Microtronic - The Next Generation Is a 4-bit MCU Trainer Running on an Arduino Mega

Emulate a microcontroller kit from 1980s West Germany.

James Lewis (https://www.hackster.io/baldengineer) Follow

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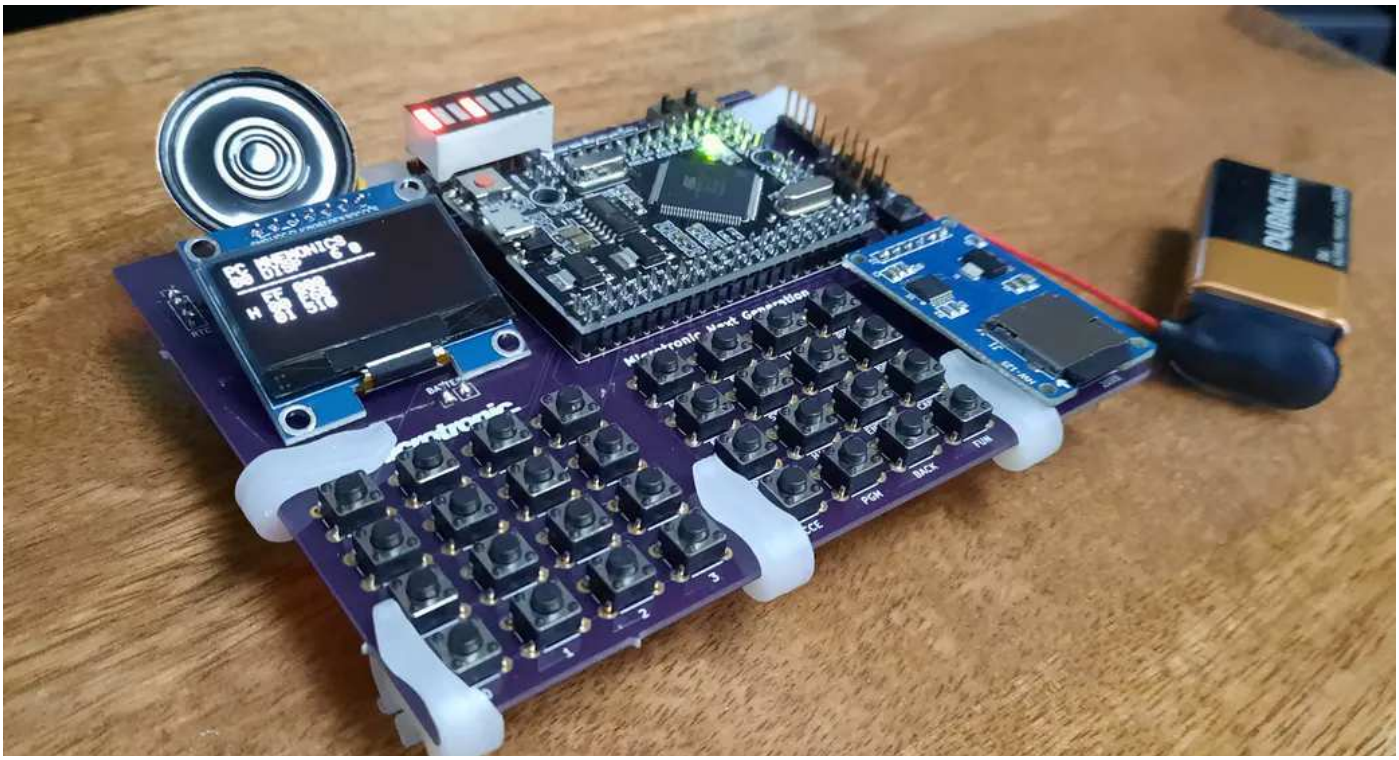

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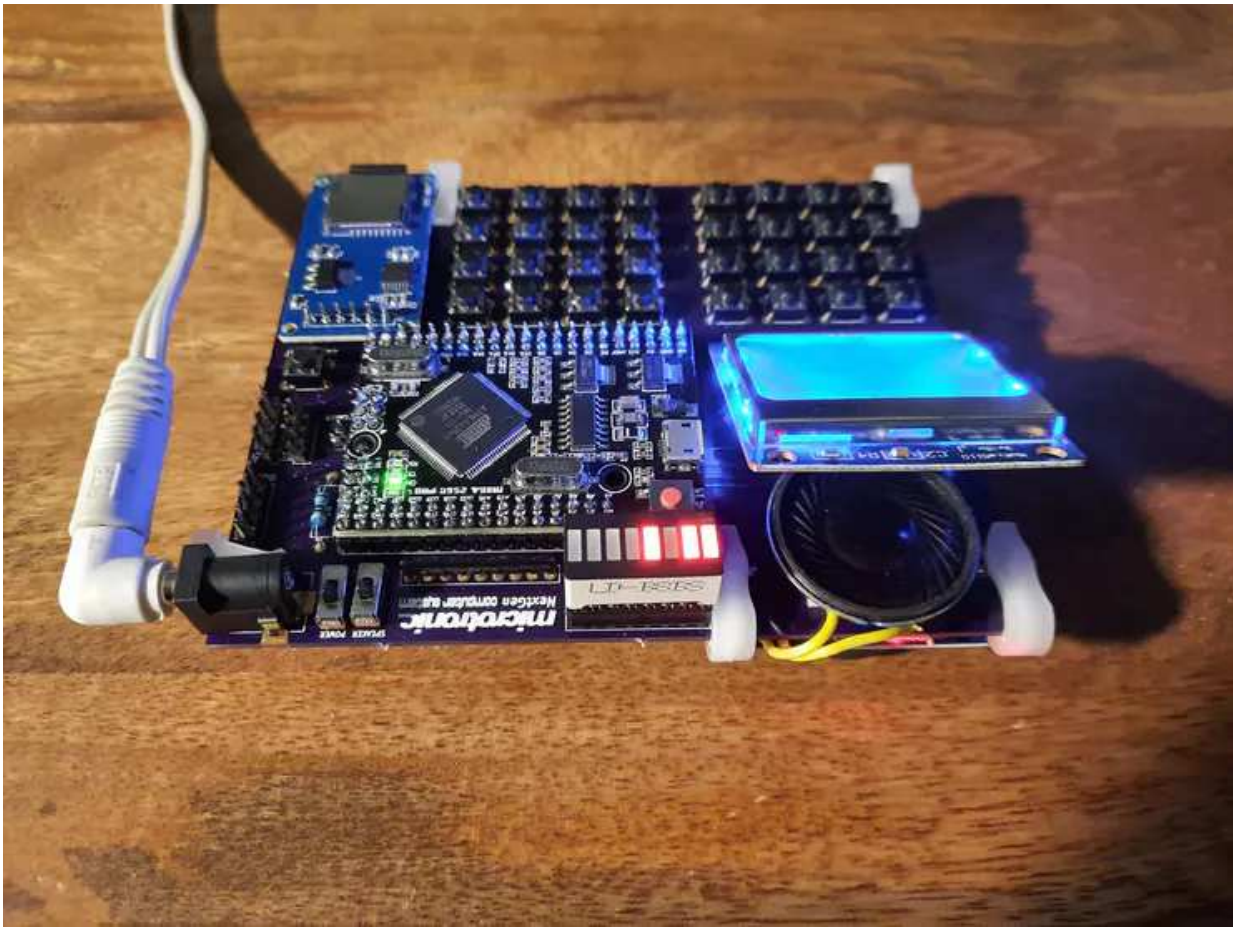
Early microprocessors came with trainer systems to help users understand the chip's operation. These typically included some basic hardware like input keypads, output LEDs, and memory. One example is the Busch Microtronic 2090 released back in the 1980s. Computer scientist Michael Wessel had one as a kid. Using an Arduino 2560, they created an emulated version of that trainer board called Microtronic - The Next Generation (https://hackaday.io/project/176466-microtronic-the-next-generation).

> "The Microtronic has a very comfortable, versatile and intuitive instruction set. The (German) instruction manuals are exceptionally well written. This unique combination makes the system stand out from its 4-bit competition as an education system, even nowadays. It is still highly effective in teaching students the basics of microcomputer (machine code) programming and IMHO, there is no better 4-bit trainer available." — Michael Wessel on the original educational trainer system.

Busch's Microtronic 2090 used a 4-bit TMS1600 microcontroller from Texas Instruments. It came outfitted with 256 12-bit words for RAM, 7-segment LED displays and a hexadecimal keypad. TI's designers probably borrowed the display and keypad from their calculator line.

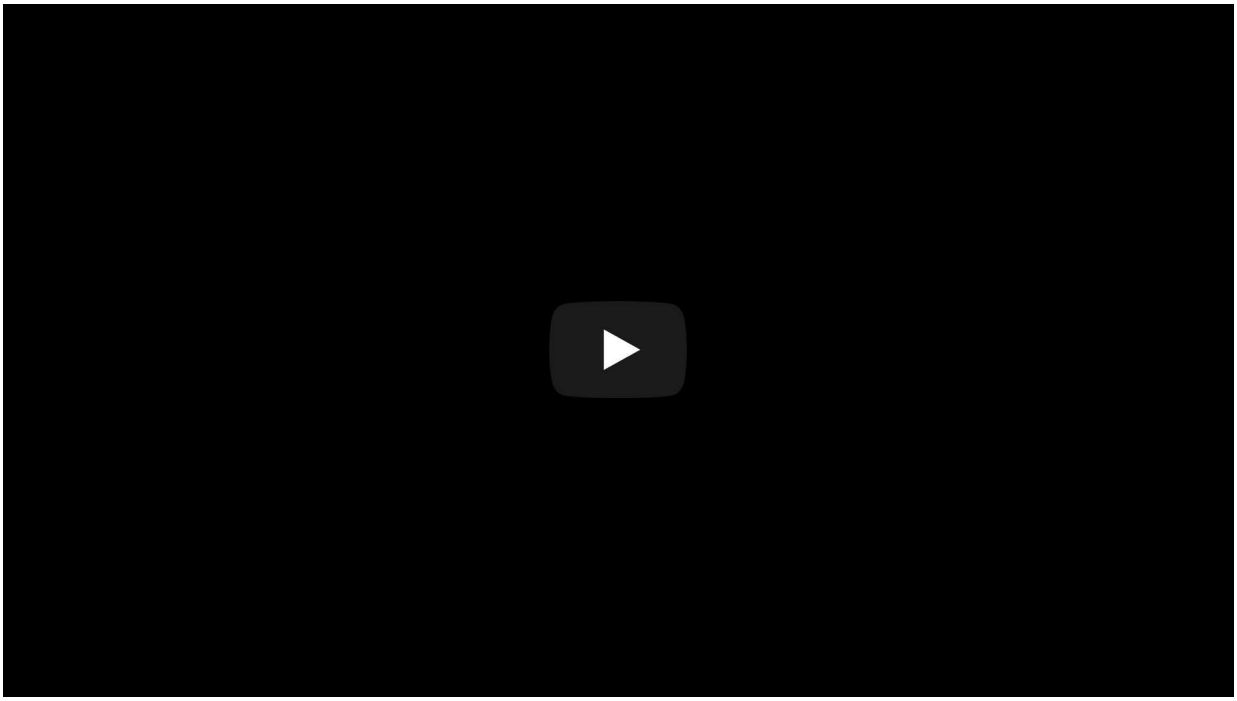
Wessel's Microtronic - The Next Generation recreates this trainer kit using an Arduino Mega 2560. Modern improvements include support for 8-segment LED bar for output indicators, an SDCard interface, and a graphic display.



Arduino firmware emulating the trainer is available to support three different screens: Nokia 5110, SH1106 SPI OLED, and an SH1106 I2C OLED. None of these match the nostalgia of red 7-segment displays, but they offer quality-of-life improvements like viewing the RAM's contents without an external debugger. If you have trouble deciding which route to build with, Wessel says the best performance comes with the SPI-based SH1106.

SDCard support emulates the original 2095 Cassette tape interface. One helpful feature of Wessel's firmware is that it saves files as plain text. This feature means you can easily edit them on a modern computer. Unlike small microcontroller systems of the time, you do not program it with either machine code or BASIC.

The TMS1600 is a 4-bit microcontroller. TI shipped them from the factory with a mask ROM, which made them ready-to-use in many applications. For the Busch Microtronic, the chips included a high-level interpreted language. The language supported instructions like multiplication, division, random number generator, display output, keyboard input, and real-time clock functions.



Microtronic Next Generation Demo

Code for the emulator running on an Arduino 2560 is available on Wessel's Busch 2090 GitHub repository (https://github.com/lambdamikel/Busch-2090). That repo also contains the original manuals, which have permission from the original Busch Microtronic designer to be published there. If you like this project, you may want to check out Wessel's talking Microtronic project (https://hackaday.io/project/11560-the-talking-microtronic-computer-system-emulator) as well.

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