Jack (Jianxiang) Xu

M.A.Sc (2021 - 2024) GPA 4.0 **Mech & Mechatronics Engineering + MS&C Lab** 🛡 University of Waterloo
B.A.Sc (2016 - 2021) GPA 3.7 **Mechatronics Engineering + Coop + AI Option** 🛡 University of Waterloo

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SKILLS

Software	Python, C++, C, MATLAB, C#, Java, Javascript
Tools	Linux, ROS, Git, PyTorch, TensorFlow, FreeRTOS, CANape, OpenCV, OpenGL, HoloLens, MuJoCo, MeshLab
Interests	Robotics, Mobile Manipulator, VIO, SLAM, Control, MPC, ML, RL, CV, NeRF Manifold, Embedded, IoT, Prototype
Hardware/Mech	Jetson, ESP 32, NXP ARM M3/4, AVR, Arduino, ESP8266, Ultrasonic, ToF, IMU, Fusion 360, 3D printing, 3Dx

EXPERIENCE

System Modelling and Architecture Software Intern | Tesla, Inc. (Jan. 2024 - July 2024)
- Working on Optimus Robot 🥰

Graduate Research Assistant | Prof. Soo Jeon - Mechanical Systems & Control (MS&C) Lab (Sept. 2021 - Dec. 2023)
- Research and developing tightly-coupled dual monocular VIOs with Factor Graph optimization approach to enable a fault-tolerant localization and provide a more accurate pose estimation specifically for a mobile manipulator
- Conceived and built a unified lab infrastructure and distributed robots to enable simultaneous mobile manipulation
- Explored various topics: VSLAM, VIO, Optimal Control, RL, MPC, Factor Graph, Geometric Control (Lie), Sim

Capstone Project Lead | TableUV (Aug. 2020 - April. 2021)
- Invented a palm-size autonomous table-top sanitizing robot that is cost-effective and privacy-aware and can be used to disinfect surfaces in public spaces to reduce disease transmission
- Designed the full stack from hardware to software, sensor to control, mechanical to product design

Body Control Embedded Software Intern | Tesla, Inc. (Jan. 2020 - Aug. 2020)
- Mainly developed in-house ultrasonics sensing technologies to support autopilot in embedded controllers (*C*)
- Developed thermal protection model for M3/Y steering columns (C) and mac-CAN logging tools (Python)
- Devised many automation and toolsets needed for the developments and data analysis (*Python, C*)

Body Control Embedded Software Intern | Tesla, Inc. (May. 2019 - Aug. 2019)
- Raised major issues and improved the driver profile recall interface for Model 3 Seats with complete test coverage
- Coordinated with multiple teams to develop the interface to allow a real-time coordination between the first and second row seats on the Model X (*Python, C, MATLAB, CAN*)

Jack of All Robots | Trexo Robotics (Sept. 2018 - Dec. 2018)
- Built medical paediatric exoskeletons for children with walking difficulties & Bringing back smiles to many families
- Developed a robust full-stack software system that covers firmware (*C, FreeRTOS, Cortex M4 & AVR*), middleware (*Linux, ROS*), tools (*Python*), and Android App (*Java*), providing a seamless & comfortable rehabilitation experience
- Conceived a new control system allowing patients to initiate steps as they please & Optimized application by 50%

Team Lead | Hummingbot - International Autonomous Robot Racing Team (IARRC) (Jan. 2018 - Sept. 2019)
- Led and managed a team of 20 students, developing a fully autonomous mobile robot that is capable of maneuvering through obstacles, lanes, and traffic signs at high speed on rough terrains (*Jetson TX2, ZED, M4*)
- Conducting mechanical, electrical and software system designs for the robot (*SolidWorks, ROS, C++, C*)

AR Software Engineering Intern | Interaptix Augmented Reality (Jan. 2018 - April. 2018)
- Created a state-of-the-art real-time AR reconstruction project and also conducted various R&D in CV and ML
- Developed a variety of evaluation tools (*C++, OpenGL, Python*) for multi-camera synchronization and networking
- Implemented custom calibration and point-cloud rendering for multiple RGB-D cameras

**Embedded Firmware Developer** | Baanto, Nytric Inc. (May. 2017 - Aug. 2017)
- Improved firmware performance and developed a unique and adaptive algorithm (C++) to recognize polygon shapes for multi-touch ShadowSense touchscreens in real-time over 60Hz in all form factors.
- Devised functional analysis tools (Excel, VBA, Python) and a real-time sensor data visualizing application (C#, C++, Unity), minimizing time and efforts spent on debugging and testing by over 60%

ACTIVITIES & COURSES

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Teams/Clubs	NeRF Reading Club, IEEE/TMECH/RAS Editor, UW Peer Mentor, IARRC Org., MarsRover Team
Courses	ECE780-MPC 93%, CS885-RL 94%, SYDE-CV 95%, ME649-OptimalControl 98%, CS480-ML 100%

PROJECTS — M.A.S.c. (2021-2024)
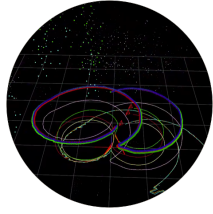
Dual-VIO-MM *(Sept. 2023 - now)*
- Tightly-coupled dual monocular VIOs through graph optimization with geometric manipulator kinematics
- Lightweight Lie algebra for Robot Kinematics in C++ with Eigen
- (C++, Python, ROS)
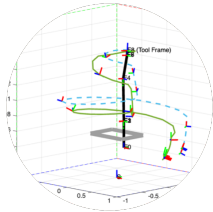
GMPIC *(Jun - Sept. 2023)*
- Geometric Model Predictive Impedance Control and
- Efficient Lie algebra and dynamic simulations based on Murray and ModernRobotics
- (MATLAB, Lie Manifold)
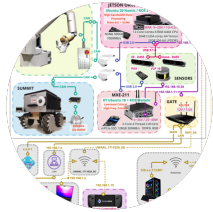
Robot-Configs *(Sept. 2022 - now)*
- Universal Robot Configuration Toolchain for UWARL robot fleets
- Automated hardware installation and auto-launching procedures
- Improve workflow, compilation and maintenance (Shell Scripts)

Waterloo-Steel *(Sept. 2021 - now)*
- Continuous development of mobile manipulator integration
- Integrated with powerful Linux embedded PCs
- Migrated to ROS Noetic and Melodic
- Improved ROS network stability
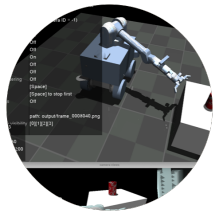
MuJoCo-Sim *(Jun.-Aug. 2022)*
- Developed MuJoCo Engine with Multi-Dynamic Visual Feeds
- Currently, it is used to develop control research for non-holonomic mobile manipulation
- (Python, MuJoCo)

Multi-Floor Demo *(Jan. - Apr. 2022)*
- Mobile Manipulator Multi-Floor Operation using the elevator with ArUco Markers
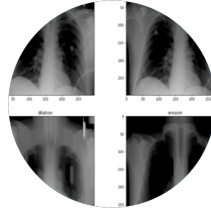- Demo ▶
- (Python, ROS)

ColTran Review *(Nov.-Dec. 2021)*
- 2021 Reproducibility Challenge - Colourization Transformer
- Extensive reviews on recent transformer works related to colourization
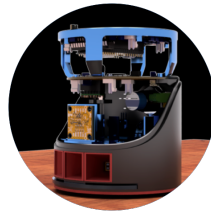- (Python, TensorFlow)

## PROJECTS — B.A.S.c. (2016-2021)

Covid-XRay *(July. 2021)*
- Built an award-winning COVID-19 x-ray detection at IEEE SIGHT Montreal, with over 90% SP PP PN SN and 99% accuracies
- (Python, PyTorch, ResNet34)
- [🏆 **2nd place in IEEE Canada**]

TableUV *(2020-2021)*
- Invented a palm-size autonomous table-top sanitizing robot in combat for general surface disease and bacterial control
- (C, Python, FreeRTOS, ESP32)
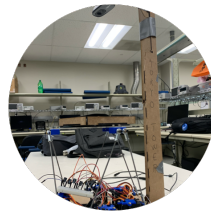- [🏆 **Best Prototype Quality**]
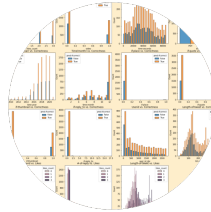
Twitter-likes *(April 2021)*
- Developed and trained a ML model to predict Twitter likes with over 52% accuracy
- [🏆 **3rd place out of 75**] within the class for CS480/680 - 100%
- (Python, PyTorch)

Matrix-Display *(Dec. 2019)*
- Designed and built a real-time IoT Matrix Display for counting active Youtube Subscribers
- Real-time sync to YouTube API
- (C, ESP32, Arduino)

StewartMaze *(Oct. - Dec. 2019)*
- Designed and built an autonomous maze solver with the Stewart Platform via vision feedback from a web camera
- Developed Vision Algorithms and IK
- (C, Python, OpenCV)
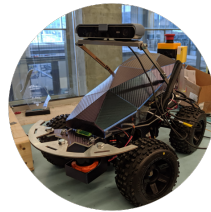
Hummingbird *(2018 - Sept. 2019)*
- Led the design and build of autonomous racing RC cars for the IARRC 2018/2019 competitions
- (C, C++, ROS, Python, RTOS, ARM, OpenCV, Fusion360, ZED)
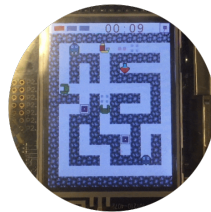
Pixel-Dungeon *(July - Aug. 2018)*
- Crafted a pixel dungeon game on a Cortex-M3 Keil Dev-boards
- Designed a custom pixel graphic and RT engine with dynamic maps, traps, monster generation, portals, and magic potions. (C, ARM, RTX)