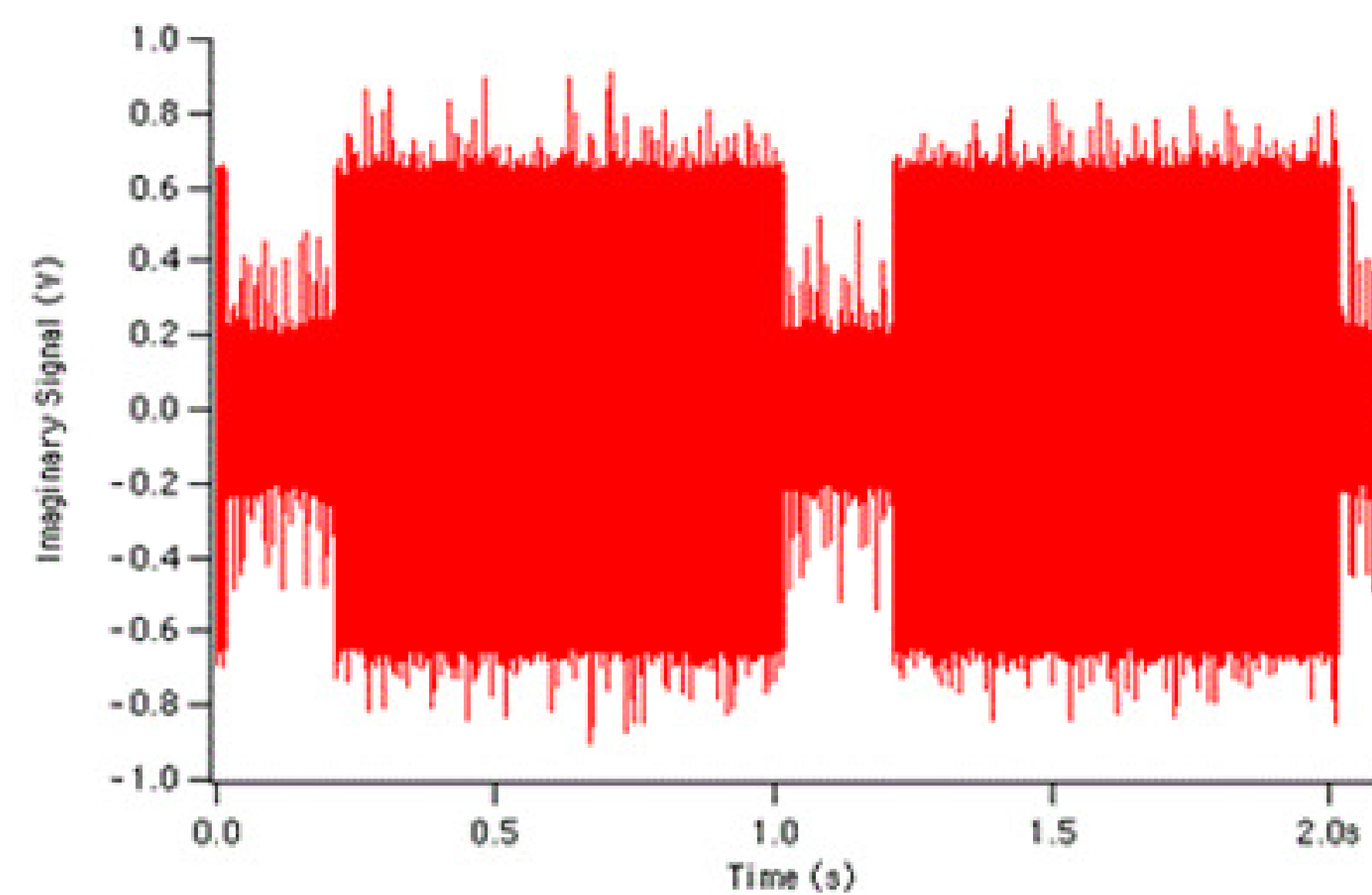


Why?

- The Arduino contains no absolute time reference
- Existing shields which implement some kind of timekeeping device require manual synchronization

Our solution:

Use the super-accurate WWVB atomic time signal. A microcontroller interprets this signal and updates a Real-Time Clock.



Source: <http://xtrsystems.com>

The WWVB Signal:

The WWVB carrier is transmitted at 60kHz. The amplitude of the signal is modulated at 1Hz as shown above to convey digital information. Low carrier power indicates a logic LOW and full carrier power indicates a logic HIGH.

Decoding the WWVB Signal:

A PIC16F1824 microcontroller was used to decode the demodulated 5V signal from the CMAX radio. The microcontroller measures the width of each pulse to determine the value of each bit received. Once a full data frame (60 bits) has been received, the microcontroller checks if the data is valid and updates the RTC with the new time.

Chrono-tomic Arduino Shield

EGR 326

Eric Born & Josh Friend

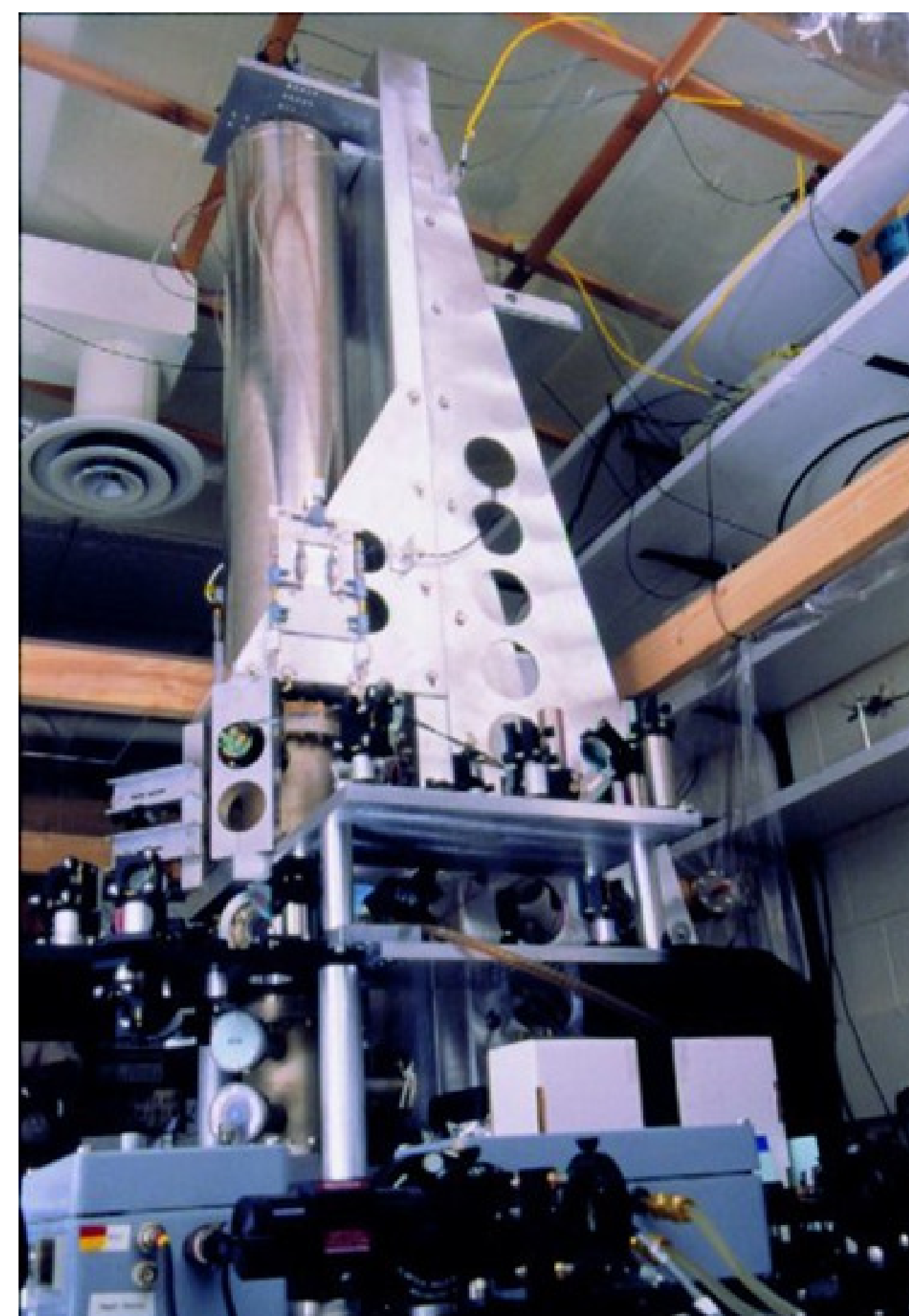
egr.gvsu.edu/~borne

What is an Arduino?

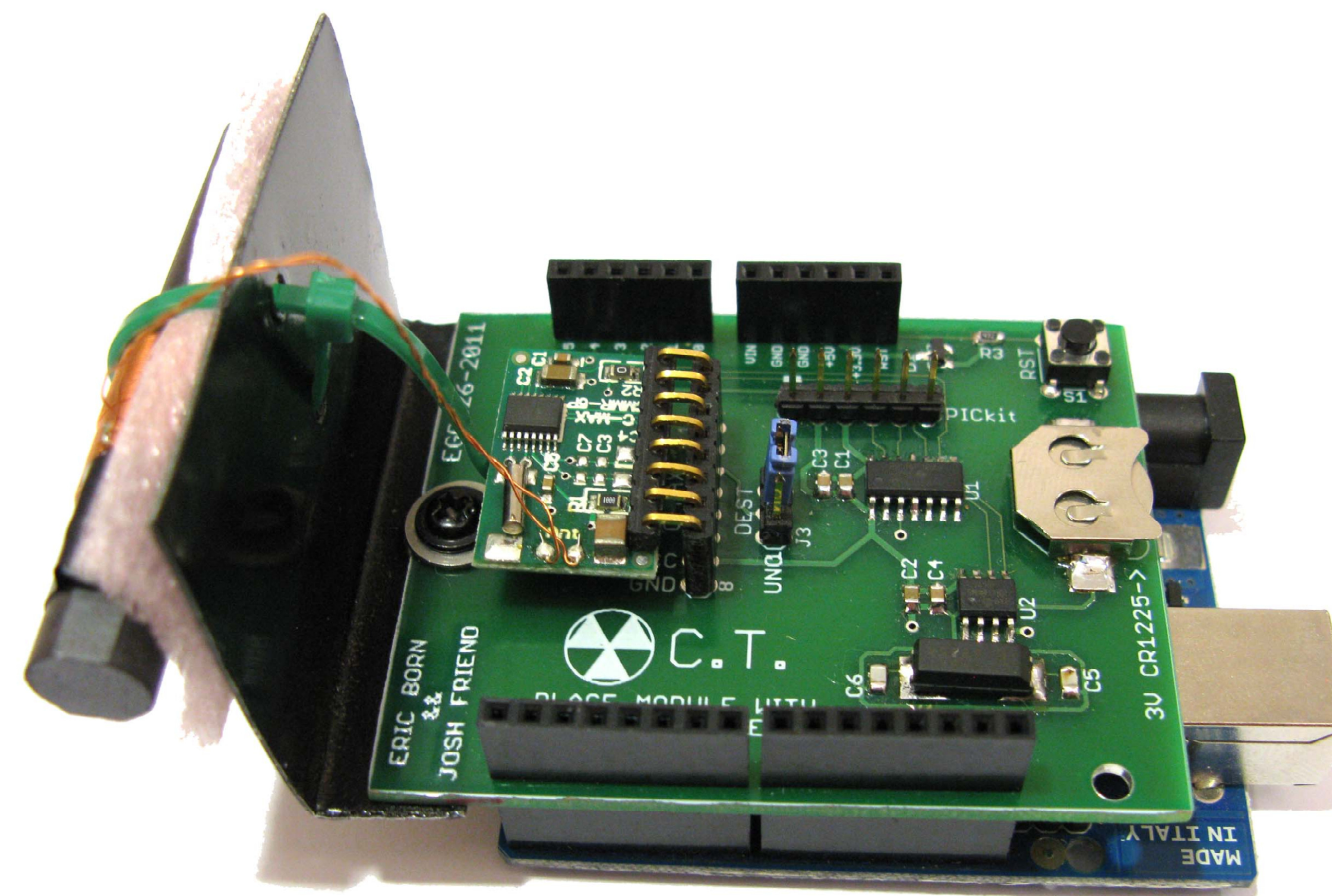
The Arduino is an open-source electronics prototyping platform. The low price (\$30) and easy to use programming language and interface make this product ideal for hobbyists or anyone interested in electronics.

What is the Chrono-tomic Arduino Shield?

Our product is an Arduino shield that uses some of the elements of existing shields (real-time clock local time reference with battery backup), and brings a new feature to an Arduino shield that was previously unavailable: WWVB atomic time synchronization. The Chrono-tomic Arduino shield contains an onboard real-time clock and microcontroller to interpret the WWVB atomic time signal and automatically update the real-time clock.



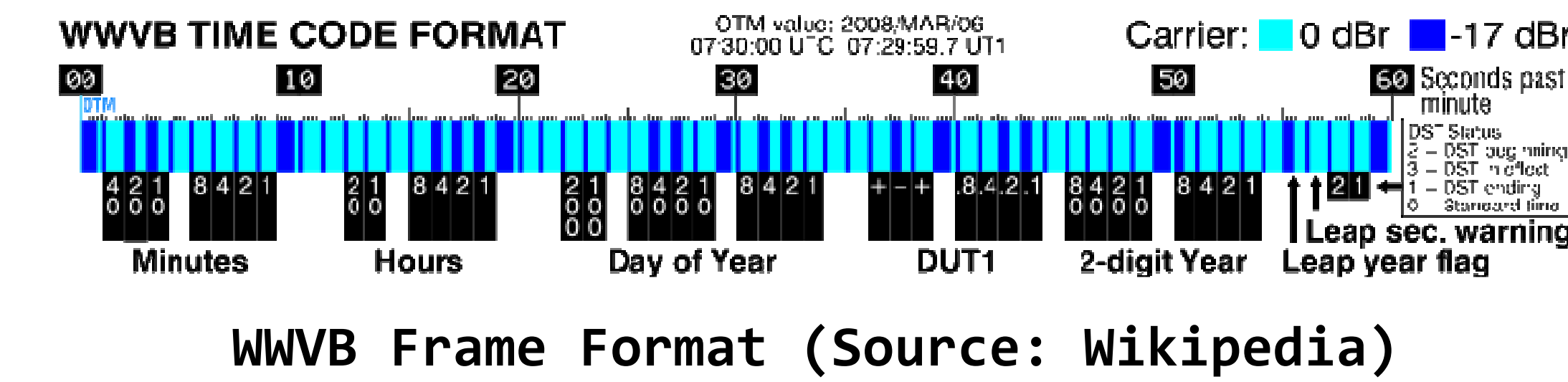
NIST-F1 Cesium Fountain Clock
Source: nist.gov



Final product mounted on Arduino Uno

Who Needs the Chrono-tomic Arduino Shield?

The Chrono-tomic Arduino Shield is for Arduino users who need an accurate, absolute time reference and do not want to worry about proper synchronization of the time reference. The Chrono-tomic Shield enables users to have an easy to use, absolute, self-synchronizing time reference that has a minimal chance of interfering with other shields they may be using.

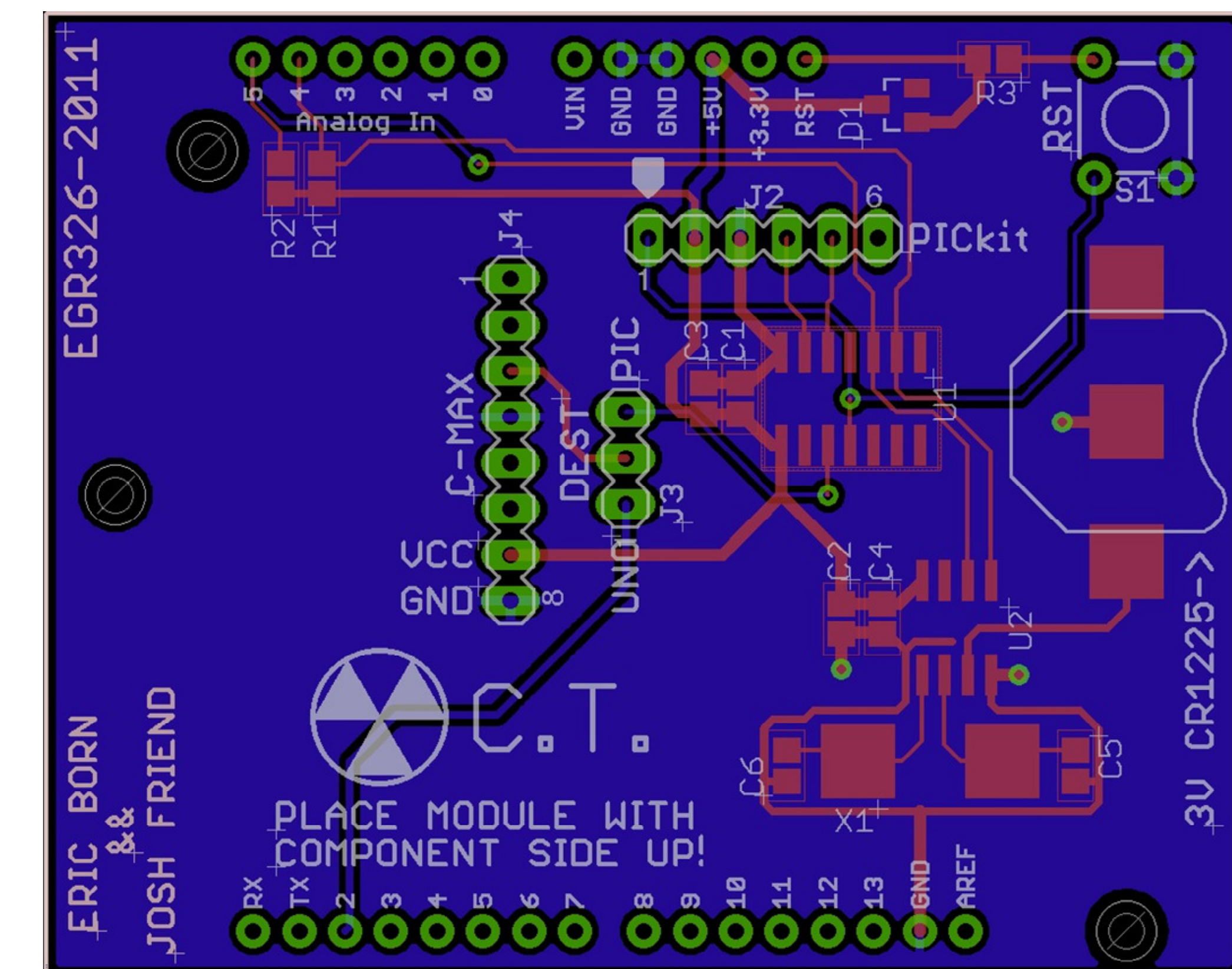


Interpreting the WWVB Signal:

Once the WWVB signal has been demodulated by the CMAX radio, the width of each pulse is measured by the PIC microcontroller to determine if it is a binary zero, one or frame reference marker. Once a full WWVB data frame (60 bits) has been received, the data is checked to see if it is valid, and then sent to the real-time clock.

Shield Hardware Design:

Schematic design and PCB layout was done in EAGLE. This allowed for the design to be verified by software before manufacturing. PCBs were fabricated by Advanced Circuits for a professional looking final product.



PCB Layout

Acknowledgments:

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Dr. Andrew Sterian - Professor
Tim Friend - Microchip Technology F.A.E.

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