Matti Pekkanen

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Robotics perception engineer completing a doctorate, with nine years in software engineering, five of them building production robotics software in C++/ROS. Combines classical perception (localization, mapping, sensor fusion, multi-sensor calibration) with learning-based methods (vision-language models, PyTorch) for autonomous mobile robots in dynamic environments. Experience building evaluation pipelines and benchmarks for perception, and taking robotics software from design through to field deployment.

EXPERIENCE

Aalto University Espoo, Finland
Doctoral Candidate, Intelligent Robotics Group *Apr. 2022 – Present*

- Developed a method to query open-vocabulary visual-language maps with natural language, reframing querying so it no longer depends on hand-tuned similarity thresholds.
- Built an evaluation framework and metrics to measure visual-language map quality and benchmark existing methods.
- Developed probabilistic mapping for dynamic environments, moving beyond the static-world and cell-independence assumptions so maps exploit the object-level semantic structure of the environment and stay accurate as scenes change.
- Improved localization and mapping in changing outdoor scenes by distinguishing static, movable-but-stationary, and moving objects, and treating each consistently between map and measurements.
- Published first-author papers at ICRA 2026, IROS 2025, and MFI 2024 (two papers); presented two workshop papers at ICRA 2024.
- Supervised student theses on visual-language maps, LLMs in mobile robotics, scene graphs, active perception for mechanical search, and scan registration; teaching assistant for two control courses.

GIM Robotics Espoo, Finland
Lead / Senior / Robotics Engineer; Project / Line Manager *May 2017 – Apr. 2022*

- Owned the perception, mapping, target tracking, and motion planning of an outdoor autonomous robot's situational-awareness system, from requirements and software architecture through algorithm design to field deployment.
- Developed multi-sensor fusion, state-estimation, and mapping components in C++ and ROS, including extrinsic/intrinsic sensor calibration and time synchronization across multiple sensors.
- Led a team of 3–6 as project manager, product owner, and Scrum Master for a multinational industrial customer, owning delivery and customer communication; became a company partner in 2020.
- Improved internal software-quality practices, including software-quality guidelines, onboarding material, and a software mentoring program.

Polea Oy Espoo, Finland
Lead Developer; Software Engineer *Jun. 2013 – May 2017*

- Built and shipped full-stack web and backend software (C#/ASP.NET, SQL Server, Azure; JavaScript front ends), owning integrations, releases, and production support.
- Led a small software team and contributed to agile process improvements; became a company partner in 2015.

EDUCATION

Aalto University School of Electrical Engineering Expected 2026
D.Sc. (Tech.) – Doctoral Degree, Robotics; Intelligent Robotics Group
Supervisor: Prof. Ville Kyrki
Thesis: Semantic-Dynamic Scene Understanding for Localization, Mapping, and Querying in Robotic Grid Maps

Aalto University School of Electrical Engineering 2018
M.Sc. (Tech.), Control, Robotics, and Autonomous Systems; minor in Computer Science
Thesis: Motion-based extrinsic parameter calibration of a robot's multisensor system

Aalto University School of Electrical Engineering 2016
B.Sc. (Tech.), Automation and Systems Technology; minor in Software Engineering
Thesis: Semantic mapping in robotics

SKILLS

Perception & estimation	localization, mapping, target tracking, multi-sensor fusion, sensor calibration & synchronization, probabilistic state estimation, filtering
Machine learning	vision-language models, PyTorch, applied ML for robotics
Programming	C++, Python, MATLAB/Octave, C#, Bash/ZSH, SQL
Systems	ROS, Ubuntu/Linux, CMake, GCC, Docker, GitLab CI/CD
Engineering	software architecture, algorithm design, motion planning, evaluation pipelines, Scrum (PSM I)

SELECTED FIRST-AUTHOR PUBLICATIONS

- **QuASH: Using Natural-Language Heuristics to Query Visual-Language Robotic Maps**. Matti Pekkanen, Francesco Verdoja, Ville Kyrki. *IEEE International Conference on Robotics and Automation (ICRA), 2026.*
- **Do Visual-Language Maps Capture Latent Semantics?**. Matti Pekkanen, Tsvetomila Mihaylova, Francesco Verdoja, Ville Kyrki. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2025.*
- **Object-Oriented Mapping in Dynamic Environments**. Matti Pekkanen, Francesco Verdoja, Ville Kyrki. *IEEE International Conference on Multisensor Fusion and Integration (MFI), 2024.*
- **Localization Under Consistent Assumptions Over Dynamics**. Matti Pekkanen, Francesco Verdoja, Ville Kyrki. *IEEE International Conference on Multisensor Fusion and Integration (MFI), 2024.*