Analog Voltmeter Clock

Leonard Chau, Fall 2024
San Francisco State University

What Does it Do?

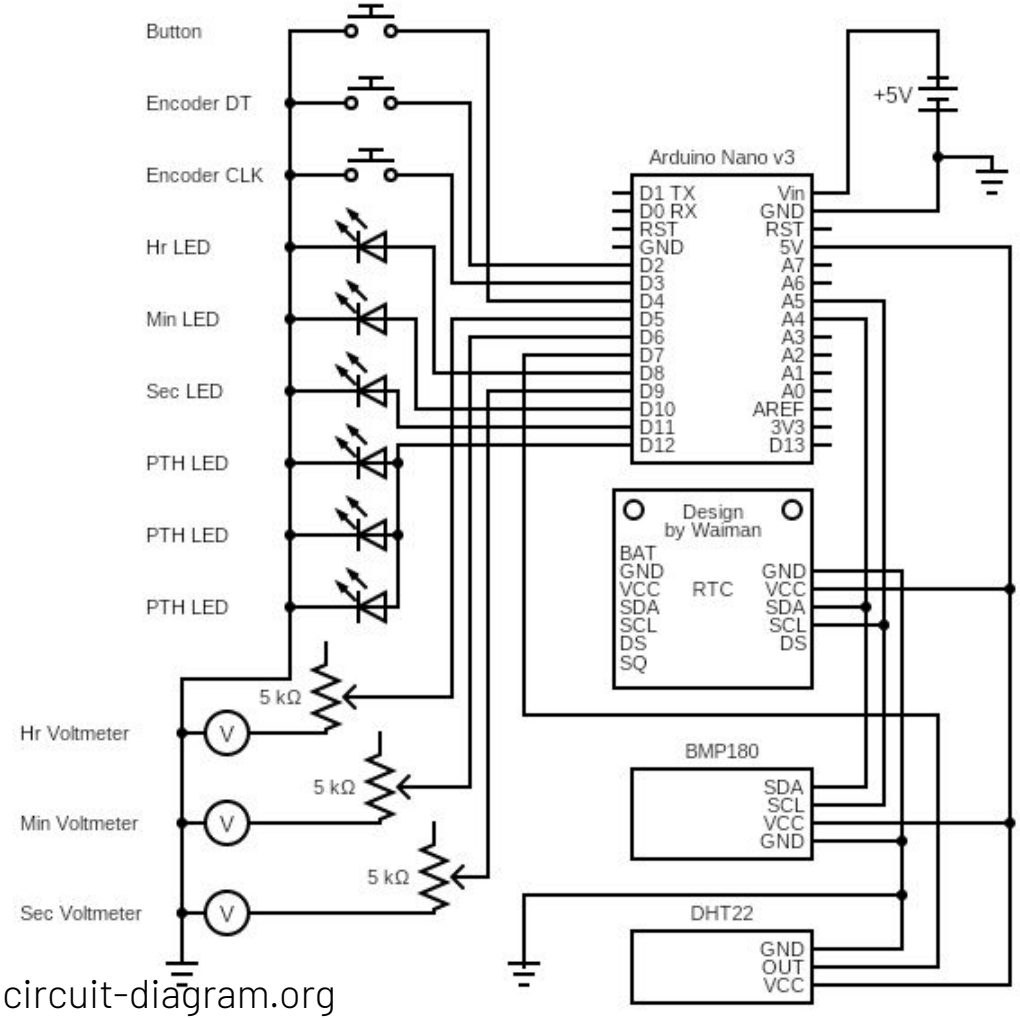
- Displays the current hour, minute, and second
- Displays the current pressure, temperature, and humidity
- Keeps clock time when powered down
- Clock time is adjustable

Why Build This?

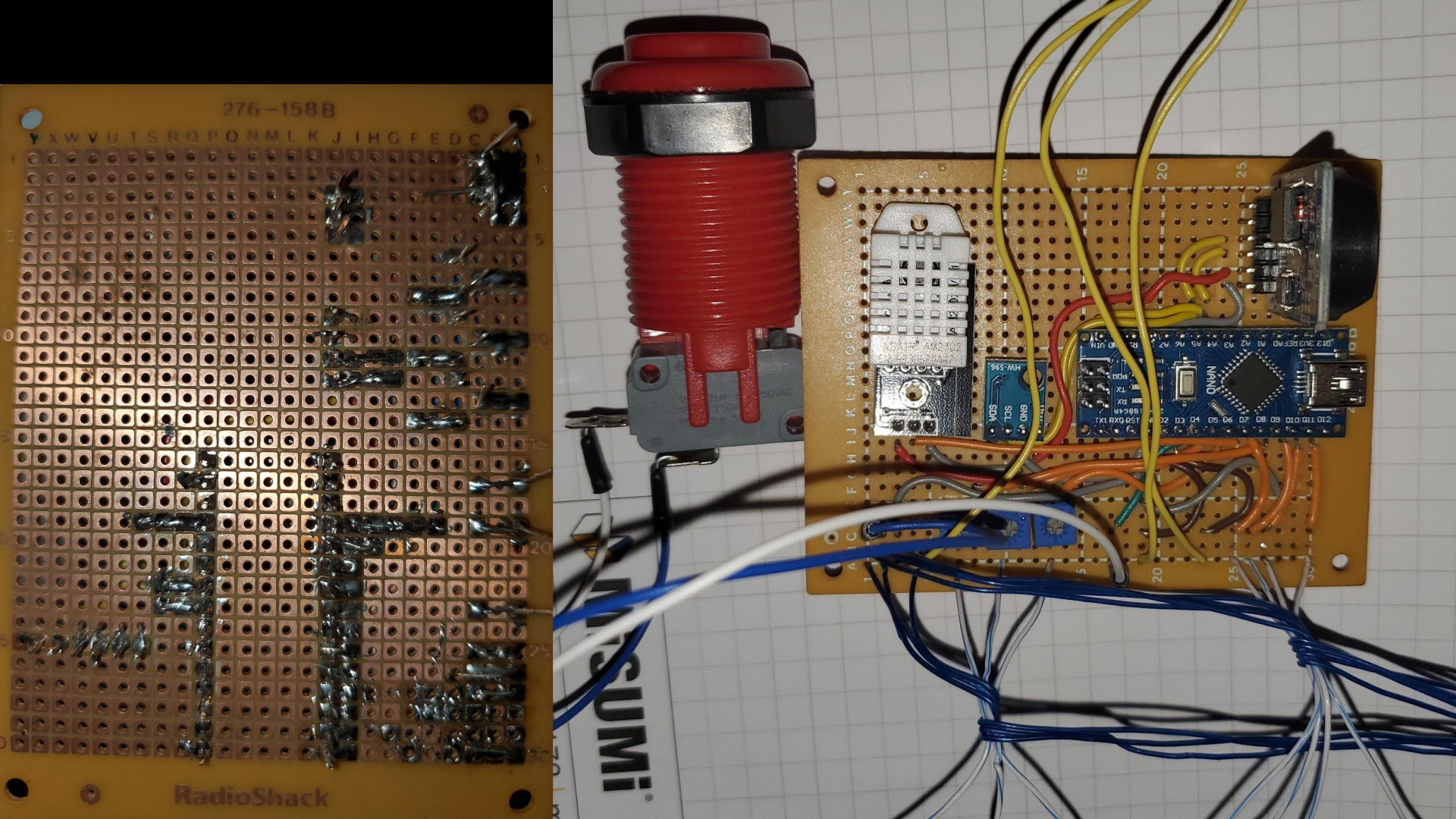
- Something unorthodox, unique, unconventional, clunky
- I think analog displays are cool
- I've been wanting to build a clock with analog display for my living space
- I would like to monitor local temperature, pressure, and humidity
- Gain experience with microcontrollers

Wiring Schematic

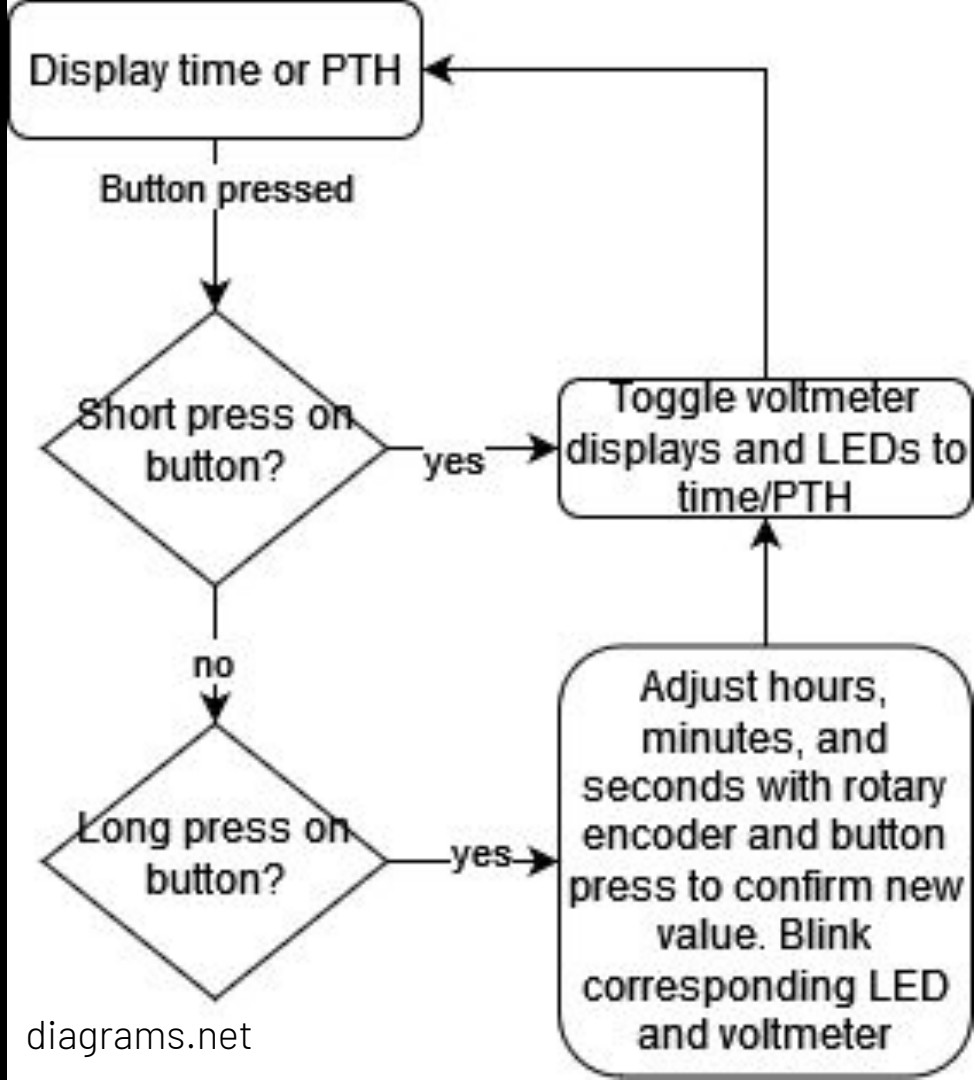
- 1 Arduino Nano
- 1 DS3231 RTC Module
- 6 6V LEDs
- 1 Button
- 2 Limit Switches (rotary encoder)
- 3 5 kohm Potentiometers
- 3 Analog Voltmeters
- 1 BMP180 Pressure Sensor
- 1 DHT22 Humidity Sensor



circuit-diagram.org


276-158B
RadioShack
NANO
HW-596
SDA
SCL
GND

Flowchart


Display time or PTH
Button pressed
Short press on button?
yes
Toggle voltmeter displays and LEDs to time/PTH
no
Long press on button?
yes
Adjust hours, minutes, and seconds with rotary encoder and button press to confirm new value. Blink corresponding LED and voltmeter
diagrams.net

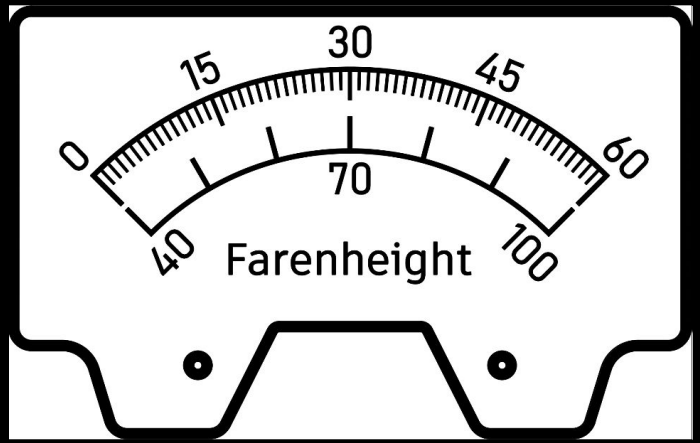
Testing Process

- Modularize circuits and code
  - Time retrieval and display
  - Time updating
  - Pressure reading
  - Temperature reading
  - Humidity reading
  - PTH display
  - Rotary encoding
  - LED states
- Build circuits on breadboard and test components
- Combine functions in a combined program
- ChatGPT for learning, ideas, inspiration, help, guidance, and debugging
  - Use it as a tool, not a solution!

Voltmeter Displays

- Modified to be 0-5V by removing internal resistor and using potentiometer
- Hours display: 0-12 hours or 950-1030 hectopascals/millibar
- Minutes display: 0-60 minutes or 40-100 degrees Farenheight
- Seconds display: 0-60 seconds or 0-100% relative humidity
- Custom printed scales to suit

seconds/temperature



Code

https://docs.google.com/document/d/1KVLUEeqVKWLGFJV9ItJOi_4preeNTFYhQCk6heJ7_aY

LED Indicators

- Displays values indicated by labels
- Adjusting time blinks individual LEDs

Sensors

I2C (SDA and SCL pins): RTC and pressure sensors
PWM: Voltmeters and humidity sensor

Now What?

- Improve, optimize, and clean the code
- Finish 3D printed housing
- Finish soldering USB power supply cable
- Wireless data transmission of time, pressure, temperature, humidity
- Logging and graphing of data
- Add function to rotary encoder in display mode
  - I ran out of PWM output pins
  - Wirelessly control light output, volume, moving art, or something else?
- Voltmeter backlighting?

Next Time...

- Use a better/newer prototype board
- Try different soldering techniques
- Using higher quality wire

Thank You!

lchau@sfsu.edu
leonardchau.com