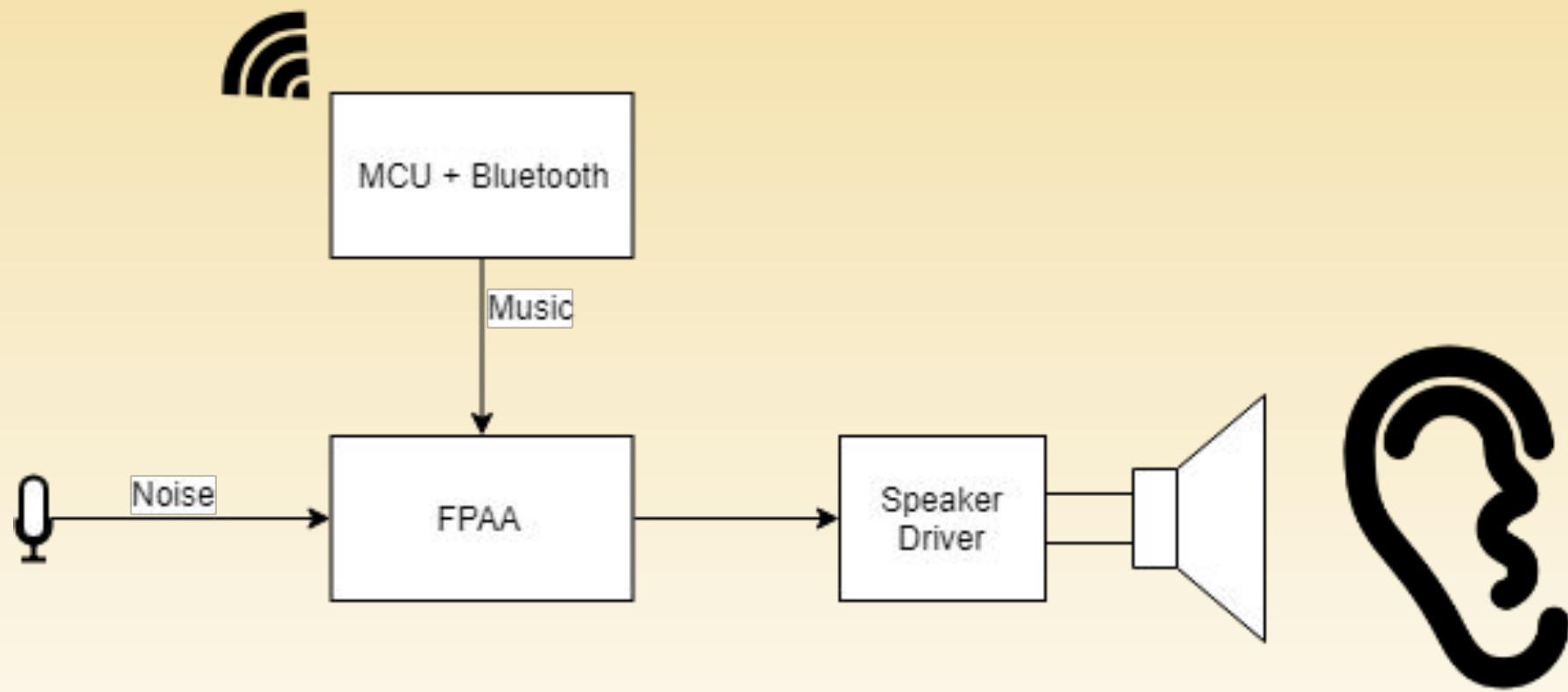
- Current noise cancelling headphones consume a large amount of power in a disruptive environment
- Goal is to develop headphones that cancel the ambient noise from a user's surroundings with a low power cost compared to current noise-cancelling headphones

System Overview

- Phone-headset overview
- Phone connected via Bluetooth to hardware system

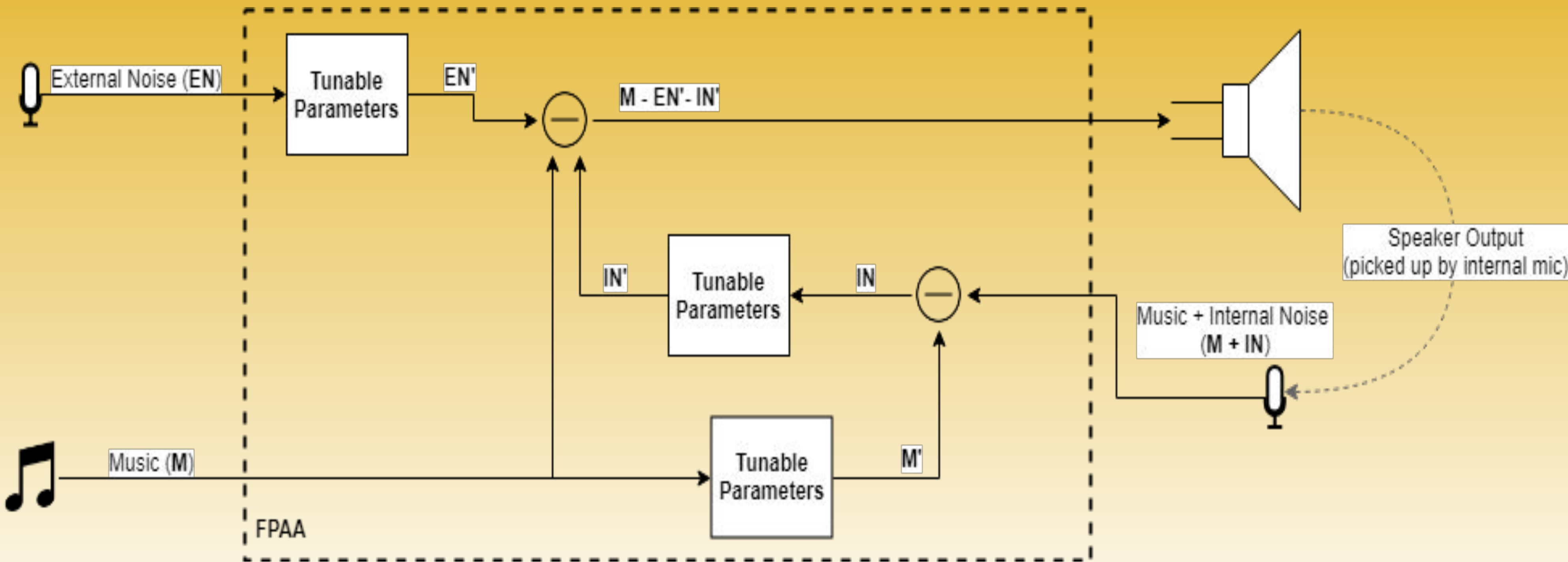


- High-level hardware overview
- FPAAs take in noise to create anti-noise signal to send to speaker driver

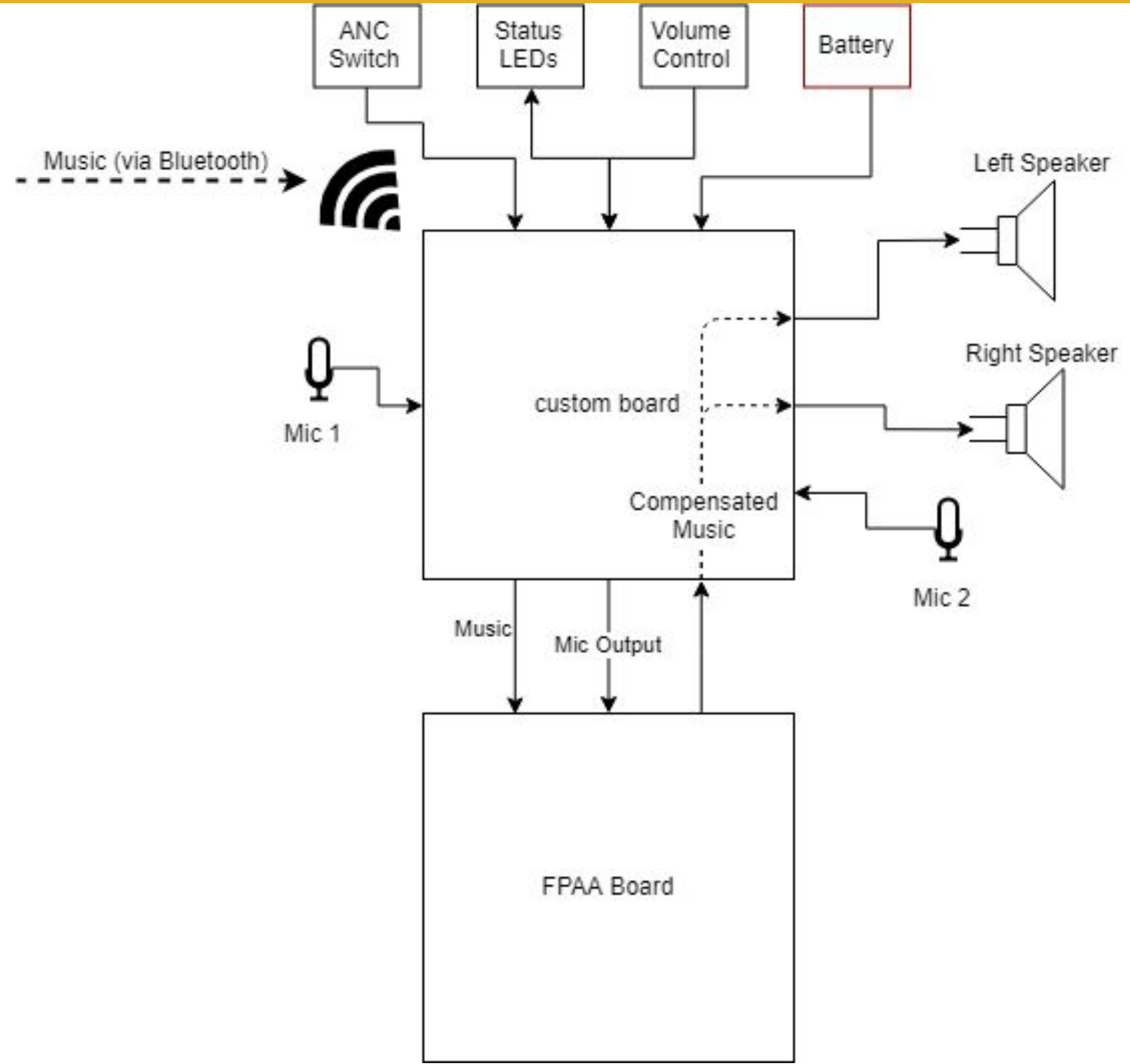


FPAAs Algorithm

- Hybrid feedback and feedforward topology
- Tunable filter parameters for testing

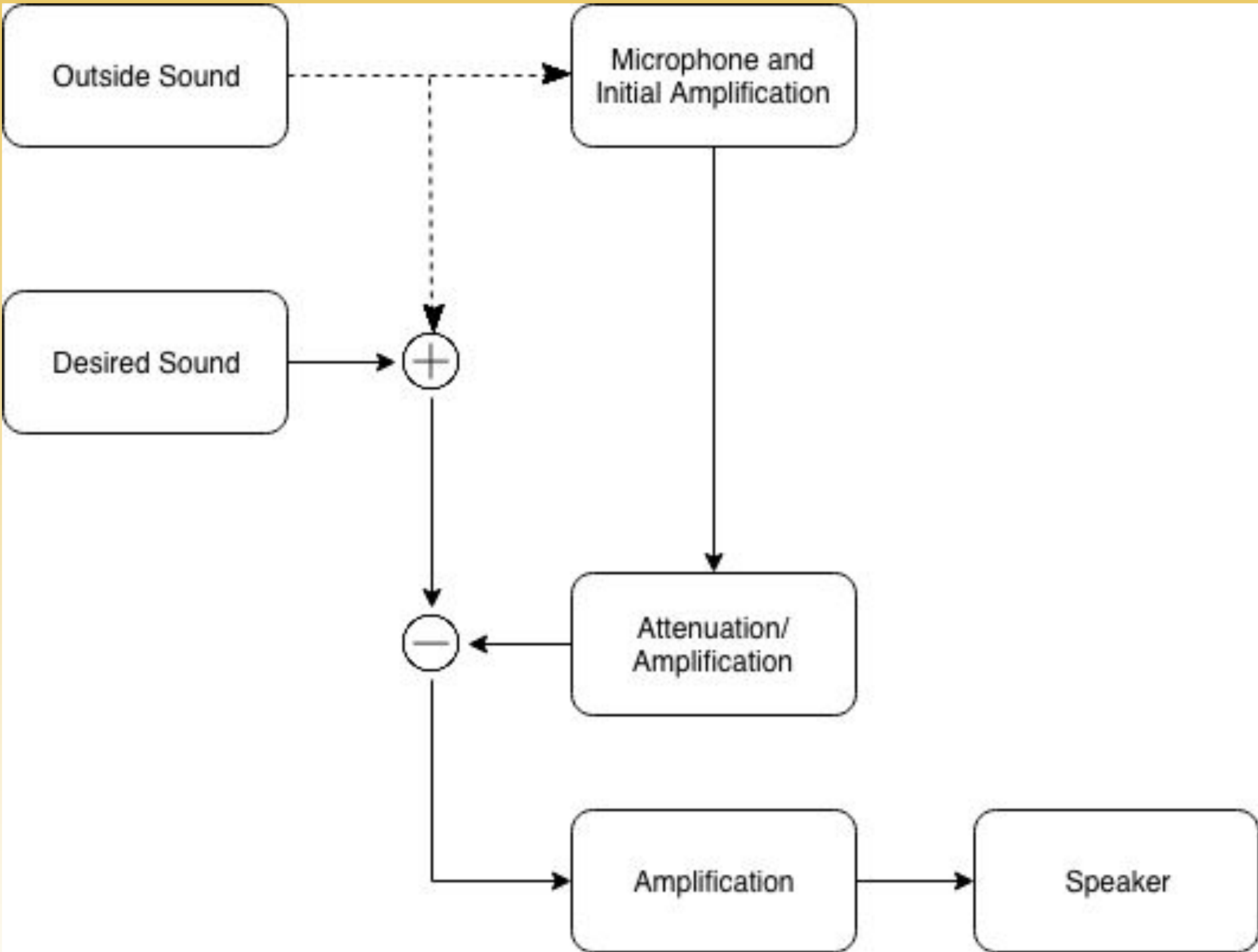


Hardware-Interface Overview



High-Level Signal Chain

- Outside Sound: babies crying, jet engines, normal conversations, etc.
- Anticipated challenges with system integration
 - Interfacing custom PCB with FPAAs and ESP32 - three discrete units



Results

Feature	Specification	Result
Headphone Ear Cup Width	> 30 mm	90 mm
Headphone Ear Cup Height	> 70 mm	110
External Supply Voltage	< 5 V	3.7 V
Impedance	< 32 Ohms	4 Ohms
Battery Capacity	> 15 hours	25.2 hours
Weight	< 0.5 lbs / < 0.23 kg	1.1 lbs