

Low-Cost Portable Light Therapy for Alzheimer's Patients

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Abstract

This paper provides an overview of the information and research conducted that ushered the creation and innovation of a low-cost portable light therapy device to help treat Alzheimer's patients. Alzheimer's has afflicted over five million people in the U.S., currently has fewer effective treatment options than other diseases, such as cancer. Of all known research, light flickering at 40 Hz at the eyes of patients has proven to be the most effective treatment for the disease. This information was used in creating the Light Therapy boxes.

1. Introduction

Alzheimer's disease affects over five million individuals in the United States alone and has fewer effective treatment options than other life-threatening ailments, such as cancer. Since 2000, the Alzheimer's Association has reported an increase in deaths by a factor of 89%. Currently, this disease has taken the lives of 1 in 3 Americans. Meanwhile, alternative treatments remain largely uncharted and under further studies. While limited in options, available treatments include cognition-enhancing medications, such as Donepezil and Memantine, to temporarily alleviate symptoms. However, the increasing role of technology in medicine holds great promise in treating the disease. MRIs, CTs, and PETs provide doctors with an accurate image of the brain, enabling them to determine a proper course of treatment and to detect any changes. As of now, one study conducted by researchers at the Massachusetts Institute of Technology has proven to deteriorate beta amyloid plaques. This novel, noninvasive approach utilizes light waves at a frequency of 40 Hz, fashioned in the form of a small box, to decompose beta amyloid plaques, which are significantly higher in Alzheimer's patients. Through experimentation with mice, researchers have found a method to decompose beta amyloid plaques by exposing the mice to 40 Hz gamma oscillations for one to two hours. The results of flickering this light at a specific frequency have shown a significant decrease in the amount of beta amyloid plaque clumps in the mice's brains. After conducting further research and employing the information received, we altered the light

therapy box into something affordable for patients and their families to obtain from a pharmacy, for instance. This device is not only affordable but is small enough to fit in the palm of the patients' hand, and is battery powered. The device consists of a screen with an acrylic finish to disperse the light evenly, a 12V battery to power the device, LED strips running along the inside of the box to ensure maximum lumens, and the electronic circuit that ensures the flickering of the LEDs at 40 Hz to stimulate brain waves. The on and off switch is on the back of the light therapy box.

2. Design of the Light Therapy Box

Major design requirements were portability, battery operated, and small physical size. Since most Alzheimer's patients are typically older, the compactness would aid with their everyday use of the device. The device contains:

- A 3 in x 2 in x 2 in acrylic box with a transparent top
- LED Strip – 12 Volts
- PCB Chip – 40 Hz Flicker schematic
 - NE555 Precision Timer (1)
 - LM358P Dual Op Amp (1)
 - 180 k Ω Resistor (1)
 - 1 k Ω Resistors (2)
 - 0.1 μ F Capacitors (2)
- Battery – 12 Volts
- Battery Holder with on/off switch
- Jumper wires

3. The Casing

The final product is shown in Figure 1. The black border on top of the box ensures all the light to stay inside the box. The screen cover has a matted acrylic finish to help disperse the light more evenly.

3. Inside the box

Figure 2 shows the schematic of the 40 Hz flicker system. The circuit uses NE555 Precision Timer to produce accurate time delays or oscillations of light in this case. The NE555 timer provides 40 Hz oscillation of light. The circuit also includes an LM358P dual operational amplifier designed for gain sensitivity, and resistors of

180k Ohms to produce a source of light oscillating at 40 Hz. Figure 3 shows six rows of three 12V LEDs are arranged side by side and connected in series. To use the device, set the switch to “on” on the back of the box and observe the lights flash.

5. Summary

Using the information obtained and conducting further research, light therapy has proven to deteriorate beta amyloid plaques that clump together between neurons in the brain. The increase in these plaques are what causes Alzheimer’s disease to progress. Our goal is to help change the lives of patients who struggle with the ailment using an effective and inexpensive treatment. Multiple people are

using the device at this point, it is too early to provide the real impact of the flicker system for Alzheimer patients.

Acknowledgement

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References

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Fig. 1 The device casing



Fig. 2 The 40 Hz Flicker

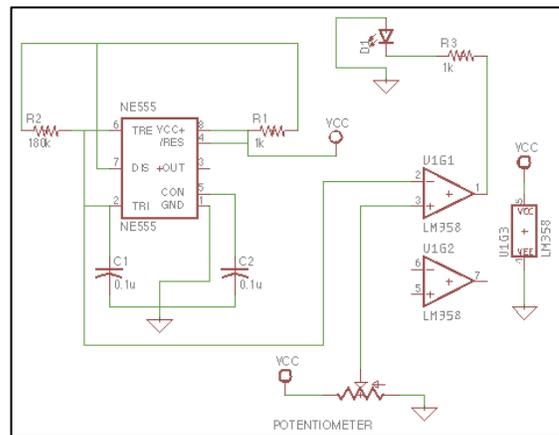


Fig. 3 The internal LED layout