

KULBIR SINGH AHLUWALIA

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SUMMARY

PhD candidate in Computer Science at UIUC (expected May 2027), researching Vision-Language Models for embodied AI and robot navigation. First-author RSS 2026 submission on VLM-based waypoint generation achieving 90% field success rate. Deployed 6 open-source VLMs at Earthsense for agricultural robot navigation. Expertise in ROS2, sensor fusion (EKF), mobile manipulation, and physical AI systems. Seeking Summer 2026 robotics/AI internship.

EDUCATION

Ph.D. in Computer Science, University of Illinois at Urbana-Champaign, USA (June 2022 - Present, Expected May 2027), GPA: 3.91/4

Advisors: Dr. Girish Chowdhary & Dr. Julia Hockenmaier

M.Eng. in Robotics, University of Maryland, College Park, USA (Aug 2019 - May 2021), GPA: 3.88/4

B.Tech. in Electrical Engineering, Punjab Engineering College, India (Aug 2015 - May 2019), GPA: 8.12/10

RESEARCH PAPERS

- **Ahluwalia, K.S.***; Gummadi, S.; Cuaran, J.; McGuire, M.; Hockenmaier, J.; Chowdhary, G. Learning Natural Language Conditioned Waypoint Generation in 2D Image Space for Agricultural Mobile Robots. (Submitting to RSS 2026) **First Author*
- Cuaran, J.; **Ahluwalia, K.S.**; Koe, K.; Uppalapati, N.K.; Chowdhary, G. Active Semantic Mapping with Mobile Manipulator in Horticultural Environments. (Accepted to ICRA 2025) [[Project Website](#)] [[arXiv PDF](#)] [[arXiv](#)]
- Rangwala, M.; Liu, J.; **Ahluwalia, K.S.**; Ghajar, S.; Dhimi, H.S.; Tracy, B.F.; Tokekar, P.; Williams, R.K. Deep-PaSTL: Spatio-Temporal Deep Learning Methods for Predicting Long-Term Pasture Terrains Using Synthetic Datasets. Agronomy 2021, 11, 2245. (published in Agronomy as part of the Special Issue AI and Agricultural Robots) [[Link to published paper](#)] [[PDF](#)]
- Liu, J.; Rangwala, M.; **Ahluwalia, K.S.**; Ghajar, S.; Dhimi, H.S.; Tracy, B.F.; Tokekar, P.; Williams, R.K. “Intermittent Deployment for Large-Scale Multi-Robot Forage Perception: Data Synthesis, Prediction, and Planning”, 2021. [[arXiv](#)] [[PDF](#)] (published at IEEE TASE, Transactions on Automation Science and Engineering)

EXPERIENCE

AI Intern, Earthsense Inc., Urbana, IL, USA

May 2025 - Aug 2025

- Developed OmniBot, a 7-stage VLM-based pipeline for NL-conditioned waypoint generation, achieving 90% success rate in field trials.
- Deployed 6 VLMs (Molmo-7B, Qwen-2.5-VL-72B, Gemma-3, Llama4-Scout) on Jetson AGX Orin at 3.8-5.6 FPS.
- Created auto-labeling pipeline with Florence2, DINO-X, Grounded SAM2, reducing prep time from 6 weeks to 1 day.

Teaching Assistant, CS498GC: Mobile Robotics, UIUC

Aug 2025 - Dec 2025

- Co-developed ROS2 curriculum: odometry, EKF sensor fusion, SLAM, mobile manipulation with 13-DOF Husky-UR3.
- Built autograding infrastructure and created 44 debugging guides addressing 80% of student failure patterns.

Graduate Research Assistant, UIUC

Aug 2022 - Present

Advisors: Dr. Girish Chowdhary & Dr. Julia Hockenmaier

- Researching 3D semantic representations for robot environment mapping and relocalization after failures.
- Constructed topological maps for visual-language navigation using IMU, GPS, and RGB camera data.

TECHNICAL SKILLS

Languages	Python, C++, MATLAB
VLMs/LLMs	Qwen-2.5-VL-72B, Molmo-7B, Gemma-3, Llama4-Scout, Spatial-VLM, Florence2, DINO-X
Libraries	PyTorch, HuggingFace Transformers, vLLM, NumPy, OpenCV, SciPy, Grounded SAM2
Robotics	ROS2 (Humble, Jazzy), Gazebo, RViz2, MoveIt2, ros2_control, Nav2
Other	CUDA, Linux, Docker, Git, Jetson AGX Orin, LaTeX, Blender

PROJECTS

- **13-DOF Mobile Manipulator Simulation (Fall 2025)** - Husky base + UR3 arm + gripper in Gazebo with ros2_control
- **EKF Sensor Fusion (Fall 2025)** - 16-state EKF fusing GPS, IMU, wheel encoders for robot localization
- **Stereo Depth Enhancement (2024)** - Diffusion model outperforming Marigold/Depth-Anything-V2 by 46%
- **SLAM from 2D LiDAR** - Split and merge line extraction algorithm
- **EKF for GPS+IMU+Encoder Fusion** - State estimation for field robots
- **Multi-Robot Coordination** - Persistent monitoring with UAV-UGV teams
- **Autonomous Vaccine Delivery Robot** - End-to-end autonomous navigation
- **Self-adjusting Roadmaps** - Navigation in unknown environments using LD-PRM
- **Visual Odometry** - Motion estimation from camera sequences
- **Teleoperated Robotic Arm** - Gesture-controlled manipulation