Penguin Tech

BASIC STAMP POWER Edition 4

robots, code, and the basic stamp microcontroller

by humanoido

Build Your Own Basic Stamp Supercomputer!

"The Basic Stamp Supercomputer is the cornerstone of our quest for knowledge and understanding."

YouTube

Contributors

- Bruce Bates
- David Buckley
- Erco
- Ken Gracey
- Matt Huntzinger
- Gwyn Johnson
- Vittorio Rossi
- Humanoido

Editorial

Welcome to the fourth issue of Penguin Tech Magazine! I never thought we would get this far! This issue is dedicated to a fantastic premier project, an amazing supercomputer made from Parallax Basic Stamps. The prospects are very exciting because for the first time, a hobbyist can build a full scale parallel clustered working supercomputer! It's affordable because you can begin with 2 Stamps and work your way up to more, maybe 20, depending on budget. Check out all the other great articles! There's no limit to what we can do if we open our minds and imagination! Ed.

Bring out your Parallax Basic Stamp Collection and build a Basic Stamp Supercomputer (BSS). Classified as a super computer model, this homebrew hobby project works similar to big World Super Computers and has 10 unique features!

A Supercomputer is a symbol of the comprehensive strength of a country. This also applies to universities, educational institutions, large corporations and, more recently, individuals with affluence and talent.

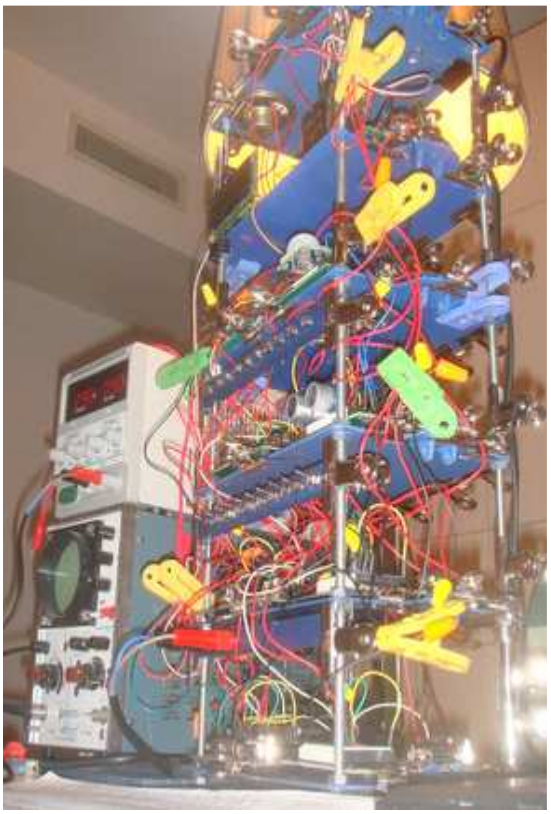
We take this one step further, and knock down the incomprehensibly complex walls of supercomputers and bring forth the simplest configurations for use by avid hobbyists on limited budgets.

If you want the same prestige, own your own, have full credit for building one, or gain the knowledge, background, experience, this is the project for you!
The concept of the Stamp Collection Supercomputer is simple. Take a bunch of collected Parallax Stamps, any variety, any board, any configuration, and stitch the bunch together in a parallel cluster network, build a rack to hold everything, and add software. Why build a hobby supercomputer model?

The Basic Stamp Supercomputer contains a growing cluster of 11 Basic Stamp processors, & peripherals.

- Learning experiences & challenges
- Expanding education & knowledge
- Gaining useful background for career
- Research Benefits
- Extending Basic Stamp power
- Creating new inventions, ideas, applications
- Own your own, prestige
- School project, credit
- Involvement, sense of great accomplishment
- Psychological relaxation, symbolic value
- Sharing, making new friends

BSS Basic Stamp Supercomputer



Super Stamp * Super Voice

Speaking with a female voice from an EMIC TTS board, the BSS is made up of an unlimited number of Basic Stamp Computers. A tiny uOLED color monitor can report sensor readings or show off some of the features. An LCD monitors traffic and conversations. Gather your friends together for a Supercomputing party. Each person brings their own HomeWork board, or any Basic Stamp board version, and adds it to the collective. The final result is a model Supercomputer! Adding a computer is simple. Just plug in port 0, and connect Vin, Vdd and Vss.

BSS Stamp Clip In Technology

In moving frequently, it would be important to have rapid assembly and disassembly of the entire BSS. This is accomplished with a new "Clip-In" technology using various plastic and metal clips designed to hold wire bundles, speakers, displays, sensors, various other peripherals and boards in place. See photo at far left.

Basic Stamp BSS Parallel Architecture Processing Software

For every ten computers, ten programs are running simultaneously, in parallel. A master computer is designated (#1), and it communicates with all remaining computers. The master decides when to wake up a computer (a process of getting the attention of any Basic Stamp computer), how to speak, when to speak, and administers rules and checks. All computers can process sensor data. Individual worker computers can report sensor results to the Master for analysis.

The Beginning – Launching the BSS

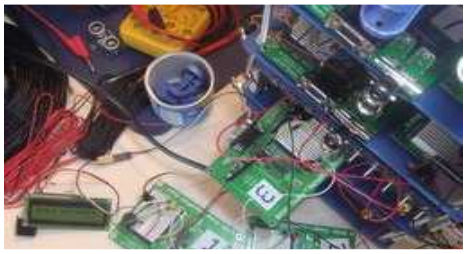
This is the dawning of a new paradigm in supercomputer technology at the hobby level. This project is a *working home Supercomputer model* made up of eleven Basic Stamp 2 computers networked together on a one-wire interface. It exemplifies the piling of numerous processor boards together (clustering) to create a system much more powerful than its individual parts. The BSS is a Parallel Stack Clustering Computer concept. **Overall Concept** Do you have a small collection of 2 or more Stamps? Here's a new idea for getting maximum use from Stamps that you never thought possible. This modest model has these features: small, light weight, portable, huge number of built-in native microcontroller ports, low power consumption, great number of sensors, low cost, battery option, field operable, and easy to program! While users of Basic Stamps have created many projects involving the connection and networking of stamps, ranging from weather stations to giant snake-like creatures, none have specifically created an open-architecture Supercomputer model. The Basic Stamp Collection "Supercomputer" BSS is a first, and derives its power not entirely from speed, but rather in other paramount aspects and features. **The hardware interface** is a one wire port specification that ties all the Basic Stamps together. Clever use of Vdd and Vss creates a solid reliable platform. Battery clips (9-volt) are tied together in parallel and routed to individual toggle switches. Each computer can be placed on the supernet or removed. This works well for isolating particular computers for special projects. **The rack** holds all the stamp processors. I built a rack for only a few dollars using half size clip boards obtained from a dollar store. Remove the clip and spring using a pliers. Threaded rods, cut to length, support the platforms at the exact distance so hands can reach in for wiring. I used HomeWork boards and BOEs, as these can be mounted two to four boards per platform level for a total of 21 computers per rack. In theory, entire racks are connectable for hundreds or thousands of micro-processors. **Software** ties together all the computers. It assigns computer #1 to be a master. The master sets the rules for communications, decides who talks and when they should speak, and can tell other

A POWERFUL PARALLAX BASIC STAMP COLLECTION

BSS Specifications (per every 10 computers added)
Stock Processors: Parallel Deca Cores (10)
Board Type: Basic Stamp HomeWork Board
Switches: 21, Lights: 20, Speakers: 11
No. of Simultaneous Running Programs: Ten
Maximum Processors Per Rack: 22 (w/o top light)
Expansion: Unlimited, Cycle Speed: 200 million CPS
Processing Speed: 40 Thousand IPS
Interface Speed: Nine Thousand Six Hundred BPS
Number of Code Statements: Five Thousand
Programmable Ports: 160, Dedicated Serial Ports: 20
EEPROM LEDs: 10, Language: PBASIC, Commands: 42
Software: Parallel Cluster Supercomputer Software
Programmable: Hardware & Software
Solderless Breadboards: 10, Autodiagnostics: Yes, at startup
Removable Processor Boards: Yes - Clip-In Technology
Programming Interface: Serial or USB
Bus: Parallel Processor Bus, Core Net: Parallel
Memory: Primary EEPROM - 65,536 bytes of non-volatile storage, Secondary EEPROM - Program Size 20,480 Bytes
RAM – 60 I/O, 260 Variables, 320 Bytes
Source/Sink Current per I/O: 20ma/25ma
Source/Sink current per unit: 40ma/50ma per 8 I/O pins
Enclosure: Array Rack, Basic Weight: 1.75 Kg (3.9 lbs.)
Power Consumption - Working: Less than 150 ma
Standby: About 90 ma*. Expanded: from 500ma
Power Source: Ten 9-volt batteries, optional power supply
Size: Very Small Footprint - 8"w x 5.5"d x 19.5"h
Battery Cost: $3.90 for ten batteries (Carbon-Zinc)
Battery Operating Time: Continuous Mode - About One Day with Carbon Zinc Batteries*. Field Operating Cost Per Unit Time: .8 cent/ minute *less sensors. Tested Sensors I/O: LCD, Vibra Tab Mass, uOLED, Peizo Speaker, EMIC Text To Speech, Accelerometer, PIR Sensor, DataLight, Micro-Keyboard, Switches, LEDs, Optoelectronic Interface, Data Terminal, ASCII Generator, Memory Expansion Board, Serial to USB Converter, 8-ohm Speaker, MEMKey, StampMEM, Some Available Sensors: Compass, Thermometer, digital pot, Date, Time, GPS, Touch, Light, Infrared, pressure, flex, rpm, ultrasonic, humidity, color, light, object detection, heat, frequency, weight, magnetics, SoundPal, wireless, hand held remote, segment display, servo controller, PMWPAL, mouse, PLC, BlueTooth, datalogger, transmitter, receiver, internet kit, RFID, Features: Affordable, different flavors, unlimited expansion, light weight, field operable, low power, battery operated, powerful ports, portable, configures with interesting concepts, open architecture,

How to DIY Model a Basic Stamp Supercomputer

Left- LCD monitor shows computer (Basic Stamp) number 11 talking to the Master. The LCD monitors all Super computing traffic on the "Supernet." Right- boards easily pull off the rack for testing, wiring and modifications.



Left- photo shows the Master being built and talking to the LCD. This is the first LCD test using a Parallax/ Scott Edwards BPI-216 serial LCD. Later versions have the yellow LED replaced with red. Right- a plastic hanger base is machined to fit switches. A Taiwan hobby tool (lower right) was used to drill holes, cut lengths and remove burrs.

Left- wiring the toggle switch bus strip. Wires are purposely kept long and loose so racks, buses, boards, and peripherals can be removed, even while operating. Note: the computers are numbered starting at bottom left for #1, using masking tape. The next upper level has computer 3 at left and 4 at right. Level 3 (from the bottom) has computers 5 at left and 6 to the right.

Left- a rack is made from half size clipboards found at a dollar store. Threaded rods came from Home Depot. Right- computer 9 has EMIC TTS text to speech running in ascii mode. The interface was simplified to three wires with handshaking. The external speaker is mounted under the top rack level. What about EMI, RFI interference? The lateral surrounding ground wires provide shielding.

worker boards what to do. The demo video shows the master talking to 11 computers, and each responding. The code shows how computers 9 and 10 can be activated to handle sensors or peripherals.

Output uses two monitors. The uOLED is for internal computational data, while the LCD display monitors traffic discussions, both text and numerical, and uses no extra ports. To accomplish the *no-port* feat, the monitor matches the party line communications rate as a serial device operating on its own. **Ports** There are 160 ports, perhaps the most powerful feature on the BSS. To show this power, computer 9 can speak using an EMIC TTS board, and 10 has a full color tiny uOLED monitor. Others control various sensors, for example, that contribute to Penguin Robot sensor development. **Can different stamps combine?** It's entirely possible to add other Basic Stamps to the hive. Software adjusts the type of Stamp to the interface communications rate automatically. The upgraded BSS has Computer 11 - a powerful BS2px on a BOE, to prove it works. The Supercomputer has 21 LED lights, 11 toggle switches, 10 speakers, and various sensors that are optional. Sensors and peripherals include lights, a keyboard, 64K RAM board, ultrasonic PING))), LCD, uOLED, PIR, EMIC TTS, Vibra Tab Mass, touch pad, thermometer, etc.

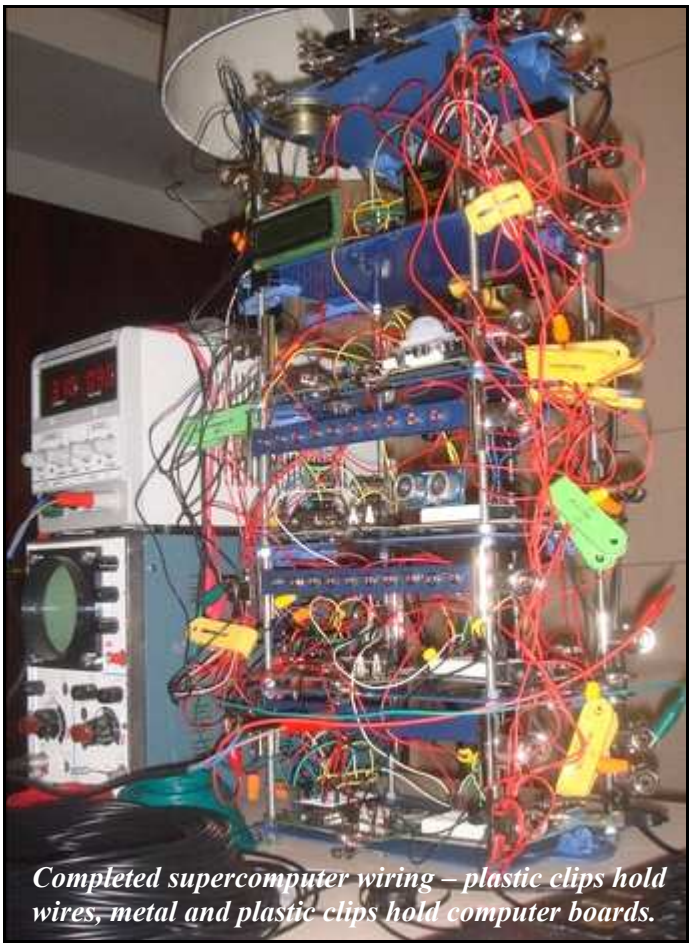
Battery& Field Operative Converting to battery is simple. Remove the 9-volt battery clips and insert batteries. Carbon Zinc batteries work fine and cost around 49 cents. For the computer with Emic Speech and uOLED display, longer lasting alkaline batteries are recommended.

Conclusion The Basic Stamp Supercomputer model is a powerful, yet simple, project that opens up the door to hands-on supercomputing knowledge for the hobbyist. ● **Humanoido**

Basic Stamp Supercomputer BSS MPP massively parallel processing
MPP is coordinated processing of a program by multiple processors that work on different parts of the program - each processor is using its own operating system and memory. Typically, MPP processors communicate using some messaging interface. In some implementations, up to 200 or more processors can work on the same application. An interconnect arrangement of data paths allows messages to be sent between processors.

Supercomputer Shielding: There's a fluorescent light directly on top of the supercomputer rack, and all those computers and wires to pick up RFI & EMI. What to do? A clever implement of ground wires acts as shielding for rock solid performance.

Basic Stamp Supercomputer Software & Plans…



Completed supercomputer wiring – plastic clips hold wires, metal and plastic clips hold computer boards.

BSS SOFTWARE

Software to run the BSS: Each name is designed to run on that computer. 9 & 10 are standard demo. Extra code accesses sensors and peripherals (uOLED display, Emic Speech)

supercomputer_1.bs2
supercomputer_2.bs2
supercomputer_3.bs2
supercomputer_4.bs2
supercomputer_5.bs2
supercomputer_6.bs2
supercomputer_7.bs2
supercomputer_8.bs2
supercomputer_9.bs2
supercomputer_10.bs2
supercomputer_11.bs2
supercomputer_12.bs2
supercomputer_13.bs2
supercomputer_14.bs2
supercomputer_15.bs2
supercomputer_16.bs2
supercomputer_17.bs2
supercomputer_18.bs2
supercomputer_19.bs2
supercomputer_20.bs2
supercomputer_9_emic.bs2
supercomputer_10_uOLED.bs2

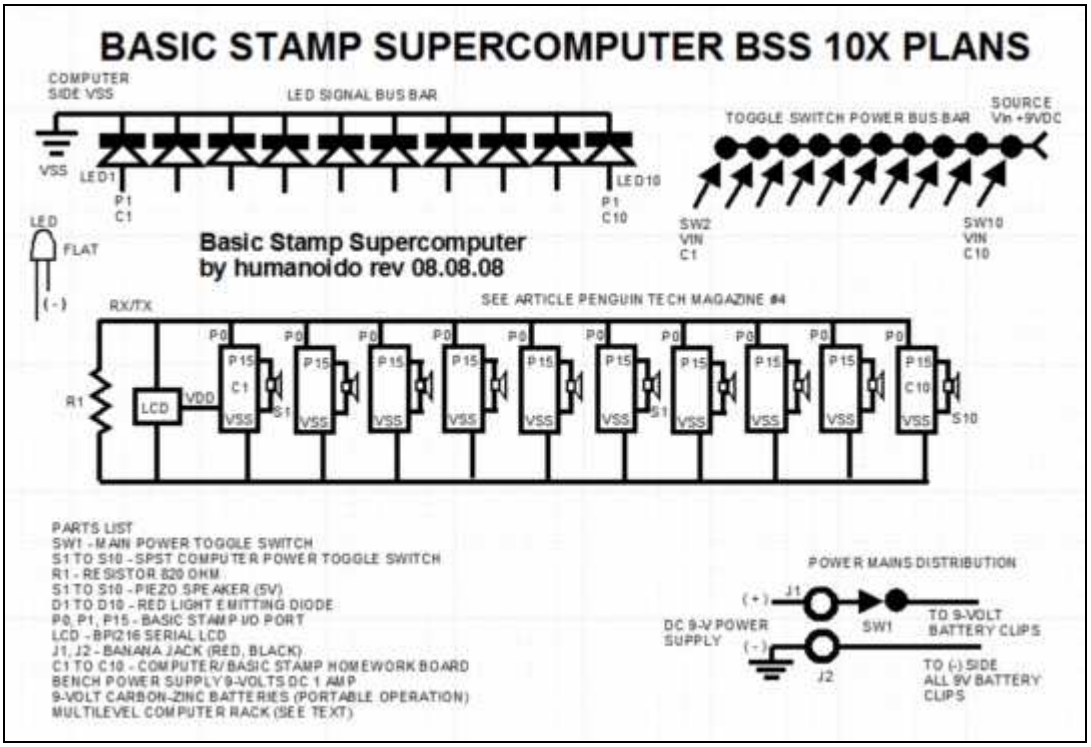
YouTube Supercomputer Movie!
http://it.youtube.com/watch?v=huukEEwy-3E

How I Used the Supercomputer Model to Develop a Super Robot Brain

Bonus Project: Penguin robot was added to the Super Pod Collective, using a one-wire interface on port 5. Tying into the master computer, Penguin increased from a single Stamp brain to 12 paralleled Stamp brains, all running programs at the same time, with power of all computers and all peripherals. This super robot was able to access many sensors that were running at the same time while making decisions and collecting data. For more information, follow the Parallax link.

• humanoido

http://forums.parallax.com/forums/default.aspx?f=10&m=308600



Plans to Build Your Own BASIC STAMP Supercomputer

Left: These are the coveted plans to build your own Basic Stamp supercomputer model. Simple schematic shows 4 sections: LED Signal Bus Bar, Toggle Switch Power Bus Bar, Main Power Control, and Computer Parallel Cluster. There are two power distribution centers. One is for 9-volt battery clips to input (Vin) +9-volt DC power to the boards from the Power Supply. Remove clips, insert 9v batteries and the project becomes portable. (Does not show sensor/peripheral attachments such as uOLED, PIR, EMIC TTS Speech, etc.)

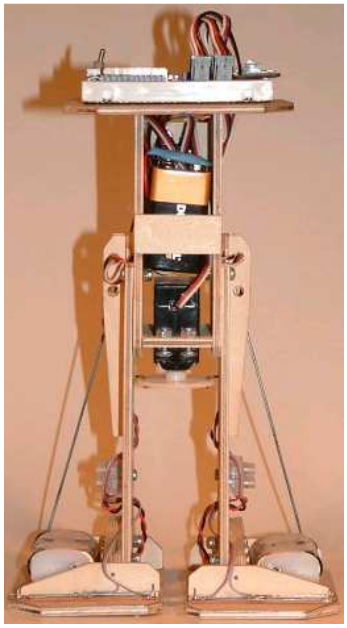
For information, updates, and a summary about the Basic Stamp Supercomputer model, follow this Parallax Forum link. http://forums.parallax.com/forums/?f=21&m=308220&g=308220#m308220

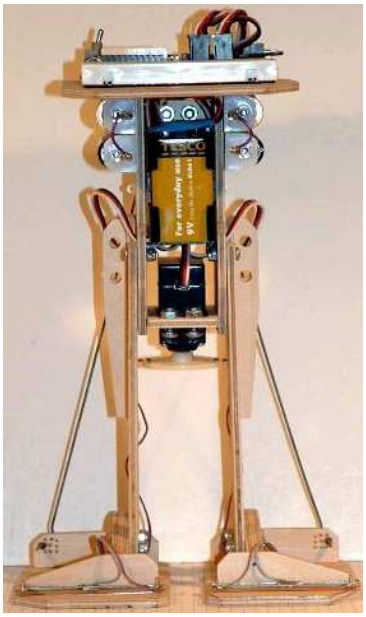
Penguin Tech Exclusive Interview with David Buckley - Inventor of the 2-Servo Tilt & Stride Mechanism

The Parallax Penguin, Toddler, and other robots can be traced back to a two-servo tilt and stride design. Learn about this remarkable design from our interview with the inventor- David Buckley!

Q - How did you come up with the idea of a two-servo tilt/stride design that could walk? What inspired you?
A - At the Shadow meetings, I often practiced walking up and down the lab examining how I walked and what was the simplest way. A parallelogram action to keep the feet parallel to the floor seemed the best way of mechanically stopping the robot tipping forward or backwards. Pressing one foot down while rocking onto the other foot solved the weight shifting. Thinking about what was needed it was obvious I could do that with just two servos.
Q - Which robots have you built using a biped tilt and stride design? Do you have a list of your robot names?
A - A three-foot high pneumatic experimental walker built at Shadow, BigFoot - prototype, BigFoot - Milford production version, TecFoot a 2 foot high five servo design, Junior - Ambler3 Class 3 servo, Tom Ambler3 Class 3 servo, POP aka SAM - Ambler2 Class 2 servo, MOM aka EFI - Ambler2 Class 2 servo, JOE - Ambler2 Class 2 servo KAS - Ambler3 Class 3 servo, Ambler2 Class JET is yet to be built. [The Ambler names expand to Sam (who digs dirt), Effi, Joel (from Egypt), Kasper (rather portly), Bridgette, Tom (a big strong guy); which are all characters from a famous film.]
Q - We heard that Parallax Inc. based their biped walking robot (Toddler) on your designs. Is this true, and how did that happen?
A - Milford Instruments, a UK distributor for Parallax, was marketing my BigFoot design. Ken Gracy got enthused to build versions resulting in Toddler. Although Parallax could just have gone ahead and copied BigFoot, like others have copied Toddler, they were kind enough to ask and pay me for the privilege, they are that kind of company.
Q – There has been several up scaled and downsized versions of this robot. Can you comment on how size affects performance in terms of stability and ease of walking? Also load handling capability?
A - Downsize is hard because there isn't as much mass and the frequencies of oscillation (rocking about) are higher. Upsize is harder because the motors need to be bigger, mass depends on length* length* length so twice the size really needs eight times the motor power. Unlike Toddler, Amblers work by being flexible and storing and releasing energy during the walking cycle. Hence, POP and MOM are much faster and more stable than Toddler, even though they are the same size.

With his famous two-servo design, David Buckley built Pop and Mom, 2-legged walkers made from wood.





Junior, a little bigger than Toddler, was just a bit better than failure, I learned a lot. TOM, bigger still, falls over because the wire links bend too much; it looks good, though. This led to POP. TecFoot, a two-foot high robot is big enough to walk dynamically, storing and releasing energy as everything flexes.

Talk About Penguin

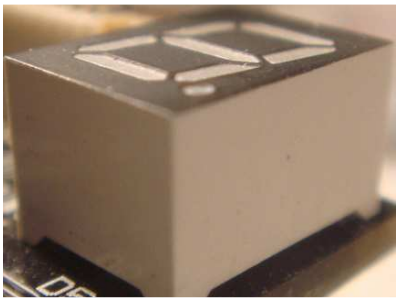
Q - Parallax Inc. has introduced the Penguin Robot, with the same "Toddler type" two-servo tilt and stride mechanism. Have you heard about this, and what are your first impressions?
A - Very nicely made…
Q - Basically, the Penguin is based on your design. Is that correct?
A - Yes
Q - How do you think Penguin will fit alongside the Toddler line of robots?
A - I think Penguin could appeal to University research labs…
Q - What is your smallest robot most like Penguin?
A - The original BigFoot
Q - What advantage do you see with Penguin as a small bot, and how would you apply it?
A - Penguin is better suited to desktop experimentation and with wireless communications can be better integrated with a PC.
Q - Keeping Penguin in mind, what hacks, expansions, and upgrades would you like to see?
A - A camera module integrated with, say, something like RoboRealm Vision software http://roborealm.com/ able to send commands back to Penguin. ● **David Buckley**

Penguin's Gold 7-Segment Display

Little Dragon Robots

This is a cute little dragon Penguin Robot. The final project assembly of boards and cables created this interesting exoskeleton that appears to look like a dragon from Chinese mythology. It has a red and green appearance with a dragon's tail, and, although totally unintentional, it draws great attention from Chinese residents.

In The News – Beijing, China One thing that's enjoyable about working on robot projects is that you never know what the final result will look like. Sometimes you get a big construction worker's hat *(see the Humanizer in PT2)* and sometimes you get a result like this awesome little DRAGON exoskeleton! After working on a Penguin project in China, the end result appeared to have this interesting circuit suit. It doesn't do much except walk around and get constant attention from everyone who sees it! Out of all the Penguin Robots, this is the most popular one in China. It's comprised of two colors – red and green. Although green represents money in America, red is the color of wealth and prosperity in China and may be used to attract good luck. Green is the color of dragons. The Chinese mythological dragon symbol dates back to 3,000 BC and stands for immortality, happiness, procreation, fertility and activity. It also represents great power, strength, and capability. It's no wonder this little Dragon Penguin gets so much attention! In particular, people's eyes are most drawn to the tail, made up of green circuit boards. (see photos). ● **humanoido**



About a quarter of an inch high, the segment display is soldered onto the motherboard. Labeled D5, the display is made up of various internal LEDs seen as segments.

It's not actually solid gold but it's worth ten times its weight in gold, in valuable functions. We're talking about the one-digit segment display mounted on Penguin's motherboard toward the back. ***Check out the five new segment programs that accompany this article, each with different methods of generating segment characters.***

What is it? Don't become too confused over the terminology. Some sources call it the LED display. Yes, it has light emitting diodes that make up the seven segments and decimal point. But it's not the LCD liquid crystal display. A liquid crystal display is another thing altogether. The digital segment display is a modern day version of the analog Nixie Tube. **How to Display Individual Segments?** - It's called a 7-segment display, but don't pull your hair out trying to light individual display segments. You can't do it with the current designed board, as far as we know. This is because it simply connects with only four pins through the shift register. The register is a DM74LS47 Binary Coded Decimal to 7-Segment Decoder/Driver with Open-Collector

(continued on page 7)

25 programs for the segment display Look in *humanoido's Penguin Robot Code.*

Lookup Display, Button Graphics	**Infinity Timer**	**Brain Timer**	**Radio**
Out Dir Display, Display Demo	**Segment Dog**	**Continuous**	**Scout Compass**
High Low Display	**Silent Timer**	**Counter**	**Tiny Timer**
Highspeed Segment	**Tiny Display**	**Counting Eye**	**One Number**
	2-digit display	**Display graphics**	**Seeing Eye Dog**
	3-digit Display	**Ping Ultravision**	**Display Dimmer**
	Basic Counter	**Powerful Eye**	**Visual Alarm**

How To Hibernate Robot Brains

How do you startup your computer in less than 20 seconds? Tired of waiting for Windows to start up or shut down? This is one way to hibernate your penguin robot brain, or any robot brain, using a Windows Editor. Let's say you have Penguin's brains (software) spread out all over the computer desktop. We're talking about being in the middle of writing a Penguin program. When you need to leave for some time, you'll want your computer off for security reasons, and don't want to change the condition of the computer. Keep the desktop,

multiple windows, apps, variables, references, pages, programs under development, research, settings, schematics, files, data, browser pages, exactly the way they are by hibernating! Hibernate will speed up your work, make you more efficient, and use your precious time to great advantage by quickly shutting down and starting up your computer. Press **Fn-F12** (on a Lenovo T60 for example), and within 20 seconds, your computer will be off and you can leave for lunch, meeting, or whatever. It's the greatest thing ever – no more waiting for Windows to boot, open up, shut down, hang, well you know what happens. ● **humanoido**

Machinist for Penguin Robots

ROCKLIN CA - Matt Huntzinger - master machinist for Parallax Penguins

He joined the team in 2007and has remained a primary anchor man for select precision products bearing the famous signature, "Made in America (by Matt Huntzinger)." Matt tools around with the HAAS and HAAS Super Mini. *"I am primarily a machinist making parts for the Penguin robot and the Motor Mount & Wheel Kit. I started here in October of 2007."* Information courtesy Ken Gracey of Parallax ●

Penguin LCD Monitor

By Vittorio Rossi

If you have a serial LCD display, you can use the *Penguin LCD Monitor* program to get useful information about your Penguin's state.

Penguin_LCD_Monitor.bpx
It monitors its input devices and Servo Calibration variables, and then displays on the LCD the following values: 1) Stride Center value/Tilt Center value. 2) Left Photoresistor level/Right Photoresistor level. 3) Compass Heading value. Given the presence of the LCD, all this info is available directly on the Penguin, running autonomously, without any connection with the PC (no need to use the Debug window). The user interacts by using an adapted version of the Penguin Virtual Keyboard by Humanoido (see penguin_virtual_keyboard.bpx at http://robotinfo.net/penguin/). The program has been developed and tested using a Parallax 2x16 Serial LCD 27977. It may be used with different serial LCD devices, by adjusting some values.

How to use the program
Setting up the LCD is very easy, since you simply have to connect its

Penguin works with Parallax LCD models 27977 and 27979, using Vittorio Rossi's Penguin LCD Monitor code. The LCD is simply held in place with elastic bands.

three pins respectively to Vdd, Vss and P5. Please read the LCD documentation, especially about the DIP-switch settings (set both ON, 19.200 baud). If you want to mount the LCD in a stable way, read the article, "Penguin On LCD," published in PT2, page 2. If you opt for a temporary arrangement, you may simply attach the display over the battery pack, using a plastic base and a couple of elastic bands (see the picture). When you turn the Penguin on, the LCD displays a welcome message. Then, the IR devices can be used as virtual buttons: just put your hand in front of the Penguin, and it will display the first set of info (Stride/Tilt values). If it detects some out of range values, then the display will flash and a warning message will appear. Pressing the virtual button again, the Penguin will cycle through the other detect/display steps (Photoresistors, Compass). The last step in the cycle is just an "LCD Off" option, which keeps the program running while saving battery power. Press the virtual button again to start a new cycle. With LCD models 27977 and 27979, you can also control the backlight function, which lights up the display so that it is easier to read the text in the dark. Before displaying the welcome text, and at the beginning of each cycle, the Penguin checks the current light level and, if it is too dark, it automatically turns on the backlight. Change the *kDark* constant to adjust this light level according to your preferences. ●

Penguin's Gold 7-Segment Display (cont. from page 6)
Outputs. It saves on Basic Stamp I/O ports. As originally intended, the primary display function was strategically thought out for displaying program numbers and identifying Penguin robots in a group. **How Can I Program the Display?** – Review the four new PBASIC programs to see how to initialize, utilize, and operate the display. The display is programmed using at least four different techniques. The easiest to understand is a series of numbers that represent the digits from zero through nine and the five graphics characters. It can also be programmed by using pin combinations of high and low and a lookup table. Graphics can be selected by the number of pushes on the reset button.

List of 5 New Programs
penguin_lookup_display.bpx,
penguin_out_dir_display.bpx
penguin_hi_low_display.bpx,
penguin_button_graphics.bpx,
penguin_button_numbers.bpx,
binary_conversion_table.bpx

Does it have other special functions? – Yes. By introducing some interesting programming, many functions can be added. For example, in the Humanoido Penguin Robot Code Suite, there's code to adjust the intensity of the display light, create a light dimmer, and make a special effects light alarm. Also, see the list of programs that use the segment display at the end of this article. **How to Show Alpha Characters?** The segment display is not intended for text messages. If you want text and alphanumeric characters, take a look at *Penguin On LCD*, which describes how to interface a green screen LCD display for text and ascii characters (see PT#2 pages 2-3), and *Penguin LCD Monitor* (above). **Why Won't Hex Numbers Show?** The display will show **decimal** numbers 0 through 9. Be aware, you cannot display the full range of **hex** numbers. **How to Program the Decimal Point?** The decimal point is actually disconnected and cannot be lit or programmed. You can, however, make your own decimal point using one of the graphic characters. **What Are Secret Graphic Characters?** Other than numbers, there are five special graphic characters that can display. Most of these are very usable and at least one is a little peculiar. They have many varied uses. For example, at least four of the symbols can be used to indicate directions with the compass. One character can serve as a rather large decimal point. **What is the Peculiar Graphic?** See photo on page 8. **How Do You Access Special Graphic Characters?** You need to run the code to display graphics. Which code you choose will determine how they will be called into use. The button code will display all five graphic characters on the Penguin display. Refer to the photo. **How to Use the Segment Display? For what purposes?** The single-digit segment display is worth its weight in gold - it has so many important functions and uses that it's mind boggling! Here's a list of a few functions, about 50 in total. It can display a graphics character to represent a decimal point. It's fully numerical-capable from zero to nine. There are five special graphics function characters. Characters can represent compass directions. It's

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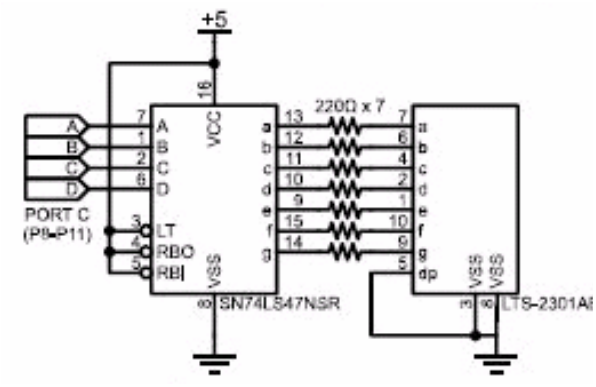
A YouTube logo indicates a movie is posted for that article. Penguin Tech journal is a concept by humanoido. Penguin Robot Society is a non-profit organization comprised of Penguin Robot and Basic Stamp enthusiasts. © 12.08.08

Penguin ROBOT Society

Penguin's Gold 7-Segment Display (cont. from page 6)

There are a total of five graphic characters which can be displayed using the built in 7-segment display. The simplest way to call up these graphics for display is by using their associated number. From left to right, the characters are represented by numbers 10, 11, 12, 14, and 13. A blank screen is 15.

an on-board debugging output screen. It can send out light wave communications. It can be modulated. The display can do Morse Code. It can become a light alarm. It can send signals. It can become a light dimmer. It can become a virtual display for two and three-digit numbers. It can be used as an event timer, watch, and calendar. It can substitute for the piezo speaker when sound is not allowed. The display can be made into a light oscillator from 0 to 100 Hz. It can be programmed as part of a pedometer. It can be interfaced to motion control movements. It can indicate increments. It can represent volume. It's ideal for representing tuning. It functions as a virtual dial or knob. It's a measuring device output. It can work with the infrared hand held remote. It can indicate overload conditions and end of memory responses. Nineteen more uses: numbers can represent levels, voltages, counts, steps, identifications, pathways, distance, groups, sequences, program numbers, phases, language phrases, diagnostics, errors, program responses, warnings, infrared or light intensity, status, speed indications. ● **humanoido**



Penguin Robot Schematic for the 7-Segment LED Display showing the original wiring of the segments and the driver chip. Pin 5 on the display is for the decimal point which is wired to ground and disabled. Schematic courtesy Parallax.

Rudolph the Red LED Penguin! Get into the holiday spirit with Erco's suggestion for a Red LED Penguin with a big red blinking nose. Just plug a jumbo red LED, short leg to (-), long leg to (s). The idea to defeat use of a current limiting resistor is by pulse width modulation in software. With LED on pin 5, code will blink the LED by gradually going from off to an increasing brightness, then repeat. Duty is a variable/constant/expression (0 - 255) that specifies analog output level 0 to 5V. It's set to a range from index 0 to 8, thus creating a voltage drop across the diode from 0 to .2 volt. The volt equation is: Average Voltage = (Duty ÷ 255) x 5 volts = [(8)/(255)] * 5 = .2 volt. penguin_rudolph.bpx ● **humanoido** YouTube http://it.youtube.com/watch?v=2zDg6NfXpUo

Useful Links & References	
David Buckley	http://www.davidbuckley.net/DB/inspired/KenGracey/KenGracey.htm#MiniToddler/
Penguin Robot Home Page	http://www.robotinfo.net/penguin/
Penguin Robot Society Email	penguin.robot@yahoo.com
Toddler & Penguin Tech Group	http://tech.groups.yahoo.com/group/toddler_robot/
Parallax Inc.	http://www.parallax.com/
Parallax Forums	http://forums.parallax.com/forums/
Robot Magazine	http://www.botmag.com/
Penguin Robot Wikipedia	en.wikipedia.org/wiki/Penguin_Robot

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