More Projects of...

Joe Grand

Zoz Brooks

Prototype This!

- Engineering entertainment program on Discovery Channel
- Four guys building prototypes of crazy things
- Followed the design/test/refine process
- Limited time & budget per episode
- Premiered October 2008 (US), ~February 2009 (World), 2012 (Netflix)
- Thirteen episodes total

Prototype This!

- Original fan site:
  - `http://dsc.discovery.com/tv/prototype-this/prototype-this.html`
- Engineering documentation & details:
  - `www.grandideastudio.com/prototype-this/`

The "Talent"

joe
grand

zoz
brooks

mike
north

terry
sandin

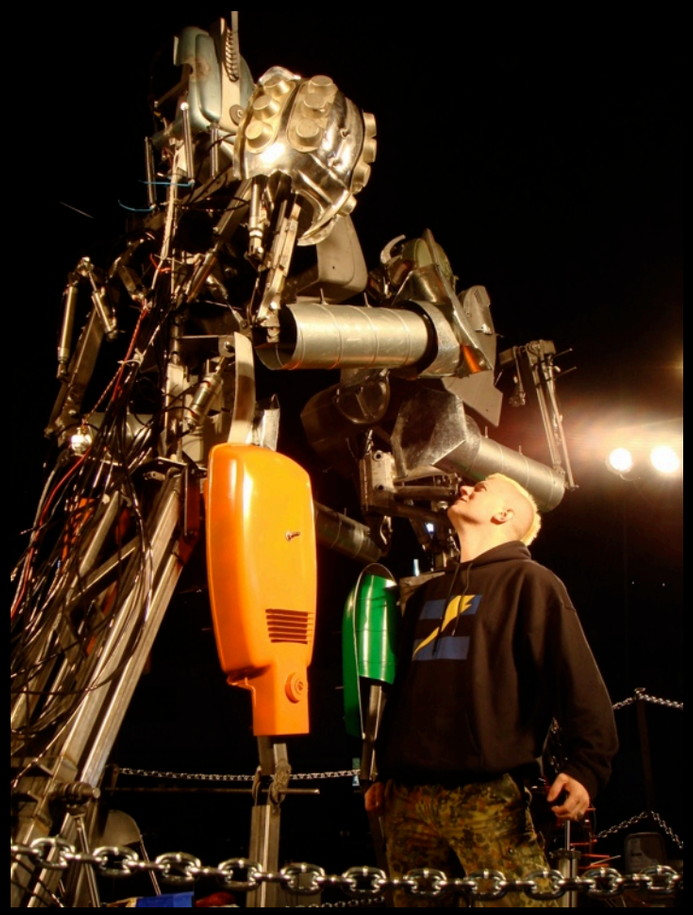
Production and Friends

Previously @ DC17

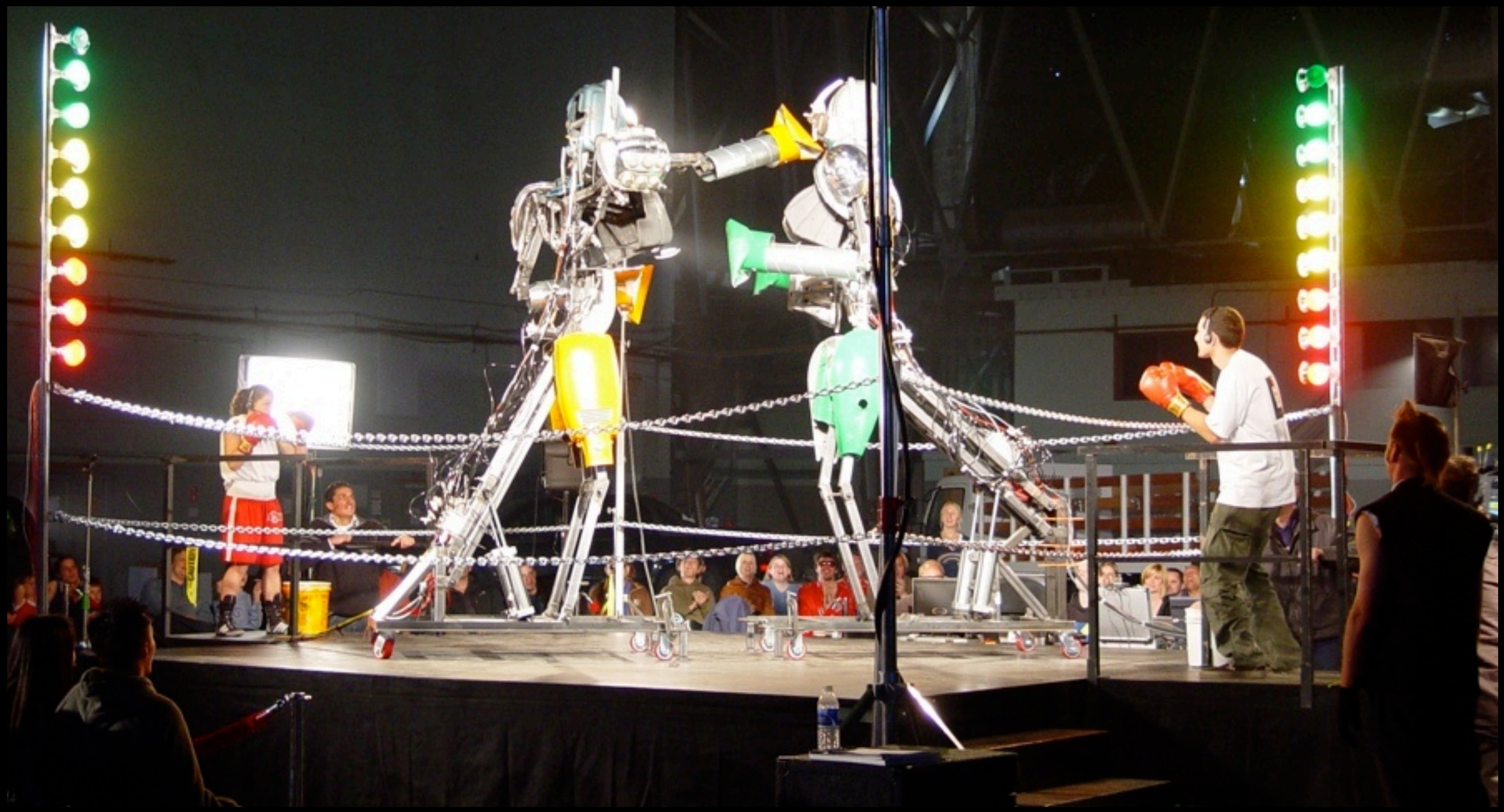
- Traffic Busting Truck
- Fire Fighter PyroPack
- Virtual Sea Adventure
- Waterslide Simulator
- Flying Lifeguard

Now @ DC20

- Boxing Robots
- Mind Controlled Car
- 6-Legged All Terrain Vehicle
- Get Up and Go
- Autonomous Pizza Delivery



Boxing Robots



- 1st official build
- ~2 weeks

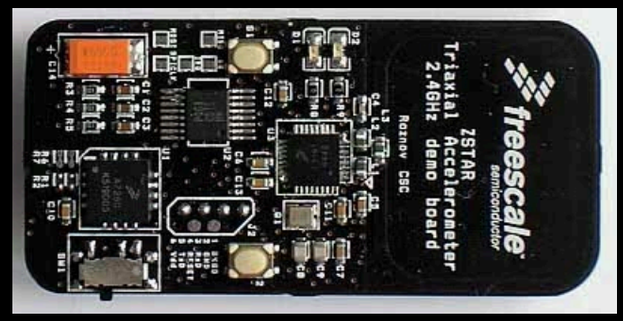
- Controlled by players outside the ring
- No $$$ for real mocap solution
- Camera/AR + accelerometers

Boxing Robots

vs.

- Built out of custom articulated steel skeleton
- Covered in body made of recycled/surplus materials
  - Visual design by Nemo Gould (nemomatic)
- Pneumatics controlled via ProXR RS-232 Relay Controller

Boxing Robots

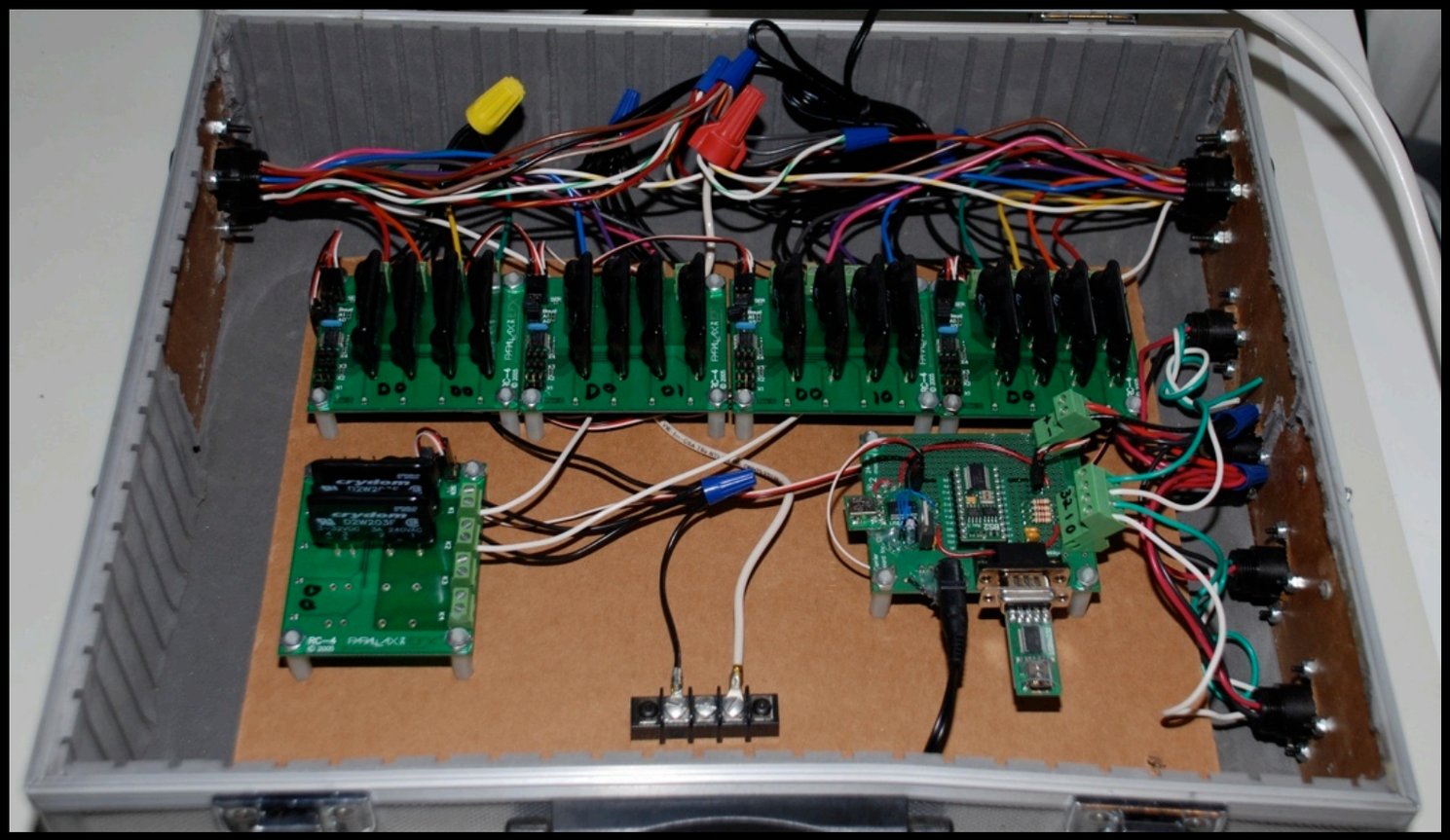


- Freescale ZSTAR Wireless 3-Axis Reference Design (MMA7260QT + MC13191 2.4GHz transceiver) on gloves
- Highest sensitivity setting (6 Gs max)

Boxing Robots

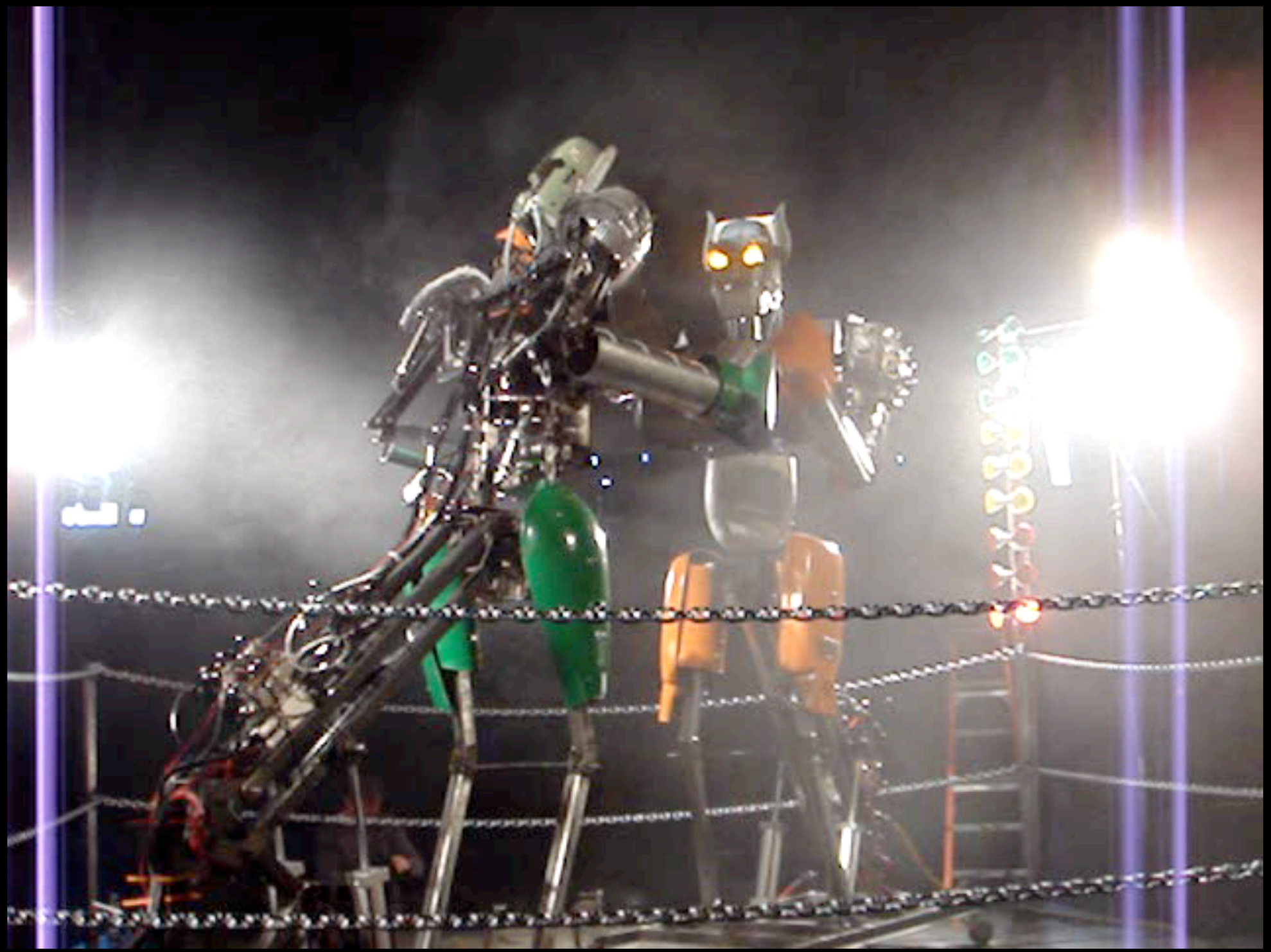
- The boxing game: C/Windows due to camera drivers
  - IDS µEye LE compact CMOS industrial cameras
- Shape filter for punch detection & classification
- ARToolkit tracking for body orientation
- Assembled motion queue and sent via UDP to pneumatics controller

Boxing Robots



- Health-o-Meter/Scoring System
- BASIC Stamp 2
- EFX-TEK RC-4 + Crydom D2W203F SSRs
- Magnet + hall effect sensor in neck to determine a "hit"
- Serial port I/F to communicate w/ Zoz's control S/W

Boxing Robots

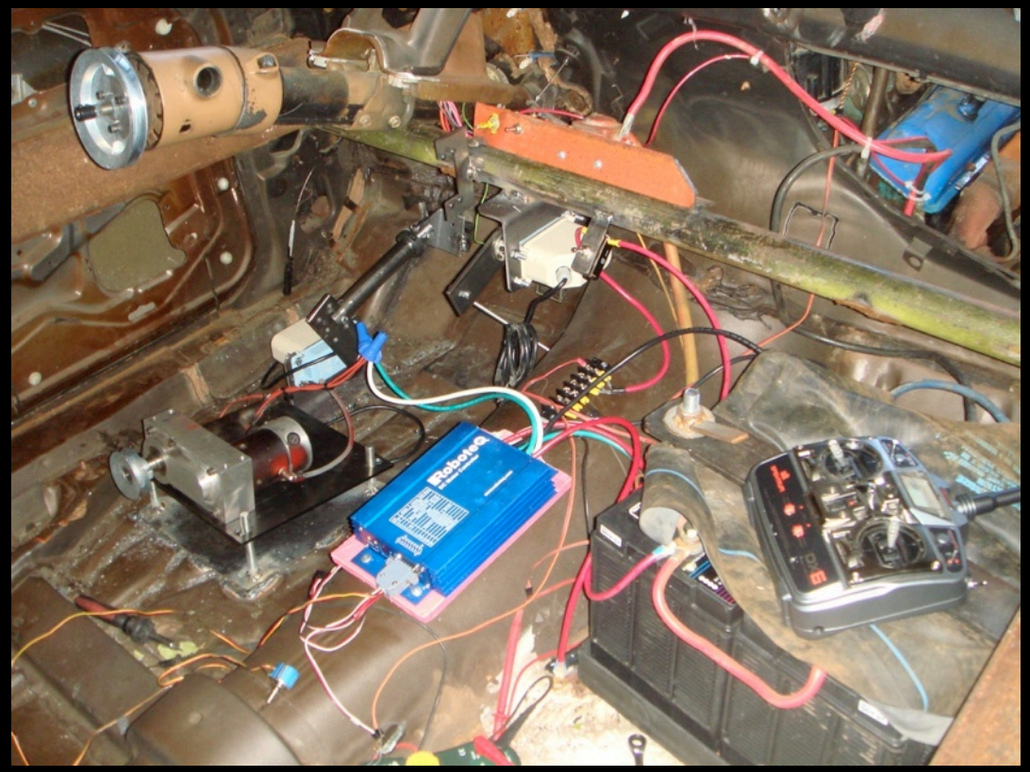


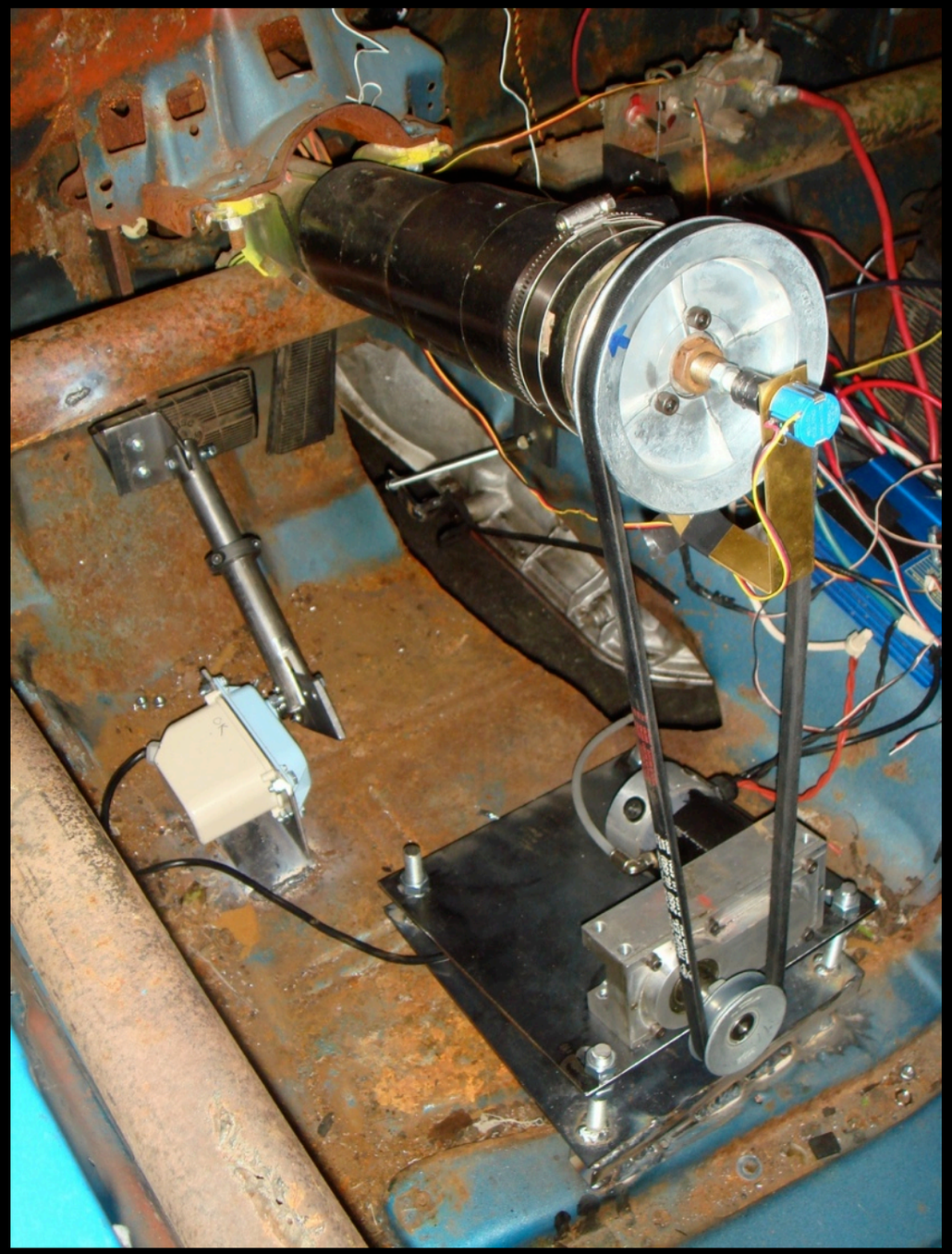
Mind C[illegible]ar

ANGER MANAGEMENT

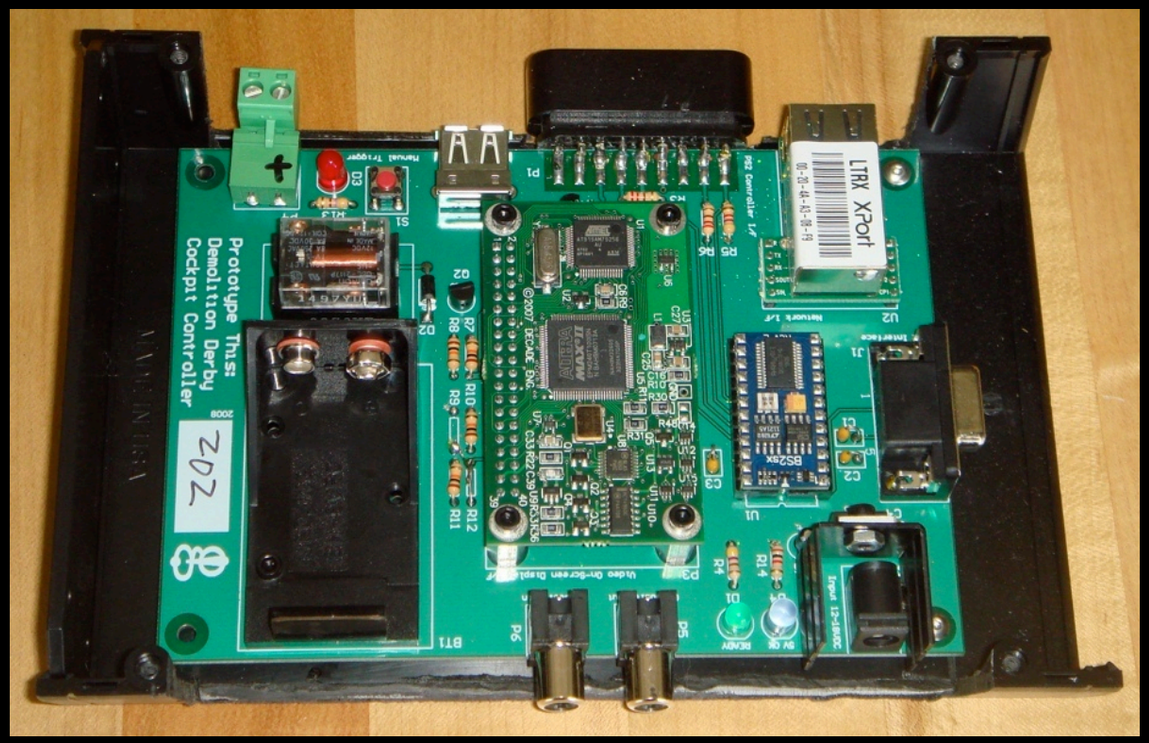
- Anger Management Demolition Derby
- Measure EKG, GSR, heart rate
- Must stay calm/relaxed in order for car to move

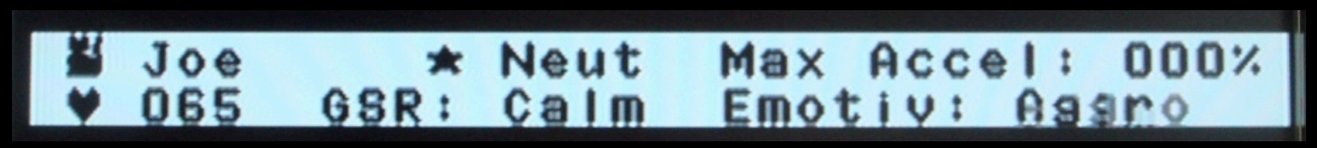
Mind Controlled Car





Mind Controlled Car





- Playstation 2 driving controller
- BASIC Stamp 2sx
- Lantronix XPORT
- BOB-4-H OSD
- Piezoelectric shockerator to make driver angry (unused)
- Data from each unit sent to Zoz's PC for processing

Mind Controlled Car

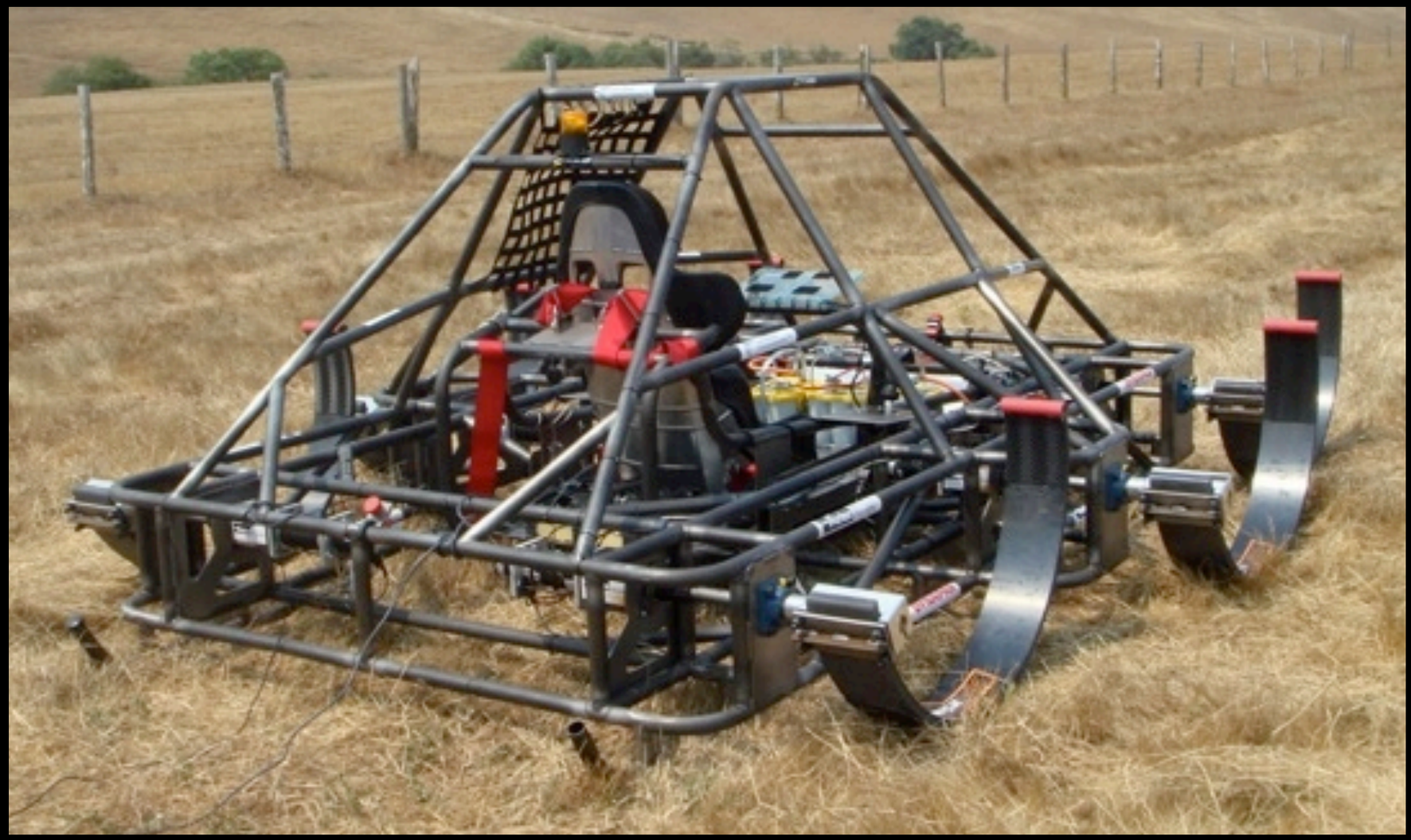
- Headset evaluation
  - Neurosky: single electrode, attention/meditation
  - Emotiv: multi electrode, facial expressions, engagement/excitement, "mind control" classifier
- Emotiv loaned us a few of their only prototypes
- Event-driven Emotiv API -> Spoon bending test

Mind Controlled Car

- Heartbeat detection: FIR bandpass filter & threshold
- PCTX USB interface to Futaba R/C controller
  - Windows USB hell
- Multithreaded 4-car derby game system

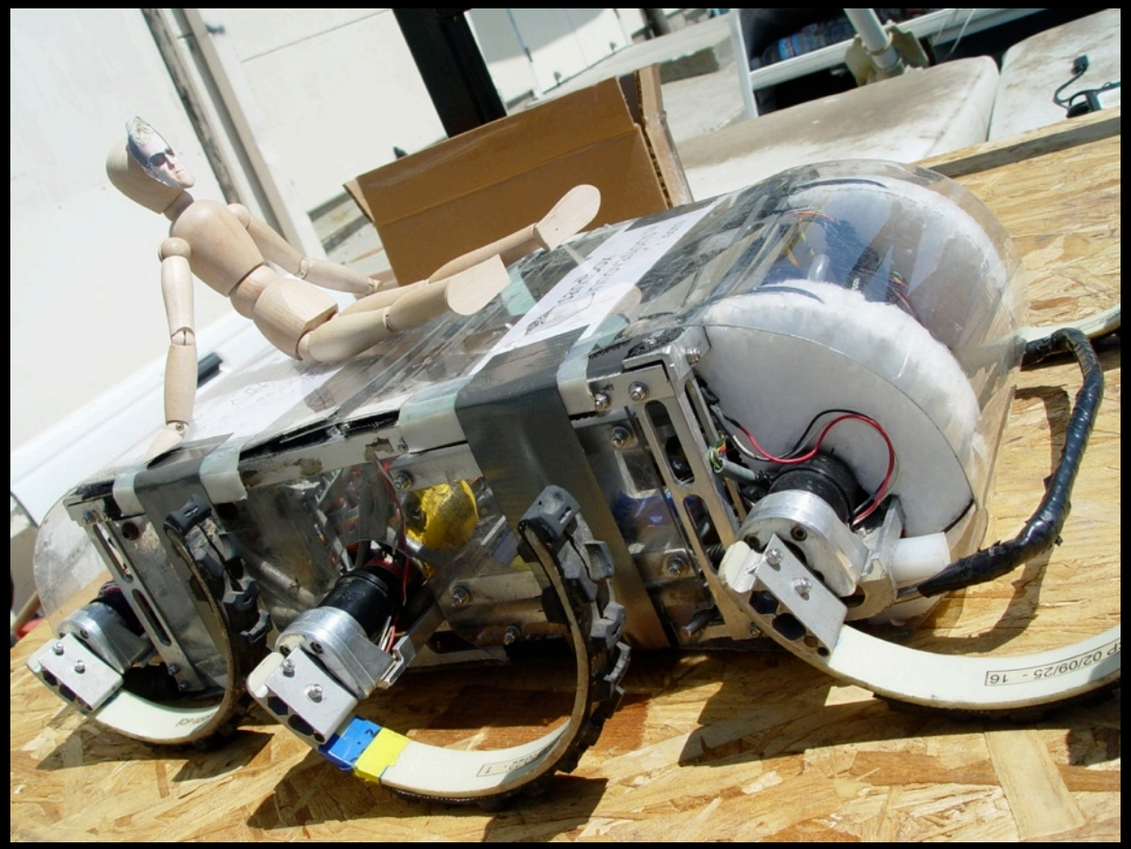
Mind Controlled Car

Six-Legged All Terrain Vehicle



- Gigantic, bio-inspired off-road robotic vehicle
- Human controlled
- ~2 weeks (twice!)

Six-Legged All Terrain Vehicle



- Synchronized alternating tripod gait
- Based on RHex robot (UPenn Kod*lab/Sandbox Innovations)
- System dynamics depend on materials properties
  - Leg springiness for forward locomotion
  - Ground slip for turning locomotion

Six-Legged All Terrain Vehicle

- Chassis engineering by Speck Design & manufactured by Top of the Hill Performance Center
  - Chromoly tube = heavy!
- Custom carbon fiber "legs" manufactured by Finish Line Advanced Composites

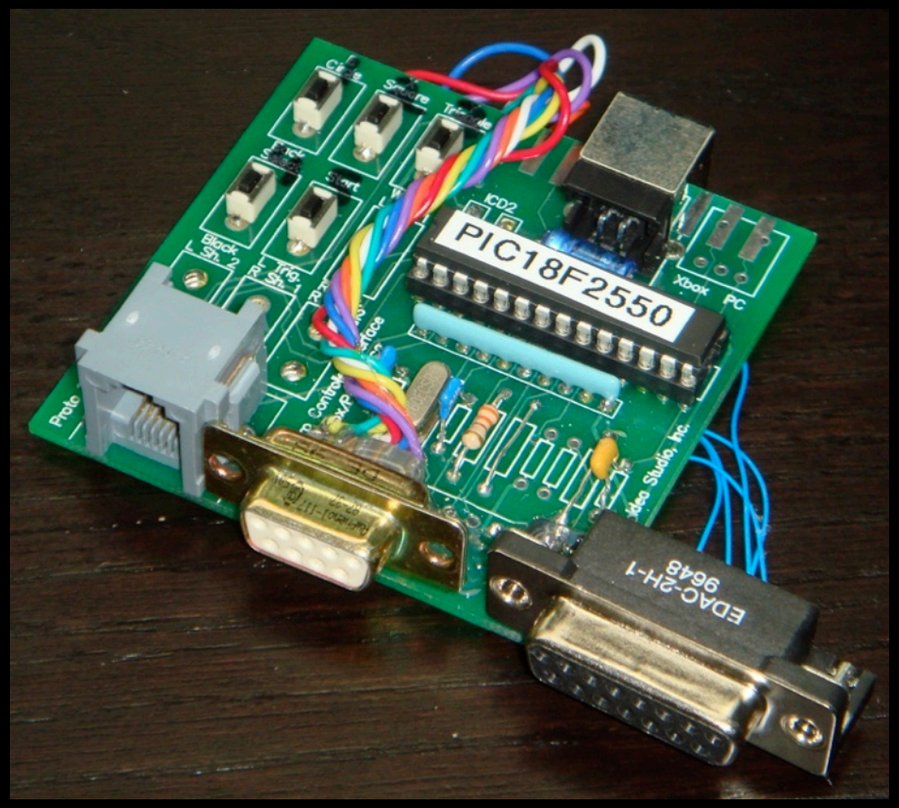
Six-Legged All Terrain Vehicle

Extremely strong and flexible...

Six-Legged All Terrain Vehicle

- Drive train
  - Motor: Custom DC MagMotor
  - Gear Box: 40:1 reduction planetary (Parker Bayside)
  - Encoder: Dynapar industrial shaft encoder
  - 3x RoboteQ DC motor controller (1st try)
  - 6x Sevcon Millipak electric vehicle controller (2nd try)
- 48V @ > 1000A (!)

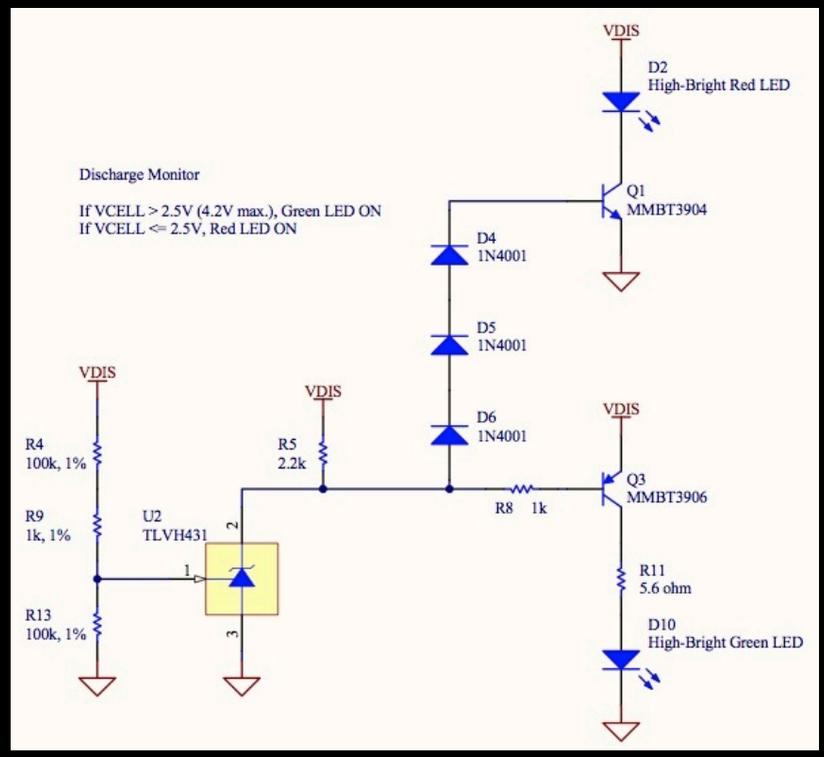
Six-Legged All Terrain Vehicle



- Control software on laptop running Linux
- Arcade-style joystick and buttons
- USB HID Joystick via PIC18F2550 (based on Joe's Stelladaptor Atari 2600 I/F design)
- Trigger serves as "dead man's switch" for safety

Six-Legged All Terrain Vehicle

- Custom battery management system
- Monitor charge and discharge
- International Battery/Thunder Sky TS-LFP90AHA (90Ah!)
- MAX745 Switch-Mode Lithium-Ion Battery Charger IC
- 4A charge current = 15 hours for full charge

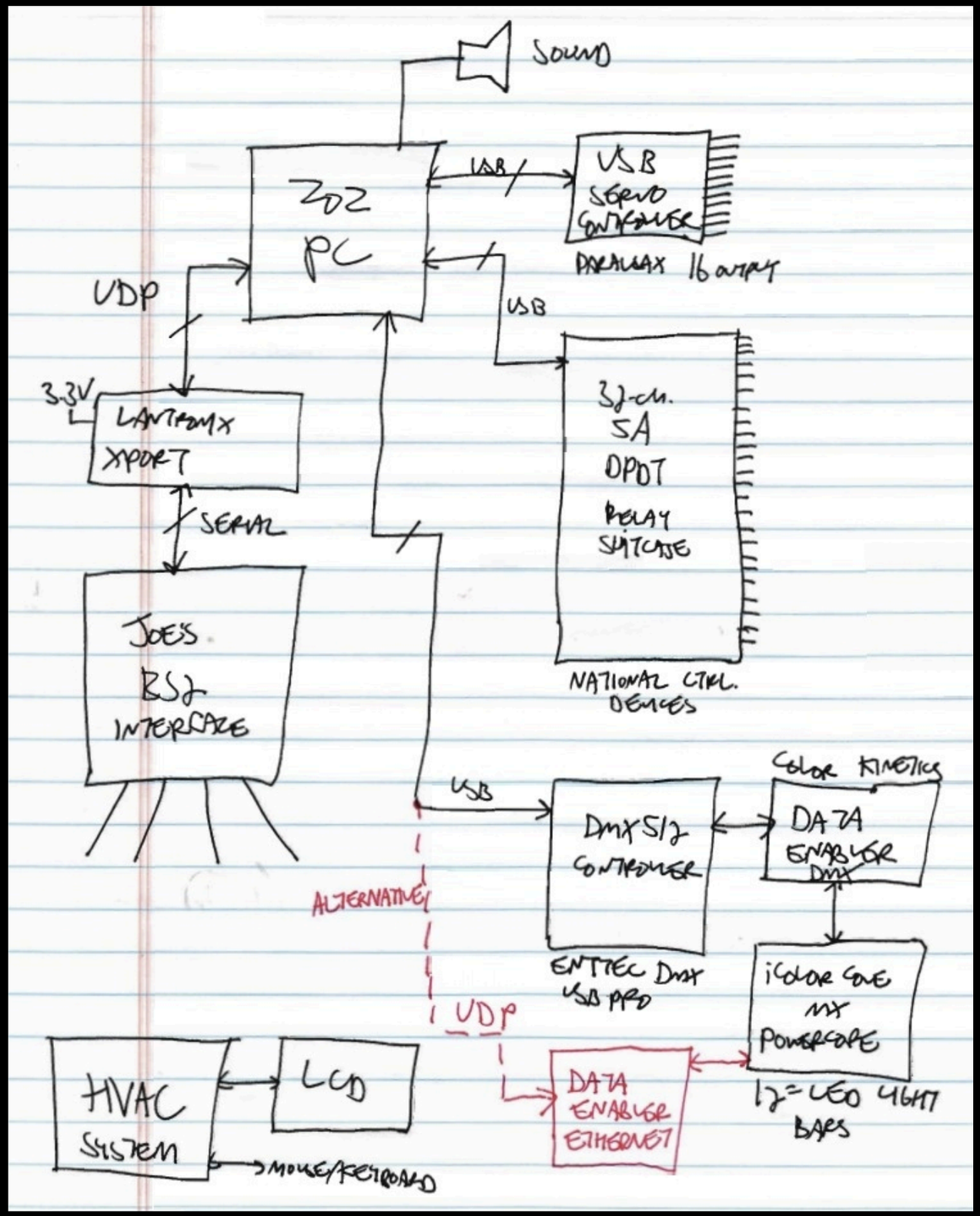


Get Up and Go

- "Futuristic" sleeping pod
- Wake, feed, shower, groom, dress
- HVAC
- Projection system
- ~2 weeks
- Public debut in Union Sq., San Francisco

- Biggest challenge:
  - Fitting everything in there!

Get Up and Go


SOUND
Z02
PC
USB
USB
SERVO
CONTROLLER
PARALLAX 16 ARRAY
UDP
USB
3.3V
LANTRONIX
XPORT
SERIAL
JOES
RS2
INTERFACE
32-ch.
SA
DPDT
RELAY
SWITCHES
NATIONAL CTRL.
DEVICES
USB
DMX512
CONTROLLER
COLOR KINETICS
DATA
ENABLER
DMX
ALTERNATIVE
ENTTEC DMX
USB PRO
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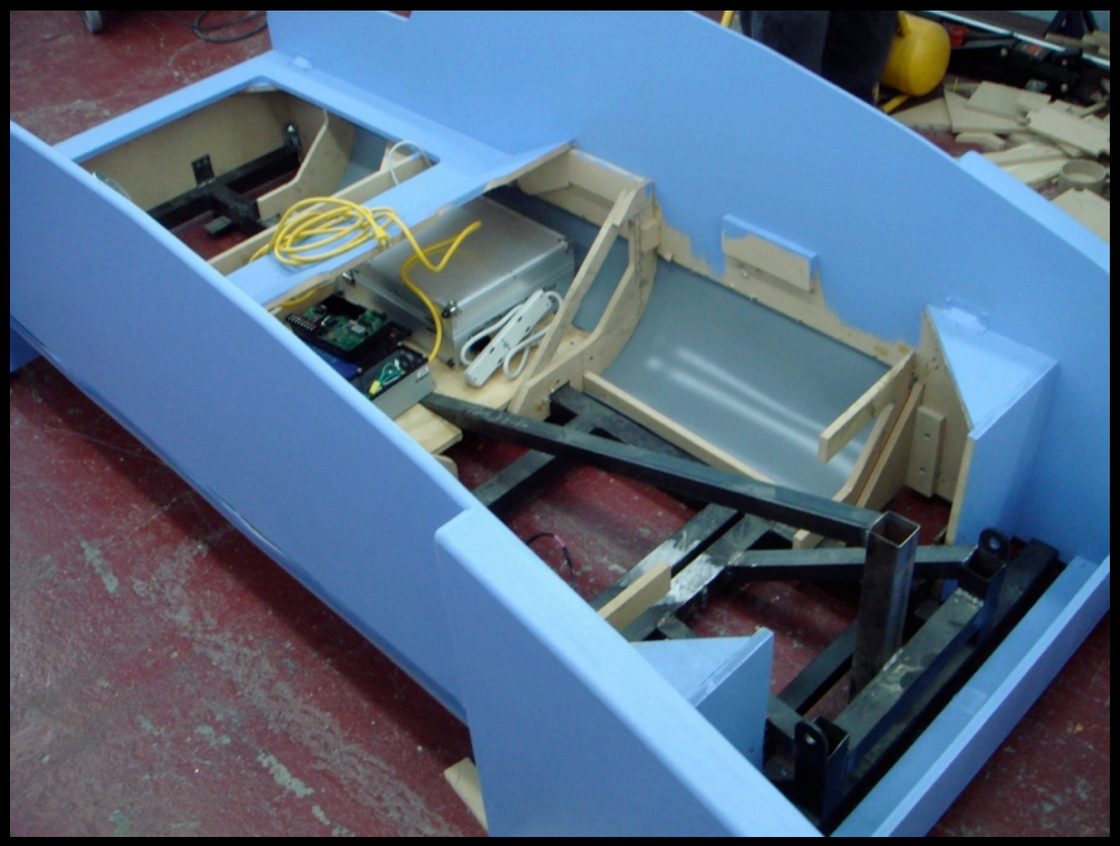
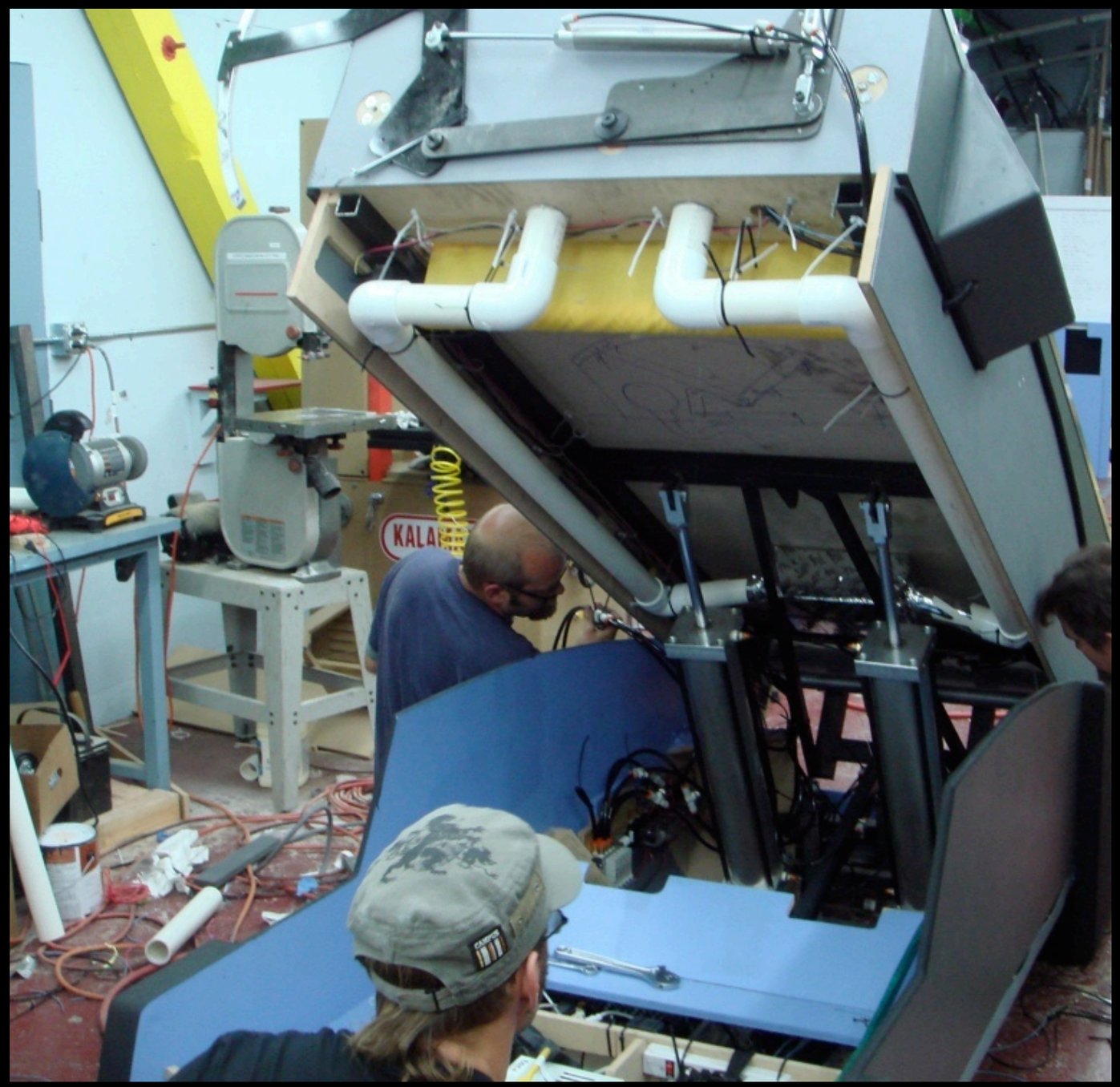
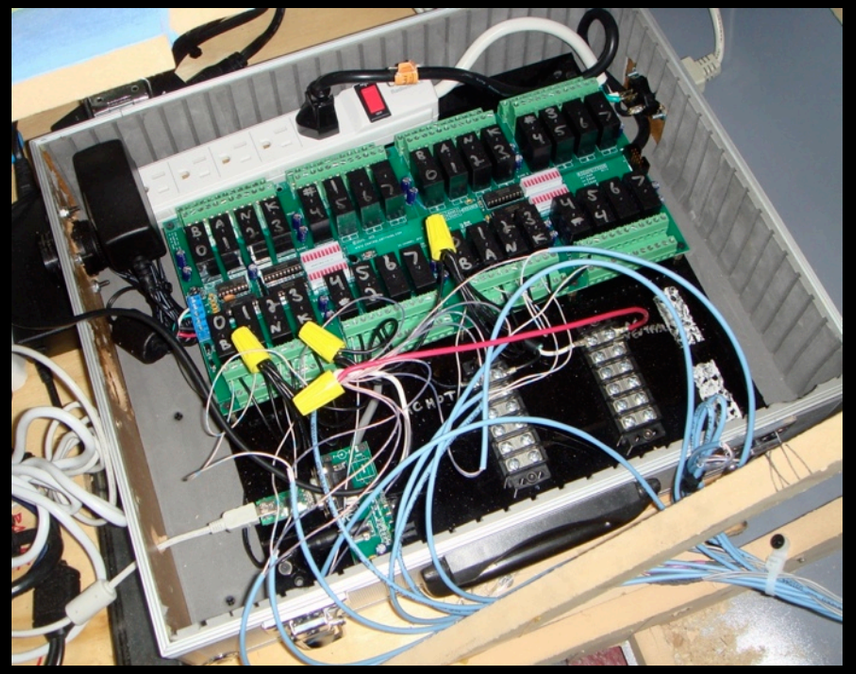
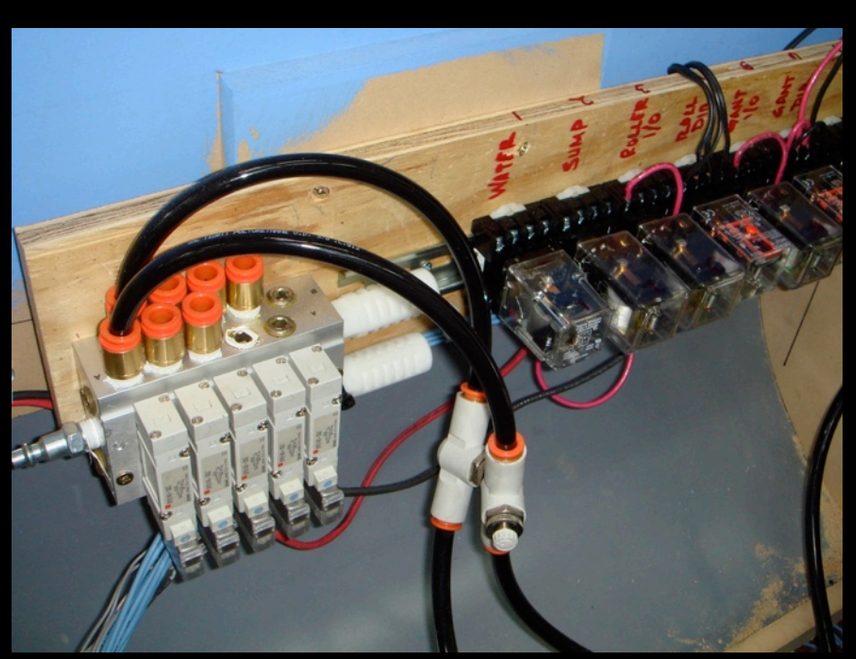
MX
POWERCORE
UDP
HVAC
SYSTEM
LCD
MOUSE/KEYBOARD
DATA
ENABLER
ETHERNET
12= LED LIGHT
BARS



Get Up and Go





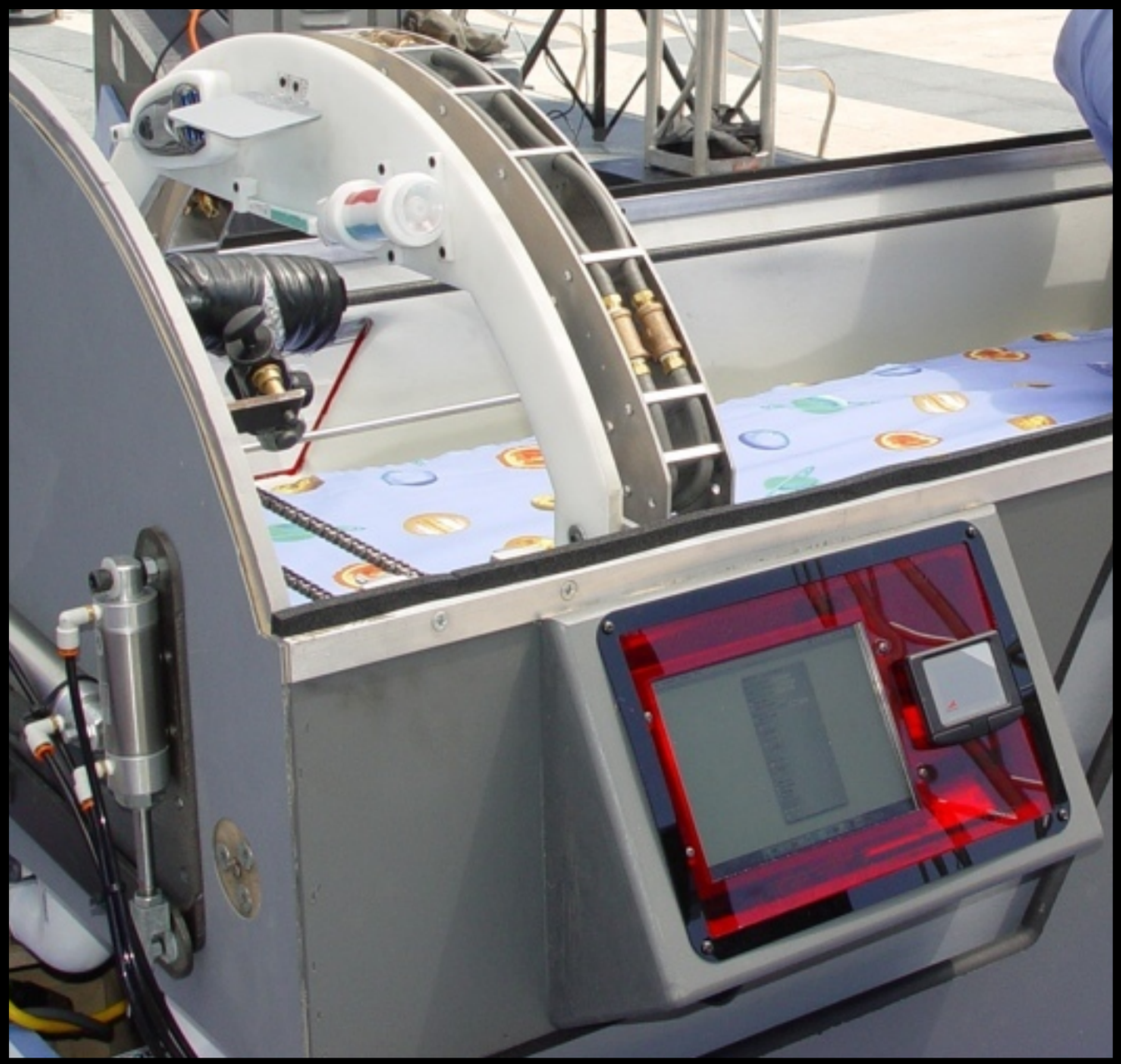


- Pneumatics controlled via ProXR RS-232 Relay Controller

Get Up and Go

- Sensor control board
- BASIC Stamp 2sx
- Photo interrupters (optical encoder)
- Servo controller
- Lantronix XPORT
- Communicates to Zoz's Mac Mini & HVAC system

Get Up and Go



- Mac Mini drives GUI & Color Kinetics lighting system
  - iColor Cove MX Powercore
  - Ethernet Data Enabler
- Pay no attention to the man behind the curtain...

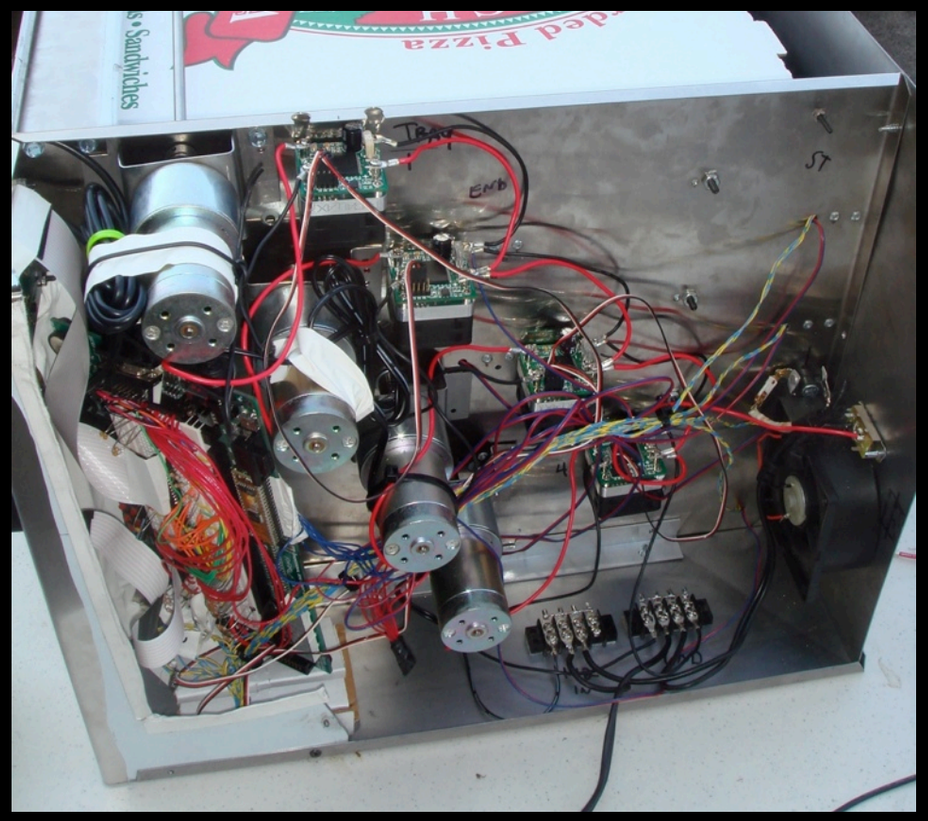
Get Up and Go

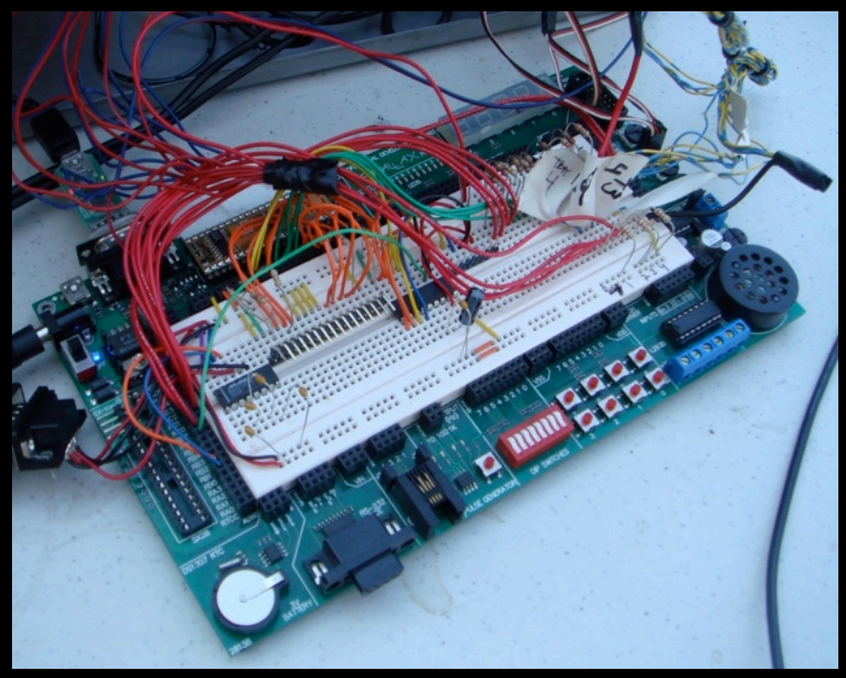
Automated Pizza Delivery

- Autonomous pizza delivery to hungry engineers
- Original version requested by network: Blimp (WTF?)
  - Weighing the pizza
- Final versions: Robot (city streets) & vehicle (longer distances)

Automated Pizza Delivery

- Pizza Pie Pack
- BASIC Stamp 2px
- Optrex 4x20 LCD
- Magtek 21040082 mag. stripe reader
- 12-button keypad
- HB25 motor controllers
- Optical detectors for tray limits





Automated Pizza Delivery

Automated Pizza Delivery

- Marathon Robotics (now Marathon Targets)
- Intended as military live-fire target for sniper training
  - Also good for delivering pizza!

Automated Pizza Delivery

- Marathon Live-Fire Target
  - Mobility platform: Segway RMP + bulletproof steel armor
  - Principal sensor: SICK LIDAR
- Urban challenges
  - Steep inclines (SF streets!)
  - Low obstacles & discontinuities: ex: curbs!

Automated Pizza Delivery

- Project by Anthony Levandowski
  - Differential GPS
  - 2x SICK linescan LIDAR
  - 1x omnidirectional LIDAR
  - 2x wheel encoder odometry
- First bridge crossing of an autonomous vehicle
  - Rolling roadblock on San Francisco's Bay Bridge
- Turned into Google's Self-Driving Car (thanks to Prototype This!)

Automated Pizza Delivery

THANK-U+GOODNITE
FROM PACSAT:KU-1

MENU
MUTE
EXIT
VOLUME
CHANNEL
INPUT