TANAY CHOUDHARY

ABOUT ME

Senior Software Engineer and Roboticist with 8+ years of industry experience across the autonomy software stack, applied to the autonomous/automated driving, and warehouse robotics industries.

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EDUCATION

Master of Science in Robotics

Sep 2015 - Dec 2016

Northwestern University, Evanston, IL
GPA: 3.89/4

Bachelor of Engineering in Mechanical Engineering

Aug 2011 - May 2015

Birla Institute of Technology and Science, Pilani, India

COURSES

- Data Structures and Algorithms Nanodegree (Udacity)
- Controls
- Robotic Manipulation
- Machine Learning
- Computer Vision
- Artificial Intelligence

SKILLS/TOOLS

Meta-Skills

• Agile Software Development
• Critical Thinking • Resilience

Programming Languages

• C++ • Python • Java • Bash

Operating System

• Linux

SW Libraries and Tools

• ROS • Gazebo • Bazel
• PCL • OpenCV
• Git • Gerrit • Github
• Jenkins • Ansible

WORK EXPERIENCE

Woven by Toyota

Cambridge, MA (remote)
Sep 2022 - Present

Senior Software Engineer

Developing the next generation of advanced driver assist and autonomy features for software-defined vehicles, as a member of the Planner team.

- Led the development of advanced autonomy features, including high speed **lane-change planning**, enabling smoother, safer L2+ highway driving.
- Optimized **runtime performance** of the autonomy stack, reducing latency in trajectory planning by over 40%, ensuring real-time responsiveness.
- Integrated the core Trajectory Optimizer library into the L2+ driving app, which involved porting thousands of external Bazel targets.
- Drove **cross-functional integration** of perception, planning, and control modules for complex driving scenarios.
- Enhanced **debugging, testing, and visualization tools**, accelerating the development cycle.
- Promoted compliance with safe coding guidelines as a **Platform Reviewer**; mentored other engineers, fostering growth and contributing to the team's technical excellence and knowledge-sharing culture.

Vecna Robotics

Waltham, MA
Oct 2018 - Sep 2022

Senior Robotics Software Engineer

Developing, integrating, testing, deploying, and maintaining the autonomy stack of Vecna's suite of mobile heavy material handling warehouse robots

- As the module owner for navigation, developed **best-in-class** path planning and obstacle avoidance features which significantly improved speed and robustness in tight, dynamic spaces, thereby maximizing uptime and throughput. Achieved a 135% increase in overall performance composite scores and a 130% improvement in autonomous recovery success rate.
- As the software technical lead, led a multidisciplinary team to design, develop, and integrate autonomy software for Vecna Robotics' Co-Bot Pallet Jack (CPJ) – an **industry first** Autonomous Mobile Robot (AMR) that combines small size, affordability, and advanced shared autonomy capabilities to disrupt traditional pallet transportation workflows.

- Led a team in developing autonomy software for a novel mobile manipulation robot designed for robotic shelf picking in warehouse environments. The Tote Retrieval & Storage (TRS) Robot was engineered to autonomously pick, place, store, and transport packages and totes across a warehouse, unlocking a previously untapped segment in the market. Won first place at the **DHL & Dell Robotics Innovation Challenge** 2017, and demonstrated a working prototype at **MODEX 2018**, thereby securing funding from interested customers to build a deployable product.
- As the **C++ domain owner**, discussed and documented best practices, encouraged their use via code reviews, and emphasized removal of tech debt.
- Brought key improvements to **pallet docking behaviors** which increased pallet handling reliability and throughput in long, densely packed lanes.

Vecna Technologies Cambridge, MA
Robotics Software Engineer Mar 2017 - Sep 2018

Played a pivotal role in the development of a dual-arm mobile manipulator designed for safe and remote Explosive Ordnance Disposal (EOD). This robot combined autonomous and teleoperated capabilities to enable effective operations in high-risk environments..

- **3D Teleoperation Interface**: Designed and implemented a user-friendly 3D teleoperation interface using ROS, RViz, and MoveIt libraries, significantly reducing the cognitive load on operators.
- **Advanced Grasp Detection**: Integrated a cutting-edge grasp pose detection library that used convolutional neural networks (CNN) on point cloud data, enabling autonomous picking of arbitrary and novel objects in cluttered environments without CAD models.
- **Autonomous Behaviors**: Developed high-level autonomous behaviors to simplify teleoperation, replacing earlier reliance on direct joint control, which was imprecise and operator-intensive.
- **Enhanced Situational Awareness**: Improved operator awareness by developing a UI that visualized depth information, providing a comprehensive view of the robot's surroundings.
- Delivered successful project milestones and customer demonstrations, showcasing reliability and potential real-world applications, and securing additional funding from the customer to advance the platform's capabilities and readiness.

HARMAN International Mountain View, CA
R&D Intern - Future Experience, Corporate Technology Group Jun 2016 - Sep 2016

Performed exploratory R&D and rapid end-to-end prototyping for a new kind of headphones with ungrounded force actuators to provide instinctive, non-visual and non-auditory feedback to the wearer. The system can be used to guide the wearer in a subtly (e.g., pedestrian navigation) or to focus the wearer’s attention in a specific direction (e.g., personal warning system) without interfering with the already heavily stimulated sensory pathways of sight and sound. Planned and created fully working prototypes, including hardware and software, showcasing the user interaction described above. This included:

- Investigating and sourcing appropriate hardware technology — microcontrollers, peripherals, actuators, sensors, power sources, and structural components — to test different concepts.
- Implementing precise mechanical systems for center-of-gravity-shifting and other ungrounded force actuation techniques, from CAD to 3D printing to mechanism assembly.
- Designing and miniaturizing electronics to control mechanical systems and synchronize them with other software components.
- Developing accompanying embedded software as well as Android apps to allow for basic interaction with the system and to demonstrate its usability.

Technical University of Darmstadt

Darmstadt, Germany
Feb 2015 - May 2015

Research Intern

Undergraduate thesis on lower-limb wearable robotics at the Locomotion Lab, Institute of Sport Science.
Thesis title: Gait Analysis and Control Design for Stair Ambulation with Lower-limb Powered Prostheses

- Investigated lower limb joints and segments during level walking, stair ascent, and stair descent to determine their biomechanics for use in the design of new and robust powered prosthetic systems which can efficiently negotiate stairs in addition to walking on flat ground.
- Performed a motion-capture experiment with an instrumented staircase setup on a healthy subject.
- This study contributed two new control insights for gait intent and gait percent detection in wearable lower-extremity robots, which are not available in the existing literature.
- Significant savings in motor peak power and energy requirements across all gaits were obtained by optimizing the spring stiffness of the Series Elastic Actuator (SEA) based powered ankle prosthesis, which allows motor and battery dimensions to be kept to a minimum — an essential requirement of wearable robots.
- The results showed that current powered prostheses can extend their capability beyond level walking to successfully negotiate stairs, with only minor modifications and sensor additions to their existing systems.

Indian Institute of Technology Hyderabad

Hyderabad, India
May 2014 - Jul 2014

Research Intern, Mechatronics Design Lab, Cyber-Physical Systems Innovation Hub

Project: Low-Cost, Simple and Scalable Series Elastic Actuator (SEA) for Robotic Applications

- Reviewed existing SEA designs and theory, created 3D models of components with simplicity, scalability, and low cost in mind.
- Acquired components and fabricated parts using 3D printing as well as conventional machining.
- Integrated the hardware, software, and electronics modules to create a working prototype.
- Performed various experiments (force sensing, manual homing, torque control, spring stiffness measurement) and achieved desirable results.
- Incorporating a spring element in the motor actuator design simplifies the force control problem into that of position control, which is easy to achieve with just an encoder.
- SEA also enhances safety, compliance, and adaptability over traditional stiff actuators, which could enable more natural interaction with humans.

MIT Media Lab Health Tech Camps

Hyderabad/Mumbai, India
Oct 2013 - Jan 2014

Health Tech Hacker, Camera Culture group, MIT Media Lab

As an undergraduate, I participated in a series of workshops conducted by the Camera Culture group, MIT Media Lab, headed by Prof. Ramesh Raskar. The workshops, which brought together engineers, designers, and clinicians from all over India, aimed at developing portable, low-cost medical diagnostic devices for India's primary healthcare sector. Collaborating closely with researchers from MIT, IIT Bombay, Harvard Medical School and LV Prasad Eye Institute Center for Innovation resulted in a highly stimulating learning experience. Each workshop was an intensive week-long hackathon which started with team formation and brainstorming, going through several iterations of prototyping, and ended with each team pitching their proof-of-concept product to an open house. Some of the projects I worked on included:

- snapBP [Jan 2014, IIT Bombay]: A non-invasive smartphone-integrated system comprising a custom optics attachment and an app that enables cuff-free blood pressure measurement.
- Eyecorder [Oct 2013, LV Prasad Eye Institute, Hyderabad]: A portable multispectral imaging platform for the anterior segment of the eye.
- In both projects, my efforts were spread into device design, optics, and image processing.

PUBLICATIONS

Google Scholar profile: https://scholar.google.com/citations?user=3lwKtWMAAAAJ&hl=en
Citations: 60 (as of Jan 2025)
Publication: A Braille-based mobile communication and translation glove for deaf-blind people
Publisher: IEEE
Conference: 2015 international conference on pervasive computing (ICPC)
Video: https://www.youtube.com/watch?v=ONnZ_HP-dzM

- Proposed the idea and brought together a team for this project, which was selected in the Texas Instruments Innovation Challenge 2014.
- Developed a working prototype, which involved creating a mobile phone integrated tactile communication glove that enables deaf-blind people to communicate independently.

OTHER ACADEMIC PROJECTS

Airbot: Mobile Robot Control and Laser Based Localization on Frictionless Surface

[Capstone Project, Master of Science in Robotics]

- Built a lightweight robot which can float on an air-hockey table, and control its orientation using reaction wheels and IMU sensor fusion.
- Reverse engineered the new SteamVR Lighthouse tracking technology (used in the HTC Vive VR headset) for localizing the robot.

Optimal Control of Kinematic Car (Roomba) While Avoiding Obstacles

[Final project for ME 454: Numerical Methods in Optimal Control of Nonlinear Systems]

Implemented the iterative LQR algorithm with Armijo Line Search, on Mathematica, to find optimal control trajectories for start to goal motion of a simple kinematic car robot (iRobot Roomba), while avoiding static obstacles in the way by accounting for them using inverse and logarithmic barrier functions.

Intuitive Robot Teleoperation

[Independent Project, Master of Science in Robotics]

- Wrote a ROS package which enables intuitive teleoperation of the Baxter robot. Using skeleton tracking information from a depth sensor, the robot mimics the hand movements of a human user via joint-space velocity control.
- Developed a custom numerical inverse kinematics solver which finds the optimum set of joint angles to minimize joint travel in addition to reaching target end-effector position.
- Featured in National Robotics Week exhibit at the Chicago Museum of Science and Industry [video].

Android Mario Kart Mobile Robot

[Final project for ME 433: Advanced Mechatronics]

- Designed, fabricated, and programmed a mobile robot made of laser cut and 3D printed parts, which follows a Mario Kart circuit – for Northwestern's Tech Cup 2016.
- Created an app using Android Studio, with sliders and live camera preview to adjust RGB thresholds on-the-go for detecting colored lines, and programmed a PIC32 microcontroller to receive the line position via USB and perform PD control on wheel motors.