Master Thesis Opportunity at CAS 🚀 *Shape the Future of Robotics and AI!* 🚀

Development of a Pedestrian Detection and Tracking System Using LiDAR for Autonomous Robot Navigation in Traffic Environments.

📂 About the Thesis:

Autonomous robots operating in dynamic, traffic environments require robust perception and decision-making capabilities. This master thesis focuses on studying and implementing existing methods for pedestrian detection and tracking [1][2] using a Velodyne 3D LiDAR sensor mounted on a Unitree Go2 or TurtleBot robot specific in outdoor traffic environments. The goal is to detect pedestrians within a defined range around the robot, form pedestrian clusters, position the robot at the centre of the cluster, and track the movement of pedestrians within it. The autonomous robot must maintain this cluster structure while following a predefined route and operate in real-time on an embedded device, ensuring high processing speed.

This research primarily emphasizes analysing and selecting the most effective existing pedestrian detection and clustering techniques rather than developing entirely new methods—though novel contributions are welcome. The study will also define appropriate evaluation metrics and implement the most suitable approach to enhance autonomous robot behaviour in traffic environments, where pedestrian movement is highly dynamic and unstructured.

🎯 What You'll Do:

1. **Review existing methods** for pedestrian detection, clustering, and tracking with LiDAR.
2. **Implement and optimize algorithms** for clustering, tracking, and robot positioning.
3. **Validate the approach** through real-world or simulated tests.
4. **Document findings** on methodology, challenges, and recommendations.

🛠 Who We're Looking For:

- Strong programming skills, particularly in Python.
- Experience with ROS2 and autonomous robotic platforms such as Unitree Go2 or TurtleBot.
- Familiarity with LiDAR-based perception, pedestrian detection, and tracking algorithms.
- Knowledge of clustering techniques and trajectory analysis.
- Strong analytical mindset and problem-solving abilities.
- Effective communication skills for documentation and presentation purposes.

🎓 Why Apply?

This thesis offers an opportunity to refine and apply state-of-the-art techniques in autonomous robotics. Your work will contribute to safer and more intelligent robot navigation in complex, traffic environments. Join us in shaping the future of mobile robotics!

💡 *Ready to take off? Apply now!* Send your application including CV and Master's transcripts to john.arockiasamy@kit.edu or in-person at John Pravin Arockiasamy - Room: 5A-05.1 (Building 05.20).
Starting Date: ASAP!

📌 Reference:

1. Wang, Wenguang, Xiyuan Chang, Jihuang Yang, and Gaofei Xu. "LiDAR-based dense pedestrian detection and tracking." *Applied Sciences* 12, no. 4 (2022): 1799.
2. Eskandar, George. "An empirical study of the generalization ability of lidar 3d object detectors to unseen domains." In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 23815-23825. 2024.