Nicholas J. Conn, PhD

Executive • Scientist • Engineer • Inventor • Entrepreneur

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Overview

I am passionate about creating revolutionary technologies that have a meaningful impact on people's lives. I believe in the power of teamwork and leading by example. As a leader, I foster a culture of continuous learning, honesty, mutual respect, and fearlessness. I empower my team with the mentoring, resources, and autonomy needed to both grow individually and better the organization. My specialties include algorithm development, machine learning, clinical study design, hardware engineering, and embedded software development. I have successfully navigated the FDA 510(k) regulatory pathway from concept to clearance. Earlier in my career, I founded a company based on technology I developed during my PhD, which raised over $55M.

Skills

Leadership

- Cross functional strategic leadership
- Team building
- New capability development
- Contract negotiation
- Financial and resource management
- Early-stage business development
- Public speaking and media training
- Fundraising and investor relations

Scientific and Engineering

- New product development
- Clinical study design
- Statistical analysis and design
- Quality assurance
- FDA interaction
- Verification and validation
- Wearable and IoT devices
- Electronics manufacturing

Software

- Machine learning, PyTorch
- Signal and image processing
- Python, C, C++, JavaScript
- Custom algorithms and APIs
- Computational and data science
- Amazon Web Services (AWS)
- Mathematical modeling
- Docker, git, Jira, Linux, and more

Experience

Casana **Chief Scientific Officer and Board Member** Rochester, NY 2020 – 2024

- Managed the scientific operations of the company, including the scientific and medical advisory board
- Led clinical, scientific, and technical interactions with FDA, including pre-submissions and 510(k) submissions
- Responsible for clinical study strategy, design, and analysis; successfully completed 10+ IRB approved studies
- Developed, documented, and tested FDA cleared algorithms for heart rate (HR) and blood oxygenation (SpO2)
- Led the algorithm team through multiple FDA submissions and V&V, including cuffless blood pressure (BP)
- Responsible for the quality management system and QA throughout all design and development phases
- Spearheaded second-generation eQMS and improved quality team throughput by 1.7x over a 6-month period

Casana (FKA Heart Health Intelligence)   Chief Executive Officer and Founder   Rochester, NY   2018 – 2020

- Raised over $16M in the Seed and Series A funding, including capital from General Catalyst
- Forged best-in-class clinical and strategic partnerships across the country
- Developed business plan, profit and loss statements (P&L), pitch deck, and go-to-market strategy
- Primary contributor to initial firmware and hardware development for the Heart Seat
- Created a strong culture of excellence and built a highly performing team from the ground up

Hardware Breakout LLC   Consultant and Owner   2014 – Current

- Engineering consulting services for multiple wearable device companies, developed custom signal quality and clinical algorithms, embedded code, ultra-low power systems, project planning, and grant applications
- Developed iOS application in Swift for interfacing with MIDI hardware
- Custom designed online store and blog, focusing on development kits and breakout boards
- Developed custom Android application for interfacing with wireless (BLE) development board
- Developed comprehensive battery-powered Bluetooth Low Energy Booster Pack for the MSP430 LaunchPad

Rochester Institute of Technology   Postdoctoral Fellow   Rochester, NY   2016 – 2018

- Co-authored NIH R01 grant for reducing heart failure hospitalizations (awarded) and multiple R21 grants
- Algorithm development for stroke volume and blood pressure estimation from ballistocardiogram (BCG)
- Machine learning algorithm for estimating body weight of a seated individual (TensorFlow)

Hackaday   Technical Writer (Consulting)   2014

- Create short blog posts that featured unique and innovative work, selected from a user submitted tip line
- Authored 51 posts, resulting in more than 500,000 views (2014 to 2016)

Impact Technologies (Sikorsky Corp.)   Embedded System Development   Rochester, NY   2011

- Assembled, modified, and redesigned embedded platforms which capture and record data in real-time from multiple channels to use as an input to onboard health monitoring algorithms

Biotronik SE & Co. KG   Research and Development   Berlin, Germany   2010

- Created a simulated model of the electrical conduction system of the heart used for verification of Implantable Cardiac Defibrillator (ICD) and pacemaker hardware and software
- The heart model was designed to match the electrophysiology of the human heart; it was able to accurately simulate a multitude of rhythm disorders and react to pacemaker/ICD therapy

Carestream Health   Electrical Engineering Co-op   Rochester, NY   2009

- Validated multiple image processing algorithms and a Quality Tool for FDA compliant validation using MATLAB to create stress images for artifact testing
- Statistical analysis of images to determine numerical thresholds for an early-stage digital radiography standard

Moog   Electrical Engineering Co-op   East Aurora, NY   2008

- Motor control VHDL core – creating documentation, including functional design specifications (FDS), and consolidating multiple projects into a single reusable core
- From customer specification through physical implementation – simulations, design reviews, and testing

Harris Communications   Electrical Engineering Co-op   Bridgewater, NJ   2007

- Wrote Hitachi microprocessor and VHDL code to extract data from HD video stream
- Java host for splice point insertion into VANC for HDTV transmissions and communication with hardware over SNMP for a real-time video multiplexing display, successfully used to win business deal

Education

Microsystems Engineering – PhD   **Rochester Institute of Technology**   **Rochester, NY   2016**

Specialized in cardiovascular physiology, ultra-low power medical instrumentation, biomedical signal processing, custom algorithm development, mathematical optimization, and clinical testing on human subjects.

- Co-author of grant that received $1.6 million in funding from Google, the first of its kind at RIT
- Directly managed 7 engineers and a multidisciplinary team (e.g., co-ops, consultants, masters and PhD students)
- Dissertation **–** *"Robust Algorithms for Unattended Monitoring of Cardiovascular Health"*
  - o Designed and executed over 6 IRB approved studies on over 300 human subjects
  - o Developed and published best-in-class ECG and PPG delineation algorithms
  - o First ever toilet seat that can measure blood pressure, stroke volume, and cardiac output
  - o Designed, implemented, and maintained a MongoDB database in Amazon Elastic Compute Cloud (EC2)
  - o Ultra-low-power cardiovascular monitoring system with < 5uW of idle power consumption
  - o Created all custom circuitry, firmware, and algorithms for the smart toilet seat system
- Classes – Theoretical Methods, Nanotechnology and Microsystems, Microelectronics, Material Science, Optimization Methods, Information Theory, Pattern Recognition

Electrical Engineering – MS   **Rochester Institute of Technology**   **Rochester, NY   2012**

True sub-Nyquist compressed sensing of the photoplethysmography (PPG), demonstrating a 7.5-fold power consumption reduction in the analog-front-end with custom firmware.

- Specializing in signal processing, low-power embedded systems, and machine learning
- Classes **–** Matrix Methods, Random Signals and Noise, Digital Image Processing, Adaptive Signal Processing, Digital Signal Processing, Robotics
- Thesis – *"A Comparison of Reconstruction Methods for Compressed Sensing of the Photoplethysmogram"*

Electrical Engineering – BS   **Rochester Institute of Technology**   **Rochester, NY   2011**

Biomedical option & German language concentration; multiple dean's list recipient.

- Classes **–** Anatomy & Physiology I & II, Control Systems, Electrophysiology, Biomedical Instrumentation, Embedded Digital Signal Processing of Biomedical Signals, Biomedical Signal Processing
- Study Abroad **–** Intensive linguistic and cultural studies in Marburg, Germany
- Research Grant **–** RISE Professional grant typically for master's and PhD students, provided by the German Federal Ministry for Education and Research (DAAD) to work in Berlin, Germany for 6+ months
- Senior Design Project **–** Non-contact EEG (electroencephalograph) system with novel test fixture

Publications and Patents

- Borkholder, David A.; McChord, Austin; Conn, Nicholas J.; Petrucelli, Steve; **"*Systems, devices, and methods for measuring loads and forces of a seated subject using scale devices*"**, US Patent Application 11,650,094, 2023 and 18/130,286, International EP, AU, JP, 2024
- Conn, Nicholas J., **"*Systems, devices, and methods for monitoring loads and forces on a seat*"**, US Patent Application 17/885,299, US20220378373A1, International JP, WO (PCT), EP, AU, 2022
- Conn, Nicholas J., Schwarz, Karl Q.; Borkholder, David A.; **"*In-Home Cardiovascular Monitoring System for Heart Failure: Comparative Study*"** JMIR Mhealth Uhealth 2019;7(1):e12419
- Conn, Nicholas J., Schwarz, Karl Q.; Borkholder, David A.; **"*Nontraditional Electrocardiogram and Algorithms for Inconspicuous In-Home Monitoring: Comparative Study*"** JMIR Mhealth Uhealth 2018;6(5):e120

- W. Ku, N. Conn, D. Borkholder and I. Nwogu, **_"Novel Biometrics: Analysis of an Unattended Health Monitoring System,"_** 2018 IEEE 9th International Conference on Biometrics Theory, Applications and Systems (BTAS), Redondo Beach, CA, USA, 2018, pp. 1-7, doi: 10.1109/BTAS.2018.8698600.
- Conn, Nicholas J.; **_"Robust Algorithms for Unattended Monitoring of Cardiovascular Health"_** (2016). Dissertation. Rochester Institute of Technology. Accessed from https://scholarworks.rit.edu/theses/9277
- Borkholder, David A.; Conn, Nicholas J.; Haghpanahi, Masoumeh, **_"Apparatus, System and Method for Medical Analyses of Seated Individual,"_** US Patent Application No. 15/190,534, filed on June 23, 2016
- Conn, Nicholas J.; Borkholder, David A., **_"Wavelet based photoplethysmogram foot delineation for heart rate variability applications,"_** Signal Processing in Medicine and Biology Symposium (SPMB), 2013 IEEE, vol., no., pp.1,5, 7-7 Dec. 2013
- Conn, Nicholas J.; Borkholder, David A., **_"A comparison of reconstruction methods for compressed sensing of the photoplethysmogram,"_** in 10th international conference on Sampling Theory and Applications (SampTA 2013), Bremen, Germany, Jul. 2013, pp. 204–207

Certifications

- Biomedical Principal Investigator (Jan 2021 to Current) – CITI Program, A Division of BRANY
- GCP for Clinical Investigations of Devices (Jan 2021 to Current) – CITI Program, A Division of BRANY

Awards

- Distinguished Alumni Award from RIT (2023-2024)
- Growth Equity Deal of the Year from Upstate Capital (2020)
- NextCorps (sponsored by AlphaLab) Hardware Pitch Competition winner (2019)
- Novartis Biome Pitch Competition at Cannes Lion Festival in partnership with McCann Health (2019)
- RIT Tiger Tank pitch competition winner (2018)
- 100 Years of Co-op Story Winners from RIT (2012)

Interests

- Mentoring entrepreneurs and researchers
- Turning concepts into potential products: personal cooling devices, brewing sensors, games, and more
- DIY manufacturing: PCB reflow oven, laser cutting and engraving, 3D printing
- IEEE member (since 2006): Medicine and Biology Society, Signal Processing Society
- Swimming – Painting – Language – Baseball – Cooking – Gardening – Food – Snorkeling– Piano – Rubik's Cube