



Amica Aura

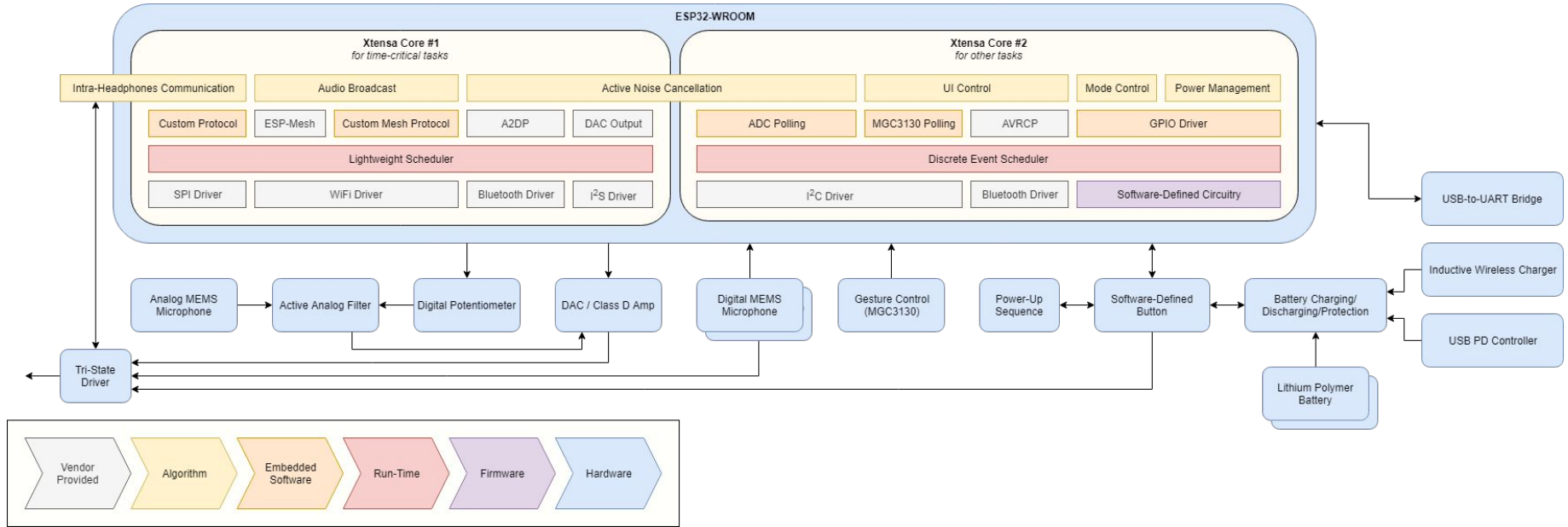
Team BA

Ethan Bless-Wint

Winston Ching

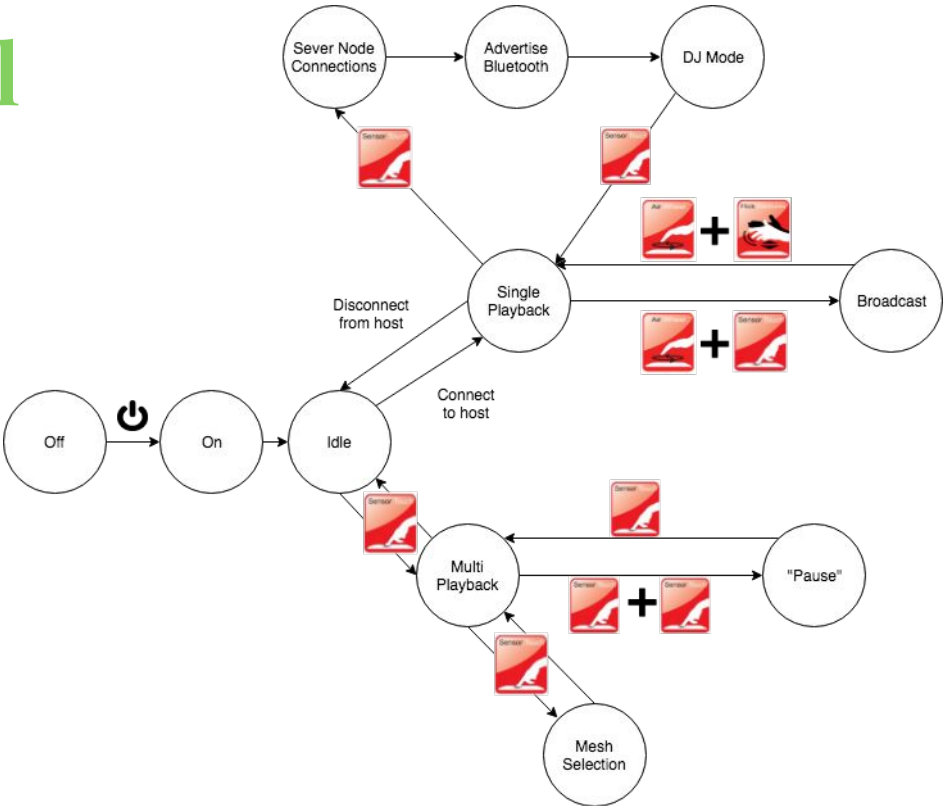
Michaela Laurencin

Functional Block Diagram



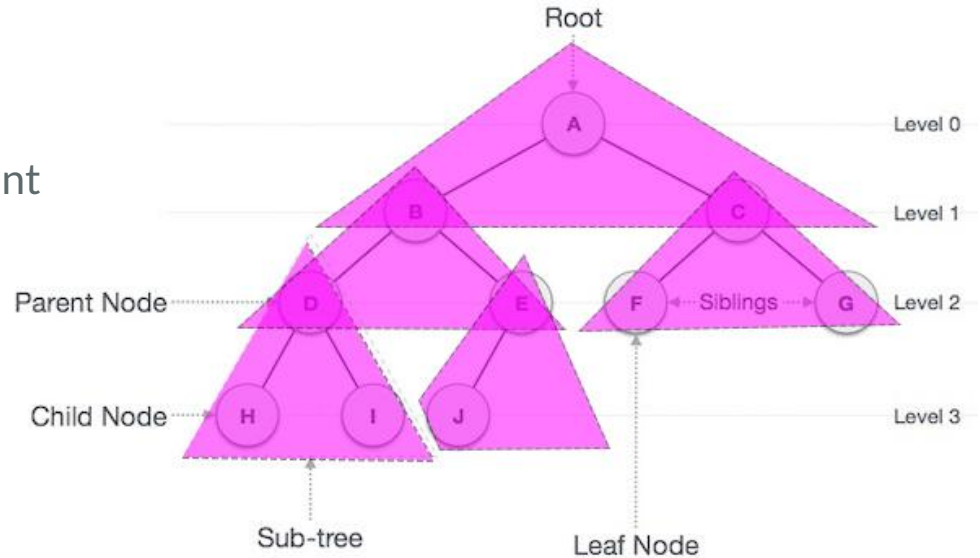
Gesture Control

MGC3130 Module



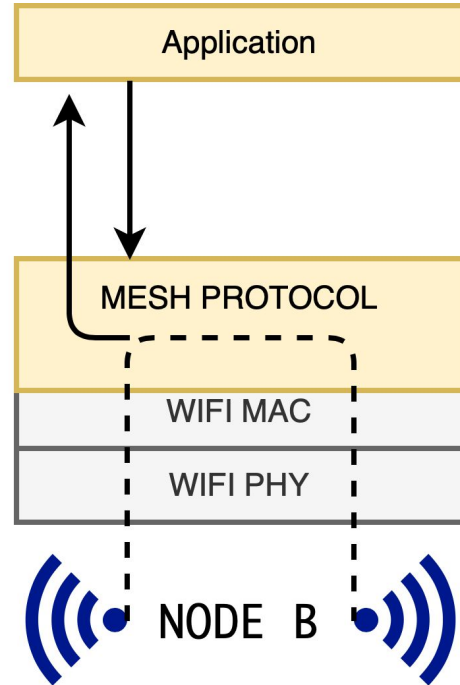
Mesh Design (PHY)

- Solution Approach
 - Multiple wifi networks
 - Tree topology
 - Packed SSID mesh advertisement
- Metrics
 - Wifi PHY Speed : 54mbps
 - Reconnection $x < 10s$
 - Per hop latency $x < 30ms$
 - Minimum ELS 423kbit/s

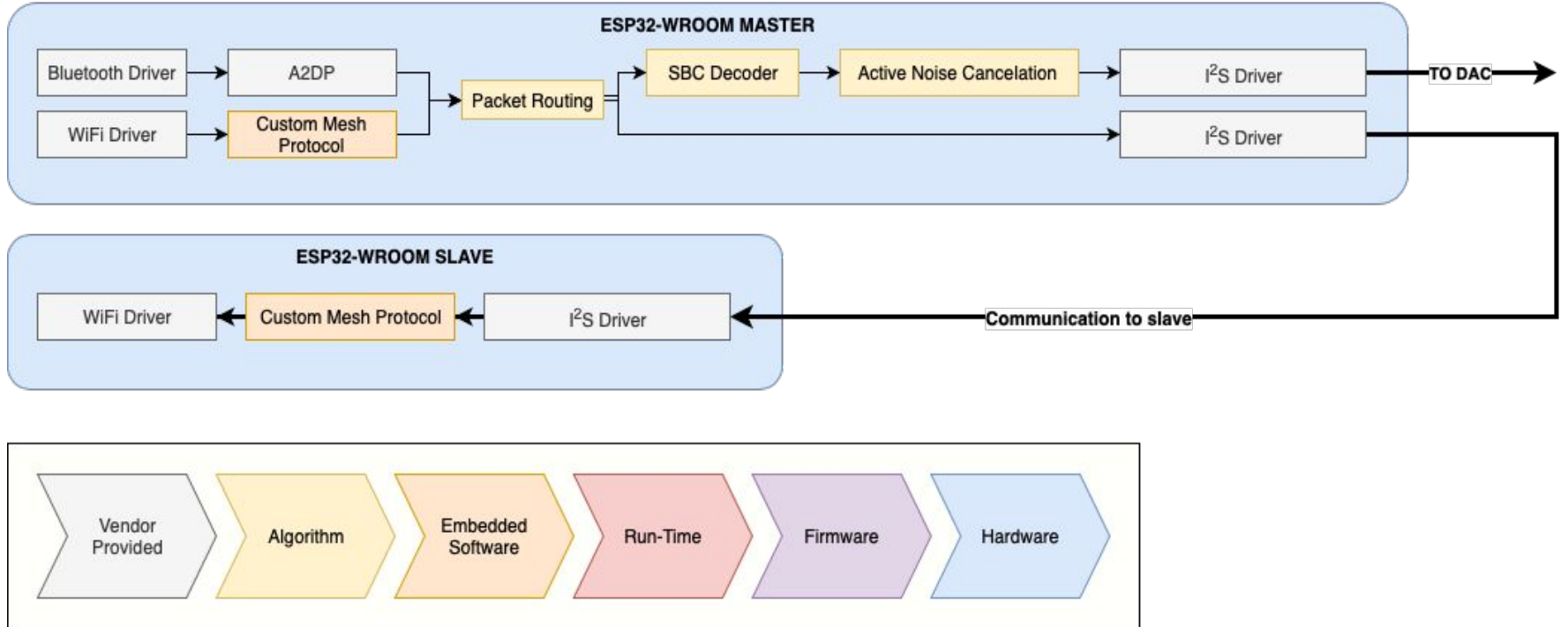


Mesh Design

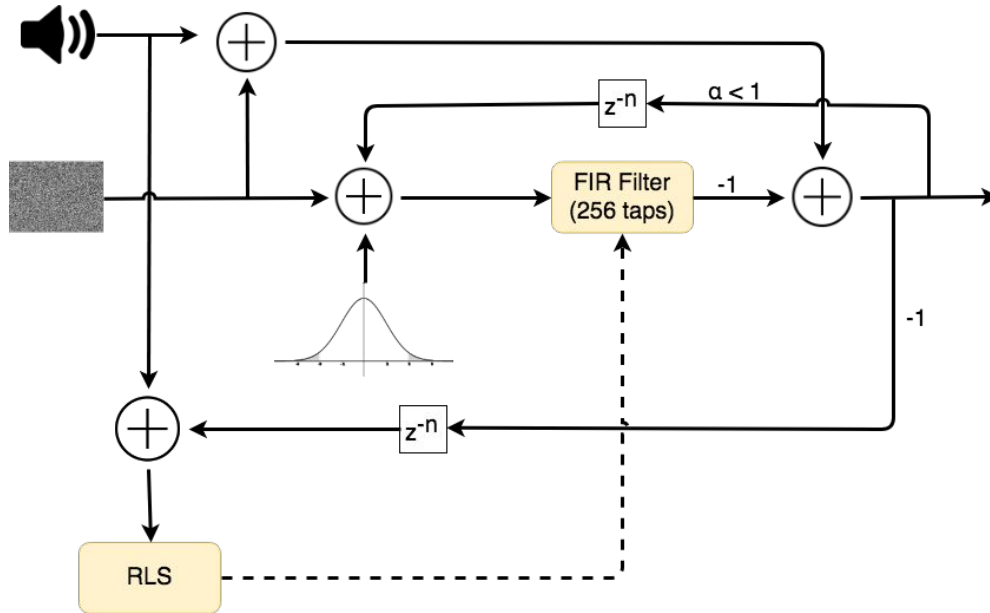
- Custom IPV6 + ICMP stack for routing
- Vendor Wifi MAC and PHY
- Testing
 - Test with Network Traffic Simulations
 - Measure RTD of acknowledged packets.
 - Test in “ideal” and “noisy” environments



Audio Packet Routing



Noise Cancellation System



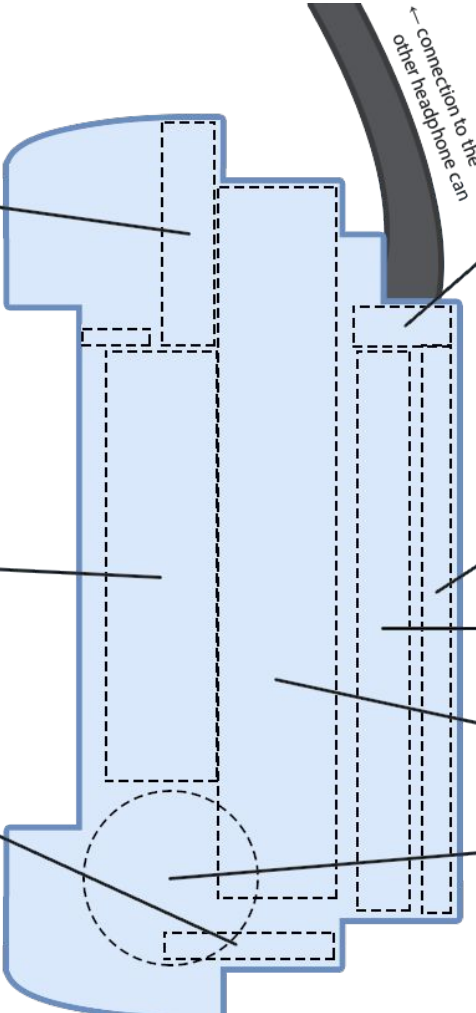
- Metrics
 - Signal to Noise Ratio
 - Total Harmonic Distortion + Noise
- Testing
 - White Noise
 - Pink Noise
 - Low Hum
 - Simulated Crowd
- Validation
 - $SNR_{HP} - SNR_{Driver}$ less than or equal 12db (4x loudness) @ 2m 60dbSPL Noise Source

6th order enclosure design

- Top PCB (main board):
- ESP 32 and antenna
 - Voltage regulator
 - Feedback MEMS microphone
 - Noise cancellation circuitry
 - I/O expander

Driver unit

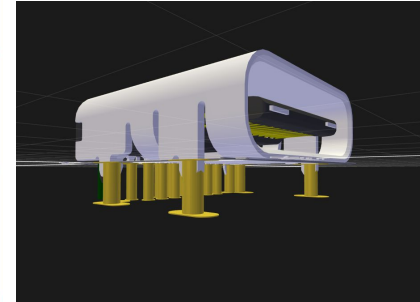
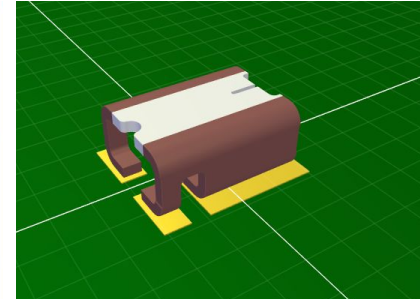
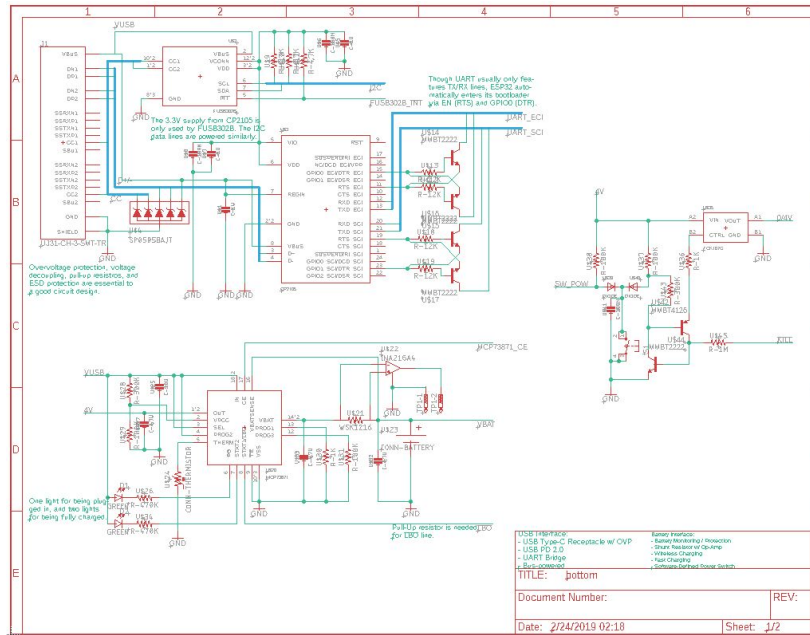
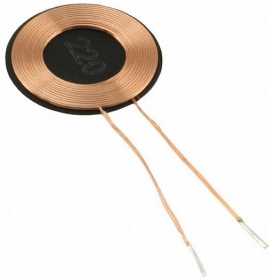
- Bottom PCB:
- UART bridge
 - Wireless charger
 - USB PD controller
 - Software-defined button
 - Battery monitor/protection



- Side PCB:
- Intra-headphone communication
 - Feedforward MEMS microphone
 - Gesture sensor
 - LED status indicators

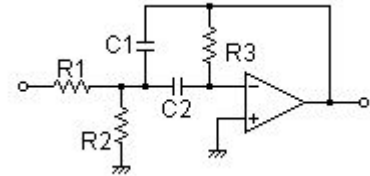
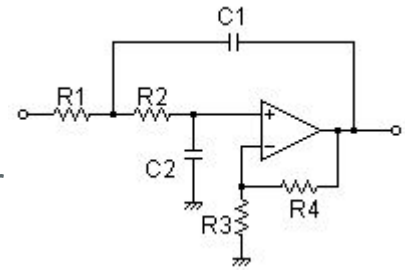
- TX/RX electrodes for MGC3130
- 2500mAh lithium polymer battery
- Polyurethane/silicone foam
- Inductive charging receiver coil:
 - Ferrite sheet

Power Supply



Configurable Analog Filter

- Need to closely approximate most FIR filters resultant from RLS
- Solution approach:
 - 1 low-pass filter, 2 band-pass filters, and 1 all-pass filter
 - Sallen-Key / multiple-feedback topology
 - 1 programmable potentiometer for each low-pass/band-pass filter
 - 2 programmable potentiometers for each all-pass filter
 - 1 programmable potentiometer for gain control
- Testing:
 - $\leq 1\%$ THD+N
 - $\leq 1\text{dB}$ of gain/attenuation when targeting for 0dB in software
 - 85 - 170 μs adjustable delay



Intra-Headphone Communication

- Solution approach:
 - Tri-State bus driver with Schmitt trigger
 - Balanced audio driver
- Digital line testing:
 - $\geq 50\text{V}/\mu\text{s}$ slew rate at receiving end
 - 0 observed data loss
 - $\leq 500\text{ns}$ of delay
- Analog line testing:
 - $\leq 1\%$ THD+N
 - $\leq 1\text{dB}$ of attenuation
 - $\leq 50\mu\text{s}$ of delay



Gantt Chart

