



Tidal Clock Gallery

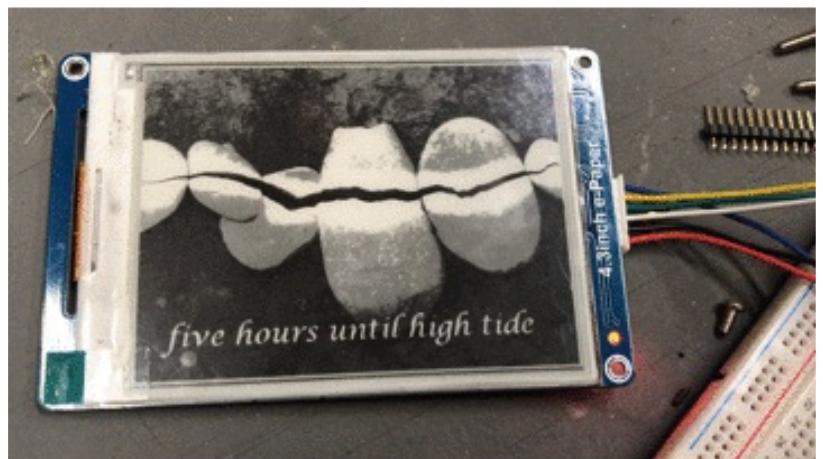


by rabbitcreek

This small self contained gallery of photos that delineate the time of tides is a nice project for the summer. The principle of tidal forecasts with a microcontroller is based on the work of Luke Miller who set up the data structure and easy code that allows the limited talents of these processors to predict the outcome of ocean wanderings. Please see my previous Instructables for further notes on how this is done: <https://www.instructables.com/id/Solar-Tide-Clock...>

This tide clock expresses the upcoming tidal spread on a e-paper screen in black and white Andy

Goldsworthy shots with a word salad of "high tide in five hours". Its power concerns are addressed by having a loosely timed TPL5111 that wakes up every hour or so and sends the processor into figuring the next high and low tide and choosing the appropriate photo from a quiver of them on a card built into the 4.3 inch screen. Of course there is a solar cell on the backside to provide whiffs of watts. Since this was a gift for a old friend it also contained a series of Easter Egg shots queued to various important dates in his life...



Step 1: Gather Your Materials

The most expensive and hard to source item for this build is the 4.3 inch e-pub screen. It is a nice item having a card memory and a separate processor that enables it to offload all the complexities of dumping

the outside and a surround of dark leather. These of course are up to you in terms of your surface build. The lipo battery this size can be easily taken from on-sale phone power tanks that you can get on sale at Walgreens--really the cheapest way of getting these batteries now. The thin film solar panels of the appropriate voltage are really nice to work with--amenable to contact cement and slight curves.

1. 4.3 Inch E-Paper 800x600 \$58.00
<https://www.dfrobot.com/product-1312.html>

2. KOOKYE 5PCS Nano V3.0 ATMEGA328P Module CH340G 5V 16M Mini USB Micro-controller Board for Arduino--cheap

bmp files onto the 4-tone screen. Unfortunately its pricey -- \$60. The frame itself is made out of surfaced aluminum -- Lowes etc. I used Teak plywood, that is normally used for redoing floors in old sailboats for

3. Adafruit TPL5111 Low Power Timer Breakout

4. Adafruit DS3231 Precision RTC Breakout

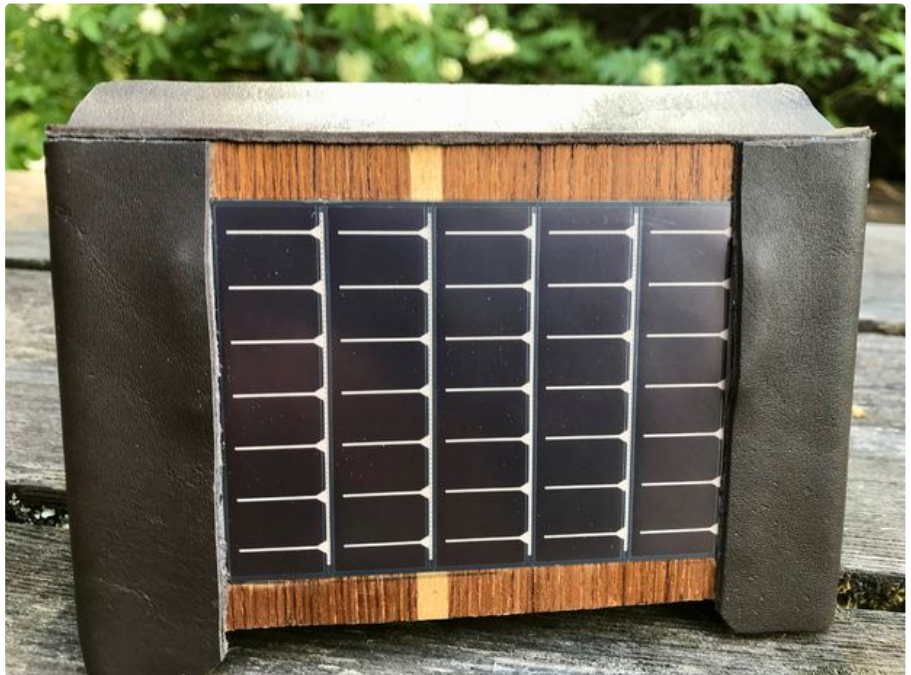
5. TP4056 Charger Board--Cheap

6. PowerBoost 500 Basic - 5V USB Boost @ 500mA from 1.8V+ from Adafruit

7. Power Switch

8. Lipo 4000mah battery -- \$10 Walgreens

9. PowerFilm MPT6-75 > .3 Watt 6 Volt Thin Film Solar Panel \$20





Step 2: Build It

The general size of the A frame picture frame is 6 inches wide by 4 inches tall. The sides are held together with a generic piano hinge attached with 4mm screws and nuts. The central hole for the screen is cut out along with all the other cuts with a metal saber saw blade. The inside areas are sprayed with a

plastic liner paint which is tough and insulates the components from the metal. The plywood is cut and carefully surfaced and glued into place on the aluminum frame with contact cement.

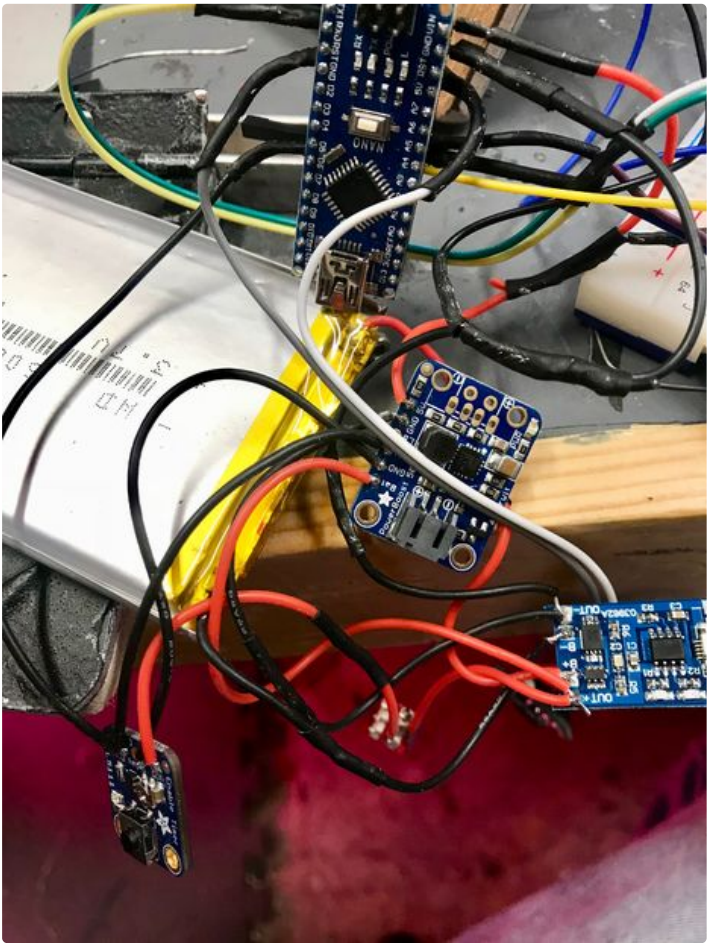
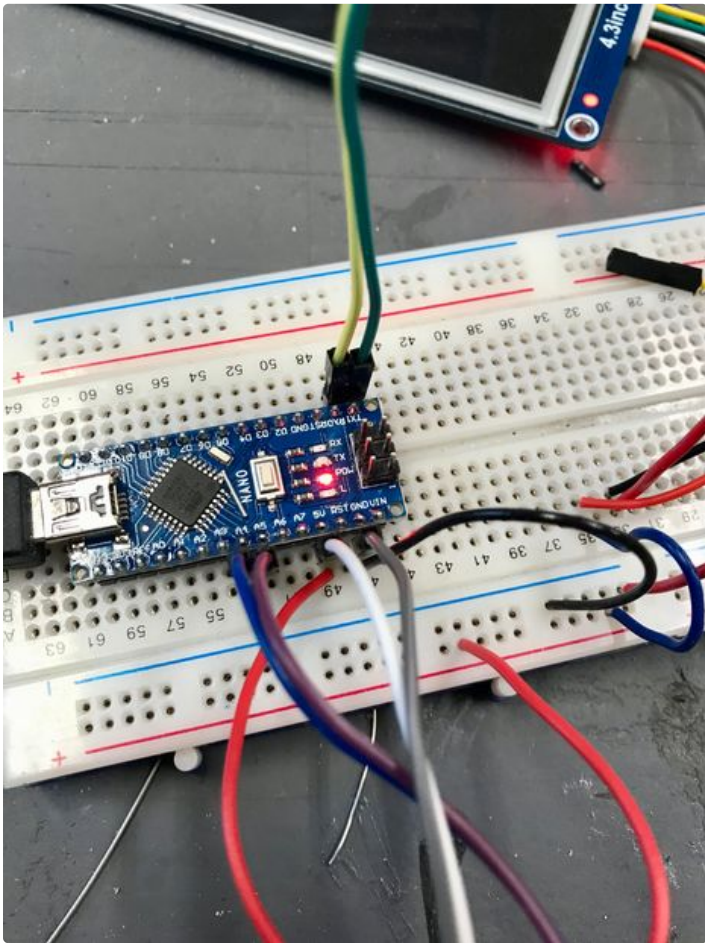
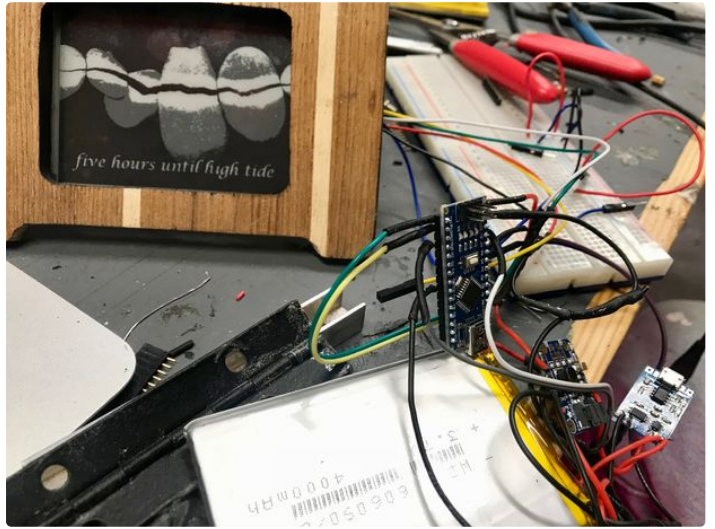
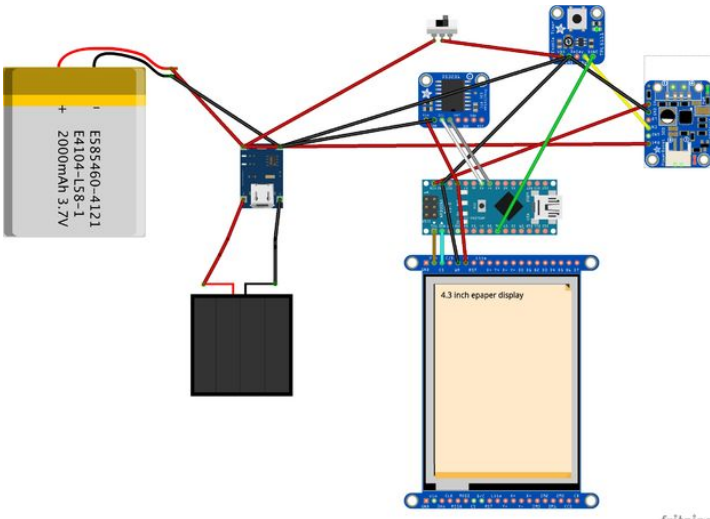




Step 3: Wire It

The fritzing diagram goes into the details of how the components fit together. The important details are that you really seem to need a nano or large arduino to run the software for the tide table and the e-paper display together. I tried a variety of other computers--WEMOS D1, and a variety of Adafruit offerings and could never get the spark. The key to power saving is of course the TPL5111 which is a really good board. It uses the enable pin on the boost board to control power to the rest of the components. Its twin, the TPL110 that controls all the power without an enable pin has never worked for me. It's important that you monitor the resistance of the board to determine

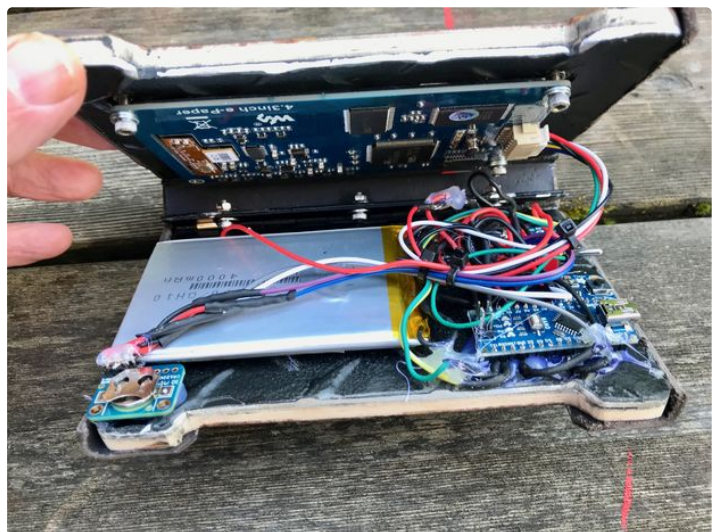
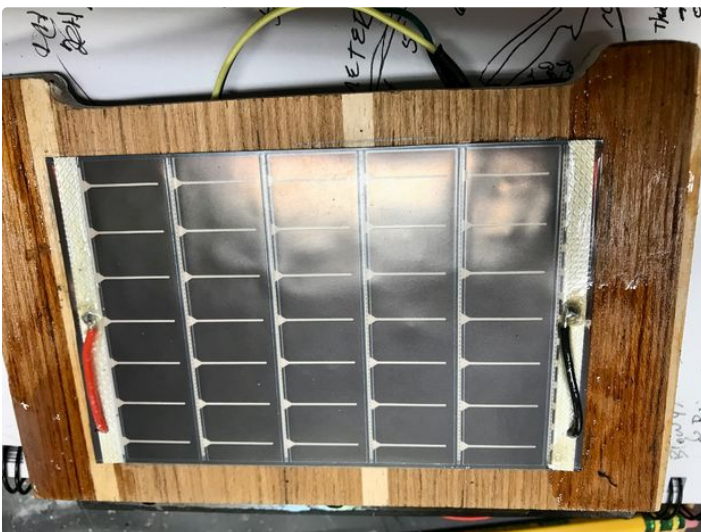
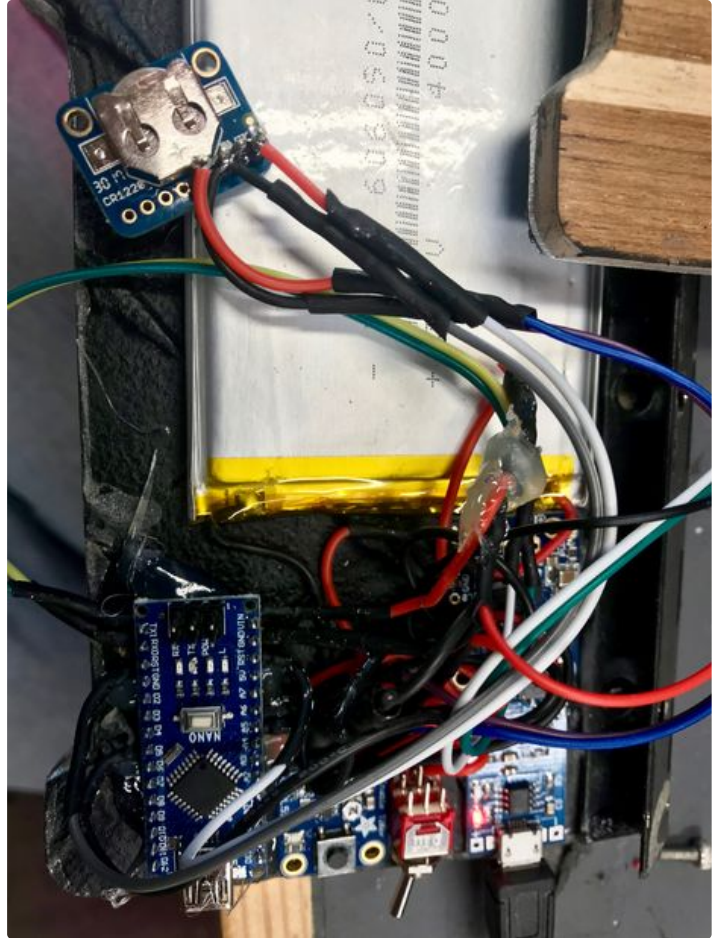
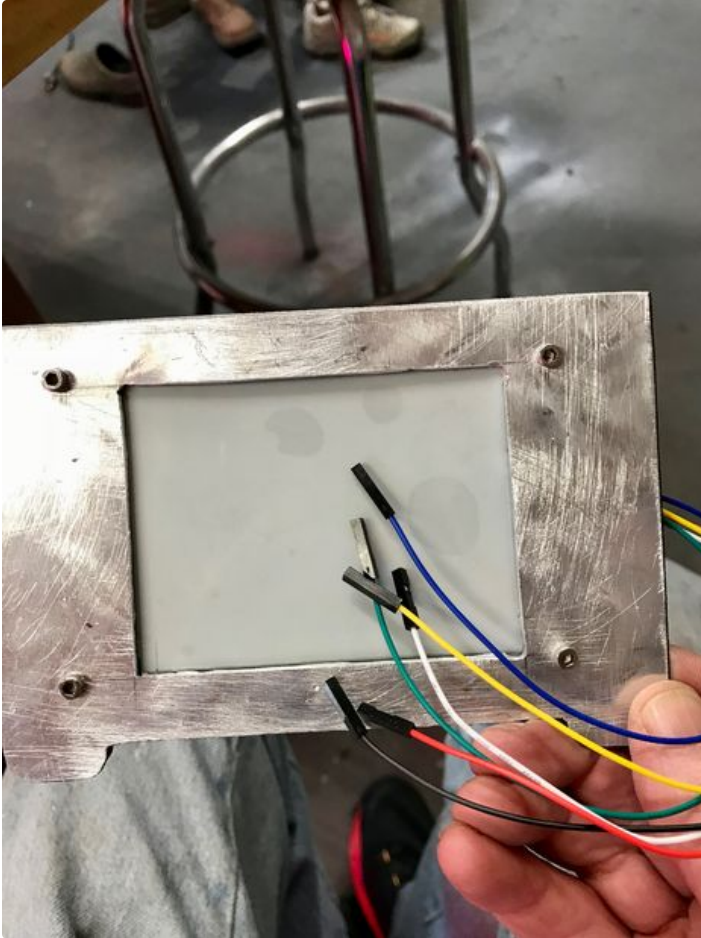
timing--instructions on Adafruits website are perfect like always. I went for every hour update to the tide clock. The pins for SDA and SCL are A4 and A5 on the nano and I used D6 for the release pin that you have to hang high to turn off the TPL. The Rx and Tx are the only attachments to run the screen along with power. The drawback is you have to disconnect whenever you upload programs or if you want to troubleshoot with the serial port. There is an easy quick connect to the screen board that makes this easy.

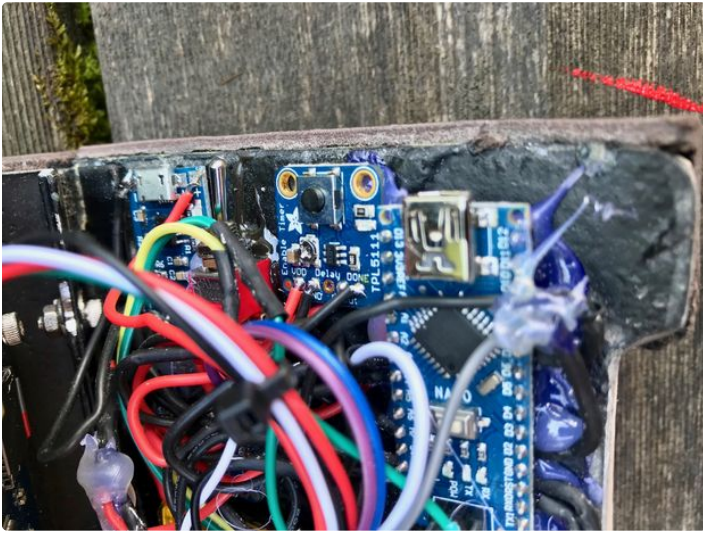


Step 4: Assemble It

This part is pretty easy--just cram and glue all your components inside the two leaves of the frame. The e-paper display basically take up one side and the rest of the chips and battery go on the other. I used a combination of hot glue and epoxy for all the connections. You want to make sure that the charging port on the TP 4056 and the programing port on your nano are both easily accessible. The thin film solar panel is contact cemented to the back of the frame

and wiring is easily done through small holes in the wood/aluminum composite. Instructions on how to wire these thin film are on their web site. You have to carefully scrape off the covering of plastic and apply a thin blob of solder to hold the wire in place. The on/off switch disconnects power to the tpl timer from the battery but allows the battery to still charge.





Step 5: Program It

The program is adapted from Luke Millers wonderful efforts at bringing tide tables to the arduino. I have adapted it to deliver high and low tides in the future by adding 15 minute aliquots of time and checking the slope of the changing tide height and direction. The program then checks for the difference between current time and the future high or low tide and then chooses an appropriate picture from the stack on the card. There is correction for daylight savings and a easterEgg array with month and days that are checked before each run and if it's a birthday or anniversary displays an appropriate photograph for the day.

This Instructable:

<https://www.instructables.com/id/E-Paper-Picture-Frame/> got me going with this type of display and contains instructions for converting appropriate JPEGs to BMP files that will work in the file system on the display. Unfortunately the method described using photoshop did not work for me and the files just sat there. The method that actually worked is described carefully in their manual:

<http://www.waveshare.com/w/upload/7/71/4.3inch-e-Paper-UserManual.pdf> -- download waveshare's software it works quite well--windows only. Find some shots that look very contrasty--and up the brightness and contrast quite a bit as the screen looks fairly emo. Andy Goldsworthy is a great artist if you haven't seen his work before look him up!



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Step 6: Using It

Not much to this section except to leave it out in the sun like an old cat on your desk and watch the casual rounding of time played out on your tiny gallery.

