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

Date: November 15th to November 21st, 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 began our initial testing process. We attempted to calibrate our sensor by creating a voltage versus illuminance plot, and connecting the points to output an equation for our code for general voltage to lux conversions.

Summary of Weekly Team Member Design Accomplishments

- Team:
    - We finalized our circuit and began testing
    - Our circuit output expected voltage values
    - We began 3D printing the circuit boxes

- Molly Wilhelmson:
    - Finished assembling the final circuit
    - Developed a testing plan

- Ella Eklund:
    - Broke headers for soldering wires
    - Measured current and voltage of circuitry before testing

- Neel Srinivasan:
    - Continued coding
    - Started testing

- Kate Briesemeister:
    - Finalized the 3D printed box design
    - Submitted the boxes to the Makerspace to get printed

Weekly/Ongoing Difficulties

Our sensor appears to be broken and is not sensing changes in light intensity, we need to figure out the root of this issue and potentially order a new sensor.

Upcoming Team and Individual Goals

- Team:
    - We need to find a sensor that changes its voltage output with changing light intensity in the correct lux range.
- Molly Wilhelmson:
    - Research new sensors to order for our final design
    - Begin working on our final deliverables
- Ella Eklund:
    - Solder wires connecting breadboards
    - Start completing individual sections of the poster presentation
- Neel Srinivasan:
    - Solder wires
    - Continue testing
    - Wrap up coding
- Kate Briesemeister:
    - Make any necessary iterations to 3D box files in order to finish the component
    - Start working on poster for final presentation

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	FL8210-6SMD	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	OPT3007YMFT	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:								**$173.80**