NATHAN T. HUI

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OBJECTIVE

Engineering student looking to explore embedded systems and robotics, particularly embedded control systems, embedded sensor networks, and low-level data aggregation from the perspective of developing technologies to enable scientific research.

EDUCATION

Masters of Science, Electrical Engineering (Intelligent Systems, Robotics, and Controls)
UC San Diego, San Diego, CA, March 30 2017 to September 7 2019
GPA: 3.005 / 4.000 Major GPA: 3.141

Bachelor of Science, Electrical Engineering
UC San Diego, San Diego, CA, September 24 2012 to March 25 2017
GPA: 3.092 / 4.000 Major GPA: 3.106

PROJECT AND RESEARCH EXPERIENCE

Triton Robosub - Mentor   January 7 2019 - current
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UCSD Dronelab / Center for Interdisciplinary Sciences, Art, Archaeology, and Architecture (CISA3) / Cultural Heritage Engineering Initiative (CHEI)   January 2015 - current
- Flew DJI S1000 to support development of underslung payload control (2024-02)
- Developed and tested a multicamera photogrammetry rig for shallow water demonstration of underwater photogrammetry in 2022-2024.
- Flew multirotor aircraft to support remote monitoring of shake table testing at the NHERI Large High Performance Outdoor Shake Table at UC San Diego from 2016 to 2024.
- Developed integrated 3-D visual mapping tools using stereo cameras to enable researchers to make high-quality 3-D models of areas in near real-time under an Undergraduate Research Fellowship from the Center of Integrated Access Networks (CIAN) in 2015.
- Falko Kuester, fkuester@ucsd.edu
- Dominique Rissolo, drissolo@ucsd.edu

UCSD Engineers for Exploration (E4E) - Project Lead   January 2 2014 - current
- Mentoring and managing students working on various research projects.
- FishSense
  - Conducted test dives to evaluate the performance and operation of an underwater camera fitted with a laser for fish length detection.
  - Supervised the development, testing, and production of citizen science systems to survey fish lengths using underwater cameras and machine learning.
  - Supported at-sea recording and measurement of fish with the California Cooperative Fisheries Research Program using non-invasive photogrammetric techniques.
- Smartfin
  - Implemented C++ firmware on Particle IoT platforms for embedded citizen science smart surfboard sensor fins.

- – Supervised and revised development of carrier PCB for embedded Particle IoT platforms.
  - – Supervised development of production procedures of Smartfins.
  - – Supervised and executed field-testing of prototype Smartfins.
- Mangrove Monitoring
  - – Led international expedition to Jamaica to survey mangrove extent using drones and on-ground survey techniques
- Guatemala
  - – Conducted scientific survey flights of multirotor-based aerial photography systems to capture imagery of Maya ruins in Guatemala to facilitate developing 3D models of ancient Maya cities in 2015.
  - – Provided autopilot monitoring and ground support for fixed-wing drone-based mapping flights to capture imagery of Guatemalan forests to facilitate developing topographic maps to help guide archaeologists in 2015.
- Radio Telemetry Tracking
  - – Leading the development, testing, and deployment of C/C++ and Python embedded software and computing hardware for aerial ecological radio transmitter tracking surveys, using software-defined radios to detect transmissions and embedded Linux single-board computers for online processing.
  - – Leading the development, testing of 3D printed mechanical subsystems in SolidWorks for mounting scientific payloads to multirotor aircraft.
  - – Developed and deployed embedded C software onto an ATMega microprocessor for controlling a sensor payload and aggregating data from low-level sensors over serial communications.
  - – Designed and built a single-board computer supporting an ATMega microprocessor for integrating sensor data and user interface hardware.
  - – Conducted daytime and nighttime test flights and scientific survey flights of a multirotor-based wildlife tracking system using radio transmitters.
  - – Integrated radio tracking sensor payloads into multiple multirotor systems using design and requirements analysis to enable robust long-endurance survey flights in austere environments.
  - – Analyzed post-crash telemetry in deployed and testing enviornments to determine and mitigate causes of crashes to facilitate system robustness.
  - – Explored technology to dynamically generate and optimize drone flight paths for aerial survey using real-time feedback from cameras and other drone sensors, including terrain following/mapping and source seeking techniques.
- Stabilized Aerial Camera Platform
  - – Developed a stabilization controller in C on an embedded microcontroller for an actively stabilized DSLR mount for a persistent aerial survey platform, aimed at providing researchers with a wide-angle view coupled with pan-capable zoom imagery.
- Instructed student pilots in practical and theoretical aspects of flying SUAS in preparation for operating drones on scientific deployments.
- Operated the autopilot and ground station for multirotor-based thermal imaging to detect birds in nests for ecological surveys.

- Primary Investigator: Ryan Kastner, (858) 534-3534, kastner@ucsd.edu; Curt Schurgers, (858) 246-1442, cschurgers@ucsd.edu

Teledyne RD Instruments - Firmware Engineer November 25 2019 - January 14 2022
- Developed Doppler Velocity Log firmware on STM32H7 MCU, providing device driver and communications packages for the WayFinder DVL.

- Transitioned Acoustic Doppler Current Profiler firmware on 68k CPU from assembly to C, providing sustainable transition to new 68k soft core CPU.

- Utilized CI/CD techniques to rapidly test and validate DSP design implemented on an FPGA.

- Conducted automated complex operational stress testing and design verification/validation of acoustic sensors.

- Developed extensible binary communication frameworks for modular inter-processor communications supporting data transfer, time synchronization, and command/control.

- Developed firmware for aggressive low-power microcontrollers to support power control of long-duration self-contained sensor systems.

UCSD SIO Jaffe Lab - Graduate Researcher   March 28 2018 - August 30 2018
- Utilized Python to develop a distributed control system for a hemispherical multicamera array run by a cluster of Raspberry Pi Zeros, and created a workflow to synchronize and stitch immersive video from the camera array.

- Improved the design of the structural support for the multi-camera array in Solidworks to improve stability and rigidness.

- Supported a deployment of a plankton camera on a Conductivity, Temperature, and Depth sensor rig on the R/V Gordon Sproul.

- Primary Supervisor: Paul Roberts (858) 534-8151, plroberts@ucsd.edu, Jules Jaffe (858) 534-6101

UCSD Veridrone - Graduate Researcher   March 30 2017 - June 15 2018
- Mentored an undergraduate research project examining using machine learning to predict multirotor failures by examining real-time telemetry.

- Performed state space exploration of slow discrete time implementation of source seeking algorithms.

- Primary Investigators: Ryan Kastner, (858) 534-3534, kastner@ucsd.edu; Sorin Lerner, (858) 534-8883, lerner@ucsd.edu; Miroslav Krstic, (858) 534-5556, mkrstic@ucsd.edu

UCSD AUVSI - System Lead   September 24 2012 - June 13 2014
- Led development of an actively stabilized composite DSLR gimbal, composite payload computer enclosure, composite payload launcher, composite battery carrier, and autopilot enclosure with minimized system volume and weight.

- Developed embedded software on a 32-bit ARM microcontroller to aggregate telemetry from an autopilot, camera gimbal, and imaging system and forward the summarized data to an image processing pipeline.

- Developed and validated embedded software on an 8-bit Atmel microcontroller in C to analyze and generate control signals for use in an RC failsafe device.

- Developed a DSLR gimbal from scratch with SolidWorks and various machine tools for isolating the imaging system from airframe during flight.

- Provided autopilot monitoring and ground support for test and competition flights.

UCSD Human Powered Submarine - Mechanical Engineer   September 24 2012 - June 14 2013

- Developed an integrated a dual-input synchronized power train from scratch for a human powered submarine with SolidWorks and various machine tools.

- Managed and organized CAD system for entire project to enable multiple designers to collaborate on the same SolidWorks assembly.

WORK EXPERIENCE

UC San Diego COSMOS - Cluster Assistant   March 30 2017 - Aug 30 2018

- Developed and implemented lesson plans to teach middle school students about robotics.

- Managed daily lab sessions where middle school students designed, assembled, and tested robots to complete various challenges.

- Supervisor: Curt Schurgers, (858) 246-1442, cschurgers@ucsd.edu; Michael Yip, (858) 822-4778, yip@ece.ucsd.edu

UCSD Outback Adventures - Lead Guide   January 2 2013 - January 15 2019

- Mentoring new staff in developing technical and interpersonal skills.

- Leading trips of students, staff, faculty, and community members to locations throughout the Southwestern United States and Western Mexico, providing instruction and leadership in outdoor activities including hiking, climbing, camping, caving, and kayaking.

- Presented various technical and leadership workshops at the Western Region Outdoor Leadership Conference, including *Emergency Backcountry Communications*, *Photography on Vertical Terrain*, and *Facilitating Staff Development on Trips*.

- Directed race planning and execution for UCSD Outback Adventures 2015 and 2014 Moon God 5K run, resulting in an improvement in race participation and net gains.

- Supervisor: Simon Teale, (858) 534-3534, steale@ucsd.edu

UCSD Outback Adventures - Rental Shop Student Manager   January 2 2013 - January 15 2019

- Managing and repairing outdoor equipment, including climbing gear, kayak trailers, first aid kits, skis, and snowboards to improve equipment readiness for trips and prolong equipment lifetimes.

- Rented outdoor recreation equipment to students, staff, faculty, and community members, and provided customer support to assist clients in planning and preparing for their outdoor adventures.

- Directed and implemented the transitioning of the Rental Shop to new Point of Sale and Rental Management software.

- Directed moving of all outdoor recreational equipment and retail inventory to a new location with fast deadline to operational status.

- Provided business operations support to other Outback Adventures programs in handling client payments, equipment usage and storage, and other general business administrative tasks.

- Mentoring new staff in developing technical and interpersonal skills.

- Supervisor: Tom Rottler, (858) 534-9098, trottler@ucsd.edu

Biosero LLC - Engineering Associate   June 30 2013 - September 20 2013

- Optimized tube cap removal device performance and systems integration, formalizing system specifications and integration with company automation products.

- Designed low-cost automated plate handling system using SolidWorks for coupling two automated liquid handling enclosures.

- Developed extensible code structure for software integration with touch screens, permitting intuitive user interface with automated liquid handling enclosures.

- Leveraged statistical computation capabilities of Microsoft Excel to analyze accuracy and precision of automated syringe pumps.

- Supervisor: Alice Tanibata, (858) 525-1645, alicetanibata@biosero.com

PILOTING EXPERIENCE

FAA Part 107 Small Unmanned Aerial Systems   Issued November 2016
36 PIC hours, 10 FI hours

- Tarot Ironman 650 - 20 Hours
- 3DR Solo - 15 Hours
- FoxTech Hover 1 - 10 Hours
- DJI Spreading Wings S800 - 3 hours
- 3DR Iris - 1 Hour

RELEVANT COURSEWORK

M.S. Electrical Engineering, UCSD
- ECE 299 - Independent Research
- ECE 285 - Intelligent Vehicles / Assisted Systems
- ECE 276A - Sensing and Estimation in Robotics
- ECE 275A - Statistical Parameter Estimation
- ECE 272A - Stocastic Processes and Dynamic Systems
- ECE 271A - Statistical Learning
- ECE 269 - Linear Algebra and Application
- ECE 250 - Random Processes
- ECE 180 - Software Systems
- ECE 180 - Smart Power Systems
- ECE 180 - GPU Programming
- ECE 143 - Programming for Data Analysis
- ECE 120 - Solar System Physics
- ECE 115 - Fast Prototyping
- CENG 114 - Probability and Statistical Methods for Engineers
- CSE 237B - Software for Embedded Systems
- CSE 237C - High Level Synthsis
- ENVR 140 - Wilderness and Human Values
- MAE 140 - Linear Circuits

B.S. Electrical Engineering, UCSD
- ECE 174 - Intro to Linear and Nonlinear Optimizations
- ECE 172A - Introduction to Intelligent Systems
- ECE 111 - Digital Design Project

- ECE 109 - Engineering Probability and Statistics
- ECE 107 - Electromagnetism
- ECE 103 - Fundamentals of Devices and Materials
- ECE 102 - Introduction to Active Circuit Design
- ECE 101 - Linear Systems Fundamentals
- ECE 100 - Linear Electronic Systems
- ECE 65 - Components And Circuits Lab
- ECE 45 - Circuits and Systems
- ECE 35 - Introduction to Analog Design
- ECE 30 - Introduction to Computer Engineering
- ECE 25 - Introduction to Digital Design
- ECE 15 - Engineering Computation
- CSE 237A - Introduction to Embedded Computing
- CSE 145 - Embedded System Design Project
- CSE 141 - Introduction to Computer Architecture
- CSE 140 - Component and Design Technologies / Digital Systems
- CSE 140L - Digital Systems Laboratory
- CSE 120 - Principles of Computer Operating Systems
- CSE 110 - Software Engineering
- CSE 101 - Design and Analysis of Algorithms
- CSE 100 - Advanced Data Structures
- CSE 30 - Computer Organization and Systems Programming
- CSE 21 - Math / Algorithms and Systems Analysis
- CSE 20 - Introduction to Discrete Mathematics
- CSE 15L - Software Tools and Techniques Lab
- CSE 12 - Basic Data Structures and Object Oriented Design
- CSE 11 - Introduction to Computer Science and Object Oriented: Java
- MATH 31BH - Honors Multivariable Calculus
- MATH 31AH - Honors Linear Algebra
- MATH 20E - Vector Calculus
- MATH 20D - Introduction to Differential Equations
- PHYS 2D - Physics: Relativity and Quantum Physics
- PHYS 2C - Physics: Fluids, Waves, Thermodynamics, Optics
- PHYS 2B - Physics: Electricity and Magnetism
- PHYS 2A - Physics: Mechanics
- BILD 3 - Organismic And Evolutionary Biology
- PSYC 7 - General Psychology: Developmental Fundamentals
- ECON 1 - Principles of Microeconomics
- HUM 5 - Modern Culture (1848 - Present)
- HUM 4 - Enlightenment, Romanticism, Revolution (1660 - 1848)
- HUM 3 - Renaissance, Reform, and Early Europe

- HUM 2 - Rome, Christianity and the Middle Ages
- HUM 1 - Foundations of Western Civilization: Israel and Greece
- ETHN 1A - Introduction to Populations Histories of the US
- TDDE 1 - Introduction to Design for the Theatre
- LTEN 23 - Literature: British Isles: 1832 - Present
- SIO 30 - The Oceans
- CHIN 20AD - Second Year Chinese - Dialect Speaker

EXPEDITION
EXPERIENCE

UCSD Jaffe Lab   Summer 2018
- Research Cruise, California Coast, 1 day, August 2018, Technical Crew

UCSD Engineers For Exploration   Spring 2015 - current
- Blueprint Earth, Mojave Desert, California. 3 days, November 2016, Sr. Engineer
- Radio Collar Tracker, Little Cayman, Cayman Islands. 10 days, May 2016, Operations Lead
- Radio Collar Tracker, Pedernales, Dominican Republic. 10 days, September 2015, Operations Lead
- Radio Collar Tracker, Pedernales, Dominican Republic. 14 days, July 2015, Operations Lead
- Maya Archeology, Peten, Guatemala. 7 days, May 2015, Technical Staff

UCSD Outback Adventures   Winter 2013 - Winter 2019
- Rock Climbing, Mission Gorge, California, 1 day, February 2019, Lead Guide
- Kayaking, Black Canyon, Arizona, 3 days, November 2018, Lead Guide (Mock Lead Supervisor)
- Caving, Anza Borrego, California, 2 days, November 2018, Lead Guide
- Backpacking, San Gorgonio, California, 2 days, October 2018, Lead Guide
- Canoing, Black Canyon, Arizona, 4 days, September 2018, Lead Guide (Mock Lead Supervisor)
- Kayaking, Coronado Bay, California, 1 day, August 2018, Lead Guide
- Kayaking, Mission Bay, California, 1 day, June 2018, Lead Guide
- Kayaking, La Jolla Shores, California, 1 day, May 2018, Lead Guide
- Snorkeling, La Jolla Cove, California, 1 day, May 2018, Lead Guide
- Snorkeling, La Jolla Cove, California, 1 day, April 2018, Lead Guide
- Kayaking, La Jolla Shores, California, 1 day, April 2018, Lead Guide
- Service Adventure, Catalina Island, California, 6 days, March 2018, Lead Guide
- Caving, Anza Borrego, California, 2 days, March 2018, Lead Guide
- Rock Climbing, Mission Gorge, 1 day, January 2018, Lead Guide
- Rock Climbing, Joshua Tree, 2 days, January 2018, Member
- Canoing, Black Canyon, Arizona, 4 days, November 2017, Lead Guide
- Caving, Anza Borrego, California, 2 days, October 2017, Lead Guide
- Canoing, Black Canyon, Arizona, 6 days, September 2017, Lead Guide
- Camping, Mt. Laguna, California, 2 days, August 2017, Lead Guide
- Kayaking, Mission Bay, California, 1 day, July 2017, Lead Guide

- Kayaking, Baja California, Mexico, 7 days, June 2017, Member
- Caving, Anza Borrego, California, 2 days, May 2017, Lead Guide
- Hiking, Mt. Laguna, California, 1 day, May 2017, Lead Guide
- Caving, Anza Borrego, California, 2 days, May 2017, Lead Guide
- Rock Climbing, Mission Gorge, California, 1 day, April 2017, Lead Guide
- Kayaking, Coronado Bay, California, 1 day, April 2017, Lead Guide
- Kayaking, Mission Bay, California, 1 day, April 2017, Lead Guide
- Kayaking, Black Canyon, Arizona, 6 days, March 2017, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, February 2017, Secondary Guide
- Rock Climbing, Joshua Tree, California, 1 day, January 2017, Secondary Guide
- Rock Climbing, Joshua Tree, California, 5 days, January 2017, Member
- Rock Climbing, Mission Gorge, California, 1 day, November 2016, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, October 2016, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, September 2016, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, August 2016, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, August 2016, Secondary Guide
- Snorkeling, La Jolla Cove, California, 1 day, August 2016, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, July 2016, Secondary Guide
- Camping, Mt. Laguna, California, 2 days, July 2016, Secondary Guide
- Mountaineering, Sierra Nevada, California, 9 days, June 2016, Member
- Rock Climbing, Mission Gorge, California, 1 day, May 2016, Secondary Guide
- Kayaking, Coronado Bay, California, 1 day, April 2016, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, February 2016, Secondary Guide
- Caving, Anza Borrego, California, 1 day, February 2016, Secondary Guide
- Caving, Anza Borrego, California, 2 days, January 2016, Secondary Guide
- Kayaking, Black Canyon, Arizona, 4 days, November 2015, Secondary Guide
- Backpacking, Joshua Tree, 3 days, November 2015, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, October 2015, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, October 2015, Secondary Guide
- Canoing, Black Canyon, Arizona, 6 days, September 2015, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, May 2015, Secondary Guide
- Caving, Anza Borrego, California, 2 days, April 2015, Secondary Guide
- Service Adventure, Catalina Island, California, 6 days, March 2015, Secondary Guide
- Backpacking, Joshua Tree, California, 3 days, February 2015, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, February 2015, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, December 2014, Secondary Guide

- Kayaking, Black Canyon, Arizona, 4 days, November 2014, Secondary Guide
- Hiking, Cowles Mountain, California, 1 day, November 2014, Secondary Guide
- Hiking, Cowles Mountain, California, 1 day, November 2014, Secondary Guide
- Caving, Anza Borrego, California, 2 days, November 2014, Secondary Guide
- Snorkeling, La Jolla Cove, California, 1 day, October 2014, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, October 2014, Secondary Guide
- Camping, Mt. Laguna, California, 2 days, August 2014, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, May 2014, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, May 2014, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, May 2014, Secondary Guide
- Kayaking, Mission Bay, California, 1 day, April 2014, Secondary Guide
- Rock Climbing, Mission Gorge, California, 1 day, February 2014, Secondary Guide
- Rock Climbing, Joshua Tree, California, 3 days, January 2014, Member
- Kayaking, Mission Bay, California, 1 day, May 2013, Assistant Guide
- Backpacking, Joshua Tree, California, 2 days, January 2013, Member
- Kayaking, Black Canyon, Arizona, 4 days, November 2012, Member

Personal
- Off-roading, Diablo Drop-off, Anza Borrego Desert State Park, California, 1 day, March 2019
- Climbing, Yosemite, 2 days, October 2018
- Caving, Anza Borrego, California, 1 day, August 2018
- Climbing, Joshua Tree National Park, 2 days, February 2017
- Climbing, New Jack City, California, 2 days, January 2017
- Climbing, Red Rocks National Conservation Area, Nevada, 3 days, November 2017
- Climbing, Alabama Hills, California, 3 days, November 2016
- Backpacking, Joshua Tree National Park, California, 2 days, February 2016
- Caving, Anza Borrego, California, 3 days, December 2015

Top Climbing Pitches
- North Arete (5.8, Alpine, 4 pitches), Mammoth Lakes Area, California, September 2018
- Change of Scene (5.10a, 1 pitch), New Jack City, California, January 2018
- Fine Day (5.10a, 1 pitch), New Jack City, California, January 2018
- Moon Where the Wind Blows (5.9, 1 pitch), Red Rocks National Preserve, Nevada, November 2017
- Manifest Destiny (5.9+, 1 pitch), Red Rocks National Preserve, Nevada, November 2017
- Ming Dynasty (5.9+, 1 pitch), Red Rocks National Preserve, Nevada, November 2017
- This is Sparta (5.9, 1 pitch), Red Rocks National Preserve, Nevada, November 2017

- Leonids (5.9, 3 pitches), El Cajon Mountain, California, February 2017

VOLUNTEER EXPERIENCE

UCSD Robosub - Mentor   November 1 2018 - current
- Mentored the UCSD Robosub team in improving their AUV by instructing students in soldering, diagnosing electrical systems issues, mechanical design, and systems design.
- Mentored the team in applying and developing foundational leadership and teamwork skills.

Catalina Environmental Leadership Program
- 12 hours, March 2018, Catalina Island, Environmental service and trail work
- 12 hours, March 2015, Catalina Island, Environmental service and trail work

Pacific Crest Trail Association
- 16 hours, March 2016, Santa Clarita, Trail work

Allied Climbers, San Diego
- 8 hours, October 2016, Mission Trails Regional Park, Trail work

ADDITIONAL SKILLS

Outdoor Leadership
Wilderness First Responder, Conflict Resolution, Experiential Learning, Group Management

Outdoor Technical Skills
Sea Kayaking (including surf launch/recovery, Eskimo roll, kayak repair, towing), Canoing, Rock Climbing (including top rope belay, anchor placement and setup, counterbalance ascent, single rope technique, lead climbing, trad climbing, gear placement, aid climbing, multipitch climbing), Land Navigation, Class B CDL

Unmanned Aerial Vehicles
Part 107 Small Unmanned Aerial Systems Pilot

PORTFOLIO

Linkedin - https://www.linkedin.com/in/ntlhui

Github - https://github.com/ntlhui