

ROBOT BUILDER

Robotics Society of Southern California

JANUARY 1991

Upcoming Events Calendar.

January 1 Happy Newyear.
January 8 RSSC Meeting at MTI College: 7-9 PM. Note 2nd Tuesday in January.
January 12 RSSC Robot Project Workshop, at Jerry Burton's Laboratory.

MEETING PRESENTATION

The December presentation to the society was a talk on the selection, care and feeding of the prime power source for our robots.

Data on three primary types of cells were presented with the pro's and con's of each. The three types were the GEL CELL, the old stand by, the LEAD ACID battery and the NiCad batteries. There was a little discussion on Lithium batteries, Mercury and other types on rare cells.

It was concluded that the GEL CELL is the best for powering our ROBOTS from the stand point of (1)safety, (2)lowest maintenance and (3)best price performance.

The LEAD ACID has been used for years and is thought of as an old stand by. There are millions out there, one in every car. Small motor cycle batteries could be used for smaller ROBOTS, and the larger batteries being used for the heavier machines. However, they are vented and leak hydrogen gas during operation. In a turn over situation, the battery could possible leak acid internally onto components of ROBOT and the consensus was that this would be very detrimental to the equipment. The Lead Acid batteries do not like repeated deep discharge that is usually part of the operation of our Robots. Deep discharges of Lead acid batteries grossly limit their life. (i.e. number of recharge cycles)

The NiCad's are a good choice however they only put out 1.2 volts per cell and therefore need more cells to provide required voltage. The price/performance is not as good as the Gel Cell. They also exhibit a condition described as memory. This is caused by the electrolyte migrating to bottom of the cells therefore reducing the output capacity. The cells must be discharged most of the way before recharging. The heat of recharging causes an expansion of the electrolyte which forces it to ooze back around all plates thereby bringing the battery back up to full capacity.

We want to thank Tom Carrol for the time and effort it took to prepare this presentation and for his articulate presentation of the topic...JJ

President's Message

The new board held their first meeting Dec 12th at my office and decided the following. There will be a monthly board meeting the last Tuesday of the month, 7 p.m. at my office. All members are encouraged to attend. This is where the planning and goals are set, so if you want to have some say on the direction of the Society this the meeting to attend.

In order to provide some structure to the Labs we decided that they will provide hands-on demos and workshops on the topic that was covered in the regular Tuesday meeting. Starting in January the Labs will be held at my Lab (North-West corner of Brookhurst & Cerritos in Anaheim, from 10 a.m. until at least noon).

The programs through April were tentatively planned as follows: January Voice recognition, February EPC Motor Control, March EPC Sonar and Other Control, April Mobile Robot Navigation.

Roger Ruzskowski and Jess Jackson will present a format for the Engineering Notebook at the next meeting and will then start putting it together. Our goal is to have the club robot fully documented as soon as possible. We also plan to put together a brief version of the information for new and existing members so everyone can get up to speed on the design.

We have made great progress in the 16 months we have been in existence and I expect us to grow and prosper in 1991. Hope everyone had a nice holiday season and are ready to dig in and start exercising our brains toward making these robots more intelligent...JB

December 4th RSSC Meeting

We had a well attended meeting and all seemed to have a Jolly old time as this is the season. We had about 25 people in attendance.

We need all members to pay their dues. If you have not paid them bring them next meeting.

The election of officers for next year was conducted. Many of the people seemed a bit reluctant to get involved. This society is a VOLUNTEER ORGANIZATION! You get out of this organization exactly what you put into it. Time and effort poured in will yield great dividend for you. SO LETS ALL GET INVOLVED!

The next slate of officers for the year 1991 are as follows:

President	Jerry Burton
VP Publicity	Joe McCord
VP Programming	Don Golding
VP Membership	Roland Koluvek
Secretary	Rodger Ruzskowski
Treasurer	Mark Frank
Robot News Editor	Jess Jackson

We want to, as a society, thank all who served last year in all capacities. It was a good first year. We as a collective group got a lot accomplished. We had demonstrations at the Orange County Fair, and the

ACP Computer Swap Meet. We also have made great strides in accomplishing our goal of having a Society Robot to serve as a base for member experiments and/or learning projects.

We also want to congratulate the new slate of officers that will take the society through the exciting year of 1991.

We have found out that most of us are very busy during the Christmas season. The society Christmas gathering was canceled because so many of us couldn't attend. The society will plan for some type of get together in the following year...JJ

NEW TECHNOLOGY

In one of the many journals and trade magazines that come across my desk, I spotted an interesting item. It was buried in the back under a small catch all column. The item an announcement that the Japanese researchers are developing artificial muscles for mechanical devices. According to Yoshithito Osada, a chemist at Ibaraki University, soft polymer gels have been developed that contract when electricity is applied and expand when the current is turned off. This could give a muscle-like quality so that devices incorporating them can raise and lower loads.

Actuators for robots made with these soft gels will behave more safely, more carefully, and more gently, says Osada. They will not tear out the knob when they open a door, and they will shake hands softly instead of crushing a hand.

The gel would be contained with in a tube. The current would make the gel contract, thereby expanding and shorting the tube length. The pull of the tube becomes the actuating force, just like a muscle. Clever people these Japanese...JJ



To our SHUT IN's

What do I mean by using the term of shut in?? I mean all those who haven't been to meetings and to the workshops. YooHoo! I know your out there. We have a whole list of people that say your members. You paid your money too!! Where are you?? It seems to me that your awful busy, your a shut in, or your wife won't let you out. I'm afraid that it's the society that has let you down. We obviously haven't meet your needs. I'd like to meet every one of you and find out just what we can do to serve you better. RSSC is a volunteer organization and that means that it belongs to YOU and ME and each and every member. Please let me know what your interests are and what you need to know.

I am volunteering my time to document new and novel things and even do the tiresome, boring and tedious writing to produce this news letter. The ROBOT BUILDER is your news letter. Make use of it, help out, come out of hiding, join in! My answering machine can be reached at 714-529-4952. Let me know how we can help....JJ

SENSORS

This is a new section to be included in each issue of the ROBOT BUILDER. The ROBOT can not know where it is in space with out some type of sensors. Think about the problem that the little machine has as it strolls about the premises. Try blindfolding your self, stuffing cotton in your ears, and putting boxing gloves on your hands then try walking around the room. This is the task that the robot tries every time the switch is turned on and he is allowed to roam.

Currently, we have provided the robot with three fixed acoustical sensors and one directional acoustical sensor.

It is the intention of this section to discuss a different type of sensor each month and the pro's and con's of each. This is an area that I will call on the resources of the society members to provide input.

In the February issue we will start with the acoustical sensors that are presently installed on the club robot. We will cover HOW IT WORKS, what some of its drawbacks may be, what some of its pluses are, how it can be improved, and just how it is being used by the software in the club robot.

This should be a very educational section over the next few months. Some of the future topics after the acoustical coverage will be IR detection, Smoke detection, heading reference, laser ranging, and any other topic that seems in need of an airing in this forum. So put on your thinking caps people and we'll have a run for our money...JJ

DECEMBER 8 ROBOT WORKSHOP

The group gathered at Joe McCoord's place, THE ROBOT COMPANY and had a great time. We ran the club robot for a while then dispersed to work on other projects. Work was conducted on at least six robots. It was interesting to watch Joe perform minor maintenance on his two robots in preparation for operation that afternoon. The operation of the club robot was observed and after he calmed down (switched off) he had his picture taken. We had fun watching the other completed Newton refuse voice commands and run around yelling "I smell smoke". We observed the initial construction start on a new Newton and your editor was commandeered to go for parts at the local electronics shop. The grand finale of the day was one of the Chucky Chicken pneumatically operated units being put through its paces.

The rest of you don't know what your missing. Why don't you try to make the January workshop. It is to be held the second Tuesday, January 8, at Jerry Burton's Place...JJ

ENGINEERING NOTEBOOK

Jerry Burton introduced a motion at the December 12 Board Meeting that the Secretary shall keep an Engineering Note Book. The motion was adopted. An action item was given to Roger L. Ruszkowski to propose an index for the note book at the January General Meeting. The note book will contain several sections of clippings. Inputs will be accepted on paper or magnetic media.

Current acceptable magnetic media is ASCII text file on 5 1/4 360K floppies. The Society is seeking help with translation to and from other magnetic media formats. If you have material please submit it.

Paper copies of the note book will be maintained. Standard page size shall be 8.5" x 11". Working page area shall be 6" x 9". Please submit what you have. It will be processed into standard pages. We want to have credit given where credit is due. Please include your name and address as the collector. Also include the cover or banner of the publication for reference. The information from the cover will help others to locate copies of the clipping. Please include the complete clipping. Mail entries are welcome at the Society mail address or they can be delivered to me at the monthly meetings.

We are a society of individuals each seeking to become more knowledgeable in a common field of science currently referred to as Robotics. I'm sure other members would like to know what ever can be gathered on any facet related to Robotics. Wanted are, book reviews, catalogs of parts, press reports, manufactures literature, papers published and unpublished. Please submit any clipping you find related to Robotics. Xerox a copy of the item. Include a Xerox copy of the banner if the item is from a larger work. Mail the item to the Robotic Society in an envelope with your name and address. We'll get the item into the index. Complete copies of the index will be available at a nominal cost...RR

EDITORS NOTE!

There are a lot of ideas, intelligence, training, expertise, skill, ability, knack and just good old savvy residing in the membership of this society! Please feel free to submit articles, short reports, or even problems to this news letter forum. In fact, I urge you to pick up your pencil and place it on the paper and just let the intelligence run out onto the paper. Or a more sophisticated way of course is to let your "fingers do the walking" over the keyboard.

Please share what you have...JJ

Name the ROBOT effort

The society's robot is coming alive and taking its first shaky steps. It has been a real learning experience and often engineering decisions have been made on the basis of what is most expeditious and the quickest way. As members continue to work on the "xxxxx" it will be refined in its inner workings and in its computer intelligence.

You noticed that I had to call our society ROBOT a "xxxxx"! It has no name. It has been born with a lot of effort and labor. It only seems right that we should have something to put in the name space on its birth certificate.

Some are called TOPO, OMNIBOT, Verbot, Probot, Robby the Robot, Dumbot and all combinations of the word ROBOT. Another word used to spawn or coin other names is the word "Android". I think the star wars and the movie industry has helped influence the use of this word. CSPO & R2D2 were exceptions in their naming conventions. I believe there is even a current movie about a "ROBOJOCK" or something of the kind.

The society needs a name for its little robot. Please begin to place brain in gear and think, think, think. Submit any results that may come to mind to President Jerry for his consideration....JJ

EDITORS CORNER

Education and Teaching is a part of the reason that non-profit societies are formed. Your editor is what is called a "Jonnie come lately". I was not one of the founders of this society and joined later. I know when I joined every body was busy building "The Robot". I sat rather quietly for a meeting or two to absorb as much as I could. I then started to ask questions and didn't get a lot of direct answers. They were rather short and to the point.

I have yet to trace down all the schematics of the boards in the robot. I'll keep asking till I have all the data in the archive. From this repository of data and information, I propose to generate information packets for all "NEW COMERS". This name is a bit reminiscent of Alien Nation but I feel that all new members need to know where the society has been and to help them get up to speed as quickly as possible. It will take a couple of months to gather and reproduce all the information needed but Rodger and I promise this will happen....JJ

TREASURERS REPORT

At the December board meeting it was reported that the RSSC balance for the year end was \$619.62 and the books were turned over to our new treasurer Mark Frank....JJ

HARDWARE WORKSHOP Dec 8th 1990

The Hardware Working Group meet 10 A.M. Saturday 8 December at the Robot Company. Society Vice President Joseph McCord hosted the meeting. DECKS from Wake Rattle and Roll fame lead the morning promenade. Several new members were present at the meeting and watched as "PETER", "PROBOT" "THE CLUB ROBOT" a SYMBOT Newton and TOPO were also promenaded through the shop by various operators. Tim even put one of his air powered machines through its operational paces. Don Golding is assembling a SYMBOT Newton from a kit and worked on it at the shop. Don's kit is blessed with a number of items tagged "some engineering still required here". Don's daughter Amy is watching the progress in the shop with some expectation. Not many people claim to have a Newton class robot on a short leash to a battery charger. Along with more than a dozen members several guest were also at the meeting. The next the meeting is planned for 12 January at Jerry Burton's Laboratory...RR

BOARD MEETING Dec 12 1990

The Society Board meet 7 P.M. Wednesday 12 December at Jerry Burton's Laboratory. All Board Members were present. Jerry greeted the new board members as elected at the December 4th General Meeting. The duties and responsibilities of each board member was reviewed. Jerry introduced a motion that the Secretary shall keep an Engineering Note Book. The motion was adopted. A motion was made that Society Board Meetings shall be held on the last Tuesday of each month at Jerry Burton's Laboratory. The motion was adopted. An action item was given to Roger L. Ruzkowski to propose an index for the note book at the January General Meeting. An action item was given to Don Golding to coordinate a General Meeting presentation on voice hardware. The January 12th Hardware Meeting will also be dedicated to voice control hardware. The business meeting then adjourned. The next board meeting is scheduled for 29 January at Jerry Burton's Laboratory...RR

The Roboteer by Jerry Burton

This month I'll cover the NAVIGATION module. This is the only module that I've actually implemented, so I can discuss the actual functions that make up the NAVIGATION module.

To review, the primary service of the NAVIGATION class is to cause the robot to move from its current position to some desired goal, while avoiding local obstacles. The current implementation uses a stack structure containing a series of X,Y positions to be attained.

The calling module pushes the X,Y positions desired onto a stack and calls the NAVIGATION module, which pops the X,Y's off the stack one at a time, moves to the desired position, pops the next one, etc. until the stack is empty. This approach gives total flexibility in that the stack is only as big as required, you don't have to preallocate space as with an array.

The Navigation class contains the following services.

navigate(gstack(np) NextStack,int AVD);

The input to this function is a gstack (generalized stack structure) containing a series of X,Y points that navigate is to go to, and an avoidance flag AVD. AVD is an integer which if TRUE (non-zero) means that avoidance is active, and any obstacle encountered is to be avoided. If AVD is false and navigate detects an obstacle it will immediately return to the caller with a failed flag set TRUE.

Each structure is popped off the stack and a turn direction and distance is calculated. These are passed to the HPC driver function MoveRobot(0,turn,dist,MoveSpeed,0). The MoveRobot returns a status value of 60001 if the move is completed correctly. If the status value is between 60020 and 60024 then a sonar abort occurred.

The moves are made one after another until the stack is empty and a return to the caller is made with the fail flag set FALSE, meaning the requested path has been successfully traversed. The global X,Y co-ordinates are updated after each move by using the values returned from the MoveRobot function. It tells the angle and distance moved.

If a sonar abort occurs and AVD is true then the avoidance logic is invoked, otherwise a return to the caller is made with a fail flag set TRUE.

The initial avoidance logic is a very simple approach. Using the Head sonar a direction that is clear is found and a move of one foot is made towards the open direction. The Navigate function is called again with another stack containing only a single value, the original goal X,Y. This will cause a turn towards the original goal and an attempt to achieve the move. If this move is successful then avoidance has been achieved and a return to the Navigate function is made to complete the path. If it is not successful, another interim move of one foot to the side is made and another attempt to achieve the original goal is made. This process continues until the ultimate goal is achieved OR it is determined that the obstacle blocks the goal X,Y completely.

Experiments using this logic show that the robot moves around obstacles in a crab-like fashion.

i.e. it moves sideways, then forward, then sideways, and forward until it finally reaches the destination point. Another logic that will be tried in the future will be to move around the obstacle by maintaining a fixed distance from the obstacle while still moving 'towards' the destination. This should cause the robot to move around the obstacle using a shorter path.

Another logic that I intend to try is to use a beam splitting technique using the head sonar to attempt to determine the area that is blocked and then plan a sub-path to move to the side of the obstacle and then around it.

Once you start thinking about different strategies to use you will probably come up with some of your own. You can then replace the functions I have done to see how well yours work by comparison. This is the ultimate goal of the club robot, to provide a platform for the membership to try out their ideas and see which ones work the best.

If a sonar abort is detected a function ChkIfClear is called to determine which sonar(s) caused the abort (a status of 60020 means the left sonar saw something and caused the move to abort. It stops after the first sonar aborts. It is possible that more than one sonar is blocked, so we have to check them all in chkIfClear). The HPC SonarStatus function is called for all four sonars to determine which

sonars have ranges less than their respective abort distances. A value Blocked is returned which contains a value indicating which sonars are blocked. A four bit vector (Blocked) indicates which sonars are blocked. The left sonar sets bit 3, the right bit 2, the head bit 1, and the center sonar bit 0.

The FindClear function uses Blocked to determine whether to look left or right to find a clearing. If the left sonars are blocked the robot looks to the right, if the right is blocked it looks to the left. If both right and left or just the middle are blocked it randomly picks a direction to look. The head is rotated until a clearing is found. Once a clearing is found the robot is turned towards the clearing and a move of one foot is made.

If a clearing can not be found the robot backs up one foot and tries again. If no clearing can be found the robot says "Help, I'm surrounded" and aborts the Navigate function.

There are a few more low level services that I won't go into here, we'll cover these in a Lab in more detail.

The current version of the NAVIGATION class does not update the E-map when it finds a 'local' obstacle. As I mentioned earlier it is still an open question as to whether NAVIGATION should update the E-map or use the services of the MAPPING class to update the E-map.

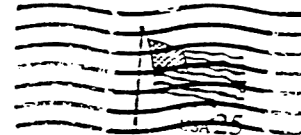
Once the MAPPING class is implemented, an experimental NAVIGATION class will be created to investigate the pros and cons of updating the E-map from the NAVIGATION class, as opposed to just updating it when MAPPING is run from the WANDER mode.

There are two excellent papers on navigation that I strongly recommend for anyone wanting to delve into the navigation problem a little deeper. One is James Crowley's "Navigation for an Intelligent Mobile Robot", IEEE Journal of Robotics and Automation, Vol RA-1, No. 1, March 1985. The other is Ronald Arkin's "Motor Schema-Based Mobile Robot Navigation", The International Journal of Robotics Research, Vol 8 # 4, August 1989. Both papers will be in the Engineering Notebook that is being put together. If any one would like copies let me know at the next meeting.

The Crowley paper is particularly interesting in that he uses a robot with a tuned horn to focus a sonar beam to a mere 5 degrees as opposed to a standard sonar with a 30 degree spread. This allows the robot to navigate using only a single sonar and appears to be quite accurate as well.

I plan to give a demo of the navigation software in April with a follow-up hands-on lab. That's it for this month, Dumbot calls, gotta go !...JB

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