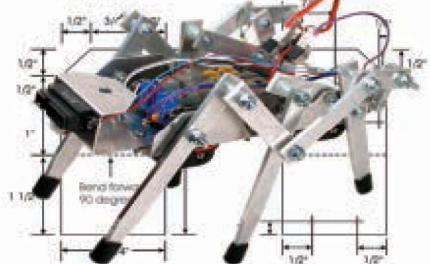


# PERSONAL ROBOTICS

UNDERSTANDING, DESIGNING & CONSTRUCTING ROBOTS & ROBOTIC SYSTEMS



■ BY VERN GRANER

## ROBOT ART

*“Where the spirit does not work with the hand there is no art.” — Leonardo da Vinci*



**WHAT IS ART?** This is a question that has been debated over the years by both the greatest and the least among us. It is generally held that, like beauty, art is subjective — judged by each person who encounters it. Humans appear to be drawn to leave their mark on just about any blank media they encounter. Artists and their works have been with us since the days of cave paintings and stone sculptures.

Yet, for such a pervasive subject, “art” has proved amazingly hard to define. The concept is so flexible, it may be used to describe works created in traditional tangible mediums such as paint, marble, metal, and wood, as well as the less tangible forms such as music, plays, poetry, and dance. As technology has touched on each of these mediums, it’s no wonder that we see art absorbing and reflecting technology. The works of artists are usually shaped by the environment that surrounds them. As modern life is immersed in technology, it’s only logical that we would start seeing technology in our art and even technology as art.

### WHAT’S ROBOT ART?

In preparing this article, I found the simple phrase “Robot Art” to be interesting in that it is delightfully ambiguous. For example, it could be taken literally to mean artworks produced by a robotic apparatus. It could also refer to conventional art (such as sculptures or paintings) that feature robots as their subject or inspiration. We could even view the robot itself as a manifestation of art!

In an attempt to explore some of the interesting and inspiring ways art and technology intertwine, this month we will focus on a number of works from some talented techno-artisans who have used technology and robotics to pursue their muse in interesting and ingenious ways.

### ROBOTICIST = ARTIST

I have yet to meet a roboticist that was not an artist (though some seem reluctant to admit it), yet their works may require a paradigm shift in order to be seen. If you look at things just a bit differently, you may find art in surprising places. Look closely, and you may see that programmers are actually writing functional poetry, bound by tighter rules even than Haiku or iambic pentameter. You may find that — exactly as a sculptor does — machinists strive to free their visions from within a plain block of material.

In some cases, only a privileged few will ever get to see the visual artworks of astounding complexity and beauty created by integrated

circuit engineers. Encapsulated in opaque black epoxy and mounted on printed circuit boards, these functional masterworks are tragically hidden away behind the mundane faceplates of various consumer electronics devices.

In the early days of electronics, printed circuit boards were drawn by hand and called artwork. In the days before CAD layout software was available, you could clearly see evidence of the “human touch” in PCB design. Though components were often laid out with military



■ The Antikythera mechanism is an ancient mechanical device designed to calculate astronomical positions. Scientific examinations place its date of creation to be between 150–100 BC.

precision, the PCB draftsman would usually create smooth, sweeping traces that wound their way from part to part guided by function, yet aesthetically placed by the eye of the layout artist. As evidenced by studying the Antikythera mechanism, it is clear that artist-engineers have been intimately involved in the integration of art and technology from as far

back as 100 BC (see Resources).

## THE ROBOT GROUP

Regular readers will notice I often mention The Robot Group in Austin, TX. I am privileged to be a member of this long-lived consortium comprised of some amazingly diverse, talented, and (truth be told) occasionally

eccentric people. Some might go so far as to dub these folks “artists” that do their very best to live up to the city motto, “Keep Austin Weird.” The group is an excellent example of folks who mix art and technology regularly and well. I’ve explored the offerings from some of our more prolific members, so this time I’ll start with one of the newer members.

## MARVIN “PROFESSOR CONRAD” NIEBUHR — FLIM FLAM LABORATORIES

I met Marvin at Dorkbot Austin in October 2006 where he had on display his collection of “Biomechanical” devices. Marvin had created an entire fantasy panorama populated with fanciful creatures crafted from re-purposed toys and technological cast-offs.



■ The Screamin’ Babyheads Band at SxSW.

He methodically deconstructs and recombines the parts to build the characters and sets that tell an engaging story. Being retired, Marvin has free time in abundance. With his classically trained art skills, extensive real-world experience as a carpenter, architect, and builder, and a voracious appetite for construction, Marvin has continued to bring out new creations and new story lines to support them at an astounding rate. Not stopping with the purely visible, Marvin went on to create the “Screamin’ Babyheads and the Instruments of Mass Distortion” band using both traditional and circuit-bent instruments to manifest an exciting and whimsical (and yes, humorously disturbing) musical tableau. He has recorded one album of material (“Heads Above Ground”) and is working to create more (see the sidebar).

His most recent creation — the “pPod” — places a cast-off car stereo inside a hand-crafted “pea pod” sculpture. He mounted a recycled 12V PC power supply inside a stylized sun to provide “solar power” for the system and then mounted tubes on tripods to hold the coaxial 5-1/4” speakers. A sub woofer system contrived to look like cactus completes the ensemble with meaty bass and twinkling blue LEDs.

A quick walk around his house (a.k.a., Flim Flam Laboratories) reveals a panorama of artworks that decorate and infuse the area with fun. His abundant proclivity to create is aptly displayed. The results of his experiments at Flim Flam Labs are scheduled to appear at the SxSW music festival, Dorkbot, and other events around central Texas. If you find yourself at a festival in Austin, look around for Marvin.

He’ll be the one in the white lab coat with the chili-pepper helmet.



■ Flim Flam Lab’s all sports trophy.



■ Failed experimental Biomechanical.

### MICRO BIO

Marvin Niebuhr, a.k.a., “Professor Conrad” of Dripping Springs, TX, is a performance artist creating musical sculpture and fine art pieces in mixed medias. His musical works have been featured at events such as Maker Faire, Dorkbot, SxSW, The Robot Group, Transparent Mic, and local music venues such as the Scoot Inn, Schultz Beer Garten, and Jack Mountain Outpost. His sculptures

have been shown at LewAllen and LewAllen in Santa Fe, NM, and he has recently become an artistic adviser at the Stock Movie Company of Smith Creek Studios in Texas Hill Country. He holds a B.F.A. from Bradley University, an M.A. from New Mexico Highlands University, and is a retired Professor of sculpture from The University of Texas-Pan American. To see more of his works, visit him online at <http://flimflamlab.blogspot.com>.



■ “Professor Conrad” plays the Optical Theremin at the Transparent Mic concert.

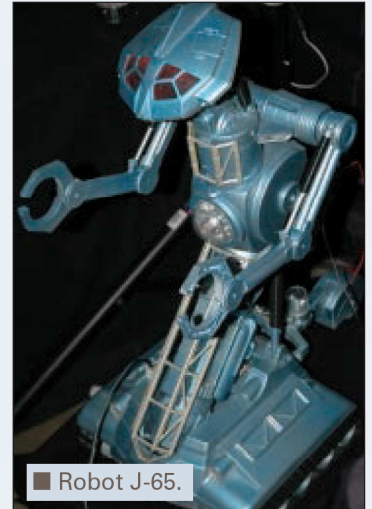


## JOHN P. FUNK — “THE QUEST FOR THE DARK PLANET”

Unsurprisingly, Dorkbot is an exceptionally good place to meet artists that create with technology. I met John at a Dorkbot presentation where he was displaying his amazing J-65 robot. Built as a prop for his upcoming '70s-style miniature model movie, “The Quest for the Dark Planet,” the J-65 is a tribute to looking at things differently and rearranging the mundane into the extraordinary. J-65 sports multiple physical motions including head tilt, body pan, arm raise/lower, and a series of lighting effects to accompany his moves.

John has brought J-65 to multiple Robot Group events, including the Alamo Draft House premiere of “Wall-E,” Maker Faire Austin, and multiple Dorkbots. In addition to creating this completely animated robot movie prop, John has also created an entire cast of miniature figures, space craft, and a comprehensive movie set that he can animate with radio control for taping action sequences. His detailed set design work shows a plethora of skills in electronics, painting, sculpting, model design/fabrication, and, of course, camera work and editing.

Like our esteemed Professor Conrad, John also writes and performs his own music. It's not unusual to find John performing at local tech/art gatherings here in Austin. Be sure to check the Resources section for links to his creations including a teaser movie trailer for, “The Quest for the Dark Planet.”



■ Robot J-65.



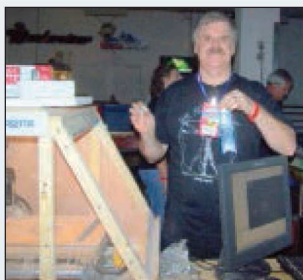
■ Robot J-65 entertains children at the Wall-E premiere.

### MICRO BIO

John P. Funk is a self-made, multi-disciplinary artist. He incorporated his first LED light in a original spaceship model in 1978 a year after he saw “Star Wars.” John has a unique process of recycling old toys, circuit bending electronics/LEDs with Kit Bashing model kits comprised of mostly recycled materials. John started a home-based independent VFX company after leaving the

computer gaming industry in late 2004. John is currently creating his own original universe in the short film “The Quest for the Dark Planet.” John participates with many groups and clubs in Austin including the Robot Group and the 3D Studio Users Group, etc. His work has been seen at Sci-fi conventions in Texas, as well as Austin Maker Faire 2007-08, Burning Flipside, SxSW Plutopia party, Dorbot Austin, and The Artspark Festival. His website is [www.cozmicfunk.com](http://www.cozmicfunk.com).

## PAUL ATKINSON — DIGITAL LIFESAVER



■ Paul Atkinson stands next to the PROBOTIX Fireball v90 CNC system, after winning the “Editor’s Choice” award.



■ CD-ROM snowflakes cut from recycled CDs by Paul Atkinson.

It seems that just about every recent project the Robot Group has done has Paul Atkinson’s metaphorical fingerprints on it. An electrical engineer by day and technological super-hero after hours, Paul has assisted the Robot Group members with darn near every project we’ve created in the last five years: the PONGINATOR, the RoboSpinArt Machine, the PingPongPrinter, and, of course, the PROBOTIX Fireball v90 CNC Router, just to name a few! When not rushing to the aid of his fellow Roboteers, Paul has spent what little free time he has becoming rather proficient with the PROBOTIX system. Not only did Paul assemble the unit and document it for the Personal Robotics column here, he has gone on to explore and improve the device, swapping out the Dremel tool for a new Colt router and working extensively with software from Vectric (see Resources) to create new works of art. For example, Paul used Vectric’s V-Carve Pro to design and cut a series of wooden sculptures for his wife. He also cut some 3D artwork such as a Christmas wreath using patterns he downloaded from the Vectric website. A series of techno-snowflakes were to follow, made entirely from recycled CD-ROM media. As there is interest from a number of our Roboteers in casting and creating molds, Paul is currently experimenting with building and cutting 3D models in foam and other media.

### MICRO BIO

Paul Atkinson is an electrical engineer in Austin, TX. He holds a BS EE from North Carolina State University and has had a career-long interest in robotics and electronics. He is a member of The Robot Group and collaborates on many of their projects. Recent work includes building and operating a Fireball CNC router, developing a commercial tube winding machine, developing a DC-DC switcher for a wild-life camera, and circuit design and PCB layout for an LED sequencer. He has participated in Maker Faire Austin, EFF-Pultopia, SxSW, Dorkbot, and other regional events.

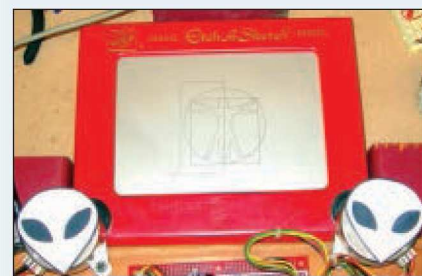


## NYSSA HUGHES AND JAMES DELANEY — MAGIC SCREEN MACHINE AND TECHNO ART



■ Nyssa Hughes and James Delaney prepare to present a project at The Robot Group weekly meeting.

I met James and his wife Nyssa back in 1995. James was a Unix system administrator for a community college and had been working with both software and hardware for a number of years. Nyssa had been sculpting, painting, and crafting artworks for that long or longer. After a bit (well, maybe more than a bit) of cajoling, I finally managed to get both James and Nyssa to come out to the Robot Group meetings. Now, they're a regular feature bringing in new devices and creations to just about every meeting. At one of these meetings, James got a chance to see the award-winning PROBOTIX Fireball CNC machine I detailed my December '08 column. Upon seeing the unit in action, James decided he wanted to experiment with computer motion control and stepper motors. Inspired by similar projects found around the Internet, he enlisted the help of Paul Atkinson and Bob Sheldon in the creation of his own X/Y vector drawing system designed to etch patterns on a simple, reusable display.



■ The Robot Group logo as displayed on the Magic Screen machine.



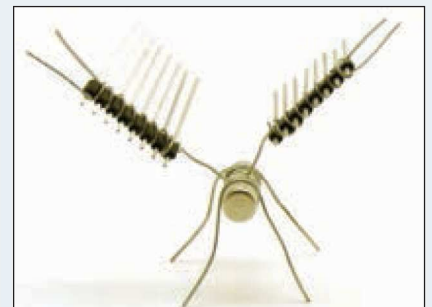
■ The finished Magic Screen machine.

Using the ATMEGA8 Development Kit by ProtoStack, James built a microcontroller system that could receive and process standard computer parallel port signals to control stepper motors. He then attached the stepper motors to the X and Y direction knobs on a second-hand Etch-a-Sketch® "Magic Screen" to

create his "Magic Screen Machine." Using a series of GNU/Open Source programs, he drew a version of the Robot Group's logo and controlled the stepper motors to draw the logo on the screen. Make sure you check the Resources section for a link to James' page with a full write-up, source code, schematics, and links to all the software he used to make the finished Magic Screen Machine. While James has been working diligently on hardware and software for his projects, Nyssa has been busy working on techno-inspired devices such as the award-winning Micro RC Jousters. Using small radio-controlled cars with fanciful paper bodies and magnetically mounted "jousters," two operators can drive their electric "steeds" and recreate the fun and excitement of a renaissance festival joust with a side order of origami. Like James, Nyssa shares all the details on how to recreate her work on her website. She even has a nice how-to video that shows the jousters being made and then actually fighting!

Though jousting may be jolly good fun, Nyssa has put down the remote controls long enough to create some technology-inspired works including the acrylic on canvas

painting entitled "The Brain" and the vector art drawing entitled "Robot Head" that was used to make a limited series of custom t-shirts. She has also created many small sculptures using electronics components, including such works as the aptly named "Fuse Bug."



■ "Fuse Bug" sculpture.

### MICRO BIOS

Nyssa Hughes is a painter, sculptor, and T-shirt designer, based in Austin, TX. Her works have been featured at The Robot Group and Maker Faire. She won an Editor's Choice ribbon at Maker Faire and was a runner-up in the "2008 National Pabst Blue Ribbon 2008 Art Contest." Recently, she participated in The Dallas Museum of Nature & Science Tech Fest, where she exhibited her Micro Remote Control Jousting cars. See examples of her work at [www.nyssa.com](http://www.nyssa.com).

James Delaney is an inventor, photographer, graphic artist, and Linux SysAdmin. His inventions include the PROF LED Sequencer,

the Trampoline Sensor MKII, and the UBUS Hallucination Generation device, and have been featured at events such as Maker Faire, EFF Plutopia, and The Robot Group. His technique for altering digital photos by using color palettes derived from classic paintings has been featured on dozens of blogs and has made the front page of digg, del.icio.us, lifehacker, and MAKE: blog. Delaney's graphic art has appeared on posters and the covers of CDs and DVDs. His video animations have been utilized in such documentaries as the national PBS series "Visiones" and "I Love My Freedom, I Love My Texas," and the royalty free backgrounds "nMotions." He lives in Austin, TX. To find out more visit: [www.unfocusedbrain.com/](http://www.unfocusedbrain.com/).



## CRAIG GOLDSMITH — THE CLOCKWORK FAIRIES

When I started on this article, I had fully intended to only feature the creations of people in The Robot Group for a number of reasons, not the least of which is that I would be able to lay hands on any of the projects to verify their authenticity and to get pictures for the article. So far, all of the works featured have been created by Robot Group members. However, I came across a labor of love from a dad to his daughter and I just had to include it, as well.

I was touring the Completed Projects section of the Parallax online forums when I saw an amazing device created by Craig Goldsmith (a.k.a., “Zoot”) for his daughter. Having created things for my children as well (see Peanut Butter Monster Detector, October ‘08) I felt a resonance with Craig and his one-of-a-kind project, “Clockwork Fairies.”

Based around the Parallax SX series microprocessor, the Clockwork Fairies is a tour de force in electronics and enchantment. In his own words from the online posting, this is what Craig had to say about his creation:

*“Here’s a little something I constructed as a holiday gift for my daughter. Wooden box with acrylic front, prismatic flowers, LEDs, and “clockwork” fairies.”*

*The LEDs cycle through various patterns; the LEDs inside the box cast interesting reflections around the inside. When the user waves their hand in front of the IR emitter/detector pair, a small gearbox motor cranks the fairies back and forth for a random time.*

*A small photo resistor detects when the lights have been shut off – in that case, the box shuts down with the LEDs dimly twinkling and nothing will start the motor. In the morning, it “wakes” up after several minutes of daylight.*

*The circuitry is built around a Parallax SX-series microcontroller, which is used for driving some of the LEDs, the IR pair, and sigma-delta ADC on the CDS cell. A ULN2803a sink driver runs the motor and the LED bank inside the box.*

*The SXB/assembly code cycles through the patterns at different speeds; a flag set by the main state machine lets the LEDs either be run in a bitmap “pattern” mode (each LED is on/off) or PWM mode, where each LED can have PWM brightness level and ramp speed set. The effects are quite striking – at high speeds, the bitmap patterns approach “solidity;” the PWM random modes are very “twinkly.”*

*The fairy art was created by me and printed to high-quality matte photo paper (the kind with plasticized finish), and mounted to air-craft plywood cutouts and trimmed. The rest of the construction was just from bits I had lying around.”*

Incorporating sensors, motors, lights, software, experience, and no small amount of talent, Craig was able to make an entertaining and utterly delightful personal gift that could be passed down through generations of their family. A true labor of love and an excellent closing example of what can happen when art and technology are skillfully mixed.

Craig has graciously posted all the source code, schematics,

and pictures to help others make their very own animatronic sculptures. Make sure you check the Resources section for the direct link to his forum post.

### MICRO BIO

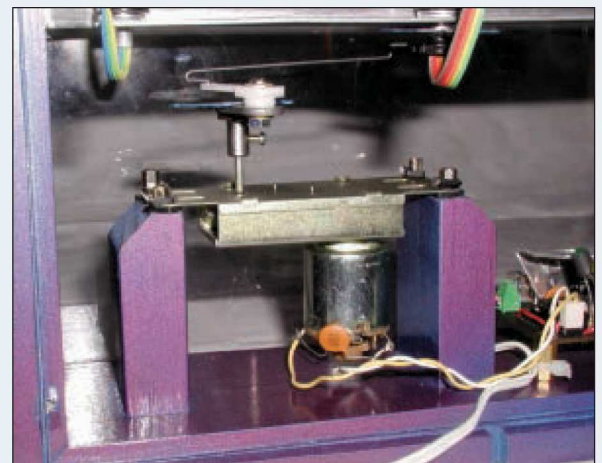
Craig Goldsmith is a graphic, object, interactive, and embedded electronics designer based in Albuquerque, NM. He is also the host of the seminal “Coffee Express” participatory radio program on KUNM-FM. Visit his website at <http://1uffakind.com>.



■ Craig Goldsmith’s “Clockwork Fairies” project.



■ The PCB hosts LEDs, CDS cells, IR Emitter/Detector pair, and prismatic flowers.




■ The gearhead motor that drives the animatronic motion.

## ALL GOOD THINGS ...

In closing, I'd like to thank all the artists who contributed to the works featured in this article. I would also like to encourage you to explore your own artistic urges or to share your stories about art and technology with me.


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## RESOURCES

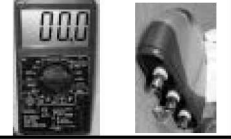
- The Robot Group  
[www.TheRobotGroup.org](http://www.TheRobotGroup.org)
- The Antikythera mechanism  
[http://en.wikipedia.org/wiki/Antikythera\\_mechanism](http://en.wikipedia.org/wiki/Antikythera_mechanism)
- Keep Austin Weird  
[http://en.wikipedia.org/wiki/Keep\\_Austin\\_Weird](http://en.wikipedia.org/wiki/Keep_Austin_Weird)
- Professor Conrad's "Screamin' Babyheads and the Instruments of Mass Distortion" videos  
[www.youtube.com/user/screaminbabyheads](http://www.youtube.com/user/screaminbabyheads)
- John P. Funk's "The Quest for the Dark Planet" trailer  
[www.youtube.com/user/cozmicpfun](http://www.youtube.com/user/cozmicpfun)
- James Delany's Magic Screen project  
[www.unfocusedbrain.com/projects/2009/cncmagic/screenmachine](http://www.unfocusedbrain.com/projects/2009/cncmagic/screenmachine)
- Jeff Epler's AXIS CNC page  
<http://axis.unpythonic.net/index.cgi/etchcnc>
- ATMEGA8 Development Kit by ProtoStack  
[www.protostack.com](http://www.protostack.com)
- Inkscape GNU/Open Source drawing program  
[www.inkscape.org](http://www.inkscape.org)
- EMC2 GNU/Open Source CNC program  
[www.linuxcnc.org](http://www.linuxcnc.org)
- PROBOTIX v90 Fireball CNC system  
[www.probotix.com](http://www.probotix.com)
- Nyssa Hughes RC Jousters site  
[http://blog.nyssa.com/site/?page\\_id=25](http://blog.nyssa.com/site/?page_id=25)
- Paul Atkinson's web page  
<http://wiki.therobotgroup.org/wiki/PaulAtkinson>
- Vectric CNC Software  
[www.vec tric.com](http://www.vec tric.com)
- Craig Goldsmith's Clockwork Fairies  
<http://forums.parallax.com/forums/default.aspx?f=21&m=322984>
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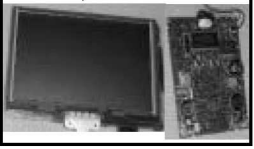


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