#21, May 1993

ENCODER

The Newsletter of the Seattle Robotics Society

3rd G.E.A.R. Campout Near

For the last two summers we've done something called G.E.A.R. which stands for "Great Escape And Retreat", the Seattle Robotics Society annual-traditional-high-tech-in-the-woods campout. Well, it's that time again, folks. Pack your weanie roasting robots and tents and lay in provisions, it's time to head for the woods, my friends, it's time for **3rd G.E.A.R.**!

3rd G.E.A.R. will be held the weekend of August 27, 28, 29 at South Whidbey Island State Park, Washington, U.S.A.

3rd G.E.A.R. is free, except for camping fees, about $9 US per night. Camping sites are first come, first serve and sites will fill up pretty quickly after 2 p.m. on Friday the 27th, so I recommend you get there before noon. To be really sure of getting a site, you should consider getting your site on Thursday the 26th. That's what several of us are doing. Sorry, we can't reserve sites for other people. You must either be there in person or have someone else put the campsite in *their* name. The important thing is that campsites cannot be reserved for people not present, so it has to be in the name of someone who is there. Any adult can pay for a single campsite, so if you anticipate not being able to make it by Friday noon, you should get someone who will be there Friday morning to rent a spot. In this situation it would be a good idea to pro-

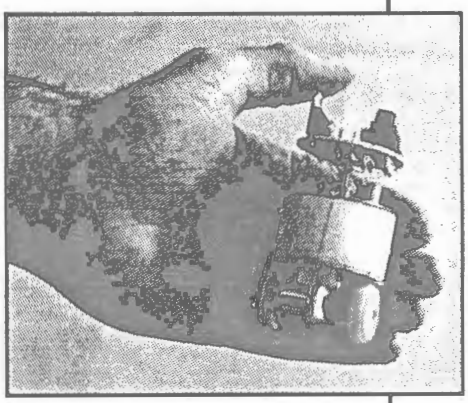
(Please see **3rd G.E.A.R.** *on p. 3)*

A Nanomouse In Toronto

by Bob Nansel

Nanomouse was the smallest "conventional" robot at the 2nd BEAM Robot Olympics in Toronto in April. By conventional, I mean it used batteries instead of solar power and it used motor-driven wheels instead of legs. It also had more than 50 transistors worth of computing horsepower.

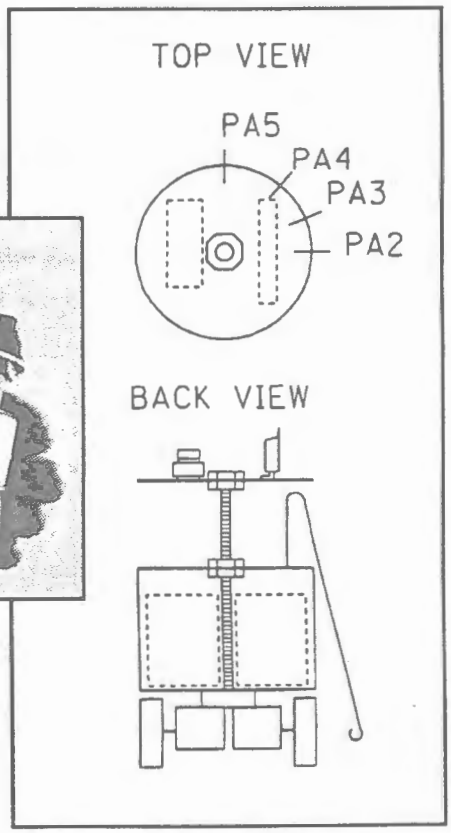
Controlling the mouse was a 68HC705K1 mcu with a LM18298T Dual H-bridge driver providing high current drive for the gearmotors (see schematic on p. 3). By using two NPN bipolar transistors as invertors, the need for a separate invertor chip is eliminated, keeping down chip count at two.



Four piano wire whiskers (labled PA2 through PA5 in the drawing this page) comprised the wall sensing array for this tiny maze runner. Three perf-board disks held in position by a threaded rod and a foam spacer formed the body of the robot, with a ring of bare copper wire bonded to the perimeter of the middle disk. Tied to ground, this ring acted as the contact for the piano wire whiskers.

Tight though resources are, the K1 mcu still has room left over in this design; IRQ\, PA6 and PA7 lines remain uncommitted. Anyone for a micromanipulator attachment?

Unfortunately, I didn't take notes when I photographed the Nanomouse, so I'm not certain who to credit with building it. The schematics both refer to a DOS directory "Kalkhof" which may be the fellow's last name. Anybody out there know the True Identity of this talented robot builder? If so, drop the editor a line so we can give him full credit. Meanwhile, whoever you are, thanks for the inspiration.



For the Love of Robotics

You may have heard of Personal Robotics. You know, those machines that were supposed to be in every home by now, washing dishes and changing diapers? And we were going to have robot vacuum cleaners, too. Wasn't there a bunch of crazy Personal Robot zealots working on all this stuff about ten years ago? Could there maybe be some money in this, or was it all just a hoax?

The First Wave went like this:

In 1977 *Star Wars* lit up the big screen. Action, adventure, lovable robots, Good versus Evil, a beautiful princess, Darth Vader... Great stuff; audiences everywhere loved it.

A certain class of people—call us the Gearheads—paid especially close attention to the robots. It got us fired up, ready to take another whack at robot building.

Make no mistake, Gearheads had been around a long time. In fits and starts through the centuries we had been building clever life-like creatures, expensive clockwork puppets that amused and amazed our rich patrons. We sometimes made a buck at it (it's amazing what you can sell to a bored Duke), but most of us had to have real jobs to support our obsession. We dreamt about robots during the night and during the day we made clocks, or fixed vending machines or pinball machines, serviced telegraphs, telephones, televisions. We struggled after hours to bring gears and springs and sprockets to life. There were never very many of us, perhaps only a few hundred in the whole world.

We built clockwork puppets to amuse our patrons...it's amazing what you can sell to a bored Duke.

By the time *Star Wars* came along, computers were loose in the land, true Personal Computers. The seventies brought us microprocessors, and *Star Wars* brought us renewed enthusiasm. There was nothing mechanical about any of the robots in *Star Wars* that a sixteenth century clockmaker couldn't have made a go of; it was self-adaptive behavior that even mice demonstrate, intelligence, the *brains* that eluded us. With microprocessors, Gearheads had finally found brains for their creatures and at last we would see Real Robots.

As we headed into the eighties that optimism was fueled when we got our own magazine, *Robotics Age.* Around then the phrase "Personal Robotics" was coined. Maybe, we thought, if we called them Personal Robots, the aura of success surrounding Personal Computers would rub off on our work. By the mid eighties I often heard fellow Gearheads saying, "Personal Robotics is in the same stage Personal Computers were in 1975..." And since Personal Computers had made billionaires faster than any industry ever, no doubt the first Gearhead billionaires were already among us.

Dozens of companies sprouted up, eager to sell to the new Personal Robotics market. Venture capital flowed. Those who had been kicking themselves for missing out on the ground floor of the personal computer revolution determined not to miss out on the Personal Robotics ground floor. Even Heathkit had robots to sell to this Personal Robotics market.

There was only one problem: the market for Personal Robots was purely a product of our imaginations. Sure, a few personal robots were sold, but soon we would see that the Pet Rock market had more staying power.

It was '85/'86 when the bottom fell out. *Robotics Age* changed its name, staggered on a few more years then folded. Another magazine, *Robot Experimentor,* lost 70% of its advertisers between issue three and issue four. When I say "lost", I mean those advertisers went out of business.

Optimism faded to gloom. If you'd asked me then what stage personal robotics was in, I'd have replied that we were more likely at the stage Aviation was in 1902. That would've been on a good day. On a bad day, I would've said it was more like the stage of the Montgolfier brothers with their first hot air balloons. That's what Personal Robotics turned out to be: Hot Air.

Why did this happen? It has a lot to do with what I call the *Jetsons* Model of robotics. In the *Jetsons* , robots are straight one for one replacements for human workers. The technology just isn't there to do *Jetsons*-style robots. We took ourselves too seriously, promissing people the *Jetsons,* and we could not deliver.

No one knows what it's gonna take to make commercially successful robots, so there aren't any experts.

No one really knows what its gonna take to make commercially successful robots, so there aren't any experts. We're all amateurs, so I call the field *Amateur* Robotics to keep my feet on the ground. I am an Amateur Robot Builder and proud of it. As the root of the word amateur suggests, we build robots out of *love.* There can be no higher calling.

The Editor

(**3rd G.E.A.R.** *continued from p. 1)*

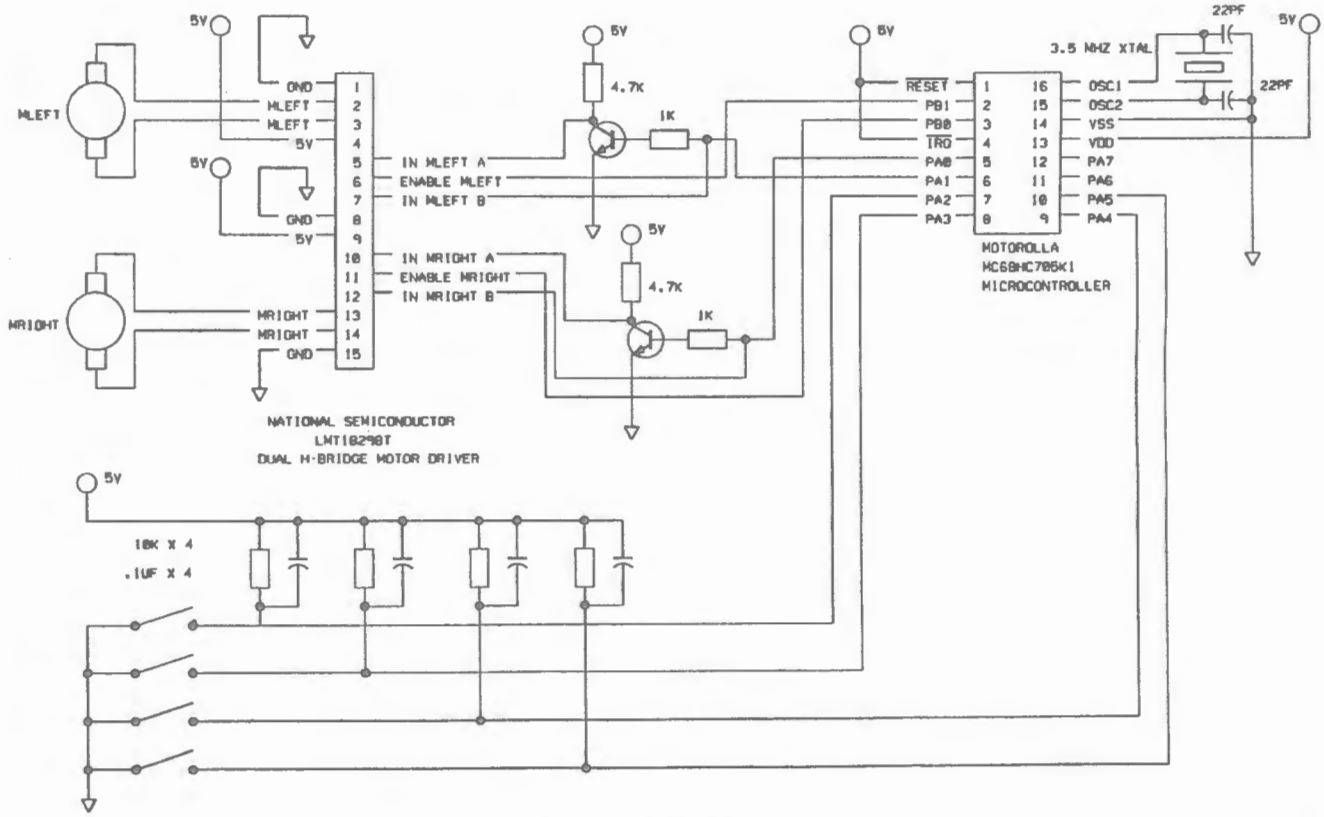
vide the person renting the site with at least a portion of your camping gear so they can set up the semblance of a camp.

Activities? First up is the traditional Barbarian Potluck Barbeque on Friday night. Practice your cave-person eating sounds, but be discrete if you intend to eat raw meat. The meal starts promptly at 6:00 p.m. (plus or minus an hour depending on how hungry the Barbarians are).

On Saturday night we'll have a repeat of the wildly popular Black Tie Formal Barbeque (bow ties recommended for those doing the cooking). A higher class version of the Barbarian Barbeque, this is a chance to show off your fanciest campfire cuisine.

How do you get there? Take the Mukilteo ferry to Clinton. First take exit 526 from I5, go past Boeing, turn right at highway 525. Go all the way to the bottom of the hill where you will find the line of cars waiting to get on the ferry. Once on Whidbey (about a twenty minute crossing), continue on 525 to Freeland. Just west of Freeland turn left on Bush Point Road. Folow this until it changes it's name to Smuggler's cove road after a few miles, then a few miles more until you get to South Whidbey Island State Park. It will be on your left.

What could be better? Robots and trees and fresh air...See you there!



Nanomouse Schematic

Gearing, Gain or Loss

by William Harrison

To the nontechnical, gears give a machine that "machine look." But gears are rarely used for that purpose. Gears can be used in a machine to gain torque, reduce speed, increase speed or simply transfer rotation.

Gearing losses are often overlooked. Gears are never 100% efficient. Some gears, such as the common spur gear, have efficiencies in the high 90's, while other gears, such as worm gears have low efficiencies (50 % and worse). Worm gears can lose most of the power being transferred.

Sometimes a low efficiency gearing train must be used in a machine, say, if a very large speed change is needed. Suppose you want an output shaft to run 100 times slower than your motor shaft. A worm gear can do that in a small space with just two gears (the worm and the worm gear). A spur geartrain would require much more space, multiple shafts, many gears and might even be less efficient. So the low efficiency of the worm gear could be tolerated to get the high gear reduction.

High losses can be used for advantage. Worm gears have high losses when the worm turns the worm gear. If instead the worm gear is driven, the losses can be astronomical. This can be used to "lock" a machine in place without additional gadgetry.

Efficiency isn't everything. Gearing losses must be considered in machine design, but they aren't always a loss.

Robotics and Teamwork

by William Harrison

Have you ever wondered why so many big impressive projects are undertaken by teams of people? It makes sense that one person has only so much expertise and resources. One person can actually accomplish very little by himself.

One person can do more by getting several people together into a team, pooling their resources. Take building a Sumo robot, for example. One person may be very good at putting together electronics, but not too good at mechanical construction or computer programming.

That person could "chip" away at it and eventually get the robot built. It would take a great deal of his resources, many retries, and not-so-good performance when done. A Sumo built by a team could be better and could require less combined effort.

The person good at electronics could team up with a machine designer, a computer programmer, and others. Each works only on the part of the robot they are good at. The Sumo robot, built by the team, would be better and more competitive.

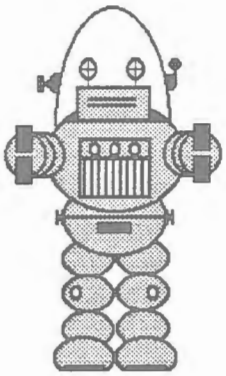
The practice, building a robot as a team, is good since many activities in day-to-day life work better with teamwork. It's more interesting working with others on a common project, too.

The one thing that a team needs, that the lone robot builder doesn't, is team management. There must be a manager, who all team members respect, who coordinates each team member's contributions with the whole project. It would do no good to have one team member design an electronic circuit that couldn't operate the motor design of another team member.

I am impressed with the fantastic amount of talent in the SRS. I think that if the club got together, the SRS could have very competitive robots. I've been pushing Sumo robots, but this would be true for any robot. We should pick a contest or demonstration, get a team put together, and astound others with what we can do.

If we just decide to do this, we need to keep in mind that the project must be managed well from the start.

I suggest, as a possibility, we get together a team to build a "world-class" Sumo robot. What do you think?



P.A.R.T.S

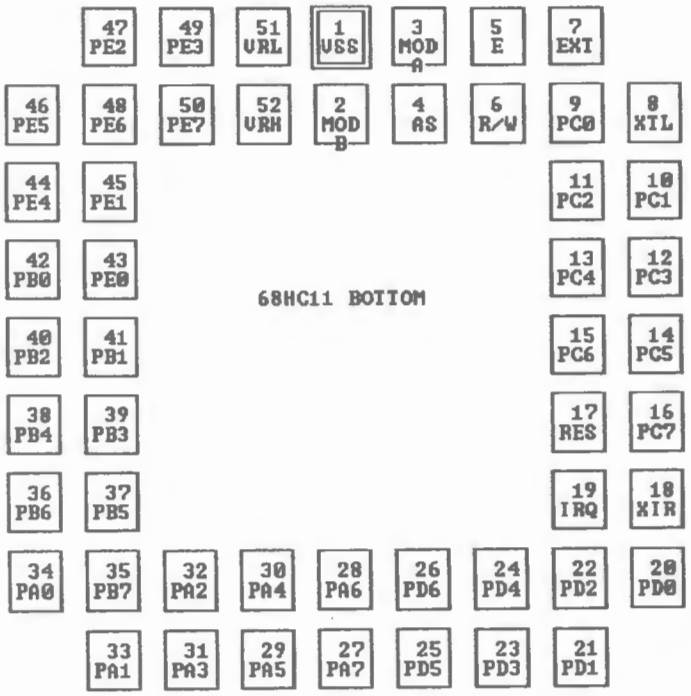
Portland Area Robotics Society

Issue # 07 By. Marvin Green (503) 656-8367.

Mobile Robots Inspiration to Implementation $39.95 -10% to club members! A K Peters (617) 235-2210

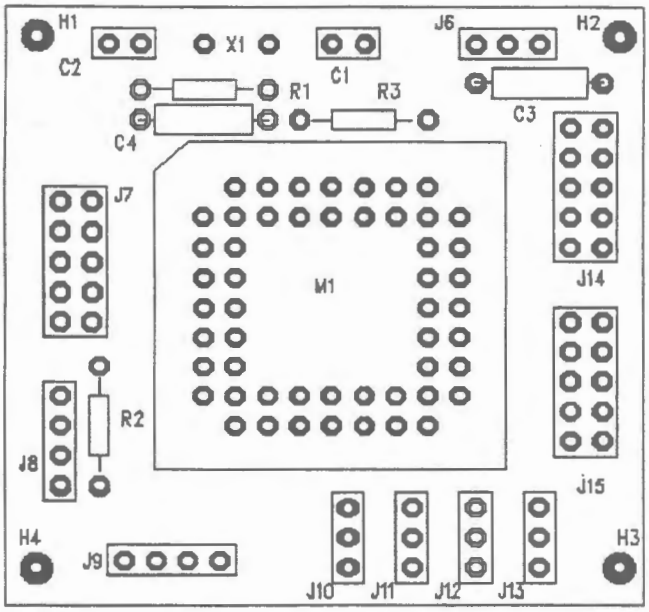
PIN OUT!

Using the 68HC11 microprocessor isn't difficult. Although the documentation from Motorola is excellent, it doesn't have a PLCC 52 pin wiring diagram. I found it awkward counting out the pins and trying to make connections, so I decided to make the job easier by drawing a pin wiring diagram. The bottom side of the 68HC11 is shown, complete with pin numbers, locations, and pin function.



68BOARD

The 68BOARD is my first attempt at creating a printed circuit board. I listed my design goals to have a clear idea of what I wanted. First it must be small, I wanted to try to design it in a 2 inch square board. The second goal was to make the board single sided. This would allow the board to be produced with a laser printer using heat transfer film. The third goal was to have all (or most) of the I/O pins come out to a header.

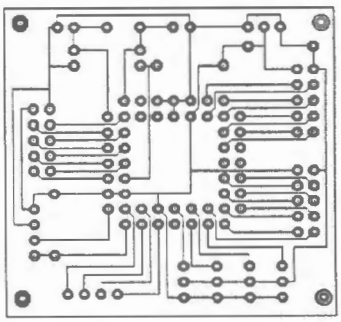


With those goals in mind I also wanted to have power supply pins on each header, four servo ports, separate serial and SPI ports, and a small prototyping area. Later I decided against the prototyping area because it would increase board size, and proto boards can be purchased cheaply from Radio Shack and Digi Key etc.

I ran through the PADS demo and the manuals exercises to get an idea of what the software could do. I felt confident. After creating the board outline, and adding a few components, my confidence was sinking. PADS has a lots of bells and whistles, and the shareware version is free, but it's not user friendly. Menu after sub menu, navigating around was a chore. In time I learned to fly from menu to menu. I just kept thinking ' FREE is a very good price.'

Using the examples in the manual, I was able to create a 68HC11 PLCC socket. I did all my parts placement, and routing by hand [ON THE FLY] even though much of this could (or should) have been automated.

I tried dozens of different layouts. The finished 68BOARD has most everything I wanted, including mounting holes. The board could be stacked and used in a network fashion. I now find it relaxing to pull up this board in PADS and just move parts around.



Manufacturing. I have called several pc board manufacturing places and found that the board could be produced for about $4.00 a board per 100 boards. Much cheaper for a greater number. The lead time is about five or six weeks. Contact me if you are interested in getting this board...

I will place all my printouts and documentation on the SRS BBS. (206) 362-5267. The file will also contain the PADS circuit if you want to play with it. The print files can be used to create a board using the heat transfer method.

Please think about adding your own experiences to the pages of the PARTS newsletter.

Ferry Schedule for 3rd G.E.A.R. Travelers

(**Boldface** indicates P.M. trip times)

Leave Mukilteo

5:05	●	7:30	○	10:00	**12:30**	**3:00**	**5:30**	**8:00**		**10:00**		**12:00**		
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Leave Clinton

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● Monday through Friday only
■ Mondays only
○ Monday through Saturday only
❑ Friday, Saturday, Sunday, and Holidays only
▲ Saturday, Sunday and Holidays only

About the Seattle Robotics Society

The Seattle Robotics Society was formed in 1982 to serve those interested in learning about and building robots. We are a diverse group of professionals and amateurs, highschool students and college professors, engineers and tinkerers. Our passion is the creation of cybernetic creatures that challenge the old definitions of life, intelligence and practicality. We meet 10:00 a.m. to 12:00 noon the third Saturday of every month at North Seattle Community College in room 1652. If you are building a robot or just planning one, come down and meet the gang. We are on an exciting journey and welcome you to join us.

Upcoming Events

August 27-29

3rd G.E.A.R.
SRS 3rd Annual Great Escape And Retreat Campout, South Whidbey Island State Park.

September 12

SFRSA Robot Races
Eighth Annual Robot Competition and Exhibition, San Francisco Exploratorium, 10 am to 4 pm. Events include: Robotic Rope Climbing, Maze Wandering and Potato Peeling. Sponsored by the San Francisco Robotics Society of America and the Exploratorium. For more information contact Brad Smallridge at (415) 550-0588.

October 3

Second Annual Robot Faire.
Orange Coast College (in main cafeteria) Displays, Demos, Robot Races, Games, Exhibits, Videos and much more. 10:00 am to 4:00 pm on Sunday October 3rd. Sponsored by the Robotics Society of Southern California. Free admission. For more information, call (714) 722-0890.

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What's Inside #21: