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Research Statement

of Lebin LIANG (PhD applicant for Fall—2026)

My research interests lie in the design and control of intelligent robotic systems, with a particular focus on human-robot collaboration and interactive autonomy. I am driven by the vision of building robots that can understand, respond to, and collaborate naturally with humans in dynamic environments. To that end, I have consistently pursued a project-driven learning path that combines system-level engineering with research thinking. I have maintained a strong academic record throughout my studies, consistently ranking at the top of my class. I graduated first in my undergraduate program with a GPA of (4.36/5.00), and continued to perform well during my master's coursework, earning a GPA of (3.77/4.00). In recognition of my academic excellence, I was awarded several honors, including the National Scholarship—one of the highest academic awards in China—and was named an Outstanding Student multiple times. More importantly, I have always treated coursework as a foundation for solving real-world problems. Rather than focusing solely on grades, I actively sought opportunities to apply theoretical knowledge through hands-on projects and research. This mindset laid the groundwork for my transition from classroom learning to system-level thinking and independent research.

Competitions & Projects: For example, as the navigation team lead of my university's RoboMaster team, I designed the entire robot system architecture, implemented a custom serial communication protocol, and developed a localization pipeline by fusing wheel odometry, IMU, and 2D LiDAR through Cartographer SLAM. Based on a ROS framework, I also created a real-time behavior-switching state machine to enable autonomous decision-making. These efforts contributed to the best result in our university's RoboMaster Competition history. Similarly, as captain of an autonomous vehicle team, I led my team to a national first prize in the China Undergraduate Intelligent Vehicle Competition.

Translating competition experience into rigorous research, I led a national innovation project on a four-wheel steering and driving (4WS-4WD) autonomous spraying vehicle. As project lead, I was responsible for the system design, vehicle kinematic modeling, trajectory tracking control, STM32-based embedded systems, and CAN bus communication architecture. The project was rated "Excellent" and resulted in an EI-indexed publication(Zhiyan et al., 2023). To further explore the frontiers of autonomy, I independently developed an indoor autonomous quadrotor system that combined visual-inertial odometry with LiDAR-based 3D reconstruction. This work was accepted as a first-author paper at the IEEE RCAR 2023(Liang, Rao, Shen, Wang, & Wu, 2023) , showcasing my ability to initiate and complete a full research cycle.

Experience: My practical experience also includes active contributions to robotics education. From 2020 to 2023, I served as an embedded systems teaching assistant at DJI's RoboMaster Robotics Camp(DJI, n.d.), where I designed and delivered courses on indoor logistics robots and developed a dedicated ROS driver for the RoboMaster EP platform. These experiences sharpened my technical communication and system integration skills.

In Spring–Summer 2025, I interned at R&D Center China Laboratory of SONY (SONY, n.d.), participating in cutting-edge research on legged robots. My work ranged from designing high-speed motor driver PCBs (with EtherCAT support) and low-level multi-joint servo control on STM32, to building full-body dynamic models and training reinforcement learning policies in Isaac Gym for locomotion tasks. I also contributed to Sim2Real transfer experiments. This experience deepened my understanding of both mechanical complexity and learning-based control for agile robotic systems.

Purpose: Currently, my research focuses on interactive and language-guided robotic systems. I am leading a project on vision-language model (VLM)-based robot navigation, where we explore how mobile robots can understand and execute natural language instructions via Retrieval-Augmented Generation (RAG) and visual-semantic mapping. In parallel, I am co-developing a mobile manipulator collaboration system that enables humans and robots to co-manipulate heavy objects using whole-body locomotion and pose-aware coordination strategies.

Conclusion: In summary, from independently developing complete autonomous systems, to leading award-winning teams in international competitions, to pursuing frontier research in human-robot collaboration and legged robotics, each step of my journey has laid a solid foundation for advanced doctoral study. I have cultivated the ability to define research problems, design complex systems, implement effective algorithms, and achieve validated outcomes. I now seek a PhD program

where I can work at the intersection of robot learning, human-robot interaction .I will contribute to the development of intelligent robots that collaborate with humans in more natural, effective, and meaningful ways.

References

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