



# Wearable Glucose Alerting System Team

**BME 301 Section 301-1**

Claudia Beckwith – BWIG & BPAG

Lauren Klein – Communicator & BSAC

Isabel Ploessl – Team Leader

**Client:** Olive Cemiglia, Callie Berg, Beth Martin    **Advisor:** Dr. John Puccinelli    **TA:** Isabelle Peters

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# Outline

- Problem Statement
- Introduction
- Last Semester Recap
- Product Design Specifications (PDS)
- Design Matrix
- Final Design
- Concluding Items
- Future Work Timeline
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# Problem Statement

- Help caregivers understand Type 1 Diabetes (T1D)
- Mediate parental stress
- Make blood glucose numbers more actionable & intuitive
- Maintain healthy blood glucose levels
- In conjunction with continuous glucose monitors (CGMs)

# Background

- T1D: autoimmune disease affecting insulin production [1]
- Insulin regulates blood sugar levels
- Affects **1.2 million children** in the United States [2]
- Device should visibly distinguish ranges:
  - Hypoglycemia (low) → Red/Orange
  - In range → Green
  - Hyperglycemia (high) → Blue/Purple

# Competing Designs



Figure 1: GlowCose [3]



Figure 2: Sugar Pixel [4]

# Current Methods



Figure 3: Dexcom G7 CGM [5]

# Product Design Specifications

- Displays indication of glucose and device status
- Visible and distinguishable from 50 m
- Time delay under 5 minutes
- Compatible with Dexcom G7 CGM
- Rechargeable power source
- Wireless connection through mobile app
- IP54 for water resistance [6]
- Comfortable and secure around wrist (12.5-17.5 cm) [7]

# Last Semester Progress

## Software

- Code pulls data from Dexcom account
- App sends data to microcontroller
- Color displayed on LED



Figure 4: Dexcom Interface



Figure 5: Flutter App Interface

## Issues

- Circuit size
- Computer as power source
- Lacking wireless connection

## Hardware & Case

- Microcontroller, LED, Level Shifter with USB-C connection
- Bilateral Silicon Band

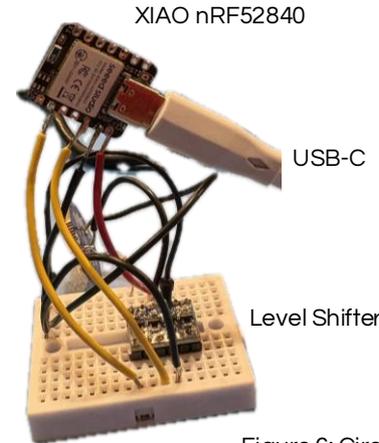


Figure 6: Circuit Hardware



Figure 7: Watch Face and Band

# Design Matrix - Connection Mode

Designs	BLE 5.0	Wi-Fi 6	Both Wi-Fi 6 and BLE 5.0
Power Consumption (25)	5/5 (25 pts)	3/5 (15 pts)	2/5 (10 pts)
Connectivity (25)	3/5 (15 pts)	4/5 (20 pts)	5/5 (25 pts)
Ease of Use (20)	4/5 (16 pts)	2/5 (8 pts)	3/5 (12 pts)
Accessibility (15)	3/5 (9 pts)	4/5 (12 pts)	5/5 (15 pts)
Feasibility (10)	5/5 (10 pts)	3/5 (6 pts)	2/5 (4 pts)
Replicability (5)	4/5 (4 pts)	3/5 (3 pts)	1/5 (1 pt)
Total (100)	79 pts	64 pts	67 pts

# Final Design - Software

- Dexcom app connected to CGM
- Input Dexcom credentials in iOS app
  - Pulls most recent blood glucose value
  - Push to microcontroller via BLE
  - Auto refresh every 5 minutes
- Microcontroller categorizes new value to color
- LED displays corresponding color



Figure 8: Information Flow Diagram

# Final Design - Hardware

- Seeed Studio XIAO Microcontroller ESP32-C6
  - BLE capabilities
  - On-board Wi-Fi
  - Battery charging ability
  - Cost Effective
  - Sleep Modes: Sleep 30mA, Light 2.5mA, Deep 15 $\mu$ A
- Lithium-Ion Polymer Battery – 3.7V
- NeoPixel Jewel RingLED – 7 x 5050



Figure 9: C6 Microcontroller [8]

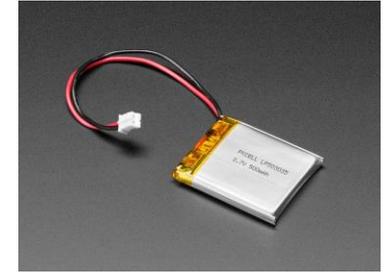


Figure 10: Lithium Ion Battery [9]

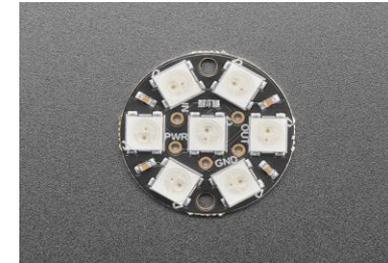


Figure 11: NeoPixel LED [10]

# Future Work Timeline

## February

- Deploy App
- Initial fabrication

## March

- Establish wireless connectivity
- Test signal strength and range
- Refine band attachment

## April

- Battery optimization
- Final testing
- ShaRx Competition

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- Dr. Beth Martin
- UW-Madison School of Pharmacy
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- Isabelle Peters

# References

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Thank You!  
Questions?

