Senior Design Team 312

Wearable Anti-Sexual Assault Device

Sponsored by Power Angel
Advised by Babak Noroozi, Ph.D.

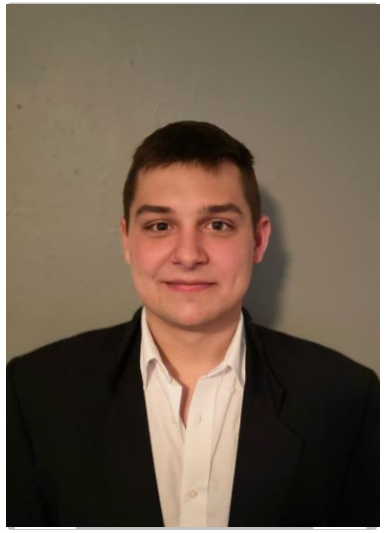
Team Introductions

Kathleen Kelly

Team Leader

Kevin Martinez

Head CPE



Scottie Jacobs

Head Developer

Andrew McGlone

Head Integration

Charles Johansen

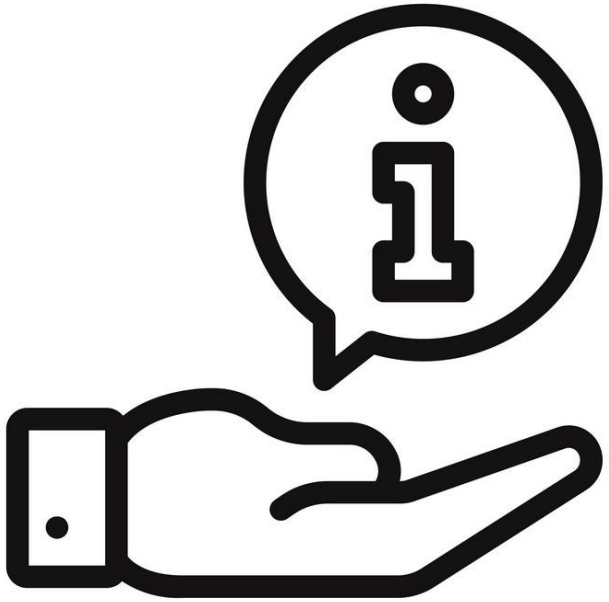
Head EE

Outline

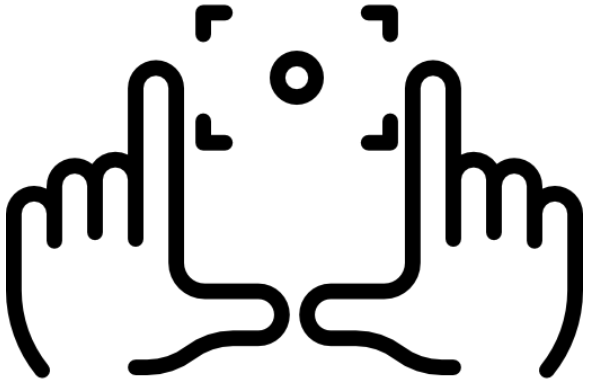
- Introduction
- Project Scope
- Targets
- Concept Generation
- Concept Selection
- Block Diagram
- Detailed Designs
- Questions

Introduction

- **Why are we doing this?**
  - There are 463,634 victims (age 12 or older) of rape and sexual assault each year in the US.
  - More than 2 out of 3 of sexual assaults go unreported.
- **How will we be doing this?**
  - Assault is detected by monitoring the when the undergarment is taken off or the device is being tampered with
  - Hall effect sensor will detect when magnet is taken away from undergarment
  - A buzzer will alarm the user and possible attacker
  - Location is reported and emergency help is contacted
  - A microphone with record evidence



Project Scope



Project Description:
Wearable device to prevent sexual assault and support the user should they be a victim to a crime.

Key Goals:

- Prevent attacker from pursuing victim
- Build a case for legal action
- Be comfortable and sleek
- Not easily tampered with

Markets:
Primary markets: Demographic is women ages 12 or older
Secondary markets: Anyone can be sexually assaulted; this device is for everyone.

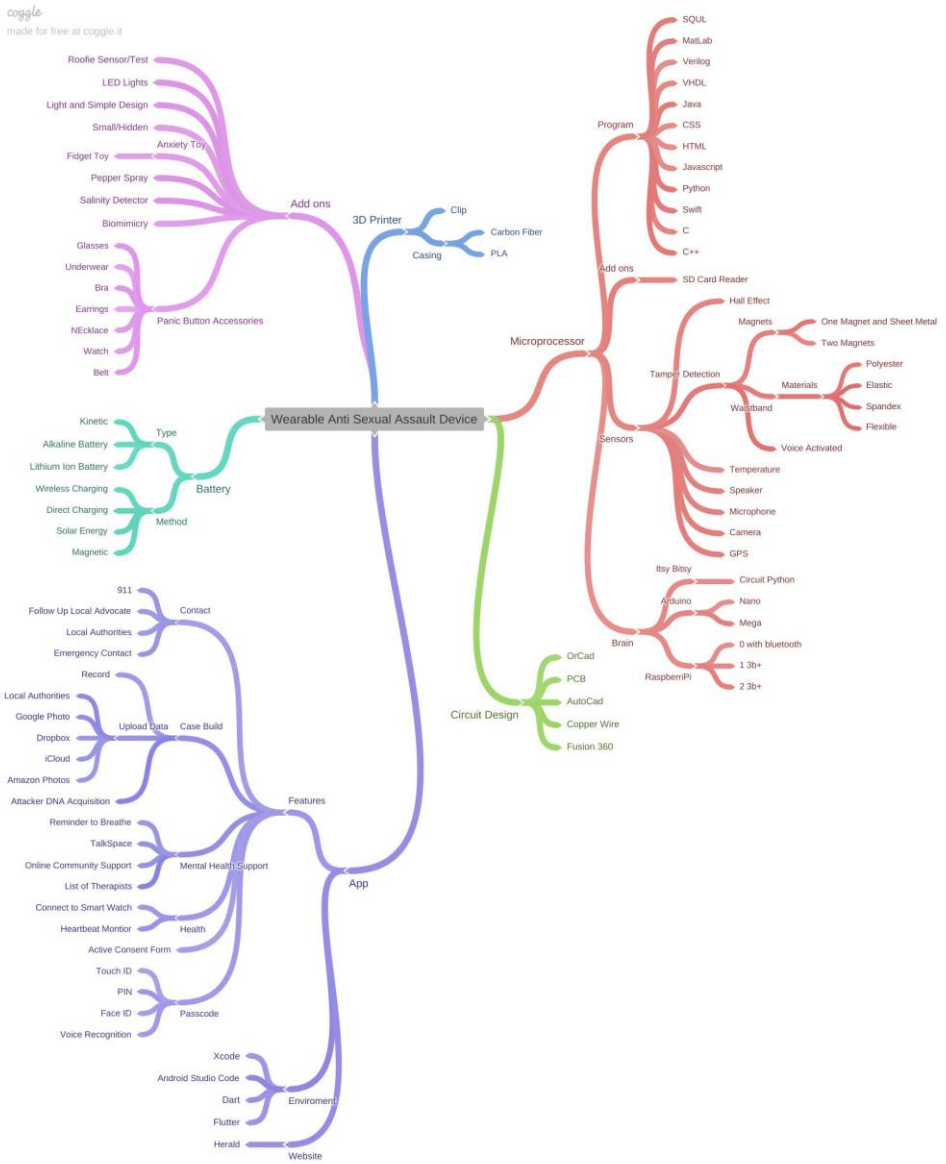
Assumptions:
- User will wear this device under clothes.
- Phone will be near user for location precision.

Targets:

Metric No.	Need	Metric	Importance	Units	Marginal Value	Ideal Value
1	Battery	Power given	High	Watts	TBD	TBD
2	Microcontroller with Bluetooth	Process and send information	High	Volts and hertz	3.4 V and 2.4 or 5 GHz	5 [GHz]
3	Sensors	Take in information	High	Miliseconds	0-5 ms	1 [ms]
4	Application	Interact with costumer	Medium	Satisfaction	3.5-5 star rating	5 star
5	Charger	Give power to battery	Medium	Amps	TBD	TBD

Concept Generation

- Narrowed Our Focus Down to:
  - Add – Ons
  - App Development
  - Microprocessor
  - 3D Printing
  - Battery
  - Circuit Design



Pugh Charts

Add ons	Contact	Case Build	Mental Heath Support	Website Access	Passcode	Enviroment	Xcode	Android Studio Code
Criteria						Criteria		
Comfortable	0	-2	3	0	2	Easy	3	4
Protect	4	2	-1	0	-1	Fast	2	4
Simple	2	-3	4	0	2	Complicated	1	3
Useful	3	5	3	1	3	Collaborative	2	4
Durable	0	0	0	0	0	Smart	3	3
Small	0	0	0	0	0	SUM	11	18
SUM	9	2	9	1	6			

APP DEVELOPMENT

Add ons	Kinetic Alkaline Battery	Alkaline	Lithium Ion Batter	Method	Wireless Chargin	Direct Charge	Solar Energy	Magnetic
criteria				Criteria				
Power Density	2	4	4	Easy	4	2	-1	3
Last 6 Hours	-1	2	3	Adaptable	5	4	2	4
Temperature	4	4	4	Difficulty to Make	1	3	2	4
Discharge Curve	3	5	4	Dependability	3	5	-1	3
Voltage	3	3	3	SUM	13	14	2	14
Small	2	4	4					
SUM	13	22	22					

BATTERY

Sensors	Hall Effect	Temperature	Speaker	Microphone	Camera	GPS	Tampering	One Magnet + Sheet Metal	Two Magners	Voice Activated	Waistband	Brain	ItsyBitsy	Arduino	RaspberriPi
Criteria							Criteria					Criteria			
Usable Evidence	2	-2	2	5	4	3	Reliable	2	2	3	1	Cheap	3	2	1
Easy to Use	3	3	4	2	1	2	Not Tamperable	2	3	4	2	Not Bulky	5	2	2
Not Bulky	2	1	4	-2	-1	2	Less Man Hours	3	3	1	2	Small	5	-1	-2
Small	2	3	1	3	1	3	Cheap	4	4	1	3	Smart	3	2	4
SUM	9	5	11	8	5	10	Hard to Remove	2	3	4	2	Easy to Learn	3	4	2
							SUM	13	15	13	10	SUM	19	9	7

MICROPROCESSOR

HoQ & AHP

Customer requirements	Customer Priority	Cost	Range	Length of Power	Storage	Compatibility
Comfortable	3	↓	0	0	0	↓↓
Discrete	4	↓	0	↓↓	0	0
Send/Receive Data	5	↑	↑↑	↑	↑↑	↑
Durable	4	↓	0	↓↓	0	0
Contact Emergency	5	0	↑	↑	↓	↑
Provide Help After	3	↓↓	↓↓	↓↓	0	↓
Long Charge	4	↑↑	0	↑	↓	↓
	%	0.53	0.67	0.5	0.6	0.52
Targets for Requirements		<$30	10 ft	6 hrs	8GB	Android /Apple

Correlations Key		
↑↑	Strong Positive	5
↑	Positive	4
0	No Correlation	
↓	Negatvie	2
↓↓	Strong Negative	1

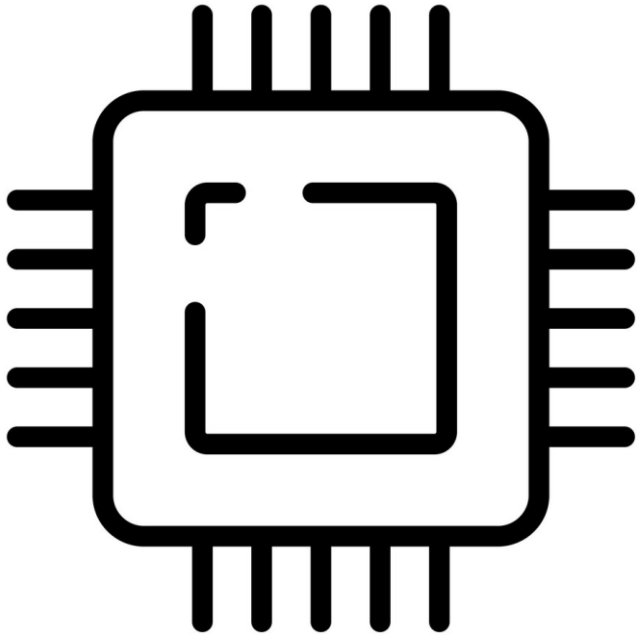
HOUSE OF QUALITY:

	Comfortable	Discrete	Send/Receive Data	Durable	Contact Emergency	Provide Help After	Long Charge
Comfortable	0	3	3	4	3	2	4
Discrete	3	0	5	4	5	1	4
Send/Receive Data	3	5	0	3	3	2	5
Durable	4	4	3	0	5	2	2
Contact Emergency	3	5	3	5	0	2	5
Provide Help After	2	1	2	2	2	0	1
Long Charge	4	4	5	2	5	1	0

ANALYTICAL HIERARCHY PROCESS:

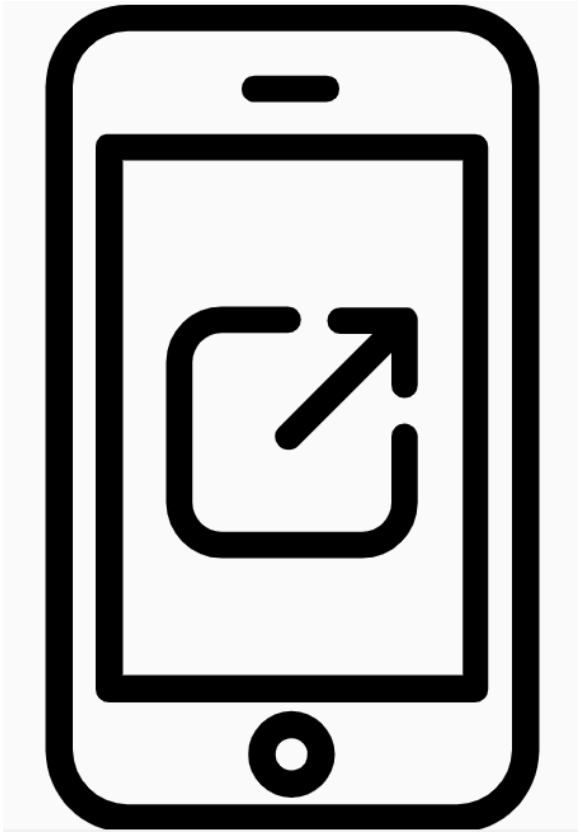
Concept Selection - Microprocessor

1. **Brain:**
   1.1. Itsy Bitsy
2. **Add On(s):**
   2.1. Hall Effect
   2.2. SD Card Reader/Writer
   2.3. Bluetooth
   2.4. Microphone
   2.5. Speaker
3. **Tampering:**
   3.1. One Magnet + Sheet Metal
      3.1.1. With the help of the hall effect sensor
   3.2. Waistband
      3.2.1. Built in Wire
      3.2.2. Elastic Material



Concept Selection - App Details:

1. **Stores Evidence Using Users Option of:**
    1.1. Camera Roll
    1.2. Google Photos
    1.3. Google Drive
    1.4. iCloud
2. **Contacts:**
    2.1. Local Authorities
    2.2. Emergency Contact
3. **Supports Mental Health**
    3.1. Online Chat Community
    3.2. TalkSpace Extension



Concept Selection - Additional

1. 3D Casing:

1.1. Carbon Fibers

2. Circuit Design:

2.1. OrCAD

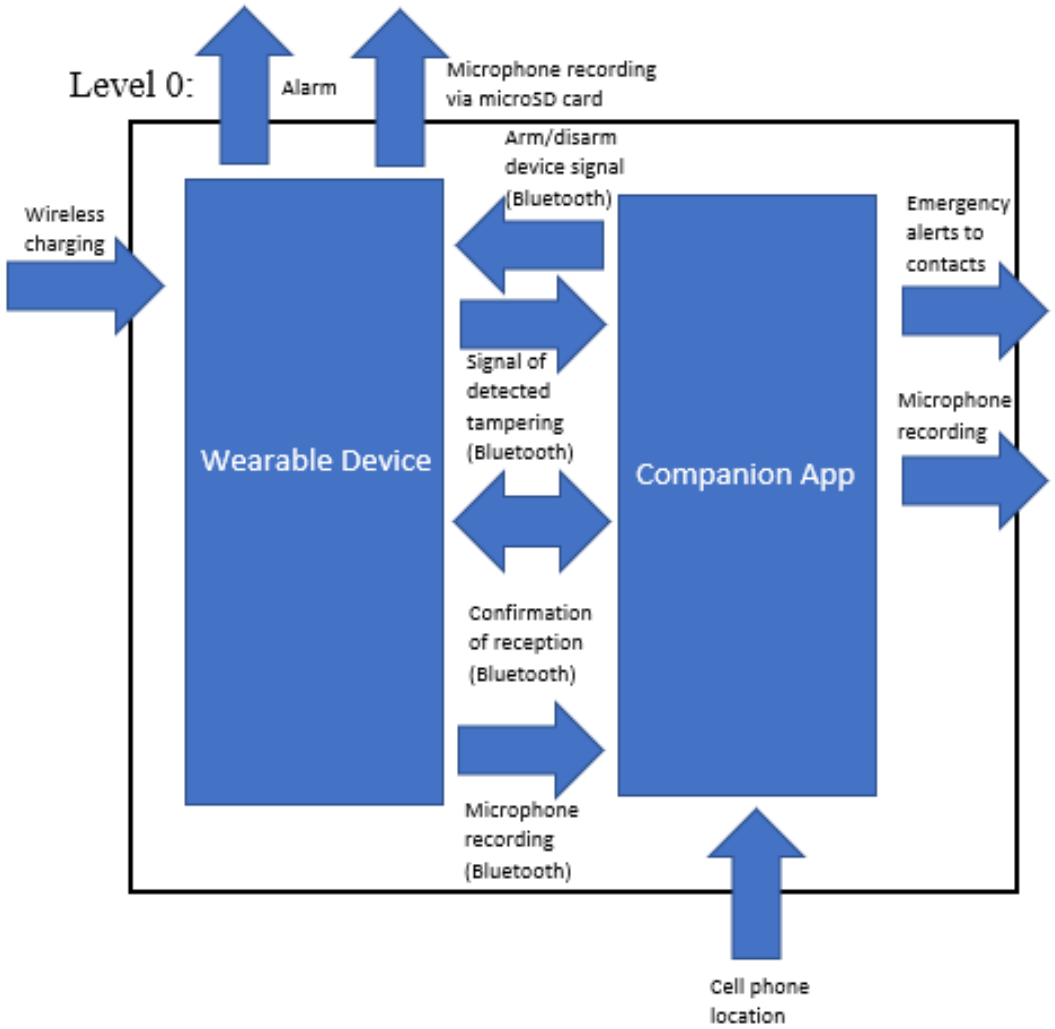
3. Battery:

3.1. Lithium Ion

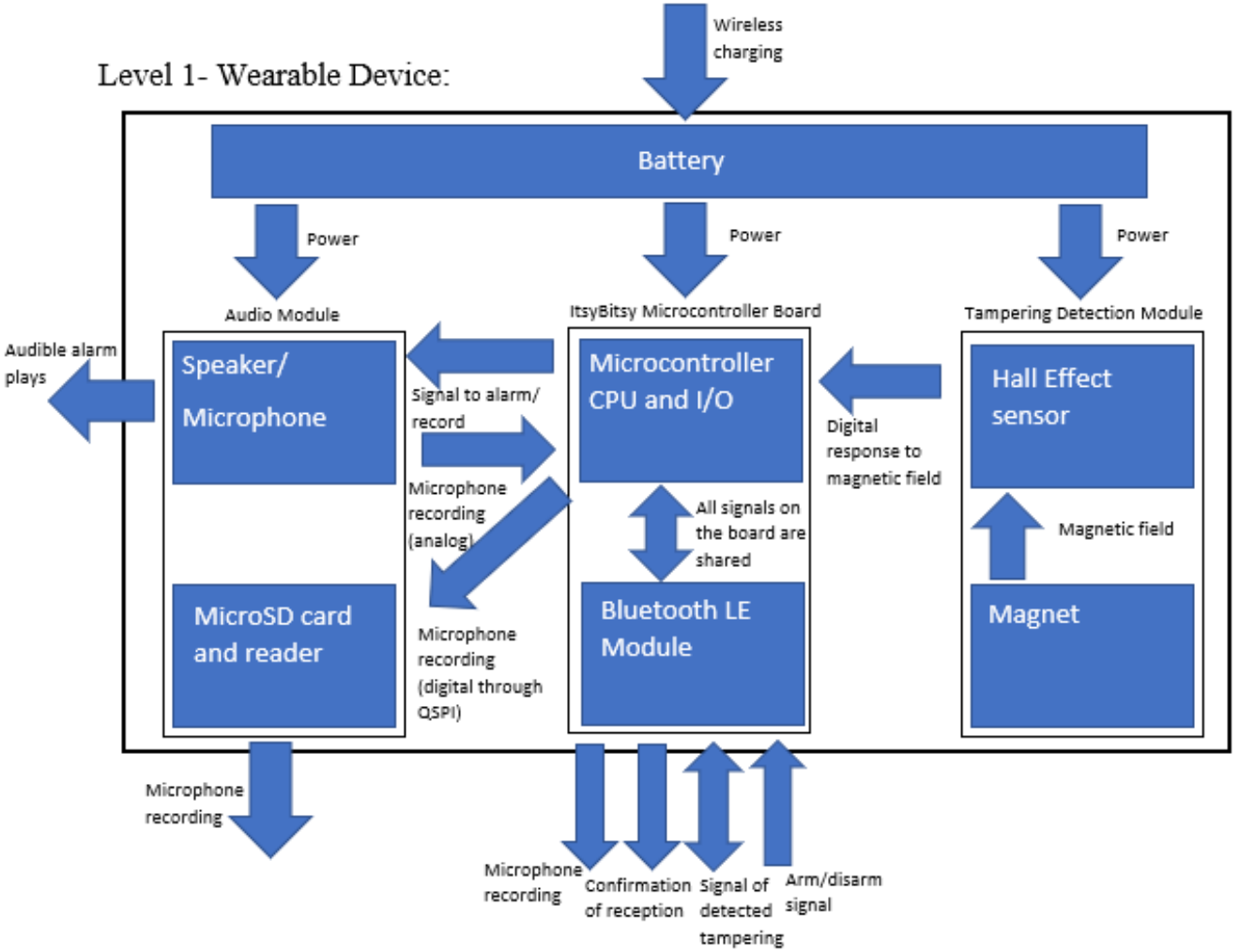
3.2. Wireless Charging

4. No Additional Add Ons

Block Diagram Level 0



Block Diagram Level 1

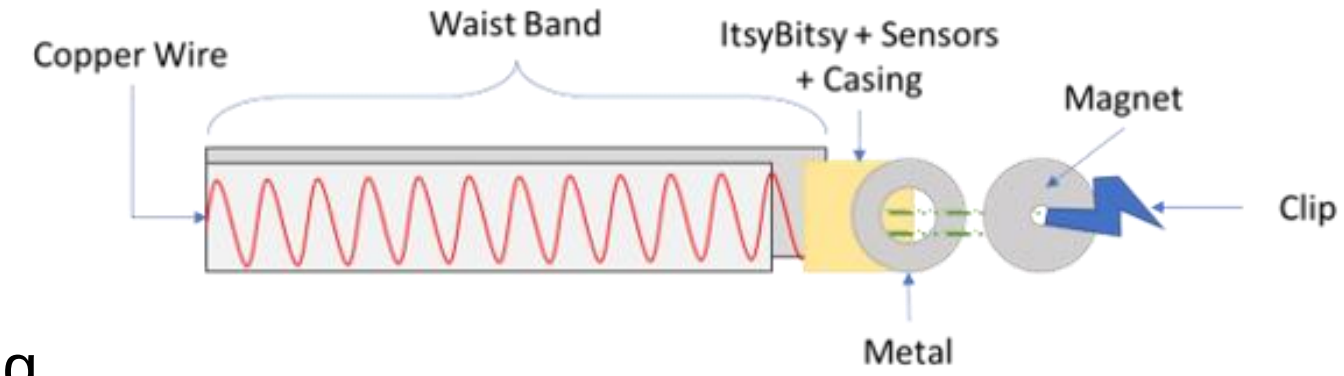


Bill of Materials

Category	Reference #	Product	Quantity	Price	Buy From
Microprocessor	0001	Itsy Bitsy	1	14.43	Amazon
	0002	Hall effect sensor	6	5.39	Amazon
	0003	SD card Reader	5	6.99	Amazon
	0004	Microphone	10	4.49	Amazon
	0005	Speaker	4	8.8	Amazon
Anti-Tampering Mechanism	0006	Magnet	10	19.79	Amazon
	0007	Sheetmetal	20	13.59	Amazon
	0008	WaistBand	4	5.99	Amazon
	0009	Wire	1	8.03	Amazon
App generation/ Code	0010	Flutter		Free	Flutter Website
	0011	Python		Free	Python Website
	0012	Visual Studio Code		Free	Visual Studios Website
Battery	0013	Lithium Ion Battery	1	TBD	
	0014	Wireless charging coil	1	TBD	
Casing	0015	3D Printer Fillament	1	20.59	Amazon
			Total $	87.5	Shipping is free with Amazon Prime, Not included in total price

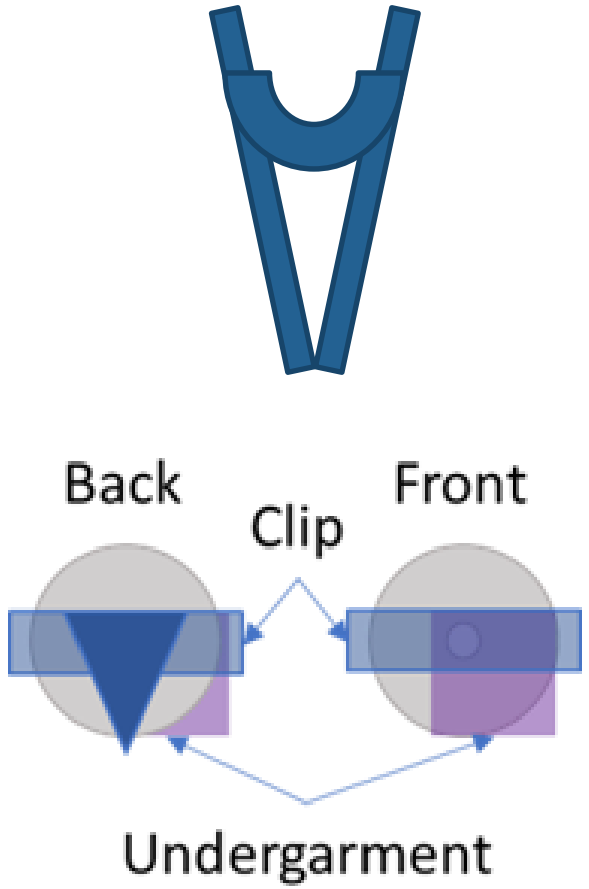
Design - Overall

- Features:
  - Magnet-Sheet Metal Trigger System
  - Wire-Waistband Trigger System
    - Made with Elastic w Copper Wire inside
  - Itsy Bitsy
    - Bluetooth Module
    - Hall Effect Sensor
    - SD Card Reader/Writer
    - Microphone & Speaker
  - 3D Printed Clip & Casing



Design - Clip

- The back will clip onto the bottoms of the user.
- The front will face the undergarment magnetized by the washer.
- The clip will be built via 3D Printing.



Presentation Recap

- Project Scope
- Targets
- Concept Generation
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- Detailed Designs
- Questions

Questions