

Joshua Jimenez

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EDUCATION

University of Illinois Urbana-Champaign

BS in Systems Engineering and Design, Minor in Computer Science

Urbana, IL

Expected May 2028

- **Coursework:** Linear Algebra, Data Structures, Analysis of Data, Dynamics, Discrete Structures; *in progress:* Control Systems, System Programming (C, threads, synchronization), AI-Driven Intelligent Systems

EXPERIENCE

Autonomous Systems Research Assistant

Center for Autonomous Construction and Manufacturing at Scale (CACMS)

Apr. 2026 – Present

Urbana, IL

Soil-Moisture Perception for an Unmanned Ground Vehicle | PyTorch, Blender/Cycles Apr. 2026 – Present

- Lead perception on a camera + lidar terrain classifier (dry / semi-wet / saturated + no-verdict) fusing RGB, near-IR, and 64-beam Ouster OS1 lidar, budgeted for a 6 W x86 SBC decoding two 5 MP streams
- Derived imaging geometry from first principles (GSD, motion blur, per-frame observation count), correcting a 2–5× overstatement of the temporal-voting budget and setting camera mode (5 MP @ 30 fps over VGA @ 112 fps)
- Built a ~13k-line, 201-test Blender/Cycles synthetic-data renderer: 10,000+ labeled frames per batch with per-pixel moisture, depth, segmentation, and simulated lidar; calibrated to LUCAS soil spectra
- Targeted sim-to-real gaps with label-blind domain randomization: photoscanned soil textures, a 336-HDRI sky bank with sun extraction, dusk/dawn and overcast regimes, canopy shadows, and vehicle self-shadowing
- Measured lighting randomization swamping the class signal (3.55× vs. 1.7×); fixed it with irradiance-tracked exposure and a regression validator; verified exposure linearity to 0.01% (84-render gray-card sweep)
- Diagnosed a domain shift between dataset generations with strip-statistic PCA and random-forest probes, isolated lamp color temperature via same-seed re-renders, and fixed it with a white-balance-relative illuminant model
- Showed via a controlled A/B pilot (1,200 synthetic images, one variable) that a brightness shortcut capped the model: widening photometric jitter gained +0.12 macro-F1 and cut saturated→dry confusions from 21 to 0
- Built the PyTorch training framework (RGB / NIR / early-fusion arms; motion-blur and rolling-shutter augmentation from vehicle speed and exposure) and an ONNX→OpenVINO fp32/fp16/int8 latency harness
- Anchored simulation parameters in bench measurements (drying-tray soil series with mass tracking, lidar-return modeling over trays, camera characterization); governed design through 25+ architecture decision records

Autonomous Navigation on a Clearpath Husky A200 | ROS 2, Nav2, C++, Python

June – July 2026

- Took a 50 kg UGV from bare hardware to autonomous point-to-goal navigation via Nav2 on a SLAM-built map
- Integrated Ouster OS1 lidar, MultiSense S27 stereo camera, and MicroStrain AHRS into ROS 2 Humble
- Wrote an instrumented closed-loop controller (C++/Python) with configurable gains, a safety watchdog, and per-run metrics logging; authored a field runbook with an e-stop pre-flight checklist

PROJECTS

Audio Rate – Acoustic Exertion Estimation | SE 498 Team Lead; audio ML

Sep. – Dec. 2026

- Lead a 3-person team building a system to estimate exertion (%HRR) from phone breathing audio; designed the 16 kHz log-mel → CNN + GRU → int8 on-device pipeline and leave-one-participant/device-out splits
- Built the iOS capture app (48 kHz audio, BLE Polar H10 client) with clock sync confirmed to ~6 ms

CATrack Inspect AI – HackIllinois Caterpillar Challenge | Python, FastAPI, Modal

Feb. 2026

- Fused Whisper and Claude Vision to grade anomalies from technicians' voice notes and photos of a Cat D6N dozer

LEADERSHIP

Product Lead, Product Space UIUC | Product Fellowship (6% acceptance rate)

Feb. 2026 – Present

- Co-lead a six-person 3D-printing feasibility study; led development of a parametric generator (Fusion 360 API)

Treasurer, Philippine Student Association | Lead financial advisor, 200+ members

May 2026 – Present

TECHNICAL SKILLS

Robotics: ROS 2 (Humble), Nav2, SLAM, Ouster lidar, stereo and RGB/NIR cameras, AHRS, V4L2, Linux

Perception & ML: PyTorch, OpenCV, NumPy/SciPy, scikit-learn, ONNX/OpenVINO, Blender/Cycles (bpy)

Languages & Tools: Python, C++, C, Swift, MATLAB, SQL, Git, FastAPI, Fusion 360, CVAT

Spoken: English (fluent), Japanese (intermediate)