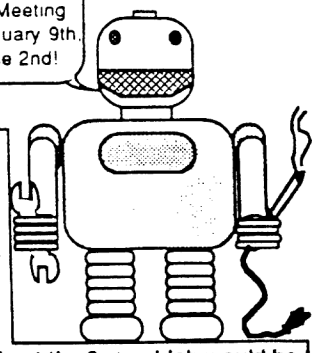
ROBOT BUILDER

January 1990

REMEMBER: Next Meeting is January 9th. Not the 2nd!



The official publication of the Robotics Society of Southern California
P.O. Box 3227, Seal Beach CA 90740, Meetings the 1st Tuesday @ 7:00 PM at MTI College

Well, can you figure your society's board out? First, you don't receive a newsletter for the month of December, and then you receive the newsletter for January- EARLY! You may have also noticed that you received the December newsletter with this issue. It was prepared November 30, but we had some difficulty behind the scenes getting it printed, folded and mailed. (quite frankly- we did not do any printing, folding, and mailing) The bottom line is: we could use some assistance from volunteer members. Offer your assistance- we need it!

Hopefully, you noted the different date for our January meeting, - the 9th and not the 2nd, which would be our normal meeting date were it not for New Years and possible late holidayers. We know some of you diehards hate changes, but we did this in the best interest of all our membership. Tell your fellow attendees. We will also hold our election for new officers for FY90 at this meeting. Several of our interim officers have indicated a willingness to continue in their office for the next year, and others might like to have a rest. Be prepared to present your candidate for our new slate of '90 officers, plus any ideas on new board positions. Another note to those of you who have not paid your dues,- THIS WILL BE YOUR LAST NEWSLETTER! If you do not want to join the Robotics Society of Southern California, but want the newsletter, the cost is $15.

The board met December 12 to discuss several key issues concerning our organization. *"Where are we going as a group of robotcs enthusiasts ?"* was number on our minds. How can we best serve the membership and still do the exciting things that we've talked about? What do the members want to do? Can we select one major goal or project and still keep all members happy? We must all remember that we have joined together with many levels of expertise, interests, and backgrounds. *All* of us must enjoy what we are doing.

Members seem to be universal in their desire to construct some sort of mobile robot. A group project would serve the interests of some, but most seem to want a robot of their own, and yet share the expertise and talents of other members in constructing such a machine. Many, if not most, have never built a robot and have no idea of how to start. Many have limited funds and have no plans to build a $1000+ machine. Several of you purchased the reprints of the Radio Electronics (RE) Robot project from Jerry Burton. Make no mistake about it,- this is an excellent approach, but it could cost upwards of $1000 when completely finished. Many feel that this is too much. I recommend that you use some of the information contained in the RE series to guide you in the construction of a larger robot (50 lbs.+). Other books will be made available for use.

Your editor, Tom Carroll, wrote an article for the February 1987 issue of *Boys Life*, the Boy Scout magazine with several million circulation. My criterior was to build an inexpensive robot (less than $50) with simple hand tools and easy-to-find parts. From information that I received from the magazine and H&R Corporation, the main supplier, over 27,000 people built, or attempted to build the robot. Granted, the article was geared for 12-18 year-olds (14- the average), but many adults have also built the machine and have computerized it and added all sorts of "bells and whistles". The article is enclosed. Think about it. The subject of the January 9 meeting will be the building of a robot for all interested members. We are open to all designs. Tom will discuss the construction of the *Boys Life* robot and will bring some of the parts and pictures of completed robots. Other members will assist you in different designs. No more talk, - we are now building machines!

We have mentioned before of having group buys for products, parts and books. The board is interested in providing members with several of the excellent texts on personal robot construction. The two *Sams* books by Mark Robilliard on microprocessor based robotics and advanced robotics, as well as *Hayden's* book by Marty Weinstein will again be available for your inspection at the next meeting. These three books, plus several by *TAB Books* are helpful for all experimental roboticists. We'd like to arrange a group buy. We will also be discussing group buys of gear motors, wheels, batteries and control circuitry for our robot projects.

MERRY CHRISTMAS, HAPPY HUNAKKAH, HAPPY NEW YEAR from your officers and board members! 'See you at the meeting on January 9, 1990. Let's do some exciting things this new decade.

EDITOR

Some Thoughts Concerning Robot Architecture.

An important consideration in any robot design is what is the purpose of the robot. If you have a specific design already in mind then you can optimize the architecture to achieve that design at minimum cost.

What architecture should you use if you aren't sure what functions you want the robot to perform ultimately ?

A so-called closed architecture, i.e. a design that covers a known and limited number of functions and has no means of easily adding functions in the future, may be desirable in some cases. A single board computer including all the interface electronics is certainly the most efficient way of implemented a set of known and specific functions.

Architecture is normally used in a hardware or physical design context. I propose we expand the concept to include system and software designs as well.

The TOPO robot, of which most of you are familiar, had a closed architecture. You could not add more subsystems like sonar, vision, speech recognition, sensors, or ?. This robot was closed with a capital C. There was no independant computer on board and the entire robot was a single function i.e. a mobile peripheral to the main computer.

It only had enough "smarts" to carry out commands transmitted to it via an RF or infra-red comm link, but not much else.

The HERO 2000 robot on the other has an open hardware architecture in that it has a number of slots available to put in additional subsystems under control of the main processor. The bus structure of the computer allows you to add boards and control software to increase the basic capability of the robot.

This approach has many advantages over the closed hardware architecture, but still has a severe limitation. The main computer, which is essentially a PC XT inside a robot base, forces you to write software for 8088 class machines in BASIC. This means the software is a closed architecture. Software written on any other machine is marginally usable. If the software is written in a compatible BASIC then it is possible to get some use from software written on say an Apple class machine.

I would like to propose that we use as a "Prime Directive" (in all three robot groups building the society robot) that we "Always design a step above the physical limitations of a specific hardware class, and create independant autonomous subsystems that have well defined interface characteristics". By this I mean we design functions and subsystems as independant modules with strictly defined interfaces so that they may be controlled by any process that adheres to the standard.

As an example, consider a sonar subsystem that has a poloroid sensor mounted on a stepper motor. The subsystem should be a plug-in module that can perform the complete sonar ranging function when commanded to do so. A set of commands given to the module, provides a well defined response, REGARDLESS OF THE PROCESS THAT COMMANDED IT TO PERFORM THE FUNCTION.

This means that such a subsystem would not require the user to be concerned with (or even be aware) of such things as timing of the sonar pulses, hardware interrupts, the control of the stepper or sensor, etc. The interface to such a subsystem would be defined at the command level, e.g. GET RANGE, SCAN 360 DEGREES, ROTATE TO 45 DEGREES, SEND LAST 10 RANGES, etc

A locomotion subsystem would perform

the task of moving the base in response to well defined higher level commands, e.g. FORWARD 10 FEET, LEFT 10 DEGREES, STOP, VELOCITY 2 FEET PER SECOND, etc.

With well defined high level interfaces defined for each subsytem and the subsystems communicating on an open bus architecture (e.g. the STD bus) a truly open architecture robot could be realized.

The Master computer could be any type desired (Intel, Motorola, etc. using any language you are comfortable with) or even a remote computer if you had some sort of communication subsystem capable of receiving commands from the remote computer and sending them to the appropriate subsystem.

Since each subsystem is self-contained you have the flexibilty to use what ever CPU is most applicable to the function. E.g. Bob uses 8051's for motor control, Don Golding uses forth on a PC for vision, I use a Z80 based system for speech synthesis. There is absolutely no reason why these three diverse environments can not be combined in one integrated robot system.

The inside of a given subsystems could completey be replaced by a more sophisticated version and the OTHER SUBSYTEMS WOULD NOT HAVE TO CHANGE. This approach provides the maximum flexibily and insures that the robot will not become obsolete when newer hardware or software becomes available.

The disadvantage of this approach is that each subsystem has to have more intelligence and hence complexity built into it. For example, the motor control board that Bob Angelo has been talking about would have to have a control CPU on board to interpret and execute the high level commands given to it. His current design requires a separate CPU to provide the current limit settings and turn on the drive motors.

His board is a step above a dumb controller in that it has some internal speed control built-in, but it doesn't go quite far enough. My idea of a motor controller subsystem is that it can operate totally on its own, thus freeing the "Master" computer from having to be concerned with how long a given motor has to be on to achieve some desired resultant motion or providing a ramping of current supply to overcome intertia and maintain a desired speed.

Another consideration for such a design is how much computer power should be on board the robot. Severasl of us have been having an on-going debate on whether the robot is totally autonoumous or gets its commands from a remote computer system. Ultimately, we would like our robot to be totally self-contained and not require the use of an external computer. This means the robot must contain its own mass storage and have some means of communicating with its human master, e.g. voice recognition.

We must be aware of this as the ultimate goal, but should try to follow an evolutionary design approach to achieve the goal. My position is that we keep the master fairly basic, i.e. CPU, RAM memory, IO - and develop the Articial Intelligence software on a larger fixed base machine. Only after the programs are developed that can provide the appropriate commands to the robot subsystems should we consider putting them on-board the robot itself.

Hopefully this discussion has sparked some thoughts in each of you and we can enter into a healthy debate over what our robot is to be. If each of you will apply your specific talents to the Society Robot Project we can truly develop an advanced machine.

Pick an area(s) and get in touch with the tem leader - let's make the 90's the decade of the Robot.

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HOME SERVICE ROBOT TO MAKE CALIFORNIA DEBUT

A demonstration of what may be the first practical service robot for home and business will take place Friday evening (Feb. 23) at 7:00 p.m. at MTI College 2011 W. Chapman Avenue in the city of Orange.

The robot, called Newton by its developers, stands 36 inches high, weighs 70 pounds, and is 19 inches across. Its sophisticated speech synthesis and recognition system enables it to understand and act on verbal instructions from people it knows, according to its manufacturers, the SynPet Company of Boise, Idaho.

The meeting at the college is being sponsored by the Robotic Society of Southern California (RSSC), an organization of dedicated experimenters in the field of advanced personal robots and robotic devices. RSSC meets monthly at MTI to learn about the latest advances in robotic technology and invites anyone interested in the development of robotics to attend its meetings.

According to SynPet, its Newton robot, which will be shown at the Friday meeting, can be a security guard, detecting fire or intruders and notifying fire departments or police, as appropriate.

Newton can awaken its owners in the morning, turn on the coffee, television, or lights on command, and turn off all appliances after the family leaves for the day, SynPet said.

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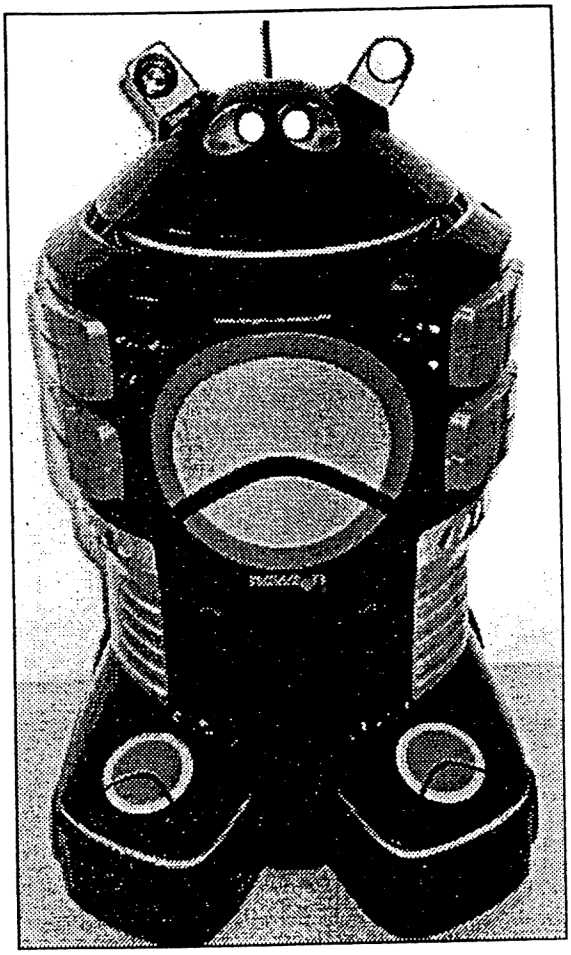

"NEWTON"

by SynPet