Use Case:

Our Goal: Discreet safety device for immediate response in threatening situations, independent of mobile device availability.

- Discretion (phone access unsafe or hindered)

- One-Hand Activation: Pendant-ring design with additional trigger options.

- Emergency Alerts: Direct communication to services via app or standalone.

- Smart Features: GPS, voice detection, and separation alerts.

- Target Age Group: Young Adults (particularly MS/HS/Uni students)

- ECE Core Areas: Software Systems and Circuits

Use Case Requirements

| Feature Category	Ring	Pendant	App/Cellular Services
Connectivity	RFID, 2m range, 99.5% reliability	Bluetooth, up to 30m range	3G LTE, low-signal capability
Physical Attributes	<1.9mm thick, <8g, size-extender, discreet button	<3 x 2.5 x 1 inch, <30g	
Battery Life		24 hrs active, 72 hrs standby, 2 hrs charge time	
Durability	Water-resistant	Drop-resistant up to 3-4 feet	
Triggers	<2N actuation force	Voice activation >90% accuracy in quiet	

Use-Case Requirements Pt.2

Category	Feature	Description/Specification
Error Prevention	False Alarm Mitigation	Special trigger designs for different lifestyles
	Device Durability	Ring: up to 10,000 presses; Pendant: up to 5,000 connection cycles
	Back-up Triggers	Bluetooth to cellular switch with >99% success rate
App Features	Customization	Add up to 5 contacts and 3 types of emergency services
	Priority Connection	If app connection fails <5s, default to cellular
	Emergency Protocol	Sequential contact method, implements IFFUL protocols

Pendant

- Microphone (audio trigger)
- ESP32 (MCU + mobile phone connection)
- U-Blox SARA Series Cellular (When Mobile device not accessible)
- RFID Receiver (comms between ring->pendant)
- Antenna for RFID and Cellular (<10cm)
- Battery (support RFID, Cellular, Bluetooth comms)
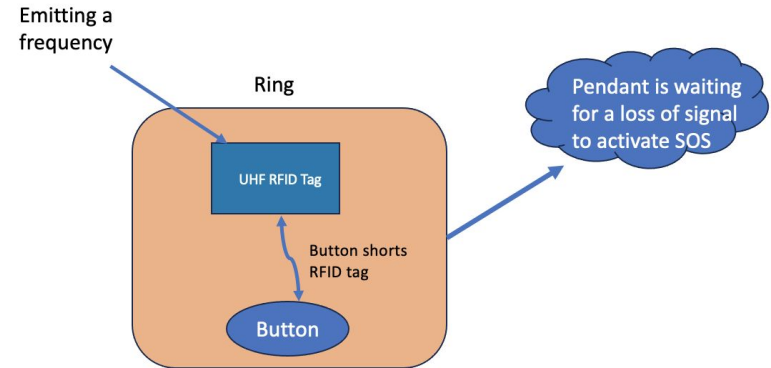- Vibration Motor (acknowledge SOS sent)

Pendant PCB
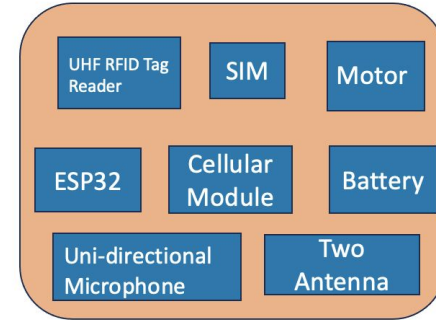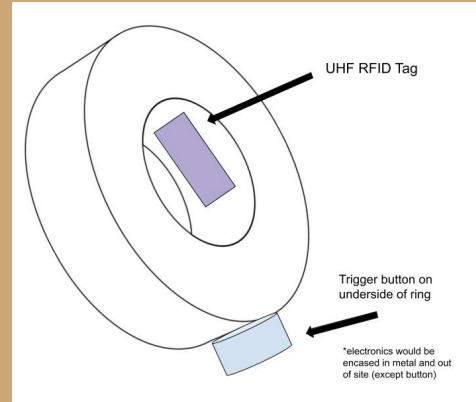

Goal Envisionment Of final design

Ring

- Button (2mm), located on the outside
- RFID wrapped inside
- Battery (if non-passive)

UHF RFID Tag

Trigger button on underside of ring

*electronics would be encased in metal and out of site (except button)

Emitting a frequency

Ring

UHF RFID Tag

Pendant is waiting for a loss of signal to activate SOS

Button shorts RFID tag

Button

Device Triggers

1. Button
   a. Located on the underside of ring for easy access
2. GPS Location
   a. trigger alerts when a person enters or exits a specific area.
3. Audio
   a. Customize a trigger word to deliver SOS messages
4. Seperation
   a. Ring -> Pendant Distance exceeds 2m

Mobile App

- Set emergency contacts in situational order
- Connect other emergency services if desired
- Set Trigger preferences
  - Life-Style trigger preferences (Possible frequent accidental button pushes)
  - Overall Trigger Preferences
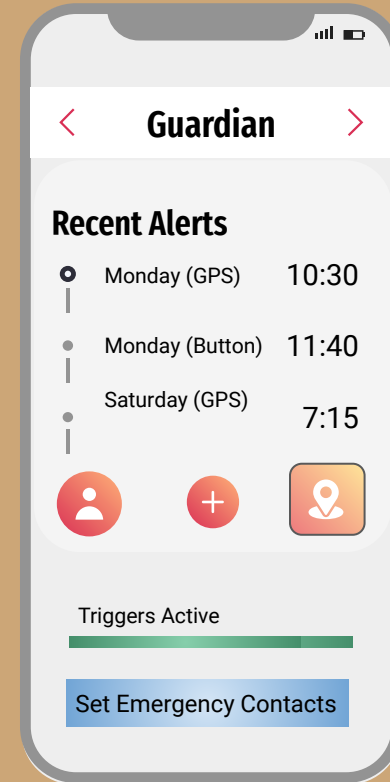
Solution Approach Diagram:
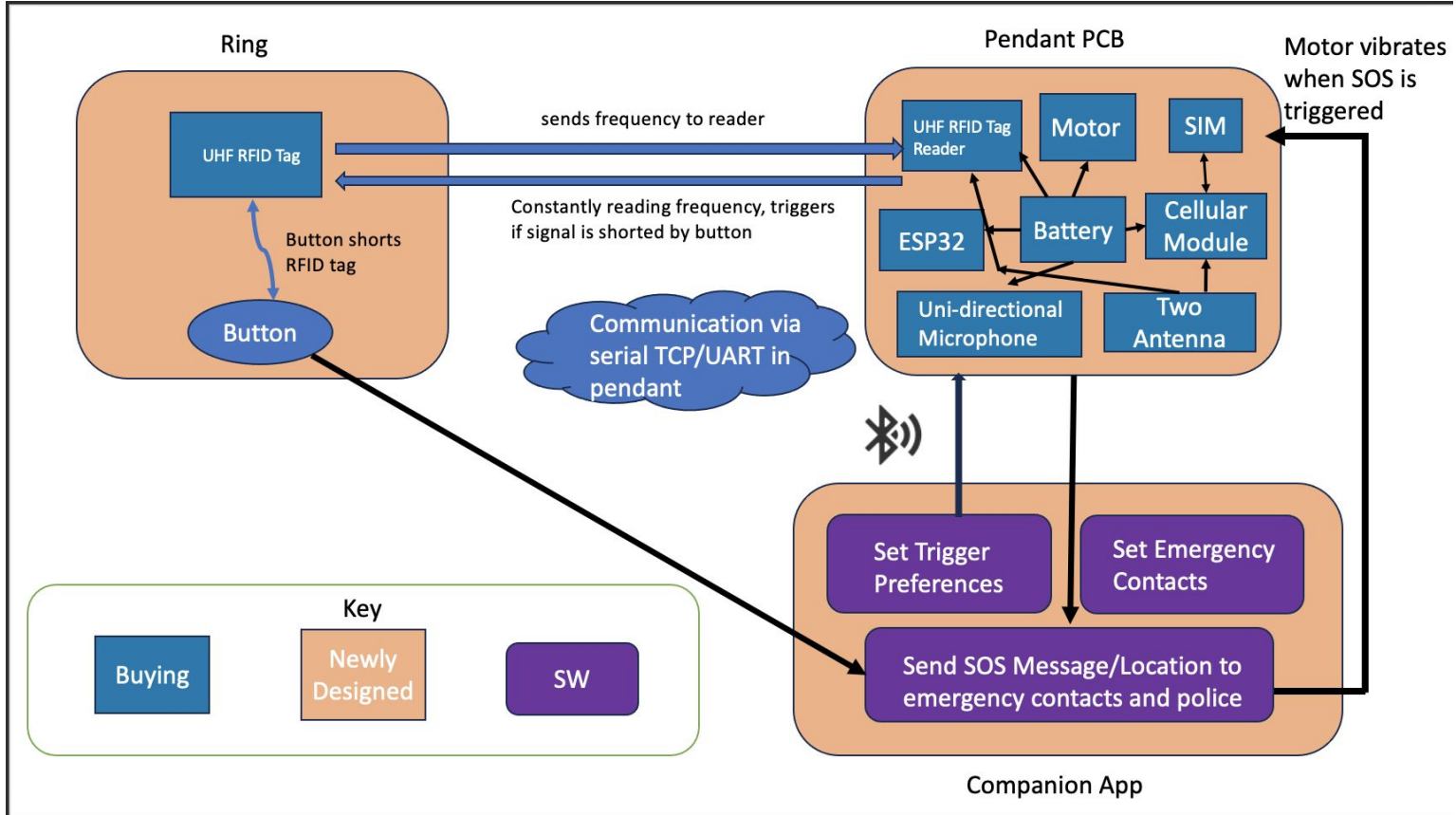
Testing, Verification and Metrics

- Communication Testing: >90% success rate
  - **Impedance test** through walls, (Ring and/or Pendant) covered by heavy clothes
    - (Ring + Pendant) **> 90%** success rate
  - **Speed of Communication Testing** (**10 seconds max** for all types after receiving to send SOS)
    - <5 seconds to discover mobile device before attempting cellular (<30s)
- Physical Attributes Testing:
  - Ring > **10,000 presses**, water resistant
  - Pendent drop survival at <4ft height >80%, electrical component life > 5,000 cycles

Testing, Verification and Metrics

- SOS Customizations Testing:
  - Uniform behavior between App and cellular module in pendant: App-pendant sync **100%**
  - Test emergency protocol simulation and lifestyle trigger preferences
    - Jobs/lifestyles that might repeatedly hit near the button… etc
- Error Prevention Testing:
  - False Alarm Real-World Scenario Testing (**noisy environments**, battery life)
  - **False alarm rate <5%**; Battery retains 80% efficiency after 300 cycles

Testing, Verification and Metrics

- GPS Trigger/Separation of Ring and Pendant
  - Create a set of x radii boundaries (within a reasonable walking distance)
  - Take jewelry outside of defined radius
    - Or split ring and pendant a certain distance
  - Test if device gets triggered within 10 seconds of exiting radius
- Edge Case testing, ensuring water resistance, ….

Gantt Chart

Completed At				
	January 2024	February	March	April
	22	29	5	12	17	19	26	4	11	18	25	1	8	15	22

Task	
Microprocessor and device options resea	Olivia
Integration between device research	Bradley
Project Proposal	All
Design Review	All
Communication Research	All
Connection Between Pendant and Phone	All
Connection Between Pendant and Ring	All
Home Page Set up	Anika
App connection to external services	Olivia
PCB Design	Anika
Phone connection to satellite	All
Create Database	Anika
Jewelry Design	Olivia
Button Trigger	Bradley
Detecting trigger word (speech)	Bradley
GPS Detection	Bradley
Interim Demo	All
Testing Communication Of Devices	All
Testing App Prefences	All
Customization preferences	Anika
Texting Sattelite Message	Anika
Testing False Trigger error rate	All
Testing Speed and Max Capabilities	All
Testing beyond MVP	All
Final Presentation	All