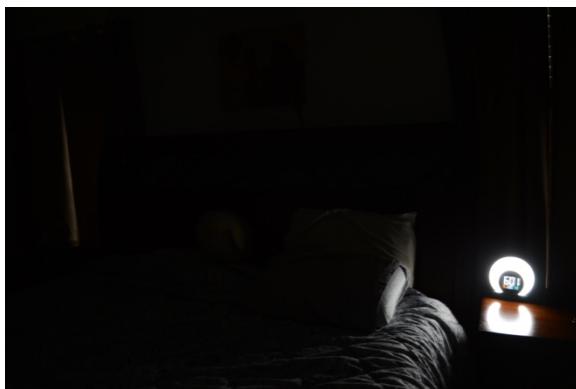


Sunrise Alarm Clock

My alarm clock had a snooze button and a stop button. If I wanted more sleep when it went off, I hit the stop button. That alarm wouldn't go off again for another 24 hours. What I needed was an alarm clock that couldn't stop.



So I took it upon myself to create an alarm clock that:

- I can't turn off if I want more sleep
- Uses LOTS of light to wake me up.
- Looks cool. If it doesn't, then it doesn't fit in with the rest of my room.



I also wanted an alarm clock that gradually woke me up with light. The ones I'd seen simply weren't up to the task, and couldn't fill my room with enough light.



The light output is so strong that it's great for bedtime reading!

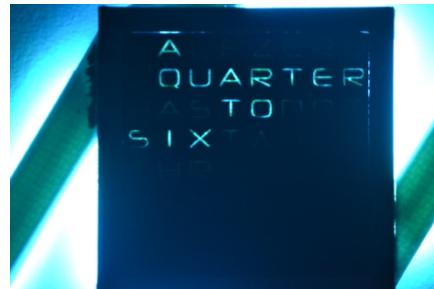
Sunrise Alarm Clock

Features:

- Word clock
- Sunrise animation (see video)
- Compass animation

Word Clock

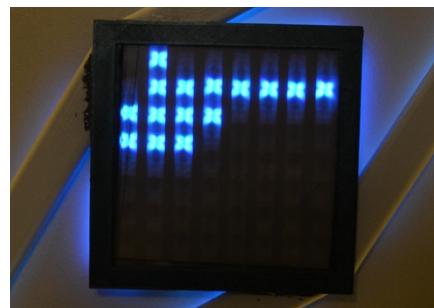
The word clock is at the center of the piece. It's accurate to the nearest quarter hour, but it's often hard to see in bright light because of the mask in front.



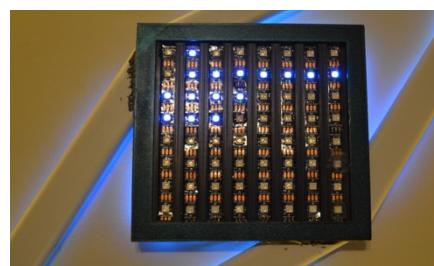
The frontmost layer is the word mask, which is simply a 3D printed plate with a very thin skin above the letters and a thicker shell to block excess light. It's actually a bit too good at its job, so it can be hard to see the words.



Behind this mask are three diffusion layers which were taken from an old computer backlight system. First are two lenses, which distort the light in directions perpendicular to each other. Then a matte diffusion layer sits atop them to more evenly distribute the light.



At the very bottom is a matrix of WS2812B addressable LEDs. The 64 LEDs are wired in series to minimize the number of microcontroller pins necessary to operate the matrix.



Sunrise Alarm Clock

Compass Animation

I needed a way to connect the outer ring lamp and the inner word clock. Initially, I planned to use three connecting pieces, but I wanted them to fit in with the rest of the piece. I took inspiration from Apple's Safari logo, creating the compass shape.



The animation itself is inspired by the Pacifica example in the FastLED library, and utilizes much of that code. I developed a more general version of the animation which takes hue, saturation, and variance as inputs from a Firebase database (more on that later) to create the final animation.



Accessory Lights

The two lights found on the side of the sunrise alarm clock were initially connected to the Firebase database as well, but after an incident involving a melted resistor, I decided it was safest to simply use a slide switch to power them on and off.

The left light is the character રીલ which is the first character of my name in Gujarati. The right light is the character શ which is my favorite Greek letter (because it looks cool, and it's the Riemann zeta function).



Sunrise Alarm Clock

Build Process

This build can be split into four stages. The outer ring lamp, the word clock, the compass network, and finally the code. The build process for the accessory lamps can be found in a separate document.

Image courtesy: [Instructables](#)

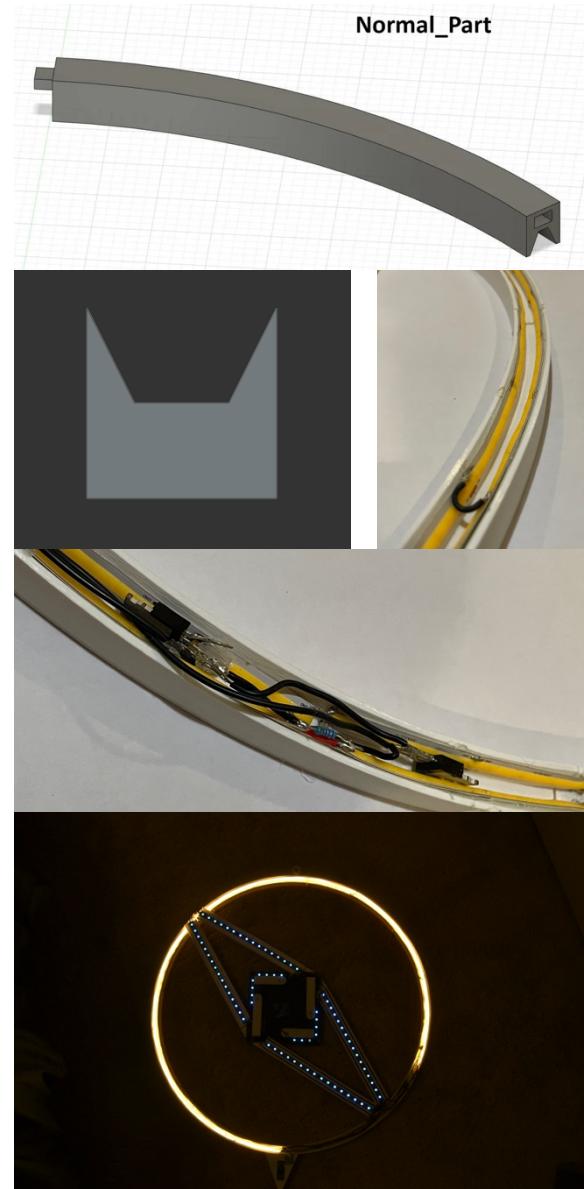
Ring Lamp

I used the 3D models from an [Instructables](#) as my base. I began by 3D printing the 8 pieces in white PLA and putting them together.

Each of the pieces is 1/8 of a circle, and has a cross section approximately as shown in the left image. Once all of them were assembled, I ran LED strips through both of the inner faces as depicted in the right image. An additional piece was printed to provide a place for the power input jack at the bottom.

MOSFETs control power regulation, stepping a 3.3V signal from the microcontroller up to the 5V needed by the LED strips.

The specific wiring of the ring lamp to the microcontroller creates two segments of lighting: one 1/8 circle segment towards the bottom left, and the other 7/8 segment. These are cycled through in binary fashion through inputs on the word clock (discussed later).



Sunrise Alarm Clock

Word Clock

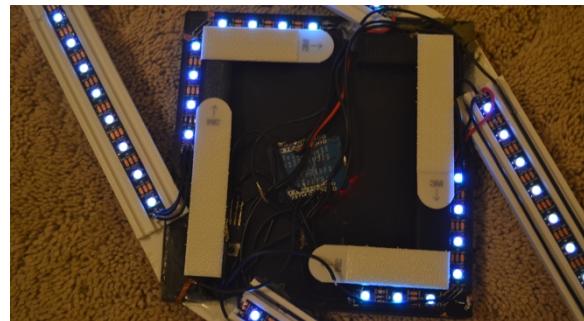
The word clock frame (as described above) is a three-layer sandwich. The front-facing layers have already been discussed. The back layer, however, contains the microcontroller, which has wires running to LEDs in every direction.

The word clock also has four capacitive touch inputs (one at each corner) using the ESP32's built-in capacitive touch hardware. The left corners control brightness, the top right is a "custom" button which is currently unused, and the bottom right button cycles through the different settings of the ring lamp.

Compass Network

This aspect of the project was by far the most difficult to construct. Because of the size of my printer (Ender 3), I printed it in 12 parts after running through several iterations. Each "edge" of the compass is three pieces: two LED carrying segments, covered by a longer shell to hide the joint.

Joining the compass network to the word clock was fairly straightforward, since I'd designed the angles specifically for that. The word clock was fairly light so a combination of J.B. weld epoxy and hot glue were used. However, the ring lamp itself is fairly heavy and is only held up through the tension of the compass network. This makes the handling entire device a tedious process, as I have to be very careful about how I hold the ring lamp and compass network.



Sunrise Alarm Clock

Code

The code uses the Firebase ESP Client and FastLED libraries. In essence, it fetches data from a personal Firebase database once per minute, which determines the brightness, hue, saturation, variation, and other parameters of the ring lamp and compass network. It also uses WiFi to collect time data.

A linear brightness function uses task threading on the ESP32 to gradually increment the brightness over 30 minutes without sacrificing any other animations (namely, the compass animation).

The code can be found at <https://github.com/Padimo/sunriseclock>.

Final Thoughts

Knowing what I know, if I were to make another device like this, I would split up the ring lamp from the word clock and compass network. It's simply too unwieldy to try to connect all of them together and hope that four Command strips will hold them up. Additionally, the 3D printed mask on the word clock was too strong, so I may re-print it in white in the future.

Since the melted resistor incident (see page 3), I've reduced the feature set on the alarm clock itself and only plug it in when I want a softer light. I haven't shown the sunrise animation because of the reduced feature set.