

Wearable Light Logger to Facilitate Full Spectrum Light Dosing for Mood Disorders

Date: November 8th to November 14th, 2024

Client: Dr. Jean Riquelme

Advisor: Dr. Brandon Coventry

Team:

Molly Wilhelmson mwilhelmson@wisc.edu (Team Leader, BSAC)

Ella Eklund ereklund@wisc.edu (Team Leader, Communicator)

Neel Srinivasan nsrinivasan8@wisc.edu (BPAG)

Kate Briesemeister kbriesemeist@wisc.edu (BWIG)

Problem Statement

Currently, there are no affordable wearable light-logging devices on the market. Full-spectrum light therapy has been proven to be successful in treating mood disorders, especially seasonal affective disorder, but patient response studies are lacking. A wearable allows for accurate representation of light intensities that reach the retina, the presumed site of action. A wearable light logger would provide convenient research into what correct dosages for optimal patient response look like for patients suffering from mood disorders.

Brief Status Update

This week, we made a lot of progress on our final prototype. We unsoldered the old headers on the circuit and replaced them with shorter ones, we sewed the spandex onto the head strap and fed the wires through, we cut and sanded the front plate to flatten it, and we cut the wires on the circuit so that the overall design is flatter. We are continuing with the fabrication of the final design with hopes of finishing up soon.

Summary of Weekly Team Member Design Accomplishments

- Team:
 - Made progress on final design
 - Took final measurements of the front and back circuit in order to 3D print the circuit boxes
- Molly Wilhelmson:
 - Cut wires on circuit components to minimize the size of the design

- Began calculating the voltage values we should expect during testing

- Ella Eklund:
 - Helped complete the wiring of the front circuit board
 - Assisted with the fabrication of the final design

- Neel Srinivasan:
 - Unsoldered old headers to flatten board circuitry
 - Soldered flat headers onto raspberry pi chip
 - Continued coding

- Kate Briesemeister:
 - Worked in the woodshop to flatten the front plate of the headlamp
 - Assisted with fabrication of the design

Weekly/Ongoing Difficulties

Figuring out the equation for converting voltage into lux. The photoresistor datasheet isn't very detailed or comprehensive.

Upcoming Team and Individual Goals

- Team:
 - Finish final design by Thursday the 21st
 - Begin testing on final design
- Molly Wilhelmson:
 - Complete calculations needed to convert voltage to lux after consulting with our advisor
 - Outline a testing protocol
- Ella Eklund:
 - Solder wires that connect the two circuit boards
 - Attach the battery to the circuit board
- Neel Srinivasan:
 - Finish code
 - Begin testing

- Solder wires for secure breadboard attachment
- Kate Briesemeister:
 - 3D print the circuit boxes
 - Create a website to connect to the Raspberry Pi output

Project Timeline

Project Goal	Deadline	Team Assigned	Progress	Completed
Meet with client	09/13	All	100%	Yes
→ Product Design Specification	09/20	All	100%	Yes
Preliminary Presentations	10/4	All	100%	Yes
Preliminary Deliverables	10/9	All	100%	Yes
Show and Tell	11/01	All	100%	Yes
Poster Presentations	12/06	All		
Final Deliverables	12/11	All		

Expenses

Item	Description	Manufacturer	Part Number	Date	QTY	Cost Each	Total	Link
Component 1								

Happy Light	Light for testing sensor	Verilux	N/A	9/13/24	2	\$49.99	\$99.98	Link
Component 2								
Battery	Battery for chip	PGSONIC	CR2045	9/19/24	1	\$1.15	\$1.15	Link
Component 3								
Head Lamp	Light that attaches to head	Fire Supply Depot	FL8210-6SM D	9/26/24	1	\$11.92	\$11.92	Link
Component 4								
Raspberry Pi	Chip for coding	Raspberry Pi	Raspberry Pi Pico W	10/4/24	1	\$7.20	\$7.20	Link
Component 5								
Comparator	Building circuit	Texas Instruments	LM393PE4	10/4/24	2	\$0.25	\$0.50	Link
Component 6								
Battery Holder	Holder for coin battery	Digikey	BS-2450	10/4/24	1	\$3.84	\$3.84	Link
Component 7								
OPAMP	Building circuit	Digikey	AD8276ARZ	10/4/24	1	\$7.37	\$7.37	Link
Component 8								

IC DAC 12BIT V-Out	Building circuit	Digikey	MCP4726A0T -E/CH	10/4/24	3	\$2.16	\$6.48	Link
Component 9								
OPAMP	Building circuit	Texas Instruments	UA741CN	10/25/24	2	\$0.25	\$0.50	Link
Component 10								
Breadboard	Building circuit	Busboard Prototype Systems	BB400	10/25/24	1	\$2.00	\$2.00	Link
Component 11								
Sensor 550NM	Measure light values	Digikey	OPT3007YM FT	10/31/24	1	\$2.79	\$5.42	Link
Component 12								
Sensor Photodiode 900NM	Measure light values	Digikey	BPW34S-ND	10/31/24	1	\$1.58	\$4.21	Link
Component 13								
DFN to DIP SMT adapter	Allows for soldering components to breadboard	Digikey	IPC0083-ND	10/31/24	1	\$4.79	\$7.42	Link
Component 14								

Ribbon Cables	Flexible wire connection around head strap	Amazon	B08LPFX7QN	10/31/24	1	\$10.39	\$10.39	Link	
Component 15									
Spandex	Flexible wire enclosure around head strap	Joann Fabrics	N/A	11/6/2024	1	\$7.92	\$7.92	N/A	
TOTAL:								\$173.8	