

Aoreugif

Laboratories

A sole proprietorship by
J. (Joule) B. Figueroa, EIT

Contents

- Who We Are
- Project Portfolio
- Contact

Who We Are

- Joule is a mechanical engineer who is certified by the state of Nevada as an EIT
 - Experienced in mechanical design, control systems, and robotics
 - BSME in mechanical engineering from the University of Nevada, Las Vegas
 - NV EIT# 0T8899
- Aoreugif Laboratories is a sole proprietorship licensed in the state of Nevada
 - NT7 Business License
 - Business ID NV20222655112
- Singular “We”

Who We Are

- Joule has worked on numerous projects throughout the last decade
- These projects were conducted prior to the start of Aoreugif Labs, but are discussed here to serve as a visual portfolio and to showcase the skillsets obtained
- Limitations of an EIT
 - May not offer engineering services and only under the direct supervision of a licensed professional engineer (PE)
 - Must follow restrictions detailed in **NRS chapter 625**
 - Industrial exemptions typically include areas in manufacturing, aerospace, and defense
 - Each State has a different set of industrial exemptions
 - Unfortunately, Nevada is more restrictive, and the exact wording is laid out in **NRS 625.095**
- Therefore, Aoreugif Laboratories is a sole proprietorship which offers services in the sciences including research and development (R&D)
 - We **do not** offer engineering services, or contract work which includes any modification of buildings or structures (see **NRS 625 and NRS 624**)
 - Our expertise is demonstrated in the following slides, and licensed professionals will be required to expand our work outside of these
 - Projects we may work on include but are not limited to researching better ways to design **consumer products, robotic systems, and human-computer interactions (HCI)**



32-bit systems using TI CCS

- Able to set up and program microcontrollers from Texas Instrument using Code Composer Studio
 - Arm based Cortex M4
 - Programmable in the Tiva C language
 - Familiar with common protocols such as I2C, CAN, RS232
- Can analysis signals using both oscilloscopes and logic analyzers
 - Via PulseView or a RIGOL DS1104
- Can read/Write/Store Inertial Measurement Unit IMU Data right inside an IC
 - Reduce load on MCU
 - If your sensor doesn't have a header file or firmware, we can write one for you!
 - Wrote a custom header file for the ICM20948 IMU based on the manufacturer's documentation (TDK InvenSense)
- <https://www.youtube.com/watch?v=q05RGwGpyll>

```
int CHD_phase(void) {
    //0 = 85000
    UARTprintf("You have selected P 10!\n");
    UARTprintf("Verify that row reaches 10!\n");

    GPIOInit(GPIO_PORT_B_BASE, GPIO_PIN_1 | GPIO_PIN_2 | GPIO_PIN_3, 0);

    int upperLimit = 210;
    int lowerLimit = 1;
    volatile uint32_t u32ZLoad;
    volatile uint32_t u32PWClock;
    volatile uint32_t u32AdjJust;

    u32AdjJust = 83;
    int PWM_FREQUENCY = 55;

    // base code was using a 40 Mhz sysClk frequency, make sure the same is true here
    // 40 Mhz / 64 = 625 kHz
    SysCtlMCLKSet(SYSCTL_PWDIV_64);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_PWM0);
    SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOPAD); // our PWM will come from this port

    // ** WDGENMCL **
    // Set SPI0 port PIN_1 (PF3) as an input and give it a WPD to protect it from PWM pin
    // Also, if you go from this subroutine "P" to "a" after exiting that could cause some issues to pin P0
    GPIOInit(GPIO_PORT_B_BASE, GPIO_PIN_1, GPIO_DIR_MODE_IN); // GPIO_PIN_1 = P0
    GPIOSetConfig(GPIO_PORT_B_BASE, GPIO_PIN_1, GPIO_STRENGTH_2MA, GPIO_PIN_TYPE_SIO_WPD);

    // config the PWM pin - P0
    GPIOInit(GPIO_PORT_B_BASE, GPIO_PIN_0);
    GPIOInitConfig(GPIO_PORT_B_BASE, GPIO_PIN_0, GPIO_DIR_MODE_OUT);

    u32PWClock = SysCtlClockGet() / 64;
    u32ZLoad = (u32PWClock / PWM_FREQUENCY) - 1;
    PWMConfigure(PWM_BASE, PWM_GEN_0, PWM_GEN_MODE_DOWN);
    PWMGenPeriodSet(PWM_BASE, PWM_GEN_0, u32ZLoad);

    // keep dividing the timer and adjust duty cycle
    PWMOutSet(PWM_BASE, PWM_OUT_0, u32AdjJust * u32ZLoad / 1000);
    PWMOutWrite(PWM_BASE, PWM_OUT_0, 0);

    // write the PWM pulse width on the pin that generates the PWM based on u32AdjJust
    // The logic should work out
    while(1) {
        while(u32AdjJust < upperLimit) {
            u32AdjJust++;
            // Reset PWM to a simmer position once upper limit is reached
            if (u32AdjJust >= upperLimit) {
                u32AdjJust = lowerLimit;
            }
            // This function changes the PWM output from pin P0 based on u32AdjJust value
            PWMOutWrite(PWM_BASE, PWM_OUT_0, u32AdjJust * u32ZLoad / 1000);
            // the magic happens with this delay, we see it longer during it's dim
            // stage and it cooms through the latter stages only to be reset
            // back to it's dim stage
            if (u32AdjJust - (upperLimit - lowerLimit) / 2) {
                SysCtlDelay(100000);
            }
            else {
                SysCtlDelay(100000);
            }
        }
    }
    return(0);
}
```



STEM curriculum

- Nasri Academy is a Las Vegas based non-profit
 - Focused on a differentiated curriculum
 - Included CAD, Coding, and Robotics
 - Fusion 360, ThinkerCAD, Scratch, Python, Lego Mindstorm and Arudino based projects
- Coached an award winning FIRST Lego League (FLL) Team



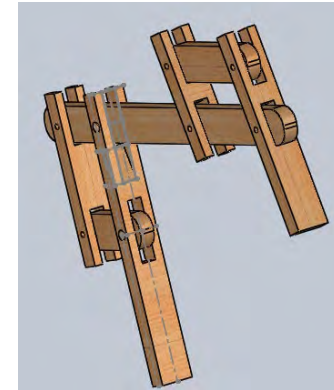
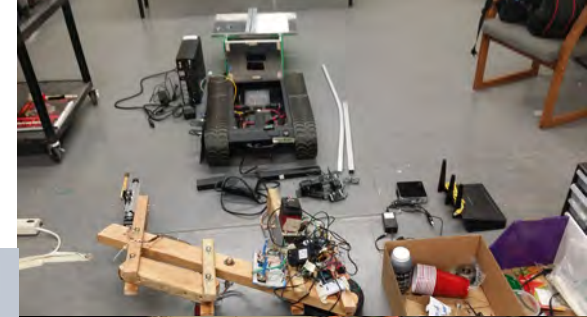
Digital Experience Lab (DeX)

- Researched with Dr. Si Jung “SJ” Kim
- Internship Program
 - Prepared Undergrad Training Courses
 - Made sure interns understood how to program inverse kinematics
 - Mini DeXter Robots
 - Raspberry Pi based with Maestro Controllers
 - Multiple animatronic tabletop humanoids which were programmed to dance together
- Suitable Technologies
 - Beam Omni Telepresence robot
 - Refurbished Beam robots to be used in HCI studies
- Tabletop Tablet Robot (TTR)
 - Designed a low budget differential drive platform to test apps on



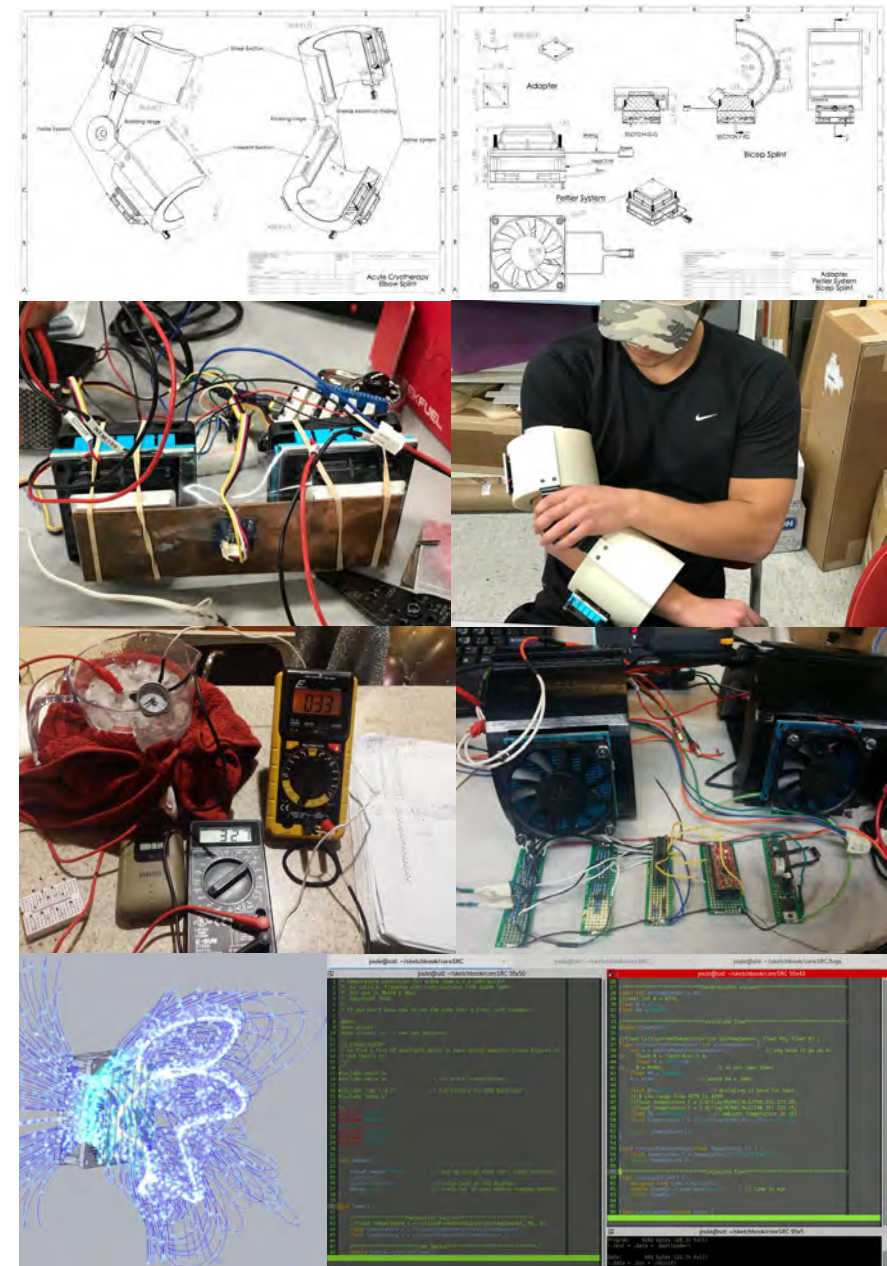
Entertainment Research Center(ERC)

- SJ's Lab was formerly named ERC
- Robotic Art
 - 3+2 DoF art making robot
 - Platform used was a differential drive MMP-40 (a tank)
 - Calligraphy art
- Modified giant servos and used Pololu motor driver
- Custom designed sheet metal brackets
- Laser cut acrylic pieces
- <https://www.youtube.com/watch?v=hRfDyqscpSw>



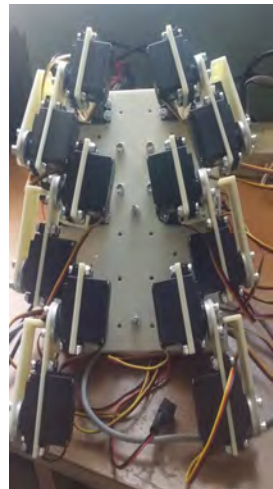
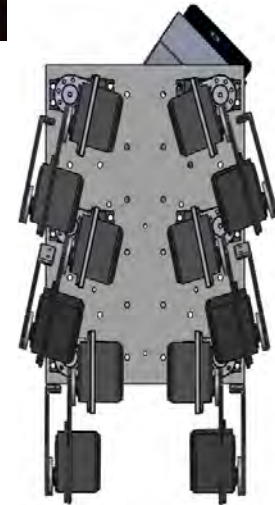
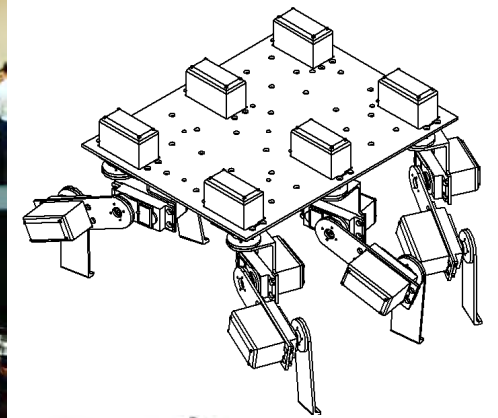
Acute Cryogenic Elbow Splint (ACES)

- ACES was a senior capstone project
- Used Steinhart-Hart Equations to design a reliable NTC thermistor calibration process
- Arduino based with switching regulator, Bluetooth, LCD, ADC IC, and voltage monitor for LiPo batteries
- Integrated fuse to test at 5, 10, and 15 amps of current
 - 12 gauge wire, really hot, somewhat hazardous
- Delivered a working prototype and a research abstract was accepted into the 2018 CSUN/OUR conference



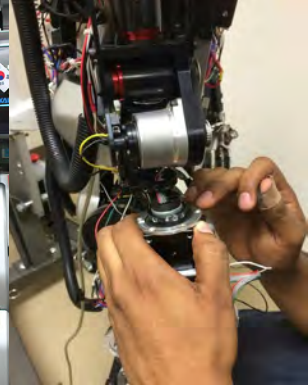
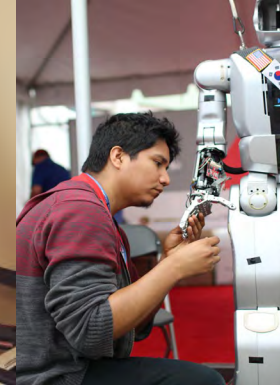
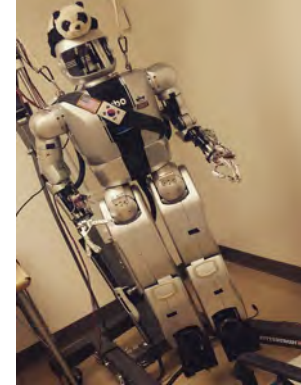
Hexy Mark I & II

- Simulated, designed for assembly, and wrote the systems architecture for a hexapod Robot
- Contracted a machine shop to manufacture linkages (mk-II)
- Mark I used an 8-bit MCU, Mark II used a 32-bit Linux OS
 - Arduino and Raspberry Pi connected to motor controllers and other peripherals
 - Teleoperated over SSH
 - Programmed in C
- <https://www.youtube.com/watch?v=0EWyNdhN1pM>



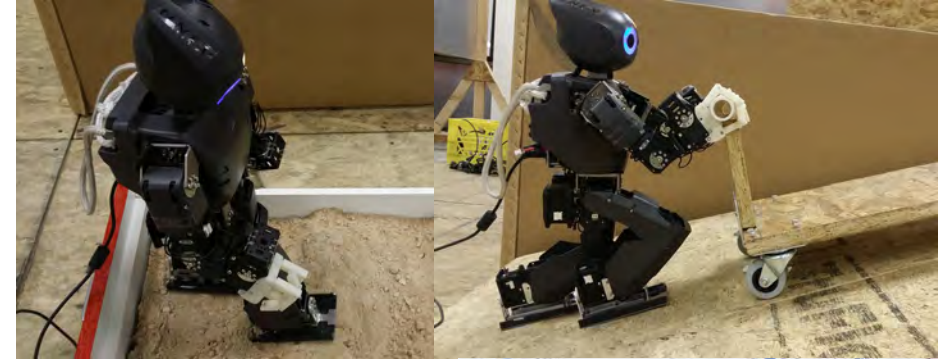
Drones and Autonomous Systems Lab (DASL)

- Reviewed architectural designs for lab space and modified using AutoCAD based on conducted surveys to present to group
- Applied ASME Y14.5 GD&T standards to force-torque sensor design on Solidworks
 - Sent designs to be manufactured on CNC by a machinist
- Programmed YMCA gestures for HKR “Jaemi” Hubo in C# using the Microsoft .NET framework
 - motion planning algorithms simulated on OpenRAVE
- Delivered Gantt charts, and provided maintenance & support for the 2015 DARPA Robotics Challenge
 - Also worked with graphic designers on marketing and branding



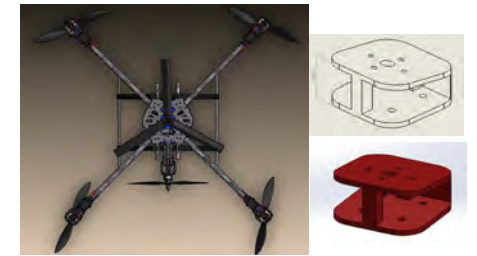
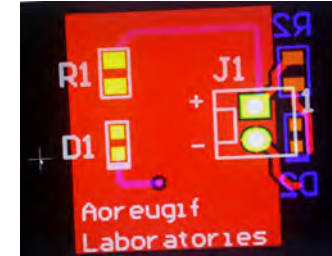
Darwin OP

- Wrote child friendly scripts for the Darwin-OP platform
 - Prevented fingers from getting crushed
- Demonstrated pushing cart in various conditions
- Gait for walking on slope, dirt, and flooded environments
 - Tested different stances to lower center of gravity
 - Tested PID values on Dynamixel servos



Other Projects

- Done with various teams throughout the years
 - Custom UAVs
 - PCB Layout
 - “High-Five” machine
 - Urban Gardening
 - Robot Surgery
 - Hackathons (various)
 - AT&T, VISA, Zappos, Barrick, etc.
 - Tracked HVAC power consumption and distribution based on work schedules
 - Programmed a sensor logger which sent CSV data to an Apache server
 - https://www.youtube.com/watch?v=E66R2u_fLOY
 - Medieval Siege Weapons



Let's Work Together

- Contact
 - joule@aoreugif.net
 - C: 702-204-4847
 - Currently under Pacific Daylight Time (UTC-7)