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Lighted electronic visual fields model

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Abstract

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LIGHTED ELECTRONIC VISUAL FIELDS MODEL

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Lighted Electronic Visual Fields Model

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BIOGRAPHY

Evelyn Johnson graduated from Northern Montana College with a B.S. degree in Elementary Education in 1961. She taught grade school in Montana during the 1960's. When Evelyn's third and youngest child entered college she returned to college to pursue an optometric degree. Evelyn plans to practice optometry in the west upon graduation.

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It is great pleasure to acknowledge the wonderful help received to make this project possible.

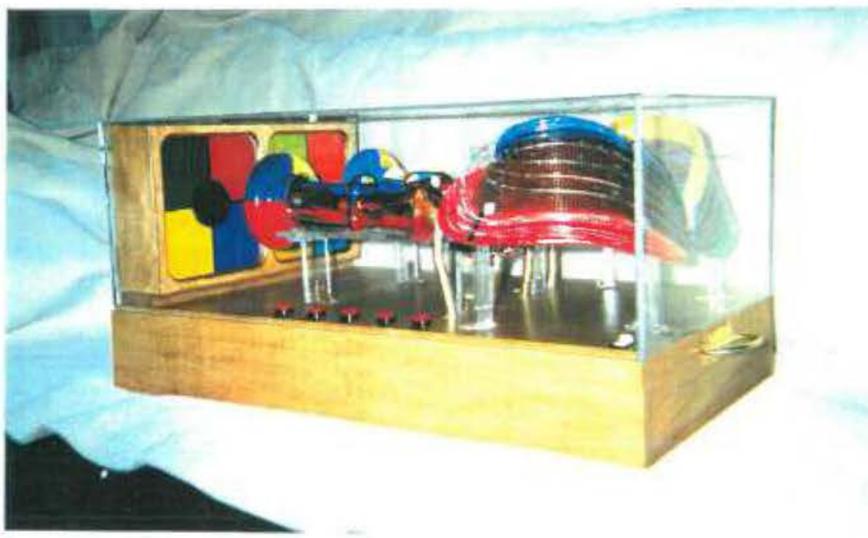
Thanks to my brother, W.K. Johnson, for contributions of building materials from his cabinet shop and help with cabinetry.

A very special thanks goes to my son, Cory Gondek, for sharing his electronic expertise and contributions of electronic materials.

Thanks to LeeAnn Remington O.D. who gave me the freedom to experiment and develop this project.

To all who helped make this project possible, my heartfelt gratitude.

LIGHTED ELECTRONIC VISUAL FIELD MODEL



This model was designed as an aide to facilitate the learning of the fields associated with disturbances in the visual pathway. The base and fields cabinets were made of wood and plexiglass. A different color of plexiglass was chosen for each quadrant of the visual field. Matching lighted tubes were constructed to simulate the optic fibers in the pathway anterior to the lateral geniculate nucleus. Lights inside the LGN light the fiber optics that fan out and end at the occipital lobe. When the red buttons on the model base are depressed and held down, lights flash to draw attention to the parts of the optic nerves that are affected and to the accompanying visual field.

The interior of the base encloses the electrical and computer parts. There is a 120V standard plug in. The current is then routed to transformers. All parts are run on very low current. Although this is not UL approved every precaution has been taken so that there will be no hazard to users.

A small computer has been built to run the model. A microprocessor runs the software that is contained in the EPROM. The software in the EPROM decodes the buttons to determine which lights should turn on or off. After the decoding, the correct data is sent to the output ports. Once the output ports receive the message, that information remains until a new message is received. The low level output from the computer ports turn the corresponding triacs on or off, 43which convert the 5V computer signal to 12V signal necessary to drive the lights.

The model is built to withstand years of use. A troubleshooting guide and diagrams are included to aid the users in any minor repairs, such as, changing lights or triacs. If additional care is needed, check to see that there is power to the wires and triacs. Someone who is familiar with electronics will be able to follow the schematic to locate the source of the problem. It is highly unlikely that there will be a problem involving the computer parts.

It is the hope of the builder of this model that the optometry students enjoy using this model, that learning is a little easier and a little more fun.

LIGHTED ELECTRONIC VISUAL FIELDS MODEL

On the base of the model are 5 red buttons which represent lesions at 5 locations in the visual pathway. To operate, press one button at a time and hold down. Continue to hold down and observe where nerve fibers are damaged and the corresponding visual field. The lights that blink represent areas of visual loss. If more than one button is depressed at a time only the lowest numbered button will respond.

Button #1: Optic Nerve Lesion

Field characteristics: Vision loss in the same eye as the lesion.
Model example: Left optic nerve lesion---Left full field vision loss.
Possible causes: Compression of optic nerve (tumors, aneurysms, hemorrhages).
Retrobulbar optic neuritis.
Demyelination of optic nerve.

Button #2: Optic Chiasm Lesion

Field characteristics: Bilateral temporal hemianopsia.
Model example: Chiasm lesion---Bilateral temporal hemianopsia.
Possible causes: Pituitary tumor (most common).
Other compression.

Button #3: Optic Tract Lesion

Field characteristics: Contralateral field defect.
Model example: Left optic track lesion---Right hemianopsia.
Possible causes: Compression of optic tract (tumors, aneurysms, hemorrhages) .
Ischemic condition from stroke.

Button #4: Meyer's Loop of Optic Radiations Lesion

Field characteristics: Field defect in superior quadrant of opposite hemifield.
Model example: Left Meyer's Loop lesion---Right superior quadrantanopsia.
Possible causes: Temporal head trauma.
Compression and ischemic conditions in the temporal lobe.

Button #5: Posterior Optic Radiations Lesion

Field characteristics: Contralateral field defect. Macula sparing.
Model example: Left optic radiation lesion (macula sparing)---Right hemianopsia).
Possible causes: Occipital lobe tumor.
Posterior cerebral artery embolism.
Ischemic conditions in brain tissue.
Contra-coup trauma.

```
; ***************************************************************************
; * Program: Light Controller Program                                       *
; * Author: Cory Gondek                                                     *
; *                                                                         *
; * Abstract:  This program reads the 5 buttons on the top front of the    *
; *      project case.    It then uses these values to index into a lookup*
; *      table.  There are 6 lookup tables.  The first table is the        *
; *      initial startup values and is used when no button is pressed.     *
; *      The other five tables are selected when the buttons are pressed. *
; *      A 0 binary value in the table represents a light that turns off. *
; *      1 is used to keep the light turned on.                            *
; ***************************************************************************

start:

; Read Buttons
                mov     p1, #11111111b      ; Write to port 1 for read impedance
                mov     p3, #11110101b      ; address buttons (74LS244)
                clr     p3.4                ; enable port (74LS154)
                mov     ACC, p1             ; Read in from port 3
                setb    p3.4                ; disable port

; Select lowest button
                jb        ACC.4, button1          ; Is button 1 pressed ?
                jb        ACC.3, button2          ; Is button 2 pressed ?
                jb        ACC.2, button3          ; Is button 3 pressed ?
                jb        ACC.1, button4          ; Is button 4 pressed ?
                jb        ACC.0, button5          ; Is button 5 pressed ?

nobuttons:      mov     DPTR, #LT0
                jmp     dolights
button1:        mov     DPTR, #LT1
                jmp     dolights
button2:        mov     DPTR, #LT2
                jmp     dolights
button3:        mov     DPTR, #LT3
                jmp     dolights
button4:        mov     DPTR, #LT4
                jmp     dolights
button5:        mov     DPTR, #LT5
                jmp     dolights

dolights:       call    blink
                jmp     START


display:        clr     A                   ; Zero accumulator
                movc    A, @A+DPTR          ; get 1st byte
                mov     P1, A               ; write byte to port
                mov     P3, #00010000b      ; write address
                clr     P3.4                ; send enable signal
                setb    P3.4                ; Clear enable signal
```

```
                clr     A                   ; Zero accumulator
                inc     DPTR                ; Move pointer to second byte
                movc    A, @A+DPTR          ; get 2nd byte
                mov     P1, A               ; write byte to port
                mov     P3, #00010001b      ; write address
                clr     P3.4                ; send enable signal
                setb    P3.4                ; clear enable signal

                clr     A                   ; Zero Accumulator
                inc     DPTR                ; Move pointer to third byte
                movc    A, @A+DPTR          ; get 3rd byte
                mov     P1, A               ; write byte to port
                mov     P3, #00010010b      ; write address
                clr     P3.4                ; send enable signal
                setb    P3.4                ; clear enable signal

                clr     A                   ; Zero accumulator
                inc     DPTR                ; Move pointer to fourth byte
                movc    A, @A+DPTR          ; get 4th byte
                mov     P1, A               ; write byte to port
                mov     P3, #00010011b      ; write address
                clr     P3.4                ; send enable signal
                setb    P3.4                ; clear enable signal

                clr     A                   ; Zero accumulator
                inc     DPTR                ; Move pointer to fifth byte
                movc    A, @A+DPTR          ; get 5th byte
                mov     P1, A               ; write byte to port
                mov     P3, #00010100b      ; write address
                clr     P3.4                ; send enable signal
                setb    P3.4                ; clear enable signal
                RET                         ; loop back to beginning

blink:          call    display
                call    delay
                mov     DPTR, #LT0
                call    display
                call    delay
                jmp     start

delay:          mov     R1, #0
loop1:          mov     R2, #0
loop2:          djnz    R2, loop2
                djnz    R1, loop1
                ret

; Light table 0 - All ON (no buttons pressed)
LT0:            DB      0FFH
                DB      0FFH
                DB      0FFH
                DB      0FFH
                DB      0FFH
```

```
; Light table 1 - button 1 pressed
LT1:            DB      00110000b
                DB      10011100b
                DB      10000001b
                DB      10101111b
                DB      00000000b

; Light table 2 - button 2 pressed
LT2:            DB      01001101b
                DB      01100111b
                DB      00111000b
                DB      01010100b
                DB      00000001b

; light table 3 - button 3 pressed
LT3:            DB      11010111b
                DB      10101101b
                DB      01000110b
                DB      00000000b
                DB      00000010b

; light table 4 - button 4 pressed
LT4:            DB      11111111b
                DB      11111111b
                DB      11110111b
                DB      11100101b
                DB      00000011b

; Light table 5 - button 5 pressed
LT5:            DB      11111111b
                DB      11111111b
                DB      11010111b
                DB      01100100b
                DB      00000010b

                end
```

Item	Quantity	Reference	Part
1	2	C1,C2	CAP
2	1	C3	.47mfd
3	1	C4	8.4K mfd
4	1	C5	0.47 mfd
5	2	D1,D2	DIODE
6	65	LP1,LP2,LP3,LP4,LP5,LP6, LP7,LP8,LP9,LP10,LP11, LP12,LP13,LP14,LP15,LP16, LP17,LP18,LP19,LP20,LP21, LP22,LP23,LP24,LP25,LP26, LP27,LP28,LP29,LP30,LP31, LP32,LP33,LP34,LP35,LP36, LP37,LP38,LP39,LP40,LP41, LP42,LP43,LP44,LP45, LP46,LP47,LP48,LP49,LP50, LP51,LP52,LP53,LP54,LP55, LP56,LP57,LP58,LP59,LP60, LP61,LP62,LP63,LP64,LP65	LAMP
7	34	Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8, Q9,Q10,Q11,Q12,Q13,Q14, Q15,Q16,Q17,Q18,Q19,Q20, Q21,Q22,Q23,Q24,Q25,Q26, Q27,Q28,Q29,Q30,Q31,Q32, Q33,Q34	TRIAC
8	11	R1,R2,R4,R5,R6,R7,R8,R9, R10,R11,R12	20 Ohm
9	1	R3	20 Ohm
10	5	R13,R14,R15,R16,R17	220 Ohm
11	1	R18	10k
12	34	R19,R20,R21,R22,R23,R24, R25,R26,R27,R28,R29,R30, R31,R32,R33,R34,R35,R36, R37,R38,R39,R40,R41,R42, R43,R44,R45,R46,R47,R48, R49,R50,R51,R52	2.2K Ohm

Item	Quantity	Reference	Part
13	5	S1,S2,S3,S4,S5	SW PUSHBUTTON
14	1	T1	12.6-0-12.6
15	1	T2	6.3-0-6.3
16	1	U1	8031
17	6	U2,U6,U7,U8,U9,U10	74LS373
18	1	U3	27C64
19	1	U4	74LS154
20	1	U5	74LS04
21	1	U11	74LS244
22	2	U12,U13	LM7805
23	1	Y1	11MHz

Troubleshooting Guide

With few exceptions, lights are independent of each other. If 2 lights are out adjacent to each other, be sure that all lights are present to complete the circuit while checking bulbs.

Problem	Solution
Light not working	1. Has the model been turned on at least 3-5 minutes? 2. Wiggle the defective lights. Connection could be loose. Check small wire on Christmas light to see if there is good connection. 3. Replace light. 4. Check that there is no free wire near breadboards. 5. Replace triacs for the appropriate light. 6. Have electronic knowledgeable person check for power problems.

Problem	Solution
Light not turning off when it should.	1. Replace appropriate triac. 2. Have electronic knowledgeable person check for problems.