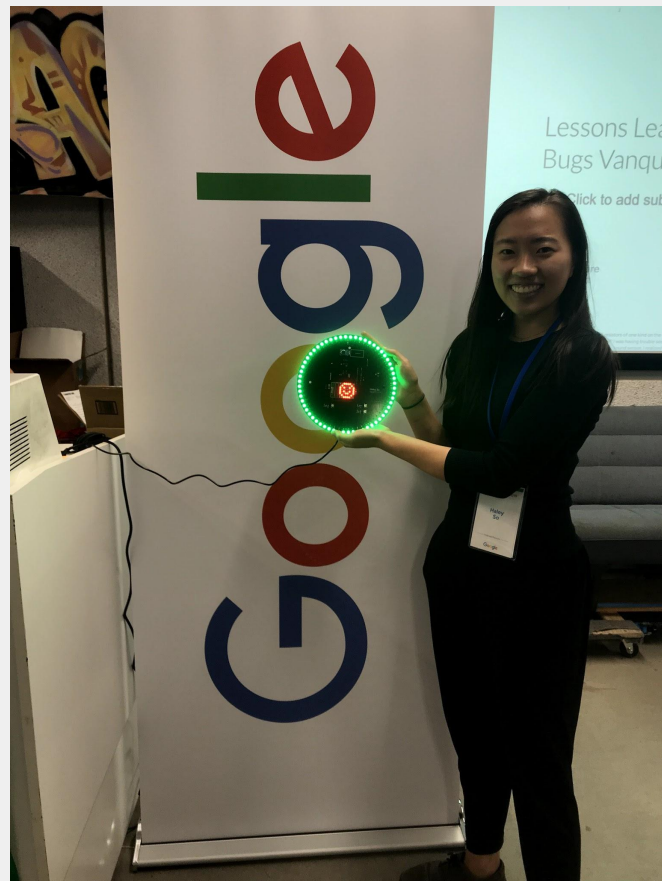


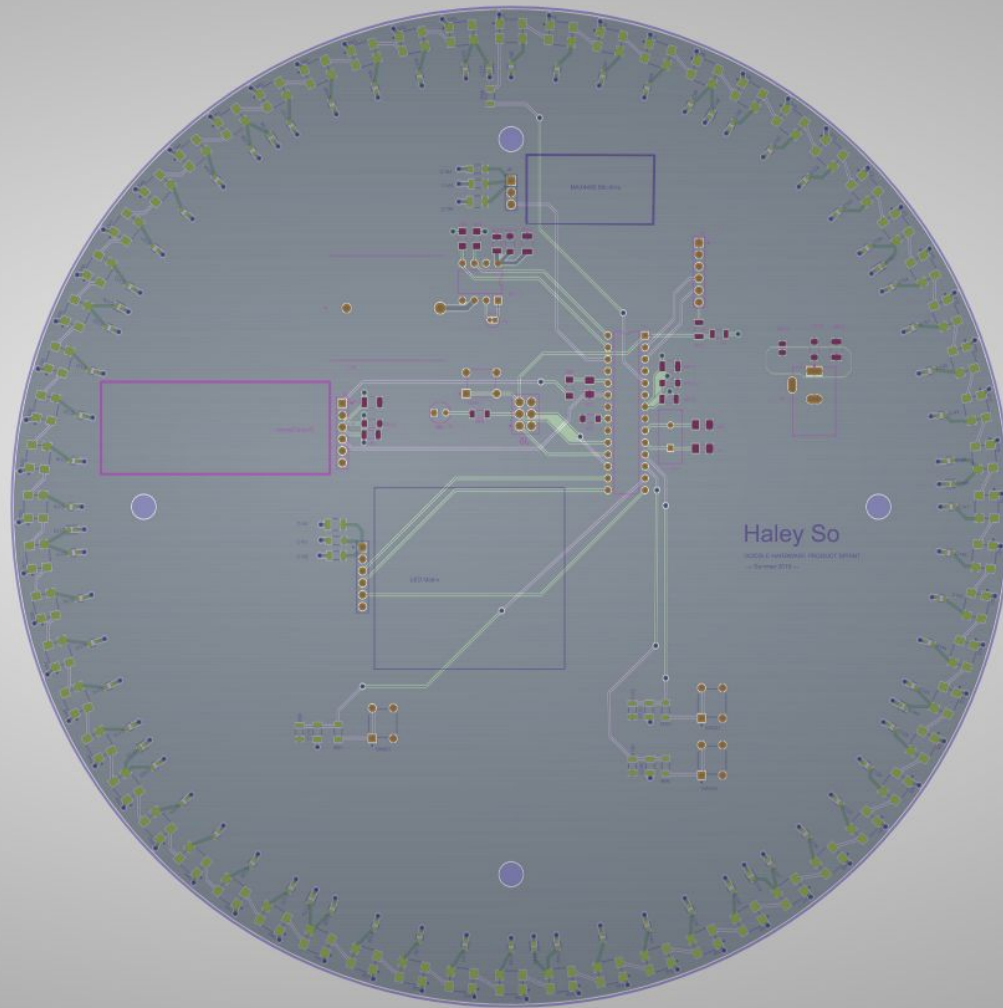
Design Book

Haley So 2019

Voila!

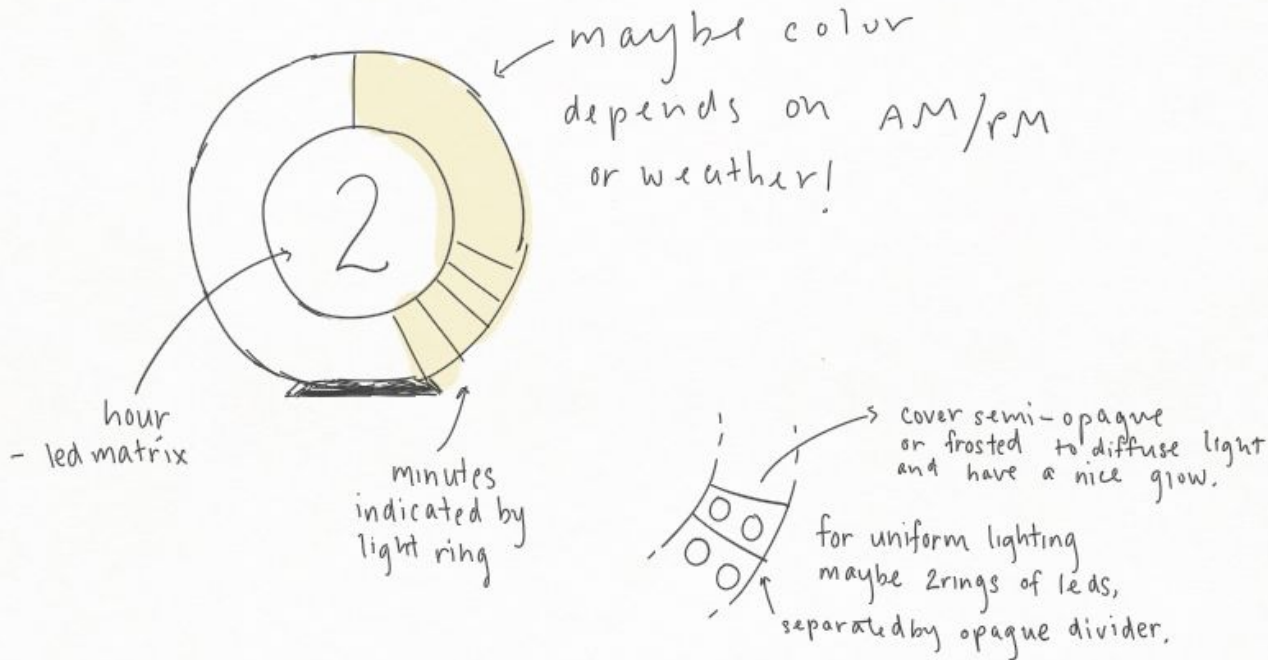


Voila!



Ideation (down-selected!)

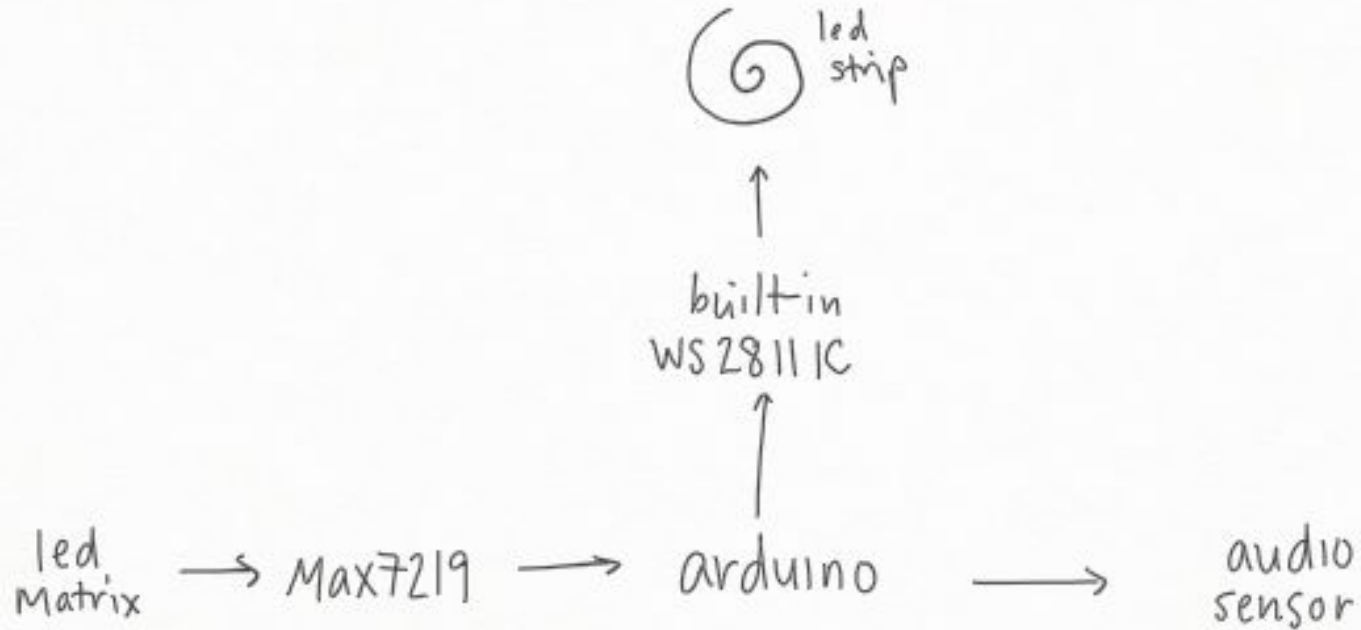
idea #1



Possibilities:

- use sound sensor and have the amplitude correspond to the brightness of the lights
- maybe lights will only turn on when you wave your hand in front of it or push a button
- play music/ding at the hour
- alarm clock? How would I set the time to wake up?
- button at top, change from time to weather

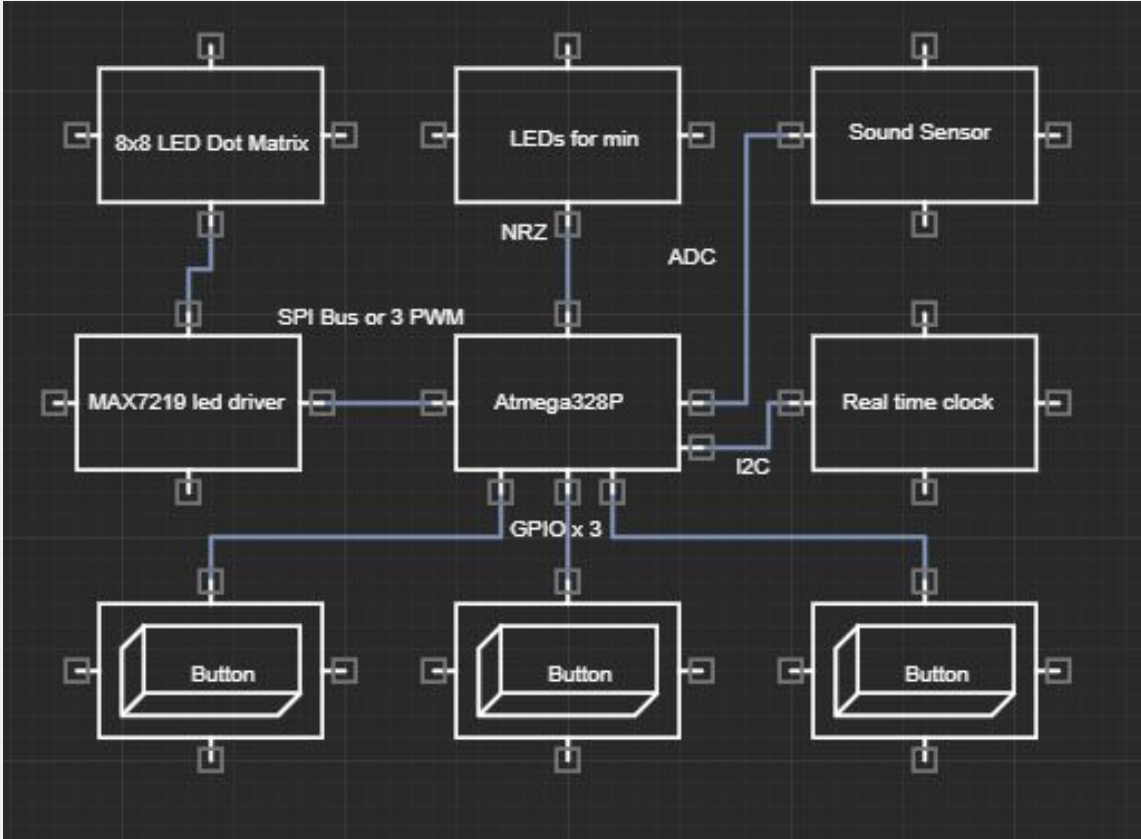
Preliminary block diagram



component selection (down-selected!)

Component	Link	Notes/use	Priority
100 Neopixel LEDs	NeoPixel RGB 5050 LED with Integrated Driver Chip - 100 Pack	- chainable (see more on later slide)	P1
Atmega328P	Arduino kit		P0
Sound Sensor Module	Arduino kit	Basically a capacitor-- capacitance changes with vibrations- two modes: can read analog (continuous) or read high once sound reaches a certain level (digital) (See later slide)	P2
LED Dot Matrix 8x8	Arduino kit	Operating Voltage: DC 4.7V – 5.3V, Typical Voltage: 5V, Operating Current: 320mA, Max Operating Current: 2A, Drive with MAX7219 LED driver chip	P1
MAX7219 LED driver chip	Arduino Kit		P1
Real time clock	Arduino kit		P0
Three buttons	Arduino kit	One button selects either hour or min--will flash, and other buttons increase or decrease Press the first button again to 'enter'	P0

Block Diagram



Pin Allocation Table:

<https://docs.google.com/spreadsheets/d/1OqjKlriLdlXydb-5rfnWKp9DKhT2HOxpZ84q08SG1-A/edit#gid=0>

	ATMEGA 328P PDIP				
RESET	1	~RESET	PC5 (ADC5/ SCL /PCINT13)	28	RTC DS1307 SCL
RXD	2	(PCINT16/RXD) PD0	PC4 (ADC4/ SDA /PCINT12)	27	RTC DS1307 SDA
TXD	3	(PCINT17/TXD) PD1	PC3 (ADC3/PCINT11)	26	MAX4466 Audio Sensor
	4	(PCINT18/INT0) PD2	PC2 (ADC2/PCINT10)	25	
Neopixel 1 DIN	5	(PCINT19/OC2B/INT1) PD3	PC1 (ADC1/PCINT9)	24	Sound VMA309 AO
	6	(PCINT20/XCK/T0) PD4	PC0 (ADC0/PCINT8)	23	Sound VMA309 DO
VCC	7	VCC	GND	22	GND
GND	8	GND	AREF	21	VCC
Crystal 1	9	(PCINT6/ XTAL1 /TOSC1) PB6	AVCC	20	VCC
Crystal 1	10	(PCINT7/ XTAL2 /TOSC2) PB7	PB5 (SCK/PCINT5)	19	single led
Button 1	11	(PCINT21/OC0B/T1) PD5	PB4 (MISO/PCINT4)	18	MISO
Button 2	12	(PCINT22/OC0A/AIN0) PD6	PB3 (MOSI/OC2A/PCINT3)	17	MOSI
Button 3	13	(PCINT23/AIN1) PD7	PB2 (~ SS /OC1B/PCINT2)	16	LED Matrix DIN
LED CLK	14	(PCINT0/CLKO/ICP1) PB0	PB1 (OC1A/PCINT1)	15	LED Matrix LOAD (~CS)

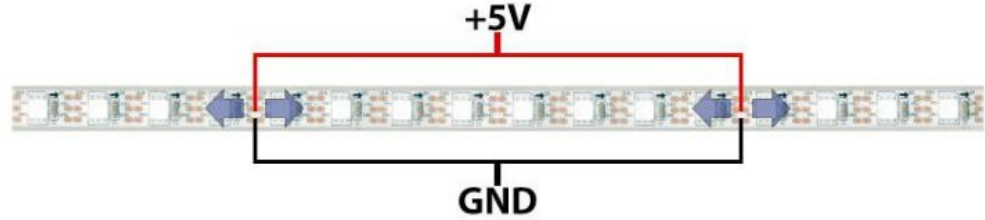
Part Details

Using the Neopixels

Pro Tip: NeoPixels don't care what end they receive power from. Though data moves in only one direction, electricity can go *either way*. You can connect power at the **head**, the **tail**, in the **middle**, or ideally distribute it to **several points**. For best color consistency, aim for 1 meter or less distance from any pixel to a power connection. With larger NeoPixel setups, think of power distribution as **branches of a tree** rather than one continuous line.

Neopixels:

- [Install library for code](#)
- [Addressing individual pixels](#)



Supply separate 5V to the pixels instead of having the arduino power it. The Arduino can only continuously supply about 500mA to the 5V pin. Each Neopixel can draw up to 60 mA at full brightness.

- Add ~470 ohm resistor between the arduino and the first pixel data input to prevent spikes that can damage the first pixel
- With through-hole NeoPixels (5mm), add a .1uF cap between the + and - pins of EACH PIXEL. Individual pixels may misbehave without this "decoupling cap"
- When using a DC Supply, add a large cap (1000uF, 6.3 V or higher) across the + and - terminals. This prevents the onrush of current from damaging the pixels.
- If powering pixels from outside source, power leds before powering microcontroller.

Using the sound sensor

- Two signal output modes: (a) `digital_signal_output` or (b) `analog_signal_output`.
 - (a) at a certain level, trigger digital signal -> high. Can change sensitivity with potentiometer
 - (b) analog signal, directly
- Connect gnd, 5V, analog in on arduino, and data in on arduino
- Analog vs digital
 - Analog would be good for music
 - But it might be annoying to have everyday noises make the clock flicker
 - I could just change the sensitivity though...will test it out with kit comes

Using MAX7219 and 8x8 led matrix

- Can control all 64 leds using only 3 pins on arduino
- 5V, 320mA, 2A (max operating current)
- Connect gnd, 5V, Data in, Clock, and CS
- Can actually only turn on 8 leds at a time, but can switch so quickly that to the human eye, the whole matrix can look on at the same time in a continuous light.
- Include the [max matrix library](#)
- Resistor btwn 5V and the IC pin to control brightness and current flow. According to the forward voltage drop

Table 11. RSET vs. Segment Current and LED Forward Voltage

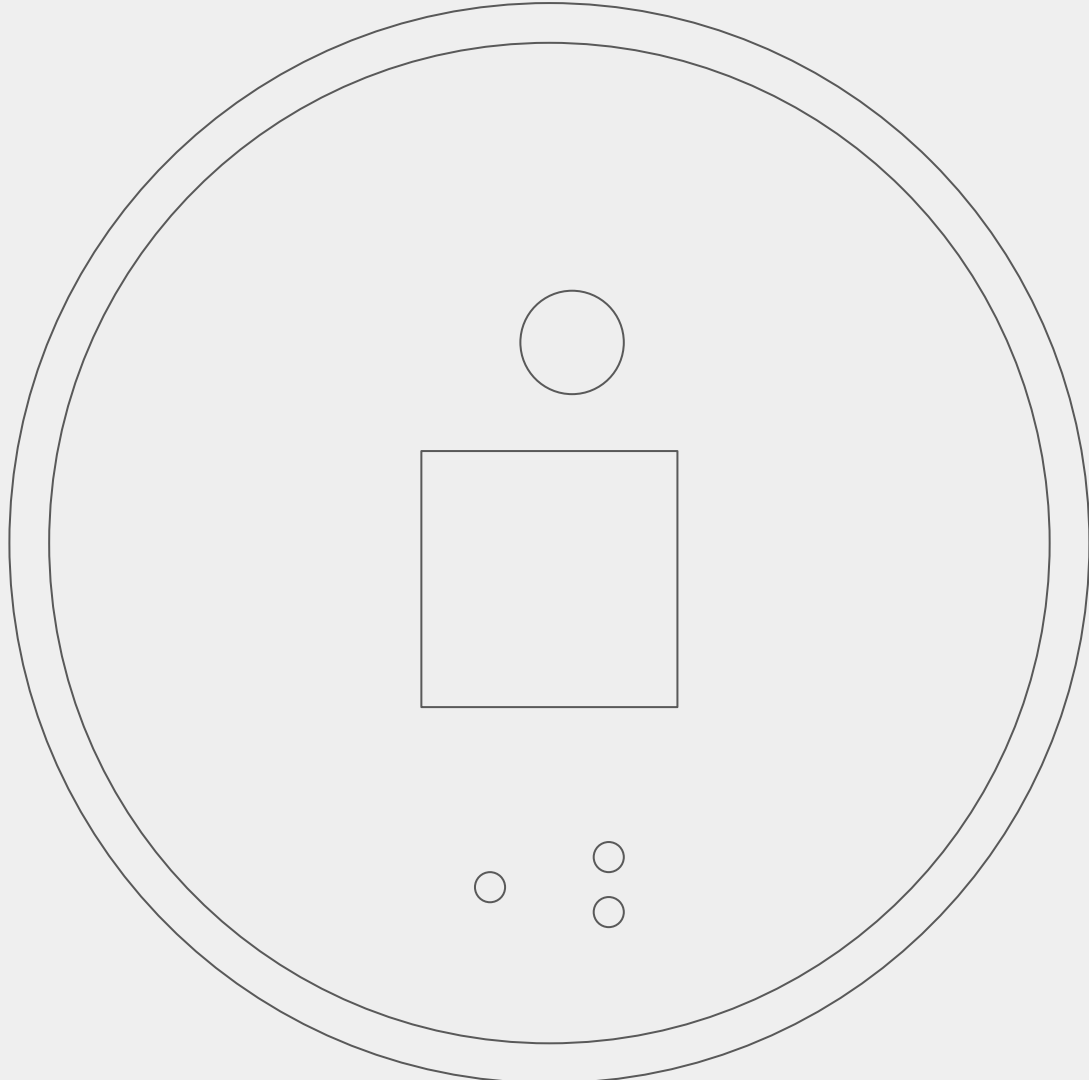
ISEG (mA)	VLED (V)				
	1.5	2.0	2.5	3.0	3.5
40	12.2	11.8	11.0	10.6	9.69
30	17.8	17.1	15.8	15.0	14.0
20	29.8	28.0	25.9	24.5	22.6
10	66.7	63.7	59.3	55.4	51.2

* Table from the datasheet of the MAX7219 IC

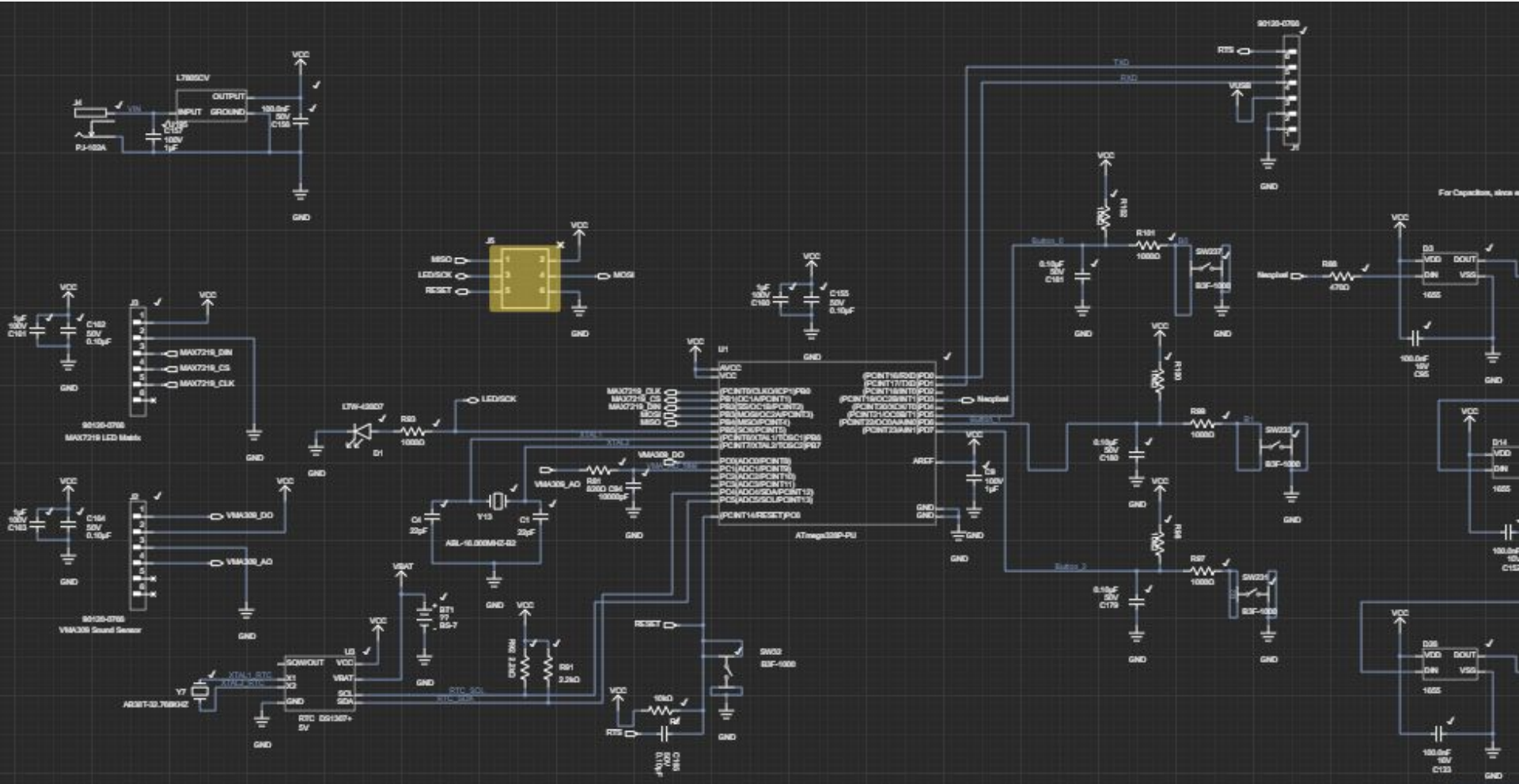
Real Time Clock

- communicates over I2C, SDA (serial data), SCL (serial clock), Gnd, 5V
 - SQW (square wave)- can read the output of internal oscillator
- Download library
- User input---buttons to the arduino

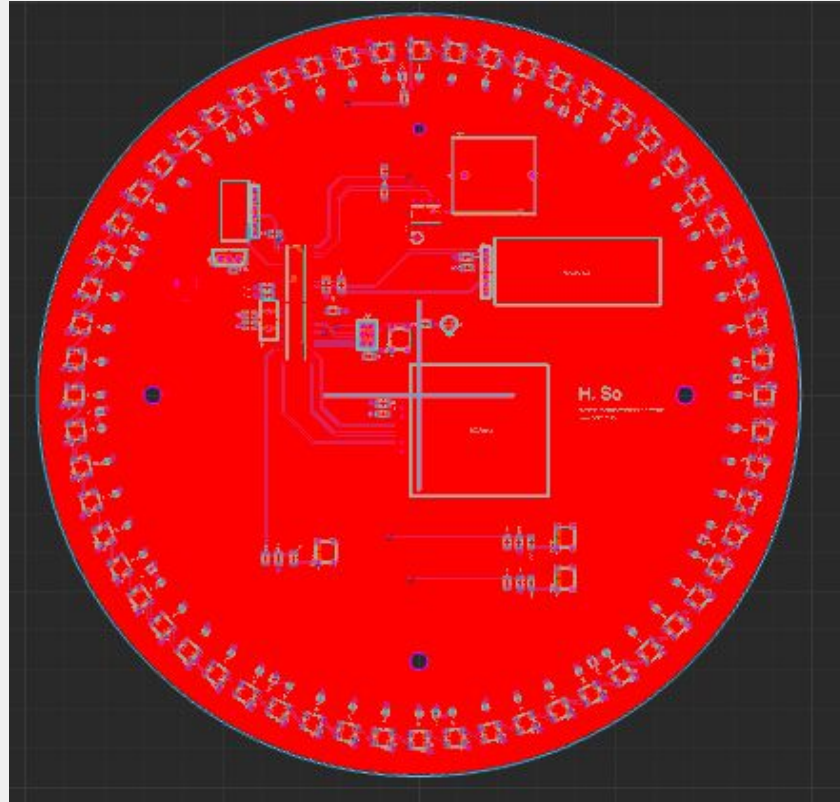
Schematic and PCB Layout



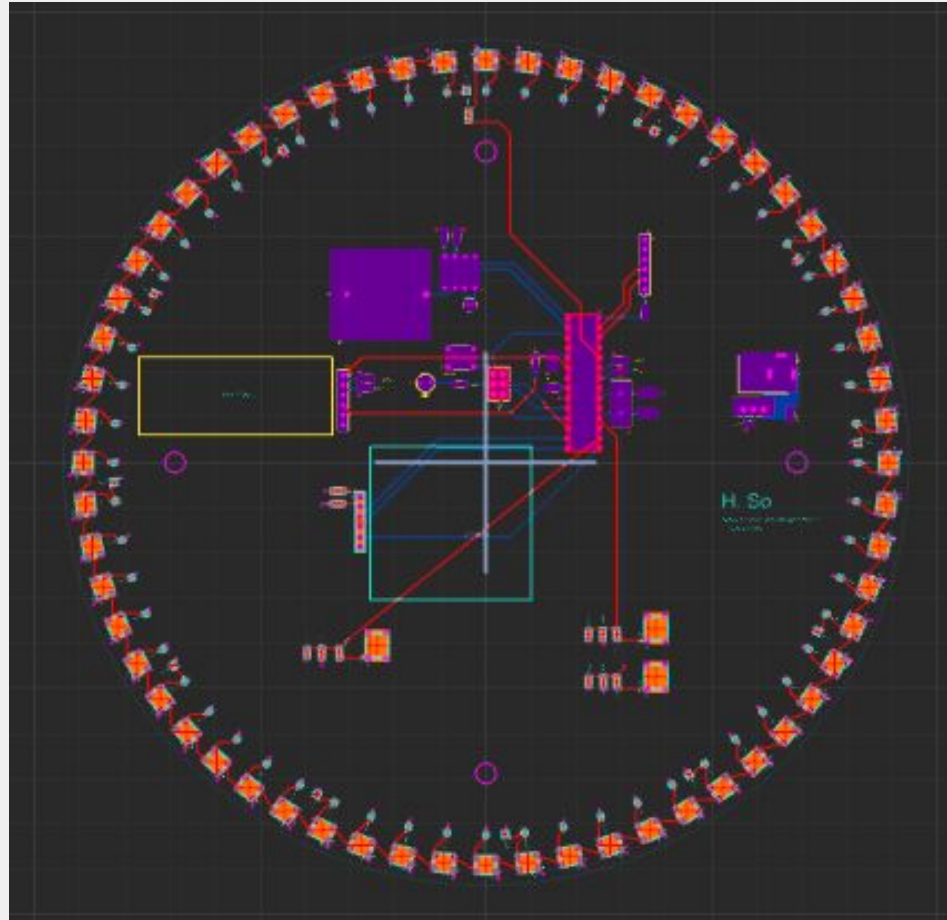
Schematic



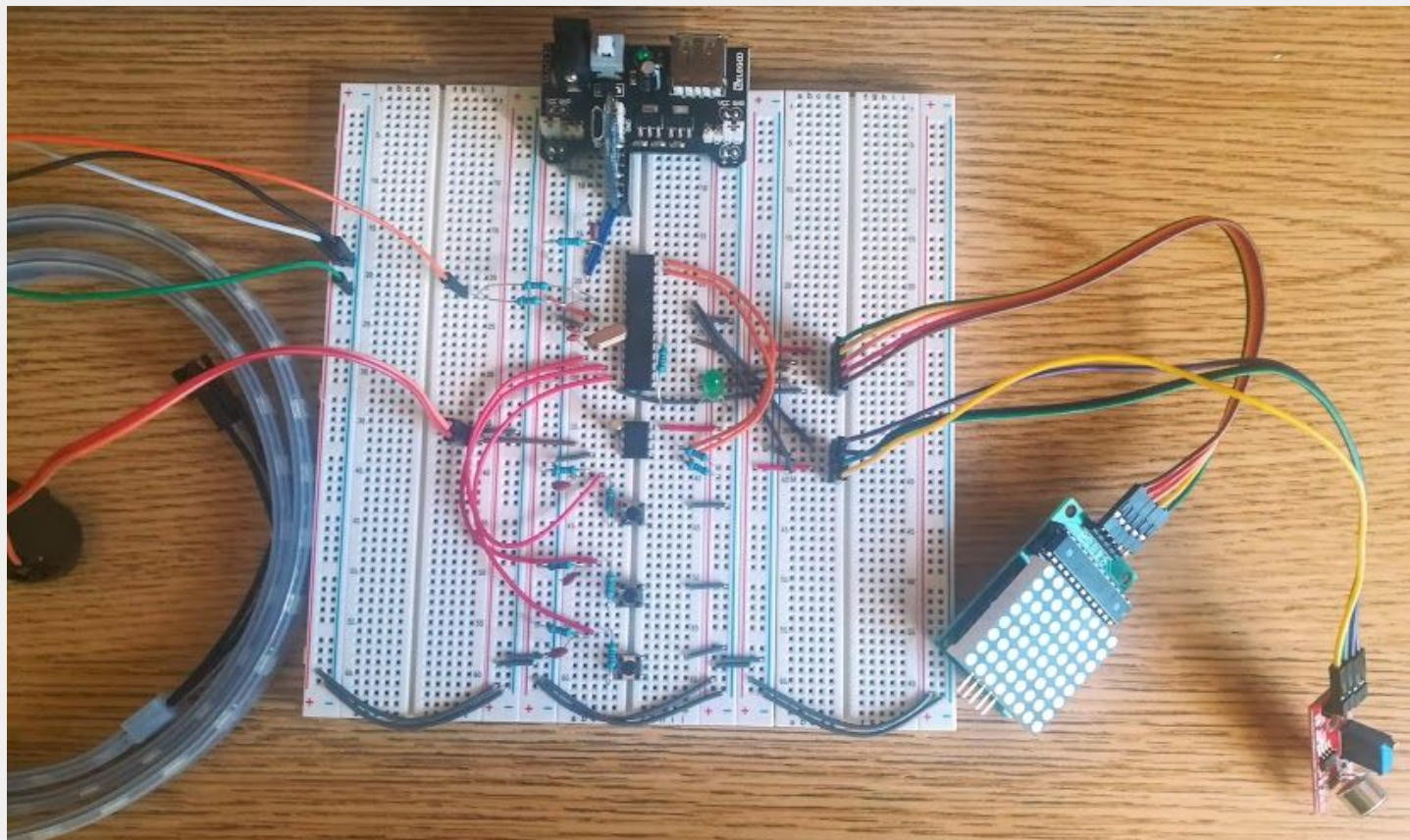
PCB Layout



Version 2 (components on back)



Prototype



OK2Fab Checklist

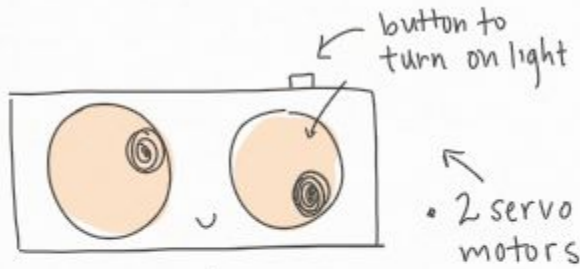
Blocks	Schematic	Layout	Software	Breadboard validation
RTC	Done	Done	Done	Done--correct time and date, can communicate with MCU
LED Matrix	Done	Done	Done	Can program shapes/numbers!---just need to set the font/ program what each number looks like
Neopixels	Done	Done	Done	Can make patterns and program leds individually as well---just working on syncing to clock and sound sensor
Sound Sensor	Done	Done	WIP	Sound sensor is reading all very similar numbers, so the leds aren't lighting up how I want them to...
Buttons	Done	Done	Done	Done

* still finalizing the overall clock code and tying everything together, but everything has been tested and besides the sound sensor, works as I'd like it to.

Archives

ideation

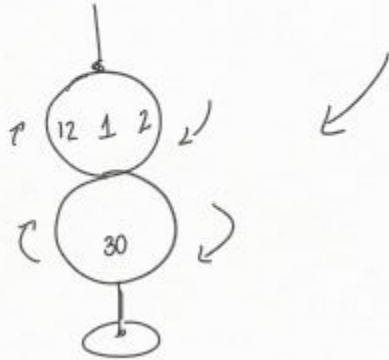
idea 2



Other ideas:

- indicate location of family like Molly Weasley's clock
- cuckoo clock

idea 3



Component options

Component	Link	Notes/use
LED 1/4 rings	NeoPixel 1/4 60 Ring - 5050 RGBW LED w/ Integrated Drivers - Natural White - ~4500K	<ul style="list-style-type: none">- need to buy 4 since these are quarter rings (~\$40 :/)- diameter 6.2 inches- embedded microcontroller inside the LED
60 pixel strip	ALITOVE 3.2ft 60 Pixels WS2812B WS2811	<ul style="list-style-type: none">- individually addressable, Input voltage: DC5V- built in chip WS2811IC Chip- better cost!
strip of 60 LEDs	Adafruit Mini Skinny NeoPixel Digital RGB LED Strip - 60 LED/m - BLACK	<ul style="list-style-type: none">- one meter long, but can be cut/taken apart- individually addressable- The way the pixels are controlled by an Arduino, the entire strip must be buffered in memory
100 LEDs	NeoPixel RGB 5050 LED with Integrated Driver Chip - 100 Pack	<ul style="list-style-type: none">- chainable
ring of 60	SparkFun LuMini LED Ring - 3 Inch (60 x APA102-2020)	<ul style="list-style-type: none">- python??
Arduino	Arduino kit	
Sound Sensor Module	Arduino kit	Basically a capacitor-- capacitance changes with vibrations- two modes: can read analog (continuous) or read high once sound reaches a certain level (digital)
LED Dot Matrix	Arduino kit	Operating Voltage: DC 4.7V – 5.3V, Typical Voltage: 5V, Operating Current: 320mA, Max Operating Current: 2A, Drive with MAX7219 LED driver chip
MAX7219 LED driver chip	Arduino Kit	

Update: Upverter block diagram

