

# SYED USAMA BIN SABIR

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PhD roboticist specializing in robotics perception and autonomy, with hands-on experience in sensor fusion, deep learning based detection, and real-world field deployment of robotic systems. Seeking a robotics perception or autonomy internship to apply expertise in ROS2, computer vision, and integrated system design to industrial-scale challenges.

## Education

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### • Cornell University, NY, United States

PhD in Biological and Environmental Engineering (Agricultural Robotics)

Jan 2025 - Present

*Research Project: Vision Based Robotic Fruit Thinning Using Soft Growing Manipulators*

*Focus Areas: Robotics Perception, Integrated Systems, Field Robotics, System Design*

### • Washington State University Pullman, WA, United States

PhD in Biological Systems Engineering (Robotics and Automation)

May 2023 – Dec 2024

Research Project: Robotic Tree Fruit Operations Using Soft Growing Manipulator

### • Air University, Islamabad, Pakistan

Bachelor of Mechatronics Engineering; GPA: 3.35/4.0

September 2016 - August 2020

Thesis Project: Design and Fabrication of Exoskeleton for Power Augmentation of Arm using Intuitive Control

## Technical Skills

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- **Robotics & Autonomy:** ROS, ROS2, NAV2, SLAM Toolbox, Gazebo, Robot Localization Module, Motion Planning
- **Perception:** OpenCV, Sensor Fusion, Sensor Noise Modelling, Computer Vision, State Estimation
- **Programming:** Python, C++, C#, C
- **Tools & Platforms:** Git, Docker, MATLAB, SolidWorks, Fusion 360, Unity
- **Hardware:** IMU, LiDAR, Stereo Cameras, Single Board Computers, Embedded Systems, PCB Design
- **Operating Systems:** Linux, Windows

## Experience

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### • Aro

Edmonton, Canada - Remote

*Robotics Engineer (Part-time)*

June 2021 – April 2023

- Led and supervised a remote software team developing autonomy and control software for autonomous mobile robots
- Deployed navigation module of ROS2 (Nav2) on an in-house developed autonomous mobile robot (AMR) to follow defined waypoints

- Implemented sensor fusion of wheel odometry and IMU using Bayesian filtering in Python and C++ for accurate AMR localization in warehouse
- Integrated SLAM toolbox for real-time obstacle avoidance by generating dynamic occupancy grid.
- Constructed custom messages for indigenous hardware modules and sensors.
- Developed low-level driver files for encoded motors in C and C++, enabling precise velocity and position control of the AMR drivetrain
- Developed AMR control interface in Unity to control and monitor robot behavior for handheld devices involving reconstruction of ROS messages in Unity pipeline.

- **Auto Canvas**

**Islamabad, Pakistan - On Site**

*Perception Engineer (Full-time)*

Nov 2020 – April 2023

- Optimized ego-vehicle perception and localization pipelines using ROS Robot Localization package
- Designed sensor placement tool to minimize blind spots for LiDAR and camera systems for autonomous vehicles
- Developed tools to visualize both final and intermediate output of existing pipelines using ROS.
- Processed large-scale autonomous vehicle datasets for clients including Porsche, Audi, AVL, and dSPACE to generate high-quality maps and trajectories.

## Projects

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- **Vision-Based Robotic Fruit Thinning with Soft Manipulator (Ongoing - Cornell University):**

- Developed a vision-based control system for a pneumatic soft robotic manipulator (SRM) for autonomous flower thinning
- Implemented deep learning based detection, perception and segmentation using RGB-D vision in ROS2, achieving 98% detection accuracy across indoor and outdoor conditions
- Integrated multi-camera visual servoing and IMU-based sensor fusion for accurate end-effector localization (position error <4 cm)
- Developed real-time perception-control algorithm achieving robust performance in unstructured outdoor orchard environments
- Conducted real-world field validation in orchards achieving end-effector position error under 4 cm, with low latency inference suitable for real-time deployment

- **Bin Lifting Mechanism – Autonomous Orchard Bin-Hauling Robot (Washington State University)**

- Designed and machined a custom bin lifting mechanism compatible with NEMA 34 slider rail
- Created structural components (machined tongs, rail system) for secure and stable bin engagement
- Integrated actuation and power distribution from the robot's onboard battery (farm-ng Amiga platform)
- Integrated mechanical, electrical, and control system modules for reliable real-world performance

- **Autonomous Indoor UGV Platform:**

- Developed an end-to-end autonomous mobile robot for warehouse logistics using ROS2 architecture
- Deployed ROS2 Nav2 stack along with SLAM Toolbox for goal-directed and waypoint-based task navigation
- Applied sensor fusion of wheel odometry and IMU for robust and accurate pose estimation
- Designed multiple configurable operating modes including surveillance, sorting, and cleaning
- Implemented real-time obstacle detection and avoidance for safe navigation around people and objects

- **Power Augmenting Exoskeleton (Undergraduate Thesis Project):**

- Designed and fabricated a lightweight wearable exoskeleton for 1.5 x arm strength augmentation
- Implemented EMG-based intuitive control using real-time gesture classification from collected data
- Applied Linear Discriminant Analysis (LDA) for signal processing and intent prediction
- Developed a fully functional prototype weighing 7 kg with 10 kg load-bearing capacity
- Delivered a cost-effective system under 600 USD, funded by Ministry of Information Technology, Pakistan

## Publications

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Syed, Ahmed, K., Sabir, U., & Naseer, N. (2021). *Design and Fabrication of Exoskeleton for Power Augmentation of Arm using Intuitive Control*. <https://doi.org/10.1109/aims52415.2021.9466021>

Divyanth, L. G., Bin Sabir, S. U., Rathore, D., Khot, L. R., Mattupalli, C., & Karkee, M. (2025). Design, integration, and evaluation of a dual-arm robotic system for high throughput sampling from potato tubers. *Computers and Electronics in Agriculture*, 241, 111266. <https://doi.org/10.1016/j.compag.2025.111266>

## Honors and Awards

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- HUGSS Poster Presentation Award, Second Place (out of 50 graduate researchers).
- Best Presentation Award International Conference on Artificial Intelligence and Mechatronics Systems (AIMS), Indonesia April 2021
- Inspiration Award FLL'19 Instructor for being the mentor of the team of students (grade 4 to grade 8) participating in an annual STEM-based competition First Lego League. The team cleared National qualifiers and stood 2nd in Finals held in Izmir, Turkey - February 2019
- Vice Chancellor's Recognition Award. This award is granted by Air University to students in recognition of their outstanding achievements in co-curricular activities that effectively contribute to the University's positive image and campus life. I represented my university at 3 international and more than 12 national-level platforms in the form of competitions, educational camps, and volunteer activities the most number in my batch. - January 2020

## Volunteer/Co-curricular Activities

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- **Excellence in Small Farms Technology Award) (FIRA & GOFAR Tour 2024) - Sacramento, CA**

Awarded to my team for developing an autonomous bin-hauling robot on the farm-ng platform for small-farm operations. Recognized for bridging prototype to commercialization, marking the first award for Washington State University at this challenge.

- **Team Lead of Mech The Tech (Team participating in Shell Eco Marathon 2019) - Sepang, Malaysia**

Lead a team of 9 individuals and compete in one of the most challenging and competitive STEM competitions.

- **President of Air University Robotics and Automation Society - Islamabad, Pakistan**

Performed my duties as the main executive of the university's Robotics and Automation Society (RAAS).

- **Vice President Air Tech'18 / Air tech'19**

Served twice as the vice president and chief technical lead of Pakistan's biggest technical Olympiad, Air Tech, by Air University.