# Robot Builder

The Official Publication of the ROBOTICS SOCIETY OF SOUTHERN CALIFORNIA
Post Office Box 26044, Santa Ana, CA 92799-6044

## PRESIDENTS MESSAGE

by Jess Jackson

Summer is here. Weather is not bad for the month of May. Jerry Burton is back from Connecticut and we'll hear about the robots at the fire extinguishing contest.

I want to take this opportunity to thank our longtime member, Roger Ruskowski for the donation of a robot to the Electrical Engineering department of CSUF. It will be used in their robot lab.

I asked our Technical VP, Henry Arnold to prepare this months program. He had some good ideas and May's meeting will have some interesting presentations.

The tentative schedule for the May meeting will be as follows:

12:30 RSSC business meeting (short one)

1:00 General meeting (needs to start immediately)

Topics FAX (714) 535-6629

Fire Fighting Robots

Jerry Burton (714) 535-8161

Use of Plexiglass in robot building

Henry Arnold jbpir2@aol.com @themall.net

Small Robot development by the government

Jess Jackson

Open forum discussion of problems, new products, software programing algorithms and membership projects.

Membership

3:30 adjourn

ITEMS OF MAJOR INTEREST:

Pete Cresswell provided some additional information about the PLANETFEST'97. This is the symposium sponsored by the Planetary Society to be held at the Pasadena Convention Center, July 3-6 1997. This provides public access to the information and data sent back from the PATHFINDER and the SOJOURNER landing on MARS July 4th.

EVENT PRICES

| Date | Event | Adult Price | Child Price(4-16yrs) |
|---|---|---|---|
| 7/3 | Symposium | $ 5.00 | $ 3.00 |
| 7/4-7/6 | Festival - | | |
| | single day | $20.00 | $ 8.00 |
| | two day | $25.00 | $12.00 |
| | three day | $30.00 | $15.00 |

These prices are for advance purchase only. You should call 818-793-5100 for more information. This should be an interesting experience to see first hand the initial data and pictures transmitted from MARS.

68HC11 SIG (Special Interest Group): Jerry Burton has set up a SIG and now meets at 9:00 before the Main meeting in the Robot Lab (room 301) in the CS building. This is the building just east of engineering building.

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**Faire Committee Meeting**

Date: May 10

Time: 11:30 a.m.

Place: CSUF EE 321

In the previous two months meetings, it was mentioned that our member, Don Golding has again offered his shop and equipment for a Saturday of Robot building. There was a show of hands of the members that wanted to take him up on his offer. See Henry Arnold for the final plans for the trip.

This will give you a chance to drill, cut, bend, machine, or turn those little pieces that you have been putting off making for lack of proper equipment.

**ADDITIONAL ITEM OF INTEREST (ATTILA):** I wanted to give you a summary of the capability of a little six legged walker named ATTILA designed and built by graduate students under the supervision of Rodney Brooks. It is my opinion that this bot was a PR machine for MIT and not a serious design for any planetary mission that I know of, however we can learn from the design.

Attila is a six legged walking robot designed to be a prototype planetary microrover. I think it would exhibit an excessively high power usage with 24 motors needed to make it work. Its job, however, is to traverse rough terrain and negotiate hazardous situations and that it will do. The walker performs its own sensing, computing, and control independent of human control. It also contains a control system that enables the robot to be fully functional despite sensor or actuator failures.

The machine measures 14 in. long, stands 6 in. high, and weighs 6 lb. It has six 3-degree-of-freedom (DOF) legs and one 2-DOF antenna. There are 24 actuators and more than 100 sensors of 14 types, all connected via a LAN to eight onboard computers.

**ATTILA'S SENSORS**

The robot's sensors are selected to give it a multirange (long, medium, and short range) view of its environment.

The IR-range sensor and CCD camera give Attila a long-range sense of the upcoming terrain, allowing it to steer itself around major hazards. The antenna provides medium range information and operates as a bump sensor and helps the robot avoid local obstacles. The lower-level sensors aid the robot in choosing proper foot placements and leg control.

The low-level sensors are the most reliable and accurate sensors in the system. They are specific in what they sense, and their outputs don't need interpretation. They include the following:

(1)Leg-mounted load sensors are strain gauges that measure force on the leg sections and detect leg collisions. There is a set of strain gauges for each DOF of the legs.

(2)Joint angle sensors are simple potentiometers that measure the joint angle for each DOF of the robot's leg.

(3)The ground-contact sensor is a potentiometer mounted on the ankle to measure the deflection of the foot as it presses against the ground.

(4)The inclinometer is made up of a +/-45 degree roll sensor and a 360 degree pitch sensor.

The high-level sensors are more complex and generate data that require more interpretation. They include:

(1)Foot-range sensors are simple modulated IR emitters with a filter and threshold detector. They can be used to detect imminent collisions during the swing phase each leg.

(2)The front antenna is a 2-DOF scanning device that sweeps an area in front of the robot to obtain information about obstacles via force sensors mounted on the antenna. It operates much like the antenna of a bug or spider.

(3)The IR-range finder is a linear position device with an IR emitter mounted on the steerable pan/tilt head. It can triangulate distances of up to about 10 feet.

(4)The visible-light camera is also mounted on the pan/tilt head and is registered colinearly with the range sensor.

(5)The rate sensor and accelerometer provide the robot with a sense of direction.

(6)Color sensors attached to the bottom of the head, are small surface mount chips to yield color information of the terrain.

The software architecture and program logic is designed to function using only the low-level sensors if required.

**ARCHITECTURE AND LANGUAGE**

Subsumption architecture was introduced in 1985 as a radically different control architecture for intelligent autonomous machines. Behavior Language was added in 1990 as a high-level programming language for implementing Subsumption architecture. Combined, these two elements helps to form a control system for the machine.

The Subsumption architecture is divided into many task achieving modules. Each level is a layer of the control system corresponding to a level of capability. You generate a higher level of capability by adding new layers to the existing base of the control system. The lower layers of the system run continually in background and are unaware of the higher layers. When higher layers take control, they subsume the roles of lower levels by suppressing or modifying lower-levels outputs.

At the lowest level, the layers are made up of behaviors that run in parallel, perform their own perception, and send messages to each other over software connections. Each behavior can be viewed as a finite state machine with inputs, outputs, and the ability to hold some data structures. The behaviors run asynchronously, monitor their own inputs, perform computations, and control actuators.

Proper behavior selection is a central issue when designing behavior based systems. Each system can be made up of several task achieving behaviors. Each system is, however, designed to activate only behaviors that are relevant to the robot's present situation. Typically, the system uses sensor values to select and activate behaviors. It's also possible for behaviors to activate other behaviors by sending messages between software modules.

A robust software system should be designed to avoid activating conflicting behaviors. To accomplish this, behaviors in control have the ability to suppress the inputs that activate other behaviors.

MIT's Behavior Language has a provision which allows assignment of an activation energy level and a threshold to each individual behavior. When a behavior's activation energy level is above the threshold, the behavior is active. If a behavior is defined as a non continuous process, the behavior routine does not run unless its activation level is above the threshold. However, if a behavior is defined as an inhibited process, the behavior routine is running, but the outputs are inhibited until the activation energy is above the threshold. Behaviors can also send activation energy to or remove it from other behaviors.

**REDUNDANCY:** Hardware designers increased the robustness of this robot by including multiple sensors in the system. This walker has many sensors that produce an overlap in detected information. As an example, both the foot contact sensor and the strain gauges can be used to determining foot contact. Software designers also increase the robustness of the system by incorporating redundant behaviors in the control system.

Robots typically have multiple sensors. The more sensors on a robot, the more information it has on the environment, and more intelligently it can behave. In addition, multiple sensors increase sensing reliability. Redundant sensors, or multiple sensors with overlapping information, can confirm each other's results. This increases confidence in the net sensor output.

With multiple overlapping behaviors, the system implements a type of voting arbitration which MIT calls command fusion. This allows behaviors to vote for alternative actions, selecting the action most consistent with the desire of the majority of active behaviors. Each behavior computes its activation level based on its performance, relevance to accomplishing the goal, inhibition from other behaviors, and priorities of the system. The resulting activation level determines the strength that the behavior's vote will carry in command arbitration.

The robot's control system also implements a system monitor network to detect sensor failures and fluctuations. The monitor system activates calibration behaviors to periodically update sensor values. These test behaviors isolate potential problem sensors, test them, and note failed performance.

Virtual sensors process sensory data and provide input for motion behaviors. They use a type of fuzzy logic to combine real sensor inputs into a virtual sensor output.

**A ROBUST CONTROL SYSTEM**

The walker was designed with a distributed and adaptive control system. The control system is tolerant of sensor/actuator failures and fluctuations. It is able to recognize when something is wrong and compensate for the problem.

A system monitor network is responsible for processing all sensory data and detecting failures or fluctuations in the sensor state. This network is made up of sensor calibration and virtual sensor behaviors.

**CONCLUSION**

We can learn from what these graduate students accomplished. This is a very complicated system with its real sensors, virtual sensors, it voting logic, etc. However, when each part or concept is taken individually, it is quite understandable. I feel that many of the concepts used in this machine would be quite valuable as applied to some of the robots being built by the membership.

See you at the meeting. . . . . . . . JJ

## Bug Eyes Offer Potential for Collision Warning

from April 1997 Photonics Spectra

ADELAIDE, Australia – Australian researchers at the Centre for High Performance Integrated Technologies and Systems at the University of Adelaide have developed a decision making optical sensor on a single chip system with a little inspiration from the insect world.

The scientists have developed a "seeing, thinking" microchip that mimics an insect's eye to detect objects and their motion and to raise red flags in case of imminent collision without the intensive computing required by traditional image processing cameras.

**Watching for shadows**

The key characteristic of insect vision detectors is that they do not have to necessarily see an object itself – just the shadows the object casts as it moves. Charge coupled device (CCD) cameras make a full image of an object that requires heavy duty computations to process into a usable form.

Out in the wild, an insect detects the moving edges of objects within its field of view. For simple collision avoidance tasks – such as vision systems sought for intelligent automobile collision warning systems, autonomous robots in the home or at the plant, or to assist the blind – insect vision chips offer a cheaper, more efficient alternative, said "bug eye" chip developer Derek Abbott. And because the bug eye chip does not depend on intensive computing, Abbott estimates that an insect chip with combined optics, detectors and logical circuits would cost approximately 10 to 20 percent of what a CCD camera costs.

"For simple collision avoidance tasks, this rudimentary vision is all that is needed," said Abbott. "Insects have been successfully doing it for millions of years".

### A cue from Mother Nature

Taking their cue from Mother Nature's design of an insect's eye, the centre's team uses photodetector circuits with a direct logarithmic response, eliminating the need for a bulky mechanical iris. Insect eyes remain compact by dispensing with variable focusing. The centre's bug eye detector uses a fixed focal length gradient index lens glued to the surface of the chip. Abbott said he expects future versions to include an integrated microlens. Each photodetector's output has its own automatic gain control and is processed in parallel, enhancing performance in low contrast conditions.

In a working system, data from the device is logged by a simple single-chip-microcontroller that tracks the movement of light and dark patches. The chip uses the data to determine relative velocity, bearing and time to impact of a moving object. Based on these parameters, the microcontroller can be programmed to make simple decisions for anti-collision warning, said Abbott.

The Australian Federal Government and Britax, a multinational manufacturer of car vision systems, have funded the bug eye chip. Britax, Abbott said, hopes to use the low-cost motion detection chip for detecting blind spots and monitoring braking distances in intelligent vehicle systems. However, he said, the methodology behind the chip lends itself to a wide range of uses. Not only could the chip offer basic senses for everything from autonomous vacuum cleaners to robot forklifts, but the bug eye detector can be made to "see" in any wavelength band including radar and millimeter wave.

Editors note: If you would like to experiment with insect vision yourself, Ublige Software and Robotics (US&R) sells a 16-cell module for under $50. Do a Web search on US&R or "insect vision" or "Prometheus" to find their products and prices.

## Deep Cycle Battery Frequently Asked Questions – Part II

Bill Darden

(Editor's Note: This is the second of a four part series on deep discharge lead acid batteries. Part I, in the April 1997 ***Robot Builder***, contains sections 1 thru 3 of the FAQ. This installment, Part 2 of the series, presents section 4, Part 3 will cover sections 5 thru 7, and Part 4 will finish off with sections 8, 9, & 10.)

The following, and the related Car Battery FAQ are the work of Bill Darden, who welcomes your comments. All of the usual disclaimers apply.

A word of caution. Batteries contain a sulfuric acid electrolyte which is a highly corrosive poison, that will produce gasses when recharged and explode if ignited. This will hurt you--BAD! When working with batteries, you need to have plenty of ventilation, remove jewelry, wear protective clothing and eye wear (safety glasses), and exercise caution. Whenever possible, please follow the manufacturer's instructions for testing, jumping, installing and charging. This FAQ assumes a six cell battery commonly used for 12 volt negatively grounded system in most recreational applications. For six volt batteries, divide the voltage by two.

The technical stuff is in [brackets].

### Contents

1. What is the bottom line?
2. Why bother?
3. How do I test a deep cycle battery?
4. What do I look for in buying a battery?
5. How do I install a battery?
6. How do I charge a battery?
7. How do I increase the life of a battery?
8. What are the most common causes of battery failures?
9. What are the common myths about batteries?
10. Where can I find more info on batteries?

### 4. WHAT DO I LOOK FOR IN BUYING A NEW BATTERY?

#### A. Reserve Capacity or Ampere Hour Rating

The most important consideration in buying a deep cycle battery is the Reserve Capacity (RC) or Ampere Hour (AH) rating that will meet or exceed your requirements. RC is the number of minutes a fully charged battery at 80 degrees F is discharged at 25 amps before the voltage falls below 10.5 volts. Some deep cycle batteries are rated in Ampere Hours. To convert Reserve Capacity to Ampere Hours, multiple RC by .6. For example, a battery with 120 minute RC will have approximately 72 Ampere Hours. This means that the battery should produce one amp for 72 hours of continuous use. Since shallower the average discharge increases the battery life, more RC is better in every case.

[If more RC is required, two six volt batteries can be connected in series or two (or more) 12 volt batteries can be connected in parallel. Within a BCI group size, generally the battery with larger RC will weigh more because it contains more lead.]

## B. Type

Car batteries are especially designed for high initial cranking amps (usually for five seconds) to start a car and no deep cycle discharges. Deep cycle (and marine) batteries are designed for prolonged discharges at lower amperage. [The plates in car battery are more porous and thinner than in a deep cycle battery.] A deep cycle battery will typically outlast two to four car batteries used in deep cycle applications. A "dual marine" battery is a compromise between a car and deep cycle battery and is used to start small engines and to provide deep cycle discharge capability.

Using two battery setups through a diode isolator is popular in recreational vehicle (RV) applications. A car battery is used to start the engine and deep cycle battery is to supply power to the accessories. When purchasing a isolator, be sure that it matches your alternator or charging system. [The batteries are connected to a diode isolator and both are automatically recharged by the RV's charging system when engine is running. For additional information on multi-battery applications, call (800) 845-6269 or (503) 692-5360 and request a free copy of "Introduction to Batteries and Charging Systems" by Ralph Scheidler.]

The two most common types of deep cycle batteries are flooded ( a.k.a. wet or liquid electrolyte) cell and valve regulated (VR).

### 1. Flooded cell

Flooded cell deep cycle batteries are divided, like their car battery counterparts, into low maintenance (the most common) and maintenance free based on their plate formulation. [Low maintenance batteries have lead-antimony/calcium (dual alloy or hybrid) plates; whereas, the maintenance free batteries use lead-calcium/calcium.] The advantages of maintenance free batteries are less preventative maintenance, longer life, faster recharging, greater overcharge resistance, reduced terminal corrosion and longer shelf life, but are more prone to deep discharge (dead battery) failures due to increased shedding of active plate material and more expensive.

### 2. Valve Regulated

Valve Regulated (VR) batteries are divided into two groups, gel cell and Absorbent Glass Mat (AGM). VR batteries are spill proof, so they can be used in closed areas, are totally maintenance free, and have a longer shelf life. Their greatest disadvantage is the high initial cost (two to three times), but arguably could have an overall lower cost due to a longer lifetime.

## C. Size

An internationally adopted Battery Council International (BCI) group number (24, 27, 31, etc.) is based on the physical case size, terminal placement and terminal polarity. Within a group, the RC ratings, warranty and battery type will vary in models of the same brand or from brand to brand. Generally, batteries are sold by model, so some of the group numbers will vary for the same price. This means that for the same price you can potentially buy a physically larger battery with more RC than the battery you are replacing. Be sure that the replacement battery will fit, the cables will correct to the correct terminal, and that the terminals will not touch anything else.

The battery manufacturers publish application guides that will contain the BCI group number replacement recommendations, and battery size, and RC specifications. Manufacturers might not build or the store might not carry all the group numbers.

Battery manufacturers or distributors will often "private label" their batteries for large chain stores. Below is a list of the largest domestic battery manufacturers/distributors in North America and my understanding of some of their brand names and private labels.

Johnson Controls Inc. (JCI)
Ameriton
Duralast (Contact local Auto Zone store)
Energizer (Contact local Target or Wards store)
Equalizer (Contact local Wards store)
Eveready (800-331-9926 or contact local Costco or Wards store)
Interstate (800-272-6548)
Motorcraft (800-392-3673)
Power Connection older Sears Diehards

East Penn (610-682-6361)
American
Electro
Deka
Dominator
Hi-Tech
Outdoorsman
Pow-R-Surge

Douglas (800-368-4527)
Farmland (Contact local store)

AC Delco/Delphi (800-223-3526)
Diehard Gold (Contact local Sears store)
Double Eagle (Contact local Firestone store)
Dura Power
Everstart (Contact local Wal-Mart store)
Freedom (Contact local Sears store)
Lastcell (Contact local Trac Auto store)
Tough One (Contact local Western Auto store)
Voyager

GNB (800-242-6750)
Action Pack (800-289-4627)
Champion (Contact local Sams store)
Omaga (800-925-6278 or contact local Wal-Mart store)
Stowaway (800-289-4627)
Super Crank (800-289-4627)
Voyager (Contact local Sams store)

Exide (800-346-3760)
Auto Express (Contact local Wards store)
Centura (Contact local K-Mart store)
Cutting Edge
DieHard non-Gold (Contact local Sears store)
Edge
Gel Master
Legend (800-538-6272 or contact local NAPA store)
Motorvator (Contact local K-Mart store)
Nautilus
Power-Tron
Prestolite (Contact local HiLo store)
Pro Start (Contact local Pep Boys store)
Quick Start (Contact local Wards store)
Sears (Contact local store)
Titan
Value-Lite (Contact local Firestone store)

**D. Freshness**

Determining the "freshness" of a battery is sometimes difficult. Never buy a flooded battery that is more than six months old. Stamped on the case or printed on a sticker is the date of manufacture. It is usually a combination of alpha and numeric characters with letters for the months starting with "A" for January (generally skipping the letter "I") and digit for the year, for example, "F5" for June, 1995. Like bread, fresher is definitely better.

**E. Warranty**

As with tire warranties, battery warranties are not necessarily indicative of the quality or cost over the life of the application. Manufacturers will prorate warranties based on the list price, so if a battery failed half way or more through its warranty period, buying a new replacement might cost you less. The exception is the free replacement warranty period. This represents the risk that the manufacturer is willing to assume. A longer free replacement warranty period is better.

Comments are always welcomed by Bill Darden at wdarden@mcimail.com or (214) 361-9566. For additional information on car batteries, the Car Battery FAQ maybe found on the Web server at

www.ee.ualberta.ca/~schmaus/ or by requesting one via email from Bill Darden.

## Speech Recognition 101

March 3, 1997 EDN

Statistical pattern recognition is the basis of all speech-to-text products. However, the pattern model varies dramatically, depending on the scope of the recognition task. When a vocabulary set comprises only numbers and a few commands, an acoustic model is usually adequate. However, a continuous- natural-speech-to-text dictation system uses complex acoustic and language models to match speech utterances to existing patterns. The system first acquires an input word or phrase and compares it to a library of stored words or phrases. The system then calculates the most probable match to find the result. the size of the library, or vocabulary, determines the complexity of the algorithm and the processing power needed to identify the correct match.

Automatic speech recognition (ASR) systems are either speaker dependent or independent. Before using a speaker dependent system, a user must orient the system to the user's articulation. Speaker independent systems, on the other hand, allow for similar word utterances by more than one speaker. Speaker independent systems are more challenging to design because of dialect, accent, age, sex, noise, and other speech variations that speakers use to utter the same word. thus, speaker independent systems require larger memories, using as much as 1500 bytes per word versus 50 bytes per word for a speaker dependent system.

ASR systems can be isolated word recognition (IWR) systems, keyword spotters, or continuous natural speech recognizers. All recognition includes the front end speech processor, the coding processor, and the recognition phase.

IWR products work only on single word utterances. they need not find end of word breaks. Keyword spotters, on the other hand, must select a pattern from a series of utterances. continuous natural speech recognizers identify ends of words, sentence structure, and all the other syntax of natural speech. Most reasonably priced dictation programs simplify continuous speech by requiring the speaker to momentarily pause between each word.

One example of a typical complex ASR is the Cambridge University (Cambridge, UK) HTK large vocabulary recognition (LVR), speaker independent system. It processes speech comprising phonemes, or fundamental sound, into a digitized format. It then searches the previously stored patterns of formatted phonemes for a match to the accumulated sequence of phonemes.

The front end speech processor converts an unknown speech waveform to a sequence of acoustic vectors. Speech is a slowly changing waveform, and each vector is a small portion of an utterance, typically 10msec. The average 10 word utterance can take about 3 seconds. Therefore, the sequence resulting from this utterance is 300 vectors long, or an average of 30 vectors per spoken word.

The front end block must extract and digitize all the necessary acoustic information to transcode the utterance. The digitized form results from processes such as discrete cosine transform, linear prediction, and Fourier analysis. The front end waveform digitization must complement the subsequent pattern matching algorithm.

Both an acoustic model and a language model comprise the coding processor stage. the acoustic model provides a method for determining the probability of a word, given a sequence of phonemes. the language model presents probabilities of the word fitting into a context of words that make sense.

In the HTK acoustic model, a statistical, "hidden Markov" model (HMM) represents each phoneme. A sequence of HMMs represents each word in a vocabulary. In principle, the model transforms each utterance to a sequence of HMMs and compares them to the vocabulary to find the most likely match. In reality, however, each phoneme varies because of the context of continuous speech. The HMM's accurate representation of the phoneme depends on the contextual information.

The HMM is a state transition model whose simplest form comprises three states for entry, exit, and loop. the accuracy of the state model depends on how well the state sequence corresponds to the phonemes when transitioning through a sequence of sounds. In practice, only the observed phoneme is known, and the state transitions are"hidden". US English requires approximately 45 phonemes.

The HTK acoustic model links phonemes in "triphones". Triphones place phonemes in the context of the preceding and following neighbors. This linking of phonemes accounts for the fact that contextual effects cause variation in the way sounds are produced. Because US English uses 45 phonemes, it can have 91,125 triphones. However, it takes only about 60,000 triphones to describe all possible US English phonetics. Triphones overlap each other and cross word boundaries to produce better acoustic models than simple phonemes.

The HTK model can link HMMs to form composite HMMs, which, in turn, link to form words that match those in the vocabulary. Linking HMMs that cross word boundaries lead to phrases that match those in the language model.

The language model lets the recognition engine estimate the probability of a certain word's being recognized, given the preceding words. the premise is that syntax, semantics, and pragmatics give higher probabilities to certain phrase utterances. For instance, you create a language model for law tasks by examining legal documents and calculating the probability of the use of certain phrases. In a legal language model, a higher probability exists that the phrase "waive the right" will be spoken more frequently than "wave the rite". Task oriented text thus eliminates the need for formal grammar rules in the language model.

In language models, an N–word–gram stores the likelihood of a word string's usage. Bigrams and trigrams – two- and three–word strings, respectively – dominate current language models. Using short N–grams has obvious deficiencies, such as exploiting longer commonly used phrases and subject–verb agreement. However, a vocabulary of words whose number is represented by W has $W^3$ possible trigrams. Computational requirements grow exponentially as the number of words an N–gram uses increases.

The decoder phase compares the acquired speech waveform data to the data from the acoustic and language models. To decode, the HTK system pursues all hypotheses in parallel; other systems may pursue a promising hypothesis to its end. The pursuit of parallel hypotheses eliminates the least likely word sequences form the acoustic and language models. this pruning simplifies the computational effort, as long as it avoids pruning the correct recognition too early in the decoding phase.

The search finds the most probable match from the vocabulary – or "grammar", in LVR systems – for the utterance. A recognition system's capability depends on the vocabulary size and the computational power available to search for probable matches.

**References**

Quinnell, Richard A, "Speech recognition: no longer a dream but still a challenge", EDN, Jan 19, 1995, pg 41.

Young, Steve, "A review of large vocabulary continuous speech recognition", IEEE Signal Processing Magazine, September 1996, pg 45.

Digital Signal Processing Applications: Volume 2, Prentice-Hall, 1995.

## RSSC History – Five Years Ago

Tom Thornton

May 1992, The Robotics Society of Southern California is beginning its thirty-third (33rd) month of robotics activities and:

Then Editor Scott MacGillivray "again" asked for submittals.

(And so do I – you don't even have to write anything ! Call or email or smail me, we'll talk or correspond about what you are doing in electronics, sonar, mechanics, motors, actuators, sensors, navigation, vision, legs, drives, software ... whatever. I'll write it up for ***The Robot Builder***. ed.)

Jerry Burton (in The President's Message) talked about giving a tutorial on stepper motors with demonstrations of his 4-wire and 6-wire 68HC11 stepper controller. *(Hey, Jerry, I think I missed this last time – how about a replay? Ed.)*

Scott MacGillivray contributed an article discussing the roots of the RSSC and its goals. *Across the intervening years it seems that the goals are very much the same today as then, i.e., "promote public awareness of the field of experimental robotics and encourage the development of personal and home robots."* ed.

## SERVO CROSS-REFERENCE CHART

Julio C. Chacon, Jr

The Novak Input Plug System is very useful if you need to swap plugs to use different servos on different radio systems. The different plug styles in the kit are individually marked. In addition, the plugs are marked "WHT, RED, BLK" in the appropriate order that they should be installed on the plug. For reference, I'll place these at the top of the chart:

| | RED(+) | BLK(–) | WHT(signal) | |
|---|---|---|---|---|
| | === | === | === | |
| Airtronics | Red | Black | Brown | |
| Sanwa | Red | Black | Black | |
| Futaba J | Red | Black | White | |
| KO Propo | Red | Black | Blue | |
| Kyosho/Pulsar | | Red | Black | Yellow |
| Japan Radio(JR) | | Red | Brown | Orange |

And there it is! All you have to do to replace the plug is make sure that you place the corresponding wire in the proper location as marked on the connector. For example, if you have a Futaba servo that you'd like to use on an Airtronics receiver, simply take the Airtronics connector from the kit, and stick the Red in RED, White in WHT, and Black in BLK. If you don't have the input kit, but you have two servos, you should write down the order of the wires as they appear on the Airtronics servo, then remove it. Next, you would remove the plug off of the Futaba servo and install the Airtronics plug by inserting the White wire where the Brown one was, then the Black to Black, and Red to Red. I Hope you make use of it! By the way, this chart is included with the N.I.P.S.

## ANNOUNCEMENT

Editor

This is the last all-paper edition of *The Robot Builder*. Beginning with the June 1997 issue all subscribers with email who are interested will receive their issue of *The Robot Builder* via email. We have not worked out the details, but tentatively the distribution will be as a .pdf file. Note that the pdf reader is FREE from Adobe.

Also new beginning in June – selected items from the newsletter will be posted to the Robotics Society of Southern California web site at:

http://www.geocities.com/capecanaveral6440/

As a minimum the Presidents message will be posted each month. As much additional info as I have time to format will also be put up. Due to space limitations most info will be text. However, we may put up pictures on a rotating basis.

To receive the electronic edition of ***Robot Builder*** send email to the editor at: mandtsys@ix.netcom.com

Tom Thornton KE6NJC
Editor

Membership / Renewal Application:

Name ______________________________

Address ______________________________

City ______________________________

Home Phone (    )    -    Work Phone (    )    -

Annual Dues: Newsletter & Membership ($20)    Check #

Area(s) of Interest / Background

Return To: RSSC
Post Office Box 26044
Santa Ana, CA 92799-6044

How did you hear about RSSC?

The Robotics Society of Southern California was originally formed in 1989 as a non-profit experimental robotics association. The goal was to establish a co-operative association among associated industries, educational institutions, professionals and particularly robot enthusiasts. membership in the society is open to all with an interest in this exciting field.

The primary goal of the society is to promote public awareness of the field of experimental robotics and encourage the development of personal and home based robots.

The RSSC publishes this monthly newsletter, Robot Builder, that discusses various society activities, robot construction projects, and other information of interest to members.

## Robotics Society of Southern California

**President**
Jess Jackson

**Past President**
Tom Carroll

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