

Nathan Daniel

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INDUSTRY

Robotics R&D Engineer II

Oct 2023 – Present

Medtronic Robotic-Assisted Surgery | Boston, MA

- Supporting cross-functional teams in development of complex electromechanical subsystems for the Hugo surgical robotic platform, enhancing system reliability and managing capital worth over \$60 million
- Collaborating with surgeons to pinpoint user experience obstacles in the surgical and robotic workflow, and translating pain points in the clinical workflow into advanced software assignments for engineers
- Implementing advanced computer vision algorithms to track instruments within patient's anatomy to enhance procedure planning and improve overall system precision and efficiency
- Writing and maintaining comprehensive technical documentation, including system architecture diagrams, user manuals, and troubleshooting guides, to support field service engineers and other software teams

PROJECTS

6-DOF Miniature Robotic Arm

- Designed, 3D printed, and assembled a 6-link robotic manipulator modeled after the MAKO 4 hip & knee replacement robot for remote software teams to facilitate repeatable position control testing, using Solidworks & RMD actuators (X6 and X8)
- Replaced original RMD encoders with RLS absolute magnetic encoders, designing custom fixtures to ensure compatibility and daisy-chaining all components into a cohesive control circuit. Tuned gains of actuators and created SW repository for precise and repeatable manipulator control

Surgical Catheter Controller Design

- Designed open & closed-loop controllers (Python/C++) to evaluate straightness of motion and directional accuracy of Johnson & Johnson's endoluminal robot catheter tip in a performance evaluation script used on every Monarch tool produced (~20,000 a year)
- Enhanced simulated case testing for instrumentation and V&V teams by redesigning closed-loop controllers to pass user interface commands directly to robot joints. This eliminated the need for intermediate inverse kinematic commands, interpreting position differences as user feedback similar to how a surgeon controls the robot

Technical Skills

Programming/Embedded Systems

- Python, C++, Java, C/Objective-C, R, x86, ARM, Arduino, Microcontrollers (e.g., STM32, AVR), FPGA Development, MATLAB/Simulink, Shell Scripting

Machine Learning/Database Management

- TensorFlow, PyTorch, Scikit-Learn, SQL, MongoDB, PostgreSQL

Software Development/Integration

- Git, Docker, Jenkins, CI/CD, Agile Methodologies

Networking/Devops

- WebRTC, Networking Protocols (TCP/IP, UDP), API Development and Integration (REST, GraphQL)

EDUCATION

Purdue University, West Lafayette | Master of Science (MS), Mechanical Engineering

Class of 2023

- Concentration in Robotics

Purdue University, West Lafayette | Bachelor of Science (BS) Mechanical Engineering

Class of 2022

- Minor in Computer Science
- Clubs & Extracurriculars:
 - Autonomous Robotics Club of Purdue Team Member and Youth Educational Lead
 - Purdue Solar Racing Club Team Member of Chassis Design Group