COMPANY
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Published
1 May 1978

FORUM REPORT 6

Compiled and Edited by the T&M Publicity Dept., Ext. 5674, D.S. 50-462.

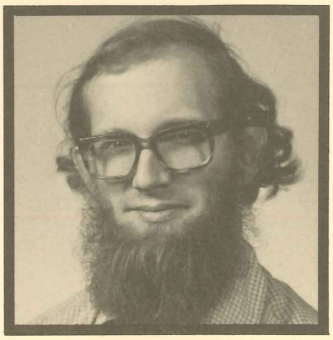
In November 1976, Bill Walker (vice president for the Test and Measurement Group) announced the formation of the Engineering Activities Council. The basic purpose of the council is to provide engineers with a forum in which they can directly present to multiple levels of management what engineers themselves consider to be important in technology.

Forum 6, "The Microprocessor Hobby Fair," was a departure from the usual engineering forum format. Participants in the Hobby Fair presented microprocessor-based projects which they had developed either on their own time and for their own use or as "G-jobs"* for their groups.

Co-chairpersons for the Hobby Fair forum were Dave Chapman (STS Engineering) and Joyce Lekas (T&M Publicity manager).

*According to Fendall Winston (former chairman of the Engineering Activities Council), a "G-job" is a project that people work on as a sideline to their regular work. The term was born in World War II industry...projects that were developed for the war effort had to be kept quiet, so they became under-the-bench projects.

Dave Chapman
(STS Engineering)



Joyce Lekas
(T & M Publicity)

A GPIB ANALYZER

Bruce Ableidinger and Jeff Bradford

Bruce Ableidinger (Logic Development Products) and Jeff Bradford (also LDP) have developed a GPIB (General Purpose Interface Bus) analyzer that uses a 7D01 Logic Analyzer and a modified DF1 Display Formatter.

Interface-dependent and device-dependent messages handshaked across the GPIB can be displayed in a familiar mnemonic format on any 7000 series crt. In this bus analyzer, a standard 7D01 Logic Analyzer acquires blocks of 256 bus "transactions" and a modified DF1 Display Formatter displays the data in GPIB format. The bus analyzer can operate in either of two modes.

In one mode, the bus analyzer synchronously acquires information using the GPIB data valid (DAV) line as a clock. As many as 256 instructions are stored in the 7DO1 and then disassembled and displayed on the DF1 in IEE-488 message mnemonics familiar to the GPIB user.

The 7D01 uses 12 of the available 16 lines to monitor ATN, EOI, SRQ, REN and the eight data lines. The eight data lines are received on channels 8-15 with the clock line going to DAV. On the other probe, channel 4 goes to REN, 15 to SRQ, 6 to EOI, and 7 to ATN. Channels 0-3 make up four user-definable probes.

In the second mode, the user assigns three of the four remaining lines to the three-wire handshake, and then uses the internal clock (at an appropriate sampling rate) to study the timing relation of the three lines.

For example, the designer could set up the word recognizer to trigger the 7D01 on any one of the ATN messages and then study the handshake lines for that message in the timing mode.

More details were given in the July 15, 1977 issue of **Engineering News** (for a copy of the article, call Jane West on ext. 5674).

Bruce Ableidinger wrote the GPIB disassembler code and Jeff Bradford, who wrote the original DF1 code, helped interface it to the DF1. The modified DF1 discussed here was announced as a product in January 1978.

If you would like more information on the operation and capabilities of the bus analyzer, call Bruce on ext. 7161 or drop by 39-089.

Standing in for Bruce Ableidinger and Jeff Bradford, Steve Rice (center, TM500 Engineering) discusses the GPIB analyzer.

AN ALTAIR MICROPROCESSOR SYSTEM

Pat Caudill

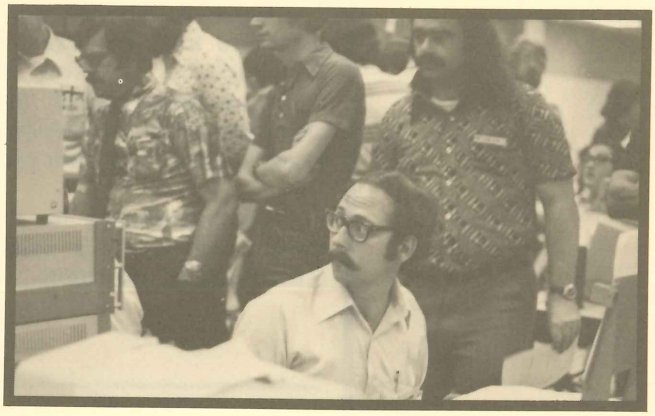
Pat Caudill (Logic Development Products) displayed an Altair microprocessor system that included a lineprinter and a disk. Pat has written I/O drivers, ROM loaders and a simple monitor for the system.

The system was one of the systems Pat and another instructor developed for teaching microprocessor programming at the University of Missouri-Columbia.

Pat is currently working with the Altair system to aid a Missouri-Columbia researcher who is using an 8080-based system to monitor monkeys trained to fly simulated aircraft. Pat explained that he develops the programs and then either records them on audio cassette tape or programs them into PROMS and then mails them to the university.

If you would like more information about Pat's project, give him a call on ext. 7858 or drop by 39-007.

Pat Caudill, (Logic Development Products), exercises his Altain microprocessor system.



STARTREK ON AN ALTAIR 8800

Lynn Cochran

Lynn Cochran (Service Instruments Division) showed a "Startrek" game on his early model Altair 8800 computer and home-build video terminal board. The video board has a built-in keyboard input port, and works with existing software. His system also includes 12K of memory, a used digital cassette drive, MIT's 8K BASIC, and the Startrek game which Lynn rewrote to fit the 12K memory. The Startrek game was the subject of an article in the June 1976 issue of the **SCCS Interface** magazine (Lynn has extra copies).

For more information, call Lynn on ext. 6208 or drop by 50-431.

Lynn Cochran, (Service Instruments Division), stands by the Altair 8800 system on which he demonstrated a "Startrek" game. Karen Walker, (Service Instruments Division), looks on.

A PROLIFIC INSTRUCTION GENERATOR

Don Dunstan

Don Dunstan (Scientific Computer Center) demonstrated a Prolific Instruction Generator (PIG) that operates in a Tektronix M6800 board bucket. Don explained that "PIG is a rudimentary HLL language with an easy to use syntax which allows great flexibility in a block-structured environment." PIG generates assembly language source code for input to an assembler.

Using the Cyber 73, Don first developed PIG as a cross-compiler. To develop PIG, Don used software tools Tektronix has produced to aid design of microprocessor software in general and compilers in particular. Continuing his work, Don used the PIG cross-compiler to develop resident M6800 software: an editor, a subset of the PIG compiler, and an M6800 relocating assembler. This software resides on PROM in the M6800 board bucket.

"The most significant attribute of the PIG project was its short development time," Don related. Don wrote the compiler in only one week, the resident editor in two weeks, and the resident compiler subset in two weeks; and Bill Lowery (also Scientific Computer Center) wrote the resident relocating assembler in two weeks.

For more information, contact Don on ext. 5616 or drop by 50-454.

Don Dunstan (left, Scientific Computer Center) explains the Prolific Instruction Generator.

4051-ENHANCEMENT ROM PACKS

Larry Gagliani

Larry Gagliani, (Scientific Computer Center), demonstrated a few of the many routines he developed to overcome some of the quirks and constraints of the 4051 Intelligent Terminal.

The 4051 is a versatile personal computer whose greatest strength is the easy interaction the user has with the terminal's processing power. To enhance that interaction, Larry wrote more than 20 routines into ROM packs for the 4051. Larry explained that he had two motivations for his work: first providing some aid for 4051 users, and second giving himself some experience in writing firmware. Having written more than 8 kilobytes of M6800 code, Larry believes he has accomplished his goals.

At the Hobby Fair, Larry described several of his routines. TNAME writes a label on the mag-tape header that is printed on the TLIST. RDHEAD lists the header of the current mag tape file. LAST finds and opens the last file on the mag tape. VLIST lists all current BASIC variables with their value, dimensions, and other attributes. CLIST lists all the 4051 resident ROM Pack CALL statements. ROMCHK lists (on the screen) the 4051 ROM checksum which allows the user to diagnose flakey operation of a 4051 without dismantling it. PECHO echoes any character printed on the 4051 screen out through an attached RS-232 port to another terminal or printer.

If you have questions or if you would like a list of the other routines Larry has developed, call him on ext. 6653, or drop by 50-454.

Larry Gagliani (right, Scientific Computer Center) explains a feature of his project

COMPONENT 6800 COMPUTER SYSTEM

Geoff Gass

Geoff Gass, Custom Modifications Engineering, demonstrated a general-purpose computer system he developed from diverse components.

The components of his system include:
-A SWTPC 6800 computer made from a commercial kit, with commercial and homebrew interfaces.
-an MSI FD-9 floppy disc memory.
-a homebrew CRT terminal (either an X-Y-Z CRT monitor or an oscilloscope can be used for display).
-a stereo cassette recorder.
-a Selectric printer (a Dura/Itel 1041).

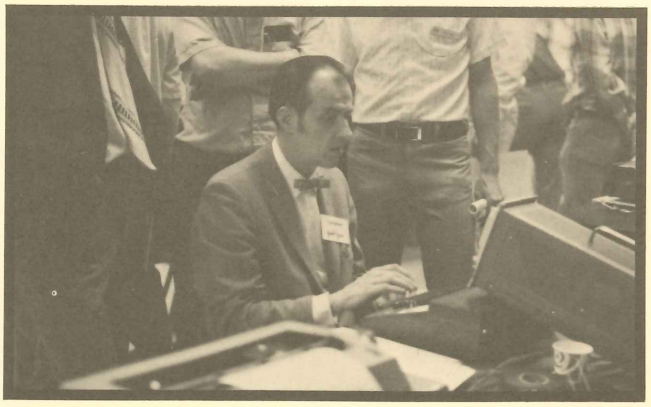
Custom Modifications Engineering is regularly using the system:
-to run a quotation-management program.
-to print a weekly activity report.
-for text editing.
-to quickly develop ad-hoc high-level BASIC programs to solve engineering problems not easily solved with a pocket calculator.

Geoff is also developing a more comprehensive order-information and cost/revenue program that will prepare quarterly and semi-annual reports from a tightly-encoded data base of about 250,000 bytes.

"Of course," Geoff says, "the system is also used to run the usual assortment of computer games." Geoff's machine-language version of John Conway's Life game (an ecology simulation) has been accepted for the Motorola Users' Group Library.

If you would like more information, call Geoff on ext. 7895 or drop by 58-134.

Geoff Gass (Custom Modifications Engineering) exercises his component 6800 computer system



AN EXPANDED KIM-1 SYSTEM

Bob Haas

Bob Haas (IDP Engineering) presented a home-brewed computer system based on a KIM-1 (MOS Technology's 6502 evaluation/training board). Bob added the following to the KIM-1:

-8K of RAM.
-a 64-character/16-line crt for fast operation.
-an ASCII keyboard.
-two digital mini-cassette tape drives for fast and reliable data storage.
-An 80-column impact matrix printer for hard copy.

Bob also developed an assembler (which he wrote in machine code) and a simple text editor.

To minimize hardware, Bob uses software to provide most of the interface to the computer. That means that the software converts serial tape data to parallel data and vice versa. The software also times the "firing" of the print needles in the matrix printer. As a consequence, the system can not overlap tape and printer operations.

If you would like more information on his system, call Bob on ext. 2519 or drop by D.S. 60-219.

Bob Haas (IDP Engineering), explains his computer system to onlookers.

AN INTEL MCS-80 ONE BOARD MICROCOMPUTER

Bob Heath

Bob Heath (Hybrid Circuits Engineering) displayed a computer system that he built for future use as a home utility controller.

The heart of the system is a single-board processor that Bob assembled from an Intel kit. The board includes an 8080 processor, a 8224 clock generator, a 8228 system controller, two 8212 8-bit buffers, eight 2111 RAM's, and a 1K monitor in ROM. The kit also provides for an RS-32 port, two 8255 8-bit parallel ports, an additional 3K of ROM and a small vector board for custom additions.

Bob added another 4K of ROM to the vector area and brought out all the address, data and control lines to an edge connector. Those lines pass from the edge connector to two 22-pin vector cards that interface the board system to a S-100 bus.

The bus allows expansion far beyond the limits of the original board. On the bus are 24K of RAM, a video driver board, a general-purpose interface board and a cassette controller board. On the bottom of the chassis there is a second video driver board that interfaces directly to the main controller board without going through the bus.

Bob plans to add more ROM and RAM, two floppy disks and numerous controllers for household lights, heating, telephone and other functions.

If you have questions about Bob's project, give him a call on ext. 6873 or drop by 50-312.

Bob Heath (Hybrid Circuits Engineering) demonstrates the Intel MCS-80 one-board microcomputer he built.

A COMPUTER-CONTROLLED MUSIC SYNTHESIZER

Carl Hovey

Carl Hovey (TM 500 Engineering) won the Hobby Fair prize for his computer-controlled music synthesizer. Carl interfaced the synthesizer to a 4051 computer which reads a modified organ keyboard to determine which notes to play and then sends control voltages and triggers to the synthesizer to generate the notes.

The computer can store a series of notes in memory and then play back the sequence while the musician adds another series. The musician can vary the tempo, pitch and timbre by turning knobs on the synthesizer.

If the musician decides not to record the notes, the synthesizer responds like an organ. Several notes may be played simultaneously, but the number is limited by the number of oscillators and envelope generators available.

Carl used a hard copy interface to connect the 4051 display screen to the output of the synthesizer. This allows the audience to see a crt light show with the music. The vertical drive is connected to a half-octave four-pole filter, and the horizontal drive is connected to a similar filter. The filters are part of a bank of filters (in the synthesizer) used to change the timbre.

If you have any questions, call Carl on ext. 1116 or drop by 94-461.

Carl Hovey (TM 500 Engineering) discusses his computer-controlled music synthesizer with Gail Jameson (Logic Analyzer Engineering).

A SC/MP COMPUTER SYSTEM

Les Larson

Les Larson (7000 Series Engineering) demonstrated a tank game program he wrote for a computer system he assembled. The processor for the computer system is a National Semiconductor board kit. Les worked with Jim Tallman to design interfaces for the TV screen, casette deck and keyboard used by the system for input/output. If you would like more information about Les' system, give him a call on ext. 7076 or drop by D.S. 39-103.

Les Larson (7000 Series Engineering) points out a feature of his tank game program.

A DIGITAL MUSIC SYNTHESIZER

Keith Lofstrom

Keith Lofstrom (Integrated Circuit Design) previewed a digital music synthesizer he is designing. The synthesizer, which Keith estimates will take another year to complete, will consist of highly-specialized, very fast hardware that will perform the actual synthesis, and a Z-80 microprocessor (in an Altair bus) that will act as a "human interface" to scan the keyboard and control switches, translate commands into control and timing sequences, look up old tones or compositions on a floppy disk, and provide information to the user on a TV display. The system will generate up to 32 complex tones at once.

Keith pointed out that digital synthesis is an emerging technique that uses digital hardware instead of the many components of traditional music synthesizers such as variable frequency oscillators, filters (to change the relative amplitude of harmonics), and amplitude controls to determine the volume, attack, sustain and decay characteristics of intrumental tones. "Because the traditional music synthesizer is often a mass of potentiometers and temperature-sensitive circuitry, any given tone may be either impossible to reproduce or at least take a long time to set up," he said.

In digital synthesis, the high speed hardware computes the output waveform as a series of points in time. Using this technique, the tone can be changed almost instantly and any sound can be produced if the computer is powerful enough. Furthermore, if the hardware is fast enough it can be time-shared to produce multiple channels...a polyphonic synthesizer.

Keith noted that **"The Computer Music Journal** is a good source of information on digital synthesis."

Keith expressed thanks to Mike Janes and others for their help in building the system. He also invited those who have the time and skill to help continue the development of "this monster." To contact Keith, call ext. 6207 or drop by 50-316.

Keith Lofstrom (Integrated Circuit Design) demonstrates his digital music synthesizer.

CRIME SIMULATION

Dick Lynch

Dick Lynch, (Lab Instruments Division), demonstrated a program that simulates crime patterns typical of American cities. Dick designed the program to benefit high school students in several ways.

First, using a microcomputer to run the program shows the students the impact that modern technology can have on society. Second, the students learn that while computers are valuable analytical tools, they do have limitations, as in the case of computer modeling.

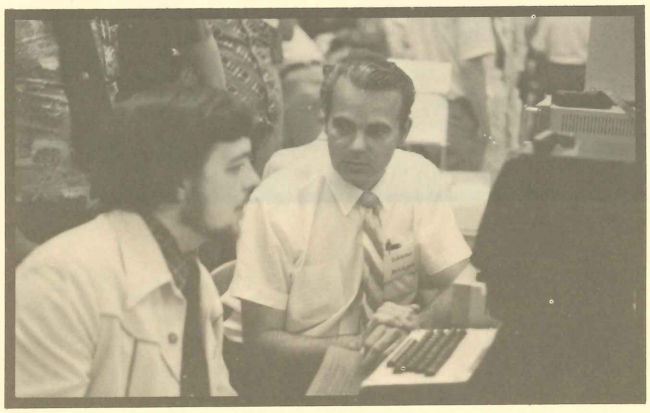
Third, the program allows students to compare the model with their own view of reality which probably doesn't include a direct knowledge of urban problems. "Use of the model fosters a better understanding of the urban crime problem and especially the causes of crime and their control and prevention," Dick explained.

Dick pointed out other values of computer models. Simulation allows the user to study phenomena without a great expense of time and money. "Also," Dick related, "simulations allow the students to study phenomena which would otherwise be beyond their understanding." As an example, he cited the use of computer programs to calculate CHI-square statistics on laboratory data. With the programs, the students can interpret the results even though they may not know how to do the math.

Dick built the computer system from kits. The basic machine is an ALTAIR 8800 with 28K of memory. An audio cassette recorder is used for mass storage of the Extended BASIC Interpreter and all application programs. Dick uses a video display module and a portable TV to provide output from his system. He assembled his own keyboard for input through a serial I/O module.

If you would like more information, call Dick on ext. 7357 or drop by D.S. 39-086.

Dick Lynch (Laboratory Instruments Division) right, listens to a question about his crime simulation program.



A SINGLE-CHIP MICROPROCESSOR DRIVER FOR A LED MATRIX

Sam Mallicoat

To drive an 8 x 8 LED matrix, Sam Mallicoat (IDO Engineering) chose the Intel 8035 single-chip microprocessor because it requires very few support chips. The patterns to be displayed are stored in a separate 2708 PROM "just like the frames of a movie," according to Sam. Ports on the Intel 8035 directly drive the display row-enable and column-enable lines.

Mallicoat said he was inspired by such diverse sources as the Apostolic Faith billboard on Portland's West Burnside Street and by the Goodyear blimp. Both use displays that have enough discrete-elements (incandescent lamps) to resolve characters and simple geometric patterns.

Mallicoat's next project is driving an array of 8 x 8 cells each of which contain red, blue and green lamps. (There will also be a diffusing screen for color blending). "Anyone out there with 192 spare light bulbs?" Mallicoat asked with a grin.

If you have questions or 192 spare light bulbs, give Mallicoat a call on ext. 2513 or drop by D.S. 60-725.

Sam Mallicoat (IDO Engineering), describes his project to an onlooker.

HYBRID CIRCUITS ENGINEERING INPUT/OUTPUT BUS

Keith Parker

Keith Parker (Hybrid Circuits Engineering) presented HCEIOB (Hybrid Circuits Engineering Input/Output Bus). Keith explained that HCEIOB is an I/O system for 8-bit microprocessors that allows a designer to think in functional I/O blocks rather than having to think about the particular microprocessor in use.

As long as an I/O element meets the speed requirement, it may be used with any type of microprocessor that has a HCEIOB controller.

HCEIOB is also a very powerful tool in multiprocessor systems because with it no I/O problems result when several types of microprocessors access common I/O resources. That means that once the designer has built a HCEIOB controller for it, a new microprocessor can be used with all previously built I/O devices.

The bus contains eight address, eight data, five control and three voltage lines, and can use a 50-conductor Scotchflex cable as its backplane. Using LS TTL technology, the bus supports eight-bit data transfers, eight level-priority interrupts, and uses a simple handshake protocol. "The bus," according to Keith, "brings the advantages of standardization to the task of communicating between a microprocessor and its I/O devices."

Currently available HCEIOB controllers are the "bit-bucket" Z-80, the 6802, the 60X, SC/MP and a ROM pack for the 4051 terminal. The ROM-pack controller can accomodate four 2716 PROMs with HCEIOB mapped over the top 256 bytes, thus allowing the ROM-pack firmware to directly access devices on the HCEIOB.

Interface devices currently available are the 6820 PIA, the 6850 ACIA, 68488 GPIA, a speech synthesizer, an 8251 UART and several discrete-register devices.

Keith also pointed out to Cyber users that there is more information about HCEIOB in the "Designers Handbook" on HCEIOBD/UN=IFDOKWP and in the "Applications Manual" on HCEIOBA/UN=IDOKWP. These files are public; the content may be sent directly to the line printer for a copy.

If you have any comments or questions, call Keith on ext. 6055 or drop by D.S. 50-389.

Keith Parker (Hybrid Circuits Engineering) stands by his project, the Hybrid Circuits Engineering Input/Output Bus.

AMATEUR RADIO PROJECTS USING MICROPROCESSORS

Neil Robin

Standing in for Neil Robin (SPS Engineering), his wife Marsha Robin presented two projects Neil developed for his dual interests in home computers and amateur radio. Neil designed a one-of-a-kind home computer three years ago partly to learn about computers and partly to do household jobs. The computer's firmware, I/O addresses, interrupts and system configuration are unique.

In the last three years, Neil has added much software and firmware: a system assembler and disassembler, hardware fault isolation firmware, a digital timer for camera shutter measurements, an electronic slot-machine game, a radioteletype demodulator and a morse-code generator. Marsha demonstrated the last two sets of software.

Radioteletype Demodulator

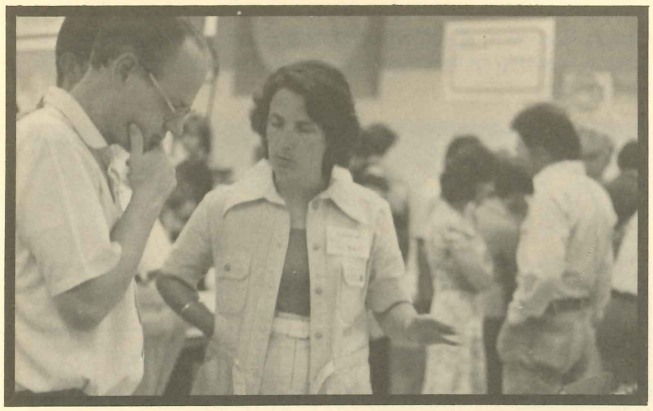
The Federal Communications Commission specifies that radioteletype transmissions use Baudot code. Most modern terminals, however, use USASCII code. For the code converter, Neil used a microcomputer as the interface controller because it could be changed to handle different incoming signals.

Ordinarily, demodulation requires several high-selectivity filters and at least one set must be adjustable to accommodate signals using different frequency shifts. Rather than take that traditional approach, Neil decided to use a phase-locked loop process of detection. A major advantage of this approach is its great flexibility, especially when auto-search software is used.

The result is a nearly automatic demodulator that allows unattended operation even on the noise low-frequency amateur bands.

If you would like more information about Neil's projects, give him a call on ext. 1159 or drop by D.S. 94-461.

Marsha Robin, standing in for husband Neil Robin (SPS Engineering), explains the operation of the radioteletype demodulator.



TWO COMPUTER SYSTEMS AND A VIDEO-TERMINAL

Eric Smith

Eric Smith (TM 500 Engineering) displayed two computer systems and a home-built video terminal. Eric assembled an Imsia computer from kits and added to it these Processor Technology Co. boards: 24K of RAM, a VDMI (a video display module), a 3P S (three parallel and one serial port), a Cuts Cassette Tape Interface and GPM (General Personality Module) boards. Put together, the system (based on an 8080) is the Processor Technology System B. The Imsia system uses the software that runs on Sol Terminal computers.

Eric developed another computer system based on an F-8 (a Fairchild microprocessor). The F-8 system includes a 4K BASIC interpreter, a resident assembler and a text editor.

Eric put the terminal together from a 4006 Computer Display Terminal case, a Byte Shop TV typewriter board, a video monitor, a 4006 keyboard, a UALT card and a modem card for phone transmission.

For more information on his system, call Eric on ext. 7698 or drop by 39-135.

Eric Smith (TM 500 Engineering) discusses the two computer systems he brought to the fair.

GAS 8080 COMPUTER GRAPHICS SYSTEM

Gary Spence

Gary Spence (Display Device Engineering) demonstrated his GAS 8080 self-contained color graphics computing system. The unit is small (15.5 by 10 by 6 inches), portable (30 lbs.), compatible with any home color TV set, low cost ($350 for the parts) and versatile. The system consists of eight subsystems.

Gary pointed out that the VIDEO DISPLAY INTERFACE used in the system has a random-access read-write memory, and displays eight-color graphics or alphanumeric characters. It is also self-scanning. The video display board outputs direct digital color and video to a modified color TV, or composite color video to the antenna connection of a standard TV. The display also has 900 easy-to-program screen locations.

The PARALLEL INTERFACE provides buffered-I/O, parallel-access to the system's address, data, control and power buses. Port size is 32K words.

The SERIAL INTERFACE provides programmability of USART functions, the frequency shift keying frequency, the phase-lock data baud rate, and encoding or decoding data. The serial interface has three ports: one for cassette tape, one for serial digital data and one for a phone modem.

The CPU-PROM-RAM subsystem provides 8K words of PROM for the operating system (a high-level language), 12K of RAM for the user's memory (plus 32K in a parallel port), and an 8080A CPU. The calculator subsystem has 64 scientific operators as well as a 32-instruction buffer memory which the user may access in a format similar to a BASIC PRINT statement. The NPU (Number Processing Unit) processing time is independent of CPU processing time.

The KEYBOARD INTERFACE provides multifunction modes of operation, alphanumerics, graphics, color selection, three direct peripheral access functions and a self-scanning keyboard circuit. The bus display provides display of the 16-bit address word, the 8-bit data word, the 8-bit control word, and the CPU status of the 15 functions.

The support system includes a removable cassette recorder, power supply (50, 12, 5 and -12 volts), a UHF video transmitter and hardwood sides to protect the keyboard and to make the unit attractive and easy to store on a book shelf.

If you would like more information about Gary's system, give him a call on ext. 7942 or drop by 50-276.

Gary Spence (Display Device Engineering) discusses his GAS 8080 color graphics computer system with a fair-goer.

A HOME-BREW AUTOMATIC DATA COLLECTION SYSTEM

Ferrous Steinke

Ferrous Steinke (CRT Instrumentation Electronics) demonstrated a 6800 microprocessor-based, automated data collections system. "The purpose of the display is to show that a microprocessor system could perform varied and apparently simultaneous functions," Ferrous related. Among other functions performed, the system used a graphic display to attract the attention of passers-by. In the display, text asked the on-looker to press a terminal key. If an on-looker depressed a key, within 15 seconds the system asked for the on-looker's name and asked several general questions about microprocessors.

If the system didn't sense a key depression, the system erased the screen and tried again to attract attention.

The observer's answers to the questions were stored on audio tape. "Of the 112 respondents, some apparently did not realize that their answers were being recorded because some were quite frank!" Ferrous said. The poll showed a strong interest in both the 6800 and the 8080 microprocessors, but with the edge going to the 6800. The 9900 was runner-up but almost all other microprocessors were mentioned at least once.

The terminal used in the display was a home-brew unit made up of pieces and parts from 4010, 4012 and 4023 terminals (mostly Country Store specials). "For aesthetic reasons," Ferrous remarked, "the external parts were purchased new."

The terminal has upper and lower case capability and serial transfer rates from 110 baud to 19,200 baud. Included were a home-built modem, a data coupler and a circuit which plays a tune through a speaker. In keeping with the theme of the computer fair, the tune chosen was "There's No Place Like Home."

The microcomputer is housed in a 4010-type pedestal base. A solid-state relay in the terminal controls AC power to the computer. The system also has computer power over-ride and RAM battery back-up.

If you would like more information about Ferrous' system, give him a call on 7949 or drop by D.S. 48-170.

Ferrous Steinke, (CRT Instrumentation Electronics), explains a feature of his home-brew automatic data collection system.

A HOME-GROWN TERMINAL

Jim Tallman

Jim Tallman (7000 Series Engineering) presented a microcomputer that he programmed to act as a terminal similiar to a 4023. The microcomputer was linked through phone lines to the Cyber computer in Building 50.

Jim's system consists of a modem, a SC/MP kit, memory, a keyboard and a TV display. One of Jim's goals was to keep the cost of the system as low as possible. His home-grown computer has an operating system that includes 1.5K bytes of PROM and 256 bytes of RAM. The operator inputs through an ASCII keyboard, and reads the microprocessor's output on a TV display.

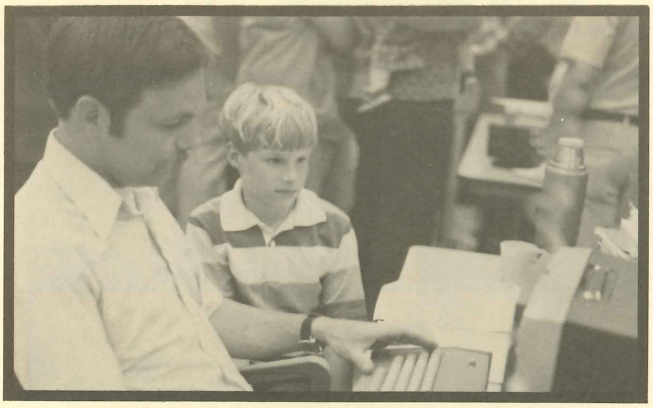
The computer has a serial input port and a serial output port. Both are RS232 compatible. Together, the ports serve as an interface for the audio cassette unit on which the program library is stored. The serial input/output port also provides communication with other microprocessors.

Jim said that he programmed the microprocessor to alternately look at the keyboard and at the serial input port. When the operator presses a key, the microprocessor passes the character to the Cyber through the output port. When the microprocessor sees a character on the input port (that is, from the Cyber), it passes the character on to the TV display. In that way, messages from the computer are displayed for the operator.

The system acts, then, as a terminal that allows the operator (at rates from 110 to 1800 baud) to communicate with any computer that uses a standard RS232 port...and all for less than $200 excluding the cost of the modified TV.

If you have any questions, give Jim a call on ext. 7076 or drop by 39-103.

Jim Tallman (7000 Series Engineering) demonstrates his home-grown terminal to Mike Larson, Les Larson's (7000 Series Engineering) son.



ASSEMBLY LANGUAGE PROGRAMS FOR THE 4051

Steve Tuttle

Steve Tuttle (SPS/TM500) demonstrated a set of assembly language programs he wrote for the 4051 computing system: NEWTAPE, an EXEC Relocating Loader, and a debugger program.

NEWTAPE is a ROM pack for the 4051. It finds the nearest file on a tape without rewinding the tape to the beginning. This allows the tape to be removed from the machine and re-inserted without having to wait for the tape to rewind. "That feature," Steve explained, "makes the 4051 a more friendly computer."

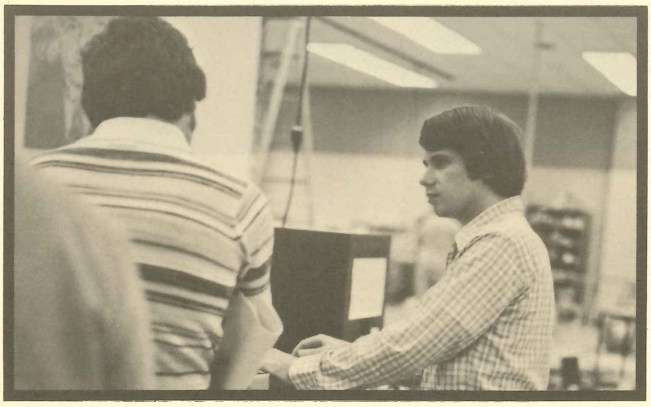
The EXEC Relocating Loader can load another machine language program into the 4051's memory space reserved for a string variable. This allows a machine language program to run on the 4051 without destroying the user's BASIC program or the variables. With this loader, large machine language programs can be combined with a BASIC program to accomplish a task that would be impractical for the BASIC program alone.

Steve also wrote (in SNOBOL) an EXEC String Format Generator program to run on the Cyber system. The program converts the machine language output of the 6800 Assembler into a series of string assignment statements compatible with the 4051. The assembler's relocatable output is also converted into a format compatible with the EXEC Relocating Loader.

Steve also modified an assembly language debugger program to run on the 4051. The program can display memory contents as hex data, ASCII data or disassembled instruction mnemonics. It can also assemble instructions for the 4051's magnetic tape unit. However, the debugger is used primarily for assembly language program development and debugging.

Steve can be reached by calling ext. 1119 or by dropping by D.S. 94-461.

Steve Tuttle (SPS/TM500) discusses his assembly language programs for the 4051 computing system.



A MULTIPROCESSING PERSONAL COMPUTER

Dave Ulmer

Dave Ulmer, (Scientific Computer Center), presented a personal computer that he said he built for two reasons: first, to give himself a chance to study the use of home computers, and second to have a tool for his further education in computers and software systems.

Dave has completed the hardware side of the project. It consists of a 4051 Intelligent Terminal (which he assembled), a 4662 Digital Plotter and a pedestal system that Dave designed using a 4051 ROM expander board to interface the 4051 controller to a 6800 microprocessor through an asynchronous dual-port memory (which Dave also designed).

Dave says the 6800 works as a general-purpose front-end and machine-language processor. A versatile telephone switching system, combined with two auto-answer and auto-dialing computer-controlled modems, allows the system to communicate with two outside timesharing systems or two terminals simultaneously (Dave has two phone lines).

Dave says the software part of the system is really the on-going project now that the hardware is complete. The system gives him a chance to experiment with programming techniques.

If you would like more information about the system, give Dave a call on ext. 6557 or drop by 50-454.

Dave Ulmer (Scientific Computer Center, right) explains the operation of his multiprocessing personal computer.

A MICROPROCESSOR-BASED FREQUENCY METER

Bill Wilke

Bill Wilke (TM 500 Engineering) displayed a 200 MHz univeral timer-counter which uses a microprocessor for calculations and for general housekeeping.

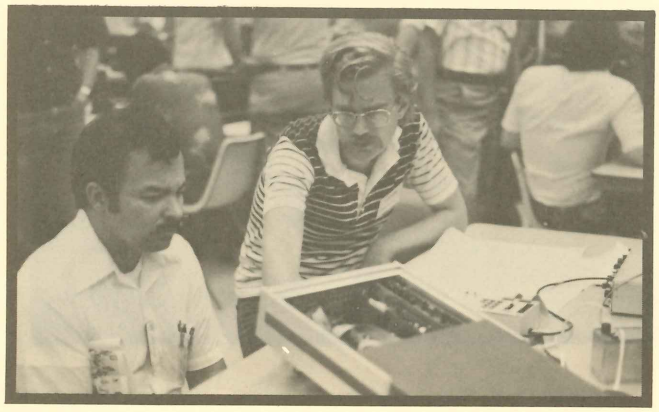
The universal timer-counter's capabilities are similiar to the TM500 DC505 Counter's capabilities, except that the universal measures frequencies by a reciprocal technique that gives much better resolution on low frequency measurements. In addition, the universal's averaging capability is greater than on other meters. A novel "pseudo-prescale" feature prevents overflow on long measurements without impairing accuracy.

The universal timer-counter uses a 6502 microprocessor, 256 words of RAM and a 1K ROM. Bill wrote the entire operating system. including the math pack, in machine language. The operating system occupies about 550 words of the 1K ROM. The microprocessor performs housekeeping functions such as running the multiplexed display and reading most of the front panel switches. Using the microprocessor for housekeeping and using software to do such things as counting below 100 Hz eliminated hardware, reduced the size of the device, reduced costs and increased reliability.

Bill also displayed a ROM emulator, a device that allows the user to write test programs and then run them as if they were in ROM. The emulator contains 1K of RAM and some control circuitry. Bill used the ROM emulator to develop the frequency meter program. A full discussion of the ROM emulator appeared in the January 4, 1978 issue of **Electronic Design.**

If you would like more information about the 200 MHz universal timer-counter, call Bill on ext. 6066 or drop by 39-135.

Bill Wilke (TM 500 Engineering, right) examines a display on his 200 MHz universal timer-counter.



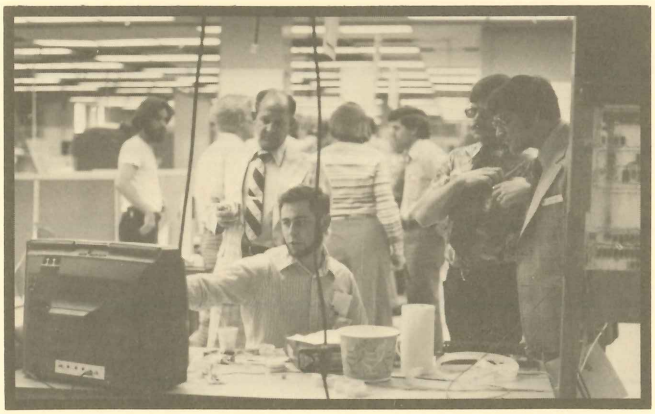
A HOME-BREW COMPUTER SYSTEM

John Ziegler

John Zeigler, (Service Instruments Division), demonstrated a truly home-brew microcomputer. Based on the 6502 microprocessor and built using wire-wrap techniques, the system features a Selectric typewriter terminal with home-brew interface hardware and software, 8K of memory, a video terminal card which displays 16 lines of 64 characters and a ROM-based teletype monitor.

For more information on John's project, call him on ext. 7749 or drop by D.S. 50-435.

John Ziegler (seated, Service Instruments Division) demonstrates his home-brew 6502-based computer.



Also presenting projects at the Hobby Fair were Tom Brandt and Jeff Eastwood (A Speech Digitizer), Tom Cheek and Larry Roger (Little Rascal), and Fritz Husher (Microprocessor-Managed Telemetry Field Site Data Processor).

Bill Walker presented the microprocessor Hobby Fair prize to Carl Hovey who won with his music synthesizer. "It's a good thing flash and showmanship had nothing to do with winning," commented one of the other participants.

Watching the proceedings, from the left, are Dave Chapman, Gary Spence, Bruce Ableidinger, Don Dunstan, Dave Ulmer, Geoff Gass, Steve Tuttle, Pat Caudill, Dick Lynch, Keith Lofstrom, Bill Wilke, Neil Robin and Joyce Lekas.

Graphic Designer: Andrea Fowler

Photographer: Larry Jackson

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Maureen Key 60 553