



Madison Section Newsletter

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Talk:

Pow erful "System on a Chip" devices are inexpensive. Usually, they come with a version of Linux for support. This talk will be about using the ARM microprocessor in a System on Chip (SOC) configuration and how to program it using a "bare metal" configuration for embedded applications. The target for this talk is the Raspberry PI zero w. This talk will be broken down into five sections.

(1) The assembly/C code that is required to initialize the interrupts, GPIOs, SPI, I2C, video core (VPU) and floating point math unit (FPU). (2) The software required to allow the programmer easy access to the GPIO ports. (3) Setting up the video processing unit and writing to the frame buffer. An example that plots the Mandelbrot set will be demonstrated. (4) Setting up the floating point unit and demonstrating how to do single instruction multiple data (SIMD) operations. An example that implements an 8 pole band-pass filter will be shown. (5) A simple operating system implemented as a cooperative multi-tasker will be shown.

December ECN Meeting: "Bring Your Hi-Tech Toys"

Entrepreneurs and Consultants Netwo



- Social/Professional Meeting
 - Date: Thursday, December 7th at 11:30 AM
- Fee: Free Location: :
 - Location: ; Sector67
 - 2100 Winnebago Street Madison, WI
- Snacks and Drinks are available at Sector67
- Please Register at the IEEE-Madison <u>event page</u>.
- Non-member guests are always welcome.

Talk: The Holiday Season is just around the corner. What Hi-Tech consumer items have impressed you? Bring your favorite one and be prepared to discuss it's technical merits. Also, be prepared to give give a brief introduction to what you do ("Elevator Speech"). This is your opportunity to discuss your company, or your consulting expertise while having fun. Speaker: Dennis Bahr, PhD, VP of R&D at HelionX, LLC has a long history of Research and Develoment in Biomedical systems. He is also the founder and president of Bahr Management, Inc., a company that develops and helps bring to market innovative medical devices for use in the cardiovascular, trauma, life support, and surgical markets. He also spends time doing research, such as designing new technologies, developing new mathematical algorithms, and doing computer based modeling. Dennis enjoys being involved with Science, especially developing new ideas and theories. One great enjoyment is developing new mathematical methods and algorithms to solve complex problems that people have said couldn't be solved.

Section News

Section Elections

Watch for an E-Mail Election Ballot: IEEE Madison officers are up for re-election. You will be receiving a ballot soon in your email, so please watch for it. This is your chance to contribute to the IEEE Madison Section by selecting officers (all volunteers) who will be helping to bring you interesting meetings and events for the Section. Please vote!

• Meeting Reviews

October Section Meeting/Joint UW-Madison Student Branch Meeting: (Photos of the event are available on the links by <u>Tom</u> <u>Kaminski</u> and <u>Charles Cowie</u>.) The talk was preceded by a display of some high-end vehicles equipped with autonomous driving systems. The vehicles were on the walk between Lot 17 and Engineering Hall on a path with a lot of student foot traffic, generating an additional draw to the meeting. The meeting was well attended and Bob Neff gave a presentation that covered the history of autonomous vehicles up to the present. Bob also discussed several of the challenges facing adoption of the technology. Despite the US Government Department of Transportation's early standards, auto manufacturers were slow to adopt to the technology in a "chicken and egg" struggle. Who would build a car to drive on a modern highway if there were no highways? Advances in technology have now made it possible to drive autonomously on modern roads, but as of today, no country in the world allows a driverless auto to operate on public highways.



October Special Meeting: Dr. James Smith, Emeritus Professor of Electrical and Computer Engineering, gave a talk to the College of Engineering Students on the topic "Space-Time Computing and the Brain". Dr. Smith based his talk on the advances in the neuroscience community that have been describing how the brain operates and claimed that Computer Architects should be shamed by the advances in the neuroscience community that have been ignored by the engineering community. He challenged the Computer Architects in the audience to quit "chasing the bright, shiny object" of deep learning neural networks and get to work on the more significant problem of finding a way to mimic the way the brain really computes.

Dr. Smith showed a taxonomy of the current neural network models and introduced the time-space model. He then went on to motivate his discoveries by showing a simple combinatorial network that transforms a vector of zero's (binary digits) to a vector of zero's, yet sorts the arrival times of the 1 to 0 transitions in sequence. He then proposed a mathematical algebra based on "Space-Time" computing and showed how it closely mimics true neural networks. Dr. Smith used introduced space-time algebraic primitives to build neural networks that behaved in the manner as all of the current models based on neuroscience research. Finally, he proposed that these primitives could be built from existing CMOS on silicon technology without the need to invent new device technology.



November Life Member Affiliate Group Meeting: Steve Schultheis gave a detailed and informative talk on the history of musical instruments and the evolution of electronic instruments, some of which attempted to mimic the traditional instruments and some of which created unique sounds of their own. Steve spent a good amount of time discussing the details of a simple microphone, showing how that device evolution over time did not substantially improve on the earliest devices. He discussed a number of trade offs in the design of the electronic instruments such as the "sampled" (huge files required) verses "simulated" (huge computational requirements) approaches to instruments. While the sampling technique works well for percussion instrument s, such as drums, pianos require huge files sizes, on the order of a half-terabyte. Sampling has little hope of duplicating the interaction of multiple keys pressed at once. During the presentation, Steve used his programmable equipment to show how different sounds could be synthesized. Steve finished the presentation with a short concert, playing a jazz tune. A printed copy of Steve's Presentation is available here.



Upcoming Meetings

November Joint EMB/Student Branch Meeting -- This meeting is open to the entire section, especially to those interested in embedded systems. Dennis Bahr has been developing portable biomedical instruments using the Raspberry Pi Zero W, a \$10 SoC on a board with WiFi and Bluetooth. Dennis has figured out how to dispense with the usual Linux operating system and get access

to both the Graphics Processing Unit (GPU) and Floating Point Unit (FPU). The result is a lower power, real-time system that can use the Open Sourced development tools developed for the Linux version.

December ECN Meeting: This is an opportunity to pitch your consulting/entrepreneur skills while having fun dis cussing your favorite current technology. You might just get a few ideas for the upcoming "giving" season.

- Regular Meetings

Section Meetings

The third Thursday of January through May, and September through December is reserved for a meeting to provide recent research, developments, trends and/or innovations in one of our membership's technical areas.

Life Member Affinity Group

The first Thursday of January, March, May, September and November is reserved for a meeting on a topic selected from a broad range including such areas as technology, science, history, culture and leisure.

IEEE-MSN-ECN Networking Meetings

- Purpose: Presentations, Discussions, networking
- Date: First Thursday o f even-numbered months
- Time: 11:45 AM to 1:00 PM
- Location: Sector67, 2100 Winnebago Street (East Side of Madison)
- Parking: Park in lot or on Winnebago Street.
- Process: Members are encouraged to make introductions, describe endeavors, and make request for: contacts in target companies, needs, resources.

Membership Upgrades

Those interested in upgrading their IEEE membership level should send their resumes or other information showing five years of significant performance in an IEEE-designated field to Charles J Gervasi via email at cj(at)cgervasi.com. Madison Section Board will attempt to find Senior IEEE members knowledgeable in the applicant's area of practice who may be able to provide references. You are invited to attend the informal networking portion of the monthly Section meetings (starting at 11:30am) to meet the Section Board members and di scuss intentions.

About IEEE



The Institute of Electrical and Electronics Engineers or IEEE (read Eye-Triple-E) is an international nonprofit, professional organization dedicated to advancin g technology innovation and excellence for the betterment of humanity. IEEE and its members inspire a global community through IEEE's highly cited publications, conferences, technology standards, and professional and educational activities. It has the most members of any technical professional organization in the world, with more than 300,000 members in around 150 countries. The IEEE consists of 38 societies, organized around specialized technical fields, with more than 300 local organizations that hold regular meetings. Discover what IEEE Member Discounts can offer you. The Member Discounts portfolio consists of insurance products and programs for the home, office

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IEEE.ORG.

Madison IEEE Section

The IEEE-Madison Section of the IEEE is a section in Region 4 of the IEEE-USA organized to serve IEEE members in the Madison, WI area with over 600 members. The 2016 Officers and Board Members are Tom Kaminski - Chair, Scott Olsen -Vice Chair, Charles Gervasi - Treasurer, Steve Schultheis - Secretary, Nate Toth - Webmaster, Tom Kaminski - ECN Chair, Dennis Bahr - Engineering in Medicine and Biology Chapter Chair, Chuck Kime - Life Member Affinity Group Chair, Charles Cowie - Life Member Affinity Group Vice Chair, David Jensen - Life Member Affinity Group Secretary, Members at Large: Clark Johnson, Craig Heilman, Dennis Bahr, Sandy Rotter.

Job Openings

Check out <u>WIEES.com</u> for electrical engineering jobs in Madison and the surrounding region. This site is maintained as a service for electrical engineers. Jobs are displayed starting with the most recent postings first. You can filter results by location and job type. If you are hiring an electrical engineer in our area, for full-time or contract work, you can post the job in the *Contact Us* section on the WIEES.com site.

Sponsored Content

DLSEMC: Streamlined Wireless Testing

Are you aware of the new medical device requirements?



The recently published 4th edition of the IEC 60601-1-2:2014 Standard has been recognized by the FDA and may now be used for electrical medical devices. This edition requires new emissions requirements, new test methods, and higher level/more stringent immunity tests for EMC compliance. These changes include new designated use environments, which are now split into three areas:

- 1. Professional Healthcare Facility Environment
- 2. Home Healthcare Environment
- 3. Special Environment



• Contact Us

The IEEE-Madison Section has a number of volunteer positions open if you are interested in helping out. Please direct any questions or comments to Tom Kaminski (Newsletter Editor) via email to tjkaminski(at)ieee.org.

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