ROBOT BUILDER

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

UPCOMING EVENTS CALENDAR FEBRUARY 1991

Feb 5	RSSC Meeting at MTI College: 7-9 pm Topic: HAC Motor Control
Feb 9	RSSC Robot Project Workshop, at Jerry Burton's Lab
Feb 26	RSSC Board meeting, at Jerry Burton's Lab
Mar 5	RSSC Meeting at MTI College: 7-9 pm Topic: HAC Sonar and other controls
Mar 9	RSSC Robot Project Workshop, at Jerry Burton's Lab
Mar 26	RSSC Board meeting, at Jerry Burton's Lab
Apr 2	RSSC Meeting at MTI College: 7-9 pm Topic: Mobil Robot Navigation
Apr 6	RSSC Robot Project Workshop, at Jerry Burton's Lab
Apr 30	RSSC Board meeting, at Jerry Burton's Lab

President's Message

It's Super Bowl Sunday as I write this and we have just completed another sucessful ACP swap-meet. We had a good turn-out in the morning and handed out a lot of literature, hopefully we will get some new members. Special thanks to Roger Ruszkowski and Tim Lewis who manned the booth the entire day. The Society robot RISKY (RSSCee) drew a lot of interest and we plan to develop a demo program by the March swap-meet, so we won't have to keep typing in commands through the keyboard (the Nady mike receiver wasn't operational so we couldn't use the recognition input to the knowledge base).

At Tuesday's meeting we will be discussing the motor control portion of the HPC, and will follow-up with a Lab on Saturday.

Note the proposal that Tom Carrol submitted for a directional microphone for the robot, reproduced in this issue. This is a good example of a proposal for an addition to RISKY. The rest of you could use this proposal as a sample for projects you would like to see added to the robot. The board will then present a priority list of projects for member approval.

The RSSC bulletin board is now operational. It operates as a sub-board to the Future Net RBBS board. Roland will be uploading the membership file and the Sysop will pre-register all current members. Any member can then log in and leave messages or up/down-load files. Everyone will have an initial password of RSSC, you should change it to something unique, once you log-in, the number is (818) 303-9595......JB

GENERAL MEETING Jan. 08 1991

The Society meeting was held from 7 P.M. to 9 P.M. Tuesday the 8th. of January at MTI College. A group of 18 were present to observe Mr. Corson of Byte-Size Stores, Inc., demonstrate the Covox sound recognition hardware and software. President Jerry opened the meeting on schedule and monthly business was conducted.

The decision was made to man a booth at the ACP swap meet. Come by and say hello to your fellow members of the Robotics Society Sunday 27 January at the ACP swap meet.

Jerry would like to see the Society displayed at the 1993 WESCON. Special Interest Groups are evolving as members are getting to together and sharing ideas.

Transforming ideas into reality is still a problem with the engineering note book. It has been recorded that the Covox Presen- tation arranged by Don Golding was absolutely spell binding.

The next Society meeting in the Library of MTI College will start at 7 P.M. on Tuesday the 5th of February......RR

HARDWARE WORKSHOP Jan. 12 1991

The Hardware Working Group meet at 10 A.M. Saturday 12 Jan. at Jerry Workshop. Society President Jerry Burton hosted the meeting. Mark Frank had the hardware systems of the societies' robot in prime condition.

A mixed hardware and software group worked on the integration of the Covox voice subsystem into the computer system of the robot.

A second group worked at establishing a Society Bulletin Board. Kevin Corson and Jerry Burton are working the bugs out for everyone. Kevin is working the host end of the board and Jerry is Beta testing the user end of the system. Next month should bring more news about how the membership can make use of this resource.

The morning went fast for everyone. We all find so much we want to do with our interest and so little time to work on the problems. In the four hours a month spent in face to face club meetings, things do not appear to advance very much.

In the month since our last hardware meeting more people than I can name have worked independantly to support ourcommon interest. While not at the meetings Mark Frank fabricated additional parts for the robot. Someone charged the batteries. Someone worked on the software. Jerry and Kevin advanced the bulletin board. Jess and Roland produced and mailed you a news letter.

Keep up the good work every one and I'll see you next month.....RR

ENGINEERING NOTEBOOK 15 Jan. 91

The notebook is a very popular idea. It seems to get mentioned at every meeting. It is said "Hey guys we should record that in the notebook". "Where do I find the notebook?" "We did that last year and you should find it in the notebook". "I didn't bring my notebook copy to the meeting but ask around some one has it". "Why don't you transcribe that dissertation and small manual into the notebook". "The bulletin board would be a great place for the notebook".

The notebook slips into conversation so fluidly. Help me with this everyone. Pass me the paper. I want to help get this information availiable to and shared with the Society. However, until someone provides a paper copy of the information to the Secretary for inclusion into the notebook we arejust wishing, hoping and dreaming that valid and interesting information will appear in the notebook for ever ones benefit. Be some of the first to contribute a jewel of wisdom. We all know real things are not yet occurring this way. Share your information in a real way. Get the things you want into the notebook by providing a hard copy to Roger L. Ruszkowski, 18409 Renault St., La Puente CA. 91744..............RR

ACTION ITEMS

These are some of the items that are needed for the completion or expansion of the club ROBOT development.

1. I'm going to call this a "DOCKING STATION" for want of a better title. This station will be used for charging and must have an automatic interconnect. It also requires some type of identifier for the ROBOT as to its location.

2. There is a need for an "RF LAN". This requirement is needed to assist in the debugging and monitoring of the operation of the mobil ROBOT's computer program. One current and specific need is a way to monitor in real time the sonar tranducer outputs so we may know exactly what the ROBOT may be seeing.

3. This need I'll call a "SONAR MONITOR". The club needs some type of hand held receiver that is tuned to the 40 khz sonar output. It should be capable of responding to the transmitted pulses, determine the amplitude and present it on some type of digital or analog display.

4. Sonar beam focusing. The present Polaroid tranducers have a rather wide (30 degrees) beam spread. To better locate an obstacle, the beam width needs to be focused and reduced to as narrow a beam as possible.

5. Sonar return signal amplitude. Jerry B proposed this action item at last months general meeting. He needs amplitude information from the sonor return to allow more exact determination of the pointing angle to the reflector or obstacle.

6. New alternate for the HPC board. The source for additional HPC boards seems to be exhausted. The other members and new members that would like to start a ROBOT project need the HPC functionally. The design of this functionally is the subject of this action item.

7. New alternate for the Motor Control board. (Same as #5)

8. Valid replacement for the TI board. There is additional effort needed to thoroughly evaluate the COVCX concept and to integrate it into the ROBOT's functionally.

9. Single Board Computer. Need to evaluate the SBC's available leading to selection of a CPU for the various distributed functions implemented on the ROBOT.

10 Heading sensor. Heading sensor is required as part of the design of our autonomous ROBOT system. See SENSORS column.

These are the currently identified needs of the RSSC. There is more than enough to keep us busy through 1992. As you have ideas and potential solutions to any of these problems, call Jerry B and bring it to the general meeting........JJ

SENSORS

This new section of the ROBOT BUILDER is to cover various sensors required by the robot. These inputs assist the software program in gaining information about the environment in which the robot lives.

I had planned to cover the sonar sensors this month but things didn't work out quite like I planned. In the next month or so this column will cover the sonar sensors.

I want to cover a new sensor that is not included as a part of the robot at the present time. Jerry Burton and the programing group are busily writing software for the robot that will allow it to map its enviroment and all the obstacles present in that world. This is quite an ambitious undertaking and my hats off to Jerry and the group tackling such a large task.

For more information on the task refer to the last three or four issues of the ROBOT BUILDER in Jerry's column "The Roboteer". In his column he describes the E-MAP and the P-MAP matrix set of tiles. The program will fill in tiles in this array defining locations of the obstacles that the sonar sensors find as the robot moves through its environment. The movement path can then be planned by using this matrix to navigate around and between obstacles. Sounds good, however this technique depends on the robot moving very precisely through its environment.

The technique depends on the spatial orientation of the environmental matrix within memory remaining fixed with respect to the robots initial heading. This is a so-so assumption but its the best we have for now. Consider the robot wheels running through water or spilled liquid of some type. The software asks the drive to turn 90 degrees and one of the drive wheels slips and doesn't propel the robot frame through the expected angle. This generates an error between the internal software universe and the real world. I would think that operation in grass or deep shag carpet would allow the error to build up beyond usable limits. The problem is that there is no feed back from the environment at this time to determine and reduce the basic error build up between the software world and the real world.

I have read some articles that propose a beacon with in the near universe for the robot to get a current or updating fix on for absolute position with in the real world. This technique, however, seems to be in opposition to the "fully autonomous" machine that is the goal of the membership.

I think that a heading reference of some type would be a valuable asset to the robot in keeping the computer "world" oriented to the actual world.

Here are some ideas that come to mind. One would be to design an optical transducer to look at a floated and heavily damped magnetic compass needle. Another would be the sampling of the earths magnetic fields with a flux-gate compass technique or possibly with a Hall effect device. I have included some of the clippings I had in my idea file to assist starting the creative juices of all of you out there.

This function is needed and I would like to propose this design need as a possible new working group. This will help keep the software types sane as they labor toward giving our little creation some smarts. It would be sad if only by a slip of the wheel that the internal smarts get scrambled.

Please help with the ideas. As an alternate I located a commercial flux gate compass that could be purchased for a thousand dollars, and it settles to an error of less than a degree in 0.2 sec. It can even be purchased with an RS232 interface connection.

This approach would seem to be an overkill for our robot. Bring your ideas to the next meeting and we'll get this worked out before it causes trouble for the software development.....JJ

A PROPOSAL for REORGANIZATION of the RSSC WORKING GROUPS

by Bob Peringer, Member

Our Robobic Society now has a working robot as a result of three working groups set up at the start of the project. The work was not equally divided. Some work was performed extraordinarily and some groups had little to do.

What is the reason for this? I feel it was the rigid organization under which the Robotic Society was initially set up.

Suppose a member -- say, a new member -- has a project in mind for thew robot. What can he do? He has no access to the club funs. He cannot reserve time for the robot to be his to work with. He can only be supurbly persuasive, if he can, in a general meeting to make things move his way. Not many scientists and engineers are that persuasive! Is it no wonder then, that many members are doing little or nothing on the club robot.

There is an alternative -- a flexible organization structure. Projects should birth, grow and flourish, and then pass away and are finished as new ones take the lead.

How can we develope such a system? Examples are all around us. Two of the most outstanding locally are the North Orange County Computer Club (NOCCC) and the Orange County IBM PC User Group (OCIPUG). These clubs enourage the formation of new Special Interest Groups (SIGs). Club officials look for group leaders and provide them with meeting facilities and newsletter space. This month (Jan 91), NOCCC has 18 SIG's of which 3 have just been formed.

What would a flexible group organization possibly look like? Club officers would see a few groups succeeding in their projects, a few groups withering, and others clamoring to be recognized, scheduled, and funded.

To a member, a flexible organization would mean that he would have the opportunity to join a sonar group or some other existing group. Or if he didn't find something he liked he could respond with a request to submit new plans on something with support and funding ready. Or he could put forward his own project, make plans, request a budget, and seek support.

The flexible organization would put barriers in no one's way. I expect the result will be competion for time with the robot, and no end to club activity.......RP

EDITORS COMMENT: We need to thank Bob Peringer for his concern and for the time he spent putting pencil to paper and documenting his concern.

This makes us realize once again that this is a volunteer organization of like minded people with an interest in robotics. However, like minded people also can have different interests, training, education, goals and needs

Each of us have our own goals, some times spoken but most times unspoken. Lets hear from more of you out there in robot land......JJ

ARTICLE REVIEW

I want to bring you reviews of various articles written about robots. This month I want to bring you the highlights of a rather different type of robot. This month I want to review the "LAWN RANGER". Yes you guessed it, it's a robot lawn mower.

This is a very interesting machine and much can be learned from reviewing the design. Some of you may even want to build one for yourself.

The LAWN RANGER is a battery powered lawn mower. To provide sufficient power to mow a lawn, the LAWN RANGER uses dual 12 volt deep-cycle batteries for power. This allows 2-3 hours of operation on a single charge. Battery power also allows the LAWN RANGER to run very quite and clean. The power head has two 24 vdc motors each turning a cutting blade covering a cutting swath of 30 inches.

The electronic control system is composed of four printed circuit boards; the CPU, motor controller, power board, and the connection mother board.

The CPU board contains a Z80 microprocessor. The Z80 continually processes the sensor data from fifteen grass sensors and calculates the correct steering path.

The motor controller board is used to control the speed of the drive motors. Velocity information from each drive wheel is fed back to the board in order to keep the LAWN RANGERS speed constant.

The power board contains DC/DC converters that convert the battery voltage to +5, +10, +30 and -10 volts. This board also contain the power MOSFET's used to control the motors.

The mother board provides the interconnections between the other three boards.

The operator must first manually steer the ROBOT around the perimeter of the yard while cutting grass and around any obstacles with in that area with a manual control unit. The initial cut around the yard is used for navigation as it will steer along the border while it cuts grass. The mower searches for high grass and it will move away from an area that has been previously cut. This feature allows the robot to move around trees and other obstacles that are surrounded by cut grass. After all the borders are cut, unplug the manual unit, switch the mower into its automatic mode,

VOICE RECOGNITION ENHANCEMENT PROJECT

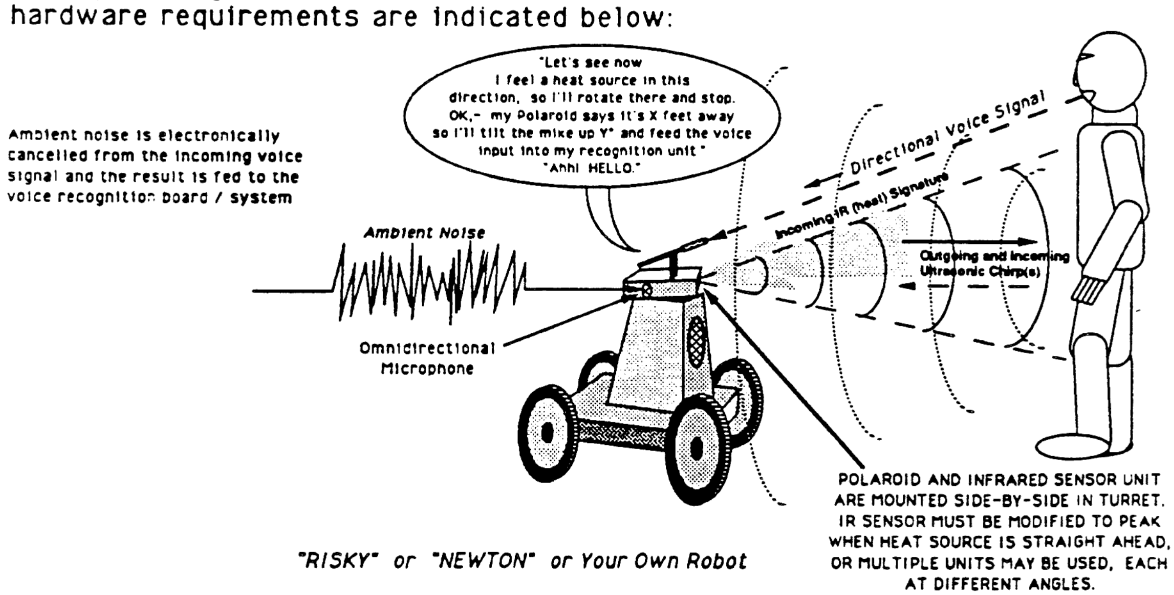
Proposed by Tom Carroll
Submitted: January 14, 1991.   Approved:

Problem: The two voice recognition systems in use by the Robotics Society of Southern California require either an RF (radio) link mike or a headset-mounted, noise-cancelling microphone for accurate voice recognition. These two systems are the $149 *Covox* Voice Master Key or the $1295 *Texas Instruments* system used by Synpet's *Newton*. The far less expensive Covox unit has some amazing features for the money but the TI unit has it's own processor built in. Both, however, require a relatively noise-free environment and a mike at the users lips.

Objective: To allow users a hands-free voice control of their mobile robots without having to use an attached RF or wired microphone, much the same as one would speak to another person or even a dog.

Approach: The development of a directional microphone that would track the user's mouth area, with a secondary microphone that would pickup the environmental noise and electronically subtract it from the directional mike's signal. This signal could then be fed into the voice recognition system with a much higher recognition rate than expected.

Proposed Solution: A small "shotgun" mike like the unit from *DAK* can be mounted on a pan and tilt unit atop the robot. A "human" locator can be one of the $15 infrared outdoor light sensors, modified for DC use. A Polaroid rangefinder can determine the "human's" distance, and through triangulation,- determine his mouth level above the floor. The hardware requirements are indicated below:



"RISKY" or "NEWTON" or Your Own Robot

Sensor and logic form digital compass

Brian Grenoble
Maxim Integrated Products, Sunnyvale, CA

Combining a Hall-effect sensor with a few ICs provides an 8-point digital compass. Four open-collector outputs on the sensor correspond to the four cardinal points of the compass. The sensor's Hall-sensing action activates one output for each of the principal directions: N, S, E, and W. Aligning the sensor with an intermediate direction, such as NW, grounds both of the associated outputs.

By detecting whether the sensor is selecting single or dual outputs, the NOR-gate scheme resolves the four sensor signals into eight distinct compass readings. Following the NOR gates, eight inverters enable the system to drive medium-power LEDs.

The circuit's power supply (Fig 2) operates from an unregulated input voltage that can vary between 5.25V and 18V. The supply includes a linear regulator, IC_1, that provides 5V for the LEDs, logic, and low-power step-up converter (IC_2). The converter generates a clean, stable 10V for the sensors, which, if necessary, allows the sensor and control/display unit to be located yards apart in a noisy automotive environment. The sensor operates from 8 to 12V.

Inductor L_1 determines the actual voltage supplied to the sensor. An inexpensive barrel (bobbin) inductor, though noisy, suits this application because the control section includes no RF-sensitive components. If higher efficiency is required, toroidal-core inductors are recommended. The sensor, like any device that responds to the earth's magnetic field, should be located away from metal structures and electric motors. In most vehicles, the windshield area meets this requirement.

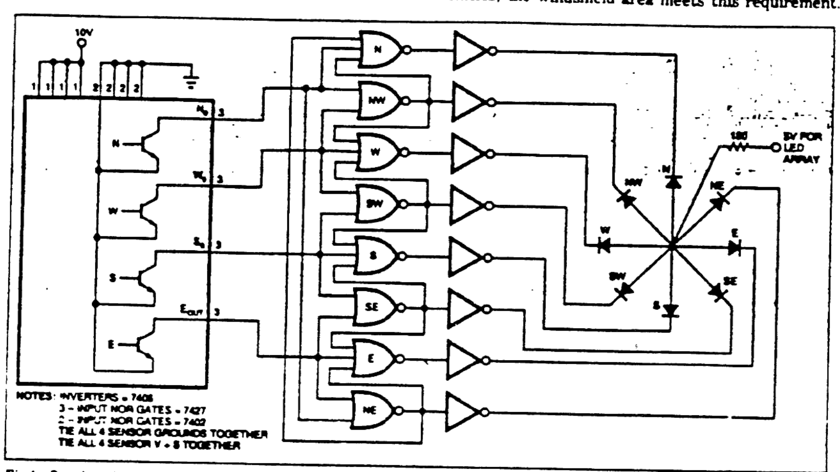


Fig 1—Based on the operation of a Hall-effect sensor, this digital compass illuminates one LED for each of eight directions.

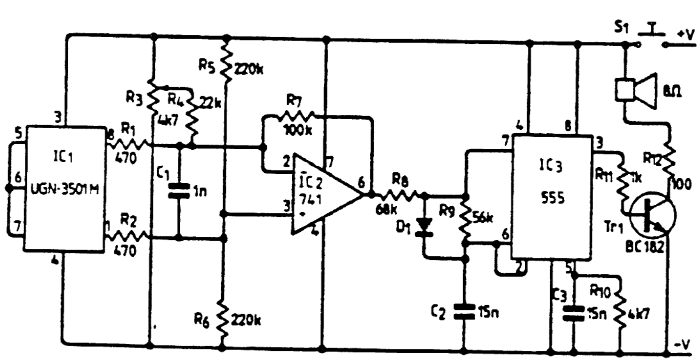
Electronic compass helps the blind

This circuit produces an audible output with a varying pitch depending on its orientation to the earth's magnetic field. The accuracy is not high but it can be used as a hand-held compass by blind people. There are already commercially available compasses for the blind based on the traditional suspended needle. This though is unsuitable if the sense of touch is impaired.

The heart of the device is the UGN-3501M Hall effect sensor IC_1 which has a monolithic Hall cell and a linear differential amplifier with differential emitter follower outputs. Typical sensitivity is 1.4mV/gauss. It is unsuitable for measuring small fields such as the earth's since the drift is comparable with the signal. To overcome this, a flux concentrator in the form of a 6cm by 9mm ferrite rod is glued to each face of the IC.

The two outputs are fed into a differential amplifier IC_2. The output voltage for zero input can be adjusted by R_3. C_1 inhibits parasitic oscillations. The output of IC_2 is fed into a voltage-to-frequency converter based on the 555 timer IC_3. Its output drives the transistor in the grounded emitter configuration with R_{12} used as a current limiting resistor. An audible note is produced from the loudspeaker. The circuit draws a total current of about 50mA.

R_3 acts as a pitch control giving an output of about 1kHz. In the circuit shown the pitch varies by an octave as the orientation is changed from north to south.



W. Gough
Department of Physics
University of Wales
Cardiff

relax and enjoy a cold drink.

The LAWN RANGER is featured as a U-build-it article in the JUNE, JULY and AUGUST issues of the 1990 RADIO ELECTRONICS Magazine. All boards and parts can be purchased from Technical Solutions, Inc P.O. Box 284, Damascus, MD 20802. Check this out at your library for further information.........JJ

BACK to BASICS

I want to make an introduction to those of you that haven't come to meetings, can't come or otherwise haven't seen our club robot. I would like to introduce you to the newest baby(creation) on the block. The society hasn't named it yet(see name the robot section of the JAN ROBOT BUILDER). Maybe you have a name for "the robot"?

I'll start the introduction from the bottom up. You have to have a base to start building upon therefore we'll start where the rubber meets the road. On the bottom are the drive wheels, approximately 10" in diameter. They are placed on center line of the robot to allow the machine to pivot about it's centerline. Fore and aft are two casters placed about two inches from the front and back edge of the base plate. I asked why those particular casters were used, and expecting an important engineering revelation, they said" because they were available". I guess I can't fault that. Anyway, the casters are just casters, nothing special.

The two drive motors are 12 volt DC type and have an approximate 22 amps draw at stall condition. They are sealed right angle gear motors with an approximate 70/1 reduction. There is no provision for direct air cooling. In operation, however, they are operating at such a low duty cycle that heating has not been a problem. Installed on the back of each motor shaft is a plastic disk rotor and optical pickoff. This allows informational feed back to the computer on how many turns the motor(and wheel) has made and the rate(RPM) of operation.

The motor control board is installed upright on mounting brackets ahead of the battery. The board is populated with components in only three of its four channels.
At present the robot only requires the drive for three motors.

Battery is a 12 Volt GEL CELL of a 35 AH capacity. It is installed between the two drive motors and about four inches behind the center line of the ROBOT to provide a weight bias to the rear. With the present configuration it is estimated that this capacity will give the ROBOT a two to three hour operational life with some margin.

A speaker is provided for the audio out put from the TI board.

A standard smoke detector is provided onboard with an input to the HPC board. The HPC board in turn passes an interrupt to the main program informing it of the current alarm status. This was included to provided a safety feature to detect potential malfunctions within the ROBOT or to detect the possibility that the ROBOT had entered a fire area potentially hazardous to the machine.

Sonar sensors are the standard Polaroid acoustical transducer that were developed for their cameras. Currently, we have provided the ROBOT with three fixed acoustical sensors and one head mounted directional acoustical sensor. All electronics for their operation and control is located on the HPC board.

Computer is a standard AT clone operating at a 12 Mz clock rate with one Meg of random access memory installed. At present the following cards are installed:

HPC(high performance card)
HD/FD controller
TI board(speech controller)
Video card
serial output
parallel output

The HPC is a distributed processor control board and is designed to handle much of the lower level control functions upon command from the program running in the AT. The HPC is plugged into an open buss slot and interfaces directly with the AT's CPU. Further details of the operation of this board will be covered in the FEB and MARCH Tuesday night meeting presentations.

Head drive motor and angular position read out is a 12 volt DC geared motor to position the upper rotational platform under program control. The program will send out a command to the HPC board which in turn commands the motor control board. The motor control board sends PWM drive power to the head motor causing the platform to begin rotation. The chopper disk feed back signals are connected to the HPC. This allows the HPC to determine if the proper angle has been traversed. The slew power will continue to drive the motor until the commanded angle has been reached.

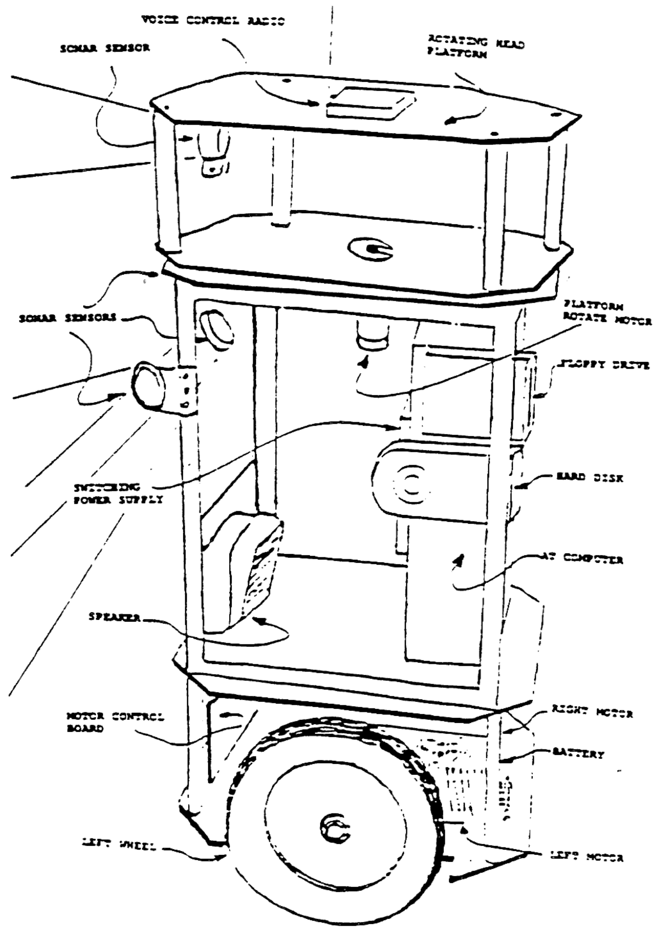
Rotational platform is a head, or a work platform to carry any club experiments that may need pointing capability. The distance between the two decks may be decreased or increased by changing the upright separator bars. The plates are connected to the supports by recessed allen screws which are readily assessable.

The upper sonar transducer is the same type device as the three fixed transducers. The location on the rotational platform allows the program to scan its environment in about a 350 degree arc. This allows scanning without having to rotate the lower body.

RF voice input is provided to communicate with the voice recognition system of the TI board. This is an audio channel for voice commands. This is standard RF transmitter/receiver technology. It is to be used primarily for voice override(for safety) while the ROBOT is operating in a fully autonomous mode.

Battery charge status is a function performed by the HPC board and sent to the program as status information.

Temperature sensor(thermistor) is located on the HPC board and the converted temperature(F) is provided to the program as status information........JJ



EDITORS NOTE: The club ROBOT has had trouble with the AT computer board exhibiting intermittent memory errors. The board was replaced with an XT (6 meg clock rate) board. The AT is presently under bench test and will be reinstalled upon clearing the problem.......JJ

The Roboteer
By Jerry Burton

In the first 6 parts of this series I covered an overall design of how the software could guide the robot to a given destination. It is now time to look at the lower level architecture of the robot that is required for this to happen.

In any given mobile robot there are a number of activities that must be carried out simultaneously. For example, while the robot motors are being pulsed at a certain frequency (PWM - Pulse Width Modulation) to create a desired motion, it is necessary to continually get range data from the sonars so that imminent collisions can be avoided. There should also be some means of overriding any motion command if the user desires the robot to stop doing what it is doing and do something else.

One approach is to use a single very powerful processor in an independant subsystem to respond to external events and modify the lower level functions as required.

The HPC from General Instruments is ideally suited to this purpose. It has a 16-bit architecture with both bit and byte operations. A 16-bit data bus, ALU, and registers, 256 bytes internal ram and 64k bytes of external memory addressing, 16x16 multiply and 32x16 divide, 8 vectored interrupt sources, 4 16-bit timer/counters with 4 synchronous outputs and watchdog logic. It is fabricated with CMOS logic for very low power consumption with 2 power save modes. A built-in UART with programmable baud rate. Four additional 16-bit timer/counters with pulse width modulated outputs. Four input capture registers and 52 general purpose I/O lines (memory mapped).

The PWM action is very time critical, in that the amount of time the motors are pulsed on, must be accurate so the desired speed and torque are maintained. Ideally, you would want to turn a motor on and have it stop later at a very specific time, while achieving the desired distance as accurately as possible. Port P of the HPC is a 4-bit output that can be controlled by timers 4-7 to generate frequency, duty cycle and pulse width modulated outputs. The 4-bit output can control 4 different motors.

The wheel sensors must be monitored constantly so that no pulses are lost or inaccuracies will creep into the movement process. When determining how far to move, the HPC calculates how many pulses should occur during the time the motion should take and counts the actual pulses coming back in to insure the motion is proceeding and when it is complete.

The executive module in the HPC receives movement commands via the XT bus and determines what distance and direction is desired. This could be a turn followed by a straight line move or just a forward/backward movement of a desired number of feet (in 1/10th's of a foot). Once the move is initiated the executive monitors the opto-isolators from the wheel motors via interrupts. When the move is complete a status message is sent back to the XT providing the results of the move.

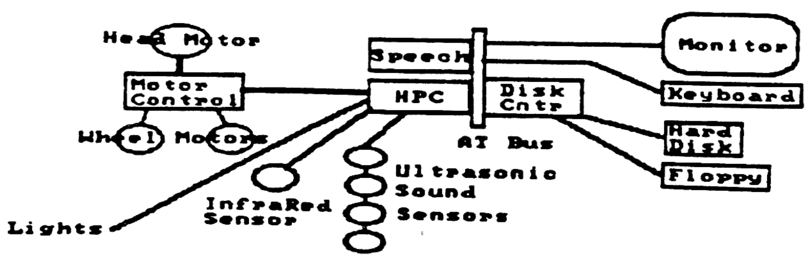
The block diagram below shows the functions performed by the HPC. The HPC is an independent sub-system that can perform commands independent of the main processor.

Some commands received by the HPC are executed immediately, others are queued. You can send up to ten commands to be executed and it will perform them one after another.

Immediate commands are ones such as getting status, or sonar ranges, IR level, light intensity, etc.

Queued commands are ones that require motor movement (base or head). Once a command is queued an immediate command can be given at any time to determine when a given command has completed and whether it was successful or not.

The Navigation program running in the XT does not have to be concerned with all the lower level processing. It merely has to send a message to the HPC to turn so many degrees and move a certain distance, while the move is being done independantly by the HPC the XT can look at other subsystems, such as, the voice subsystem or video or ?? The XT can check back on the result any time it desires, since it does not have to worry about the lower functions.....JB.



Robotics Society of Southern California
P.O. Box 3227
Seal Beach, CA 90740

DOCKING STATION HARDWARE & SOFTWARE PROJECT
Proposed by Tim J. Lewis
Submitted Jan 31 , 1991
Approved ________ 1991

Objective: The objective of this project is to create a means of allowing the club robot to be able to find it's battery charger, home in on it, and then plug itself in to it for recharging. This includes both the hardware and some of the software to accomplish this task.

Approach: The approach I would like to use is to put an RF beacon and infrared beacon on the charger unit so the robot can find it anywhere in your home environment. Once the charger is located and the robot is in the same room, within a few feet from the charger, it will use is a short range infrared sensor system to do the final locating of the charger. The charger will be equipped with an inductive pick-up unit so the robot will not need to make physical contact with the charger for the it to be recharged.

Support Required:

Electrical

The Electrical group will need to help in developing an inductive pick-up. I do not know how this is done. I do remember the RB5X robot had this type of pick-up and we might be able to get hold of it's operation manual to see how it works. Also I will need any input you may have on how to do the RF-beacon. I was thinking of a simple FM-Transmitter and Receiver System.

Mechanical

I will need some help from the mechanical group in coming up with a good design for the docking station. Any ideas you may have will be greatly appreciated.

Software

I think I can come up with some simple commands to add to the knowledge base so we can see if the hardware is functioning properly. But if I can not, I will need some help from software group in writing the test software and the software to integrate into the navigation software.

ACCORDING TO WEBSTER: (9th New Collegiate Dictionary)

Robot noun [Czech 'robota' means work]
1. a: a machine that looks like a human being and performs various complex acts (as walking or talking) of a human being; also: a similar but fictional machine whose lack of capacity for human emotions is often emphasized. b: an efficient, insensitive, often brutalized person. 2: an automatic apparatus or device that performs functions ordinarily ascribed to human beings or operates with what appears to be almost human intelligence. 3: a mechanism guided by automatic controls.

Robotics noun
Technology dealing with the design, construction, and operation of robots in automation.

Automaton noun [Greek neuter of automatos]
1: a mechanism that is relatively self-operating esp: ROBOT 2: A machine or control mechanism designed to follow automatically a predetermined sequence of operations or respond to encoded instructions. 3: An individual who acts in a mechanical fashion.

Automation noun
1: The technique of making an apparatus, a process, or a system operate automatically. 2: The state of being operated automatically. 3: Automatically controlled operation of an apparatus, process, or system by mechanical or electronic devices that take the place of human organs of observation, effort, and decision.

Autonomy noun
1: The quality or state of being self-governing; esp : the right of self-government. 2: A self-governing state. 3: Self-directing freedom and esp. moral independence.

Android noun [Greek 'androeides' manlike]
1: an automaton with humanlike form.

Mechanism noun
1. a: A piece of machinery. b: A process or technique for achieving a result. 2: Mechanical operation or action. 3: A doctrine that holds natural processes (as of life) to be mechanically determined and capable of complete explanation by the laws of physics and chemistry. 4: the fundamental physical or chemical processes involved in or responsible for an action, reaction, or other natural phenomenon.

Machine noun [Latin 'machina']
1: f: a mechanically, electrically, or electronically operated device for performing a task.

Cyborg noun
A human being who is linked to one or more mechanical devices upon which some of his vital physiological functions depend.

Intellect noun [Latin 'intellectus']
1. a: The power of knowing as distinguished from the power to feel and to will: the capacity for knowledge. b: the capacity for rational or intelligent thought esp. when highly developed. 2: a person with great intellectual powers.

Intelligence noun [Latin 'intlligentia]
1. a: 1) The ability to learn or understand or deal with new or trying situations: REASON; also the skilled use of reason. 2) The ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (as tests). b: Christian Science -- the basic eternal quality of the divine Mind. c: mental acuteness.

Sentient adjective [Latin 'sentire' to perceive, feel]
1: Responsive to or conscious of sense impressions. 2: AWARE 3: finely sensitive in perception or feeling. Also sensation or feeling as distinguished from thought.

PHYSICAL CAPABILITIES PHYSICAL APPEARANCE

animatron
android
automaton
droid
humanoid

INTELLECTUAL CAPABILITIES INTELLECTUAL APPEARANCE

In order to be considered a robot:

Must it resemble humans in appearance? (What about insects...?)
Must it be able to learn from experience?
Must it resemble an organism in intelligence?
(organisms can be simulated to some extent without intelligence)
Must it perform a mechanical (physical) function? (are computers robots?)
What if it performed only simple repetitive functions?
What if it is controlled by something (someone) else?

Perhaps a robot is any mechanical apparatus which performs a function on its own (an automaton). The intelligence of such a robot is immaterial to this definition. Grandfather clocks and toasters could be robots with this definition. These carry out predefined functions with a minimum of human supervision.

What degree of functionality and/or intelligence must a device have to qualify as a robot?

Perhaps a robot is an automaton which can learn from experience. This would disqualify many industrial 'robots'.

A robot (in Czech) means a person who works, a serf or slave.

Perhaps a robot is any mechanical apparatus which performs a task which it has been programmed or taught to do.

Maybe the best solution is to identify what groups of people consider to be robots and give them appropriate names (ex. automaton, android, insectoid, animatron etc.).

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Elaine Traficante

ROBOTICS SOCIETY PROJECT DEVELOPMENT COMMITTEE REPORT

The committee met on Saturday, 3 March 1990, at The Robot Company shop in Costa Mesa. Committee Chairman Joe McCord called the meeting to order at 1015. Thirteen members were present. By sub-committee, they were:

ELECTRICAL DESIGN SUB-COMMITTEE: Bob Angelo, Chairman; Lee La Fevre, Bob Peringer, Garren Davis.

MECHANICAL SUB-COMMITTEE: Mark Frank, Chairman; Tom Carroll, Scott Macgillivray, John Sprinkle.

SOFTWARE COMMITTEE: Don Golding, Chairman; Jerry Burton, Roland Kolevek, Ric Molen, George Ronnquist.

Following discussion, the Committee decided on the following parameters for the project:

BASE: The base of the robot will be 20" X 20" on an octagonal cut. There will be two drive wheels across the center line and the preponderance of the weight will be located behind this same center line. The two drive wheels also will be the load bearing wheels while one caster wheel, at the rear, will float as the drive wheels turn.

WEIGHT: The final weight was left open but will be in the neighborhood of 50#.

WHEELS: Wheels will be 8 to 10" in diameter, rubber tires on a plastic interior.

POWER: Enough power to carry itself, a module fitted on top, and be able to easily move over low-pile or industrial grade carpet, and over a 3/4" obstacle.

SYSTEM: AT Bus (donated by Dan Golding). Card cage & basic computer donated by Bob Angelo.

HEIGHT: Base approximately 20"; modules as necessary.

CONSTRUCTION SITE: The Robot Company, 881 W. 18th St., Costa Mesa.

Respectfully submitted,

Joseph McCord

JOSEPH McCORD
Project Development
Committee Chairman
6 March 1990

Robot Language Proposal

A meeting was held on Thursday evening by the Software Group . In attendance were: Don Golding, Jerry Burton, and Rick Moland. The main topic was how to define a universal Robot Control Language.

The following conclusions were made :

1. An English syntax would be used for ease of use.
2. The language commands would be converted to tokens.

It was proposed that the sentence structure should conform as follows:

SELECTOR	OBJECT	MODIFIERS	ACTION
Right	Arm	*10 Degrees*	Up
	Robot	*7 Inches*	Forward
Left	Hand	*23 Degrees Right*	Rotate
	Robot	*12 Degrees Left*	Rotate
Front	Rangefinder	*46 to 67 Degrees*	Scan

The result of the commands would be each *Word* would be represented by a unique *Token* value such as the table below:

WORD	TOKEN
Right	01h
Left	02h
Robot	03h

The primary advantage of this token system would to facilitate implementation on a wide variety of system architectures. Using a remote computer tied to the Robot with an Infrared Link or RS232 cable, a single 8 or 16 bit value can control various functions on the Robot. A system using onboard distributed processing could send tokens through a network to communicate with the various intelligent devices available.