DeKUT AMR

Robotics Dojo Competition 2025

Integrated Robotic System for Navigation, Plant Disease Detection, and Visual Object Classification.

AUTHORS

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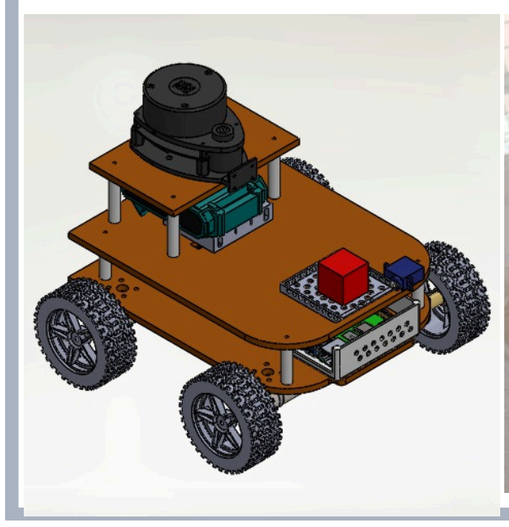
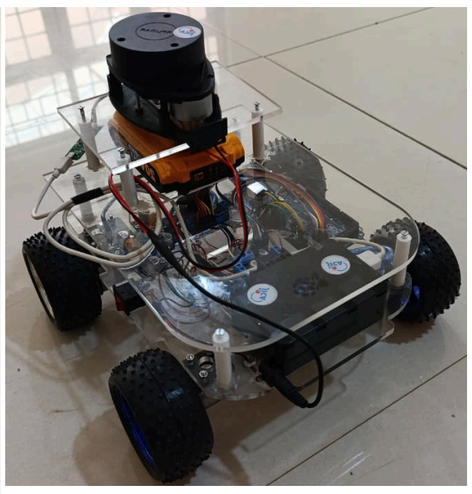
01. INTRODUCTION





- The DEKUT AMR is a skid-steer autonomous mobile robot developed for the Robotics Dojo 2025 Competition.
- Designed to handle challenging terrains such as slopes, sawdust, and rocky patches.
- It combines a laser-cut acrylic chassis, all-terrain wheels, and a 20V battery system for endurance and stability.
- Using ROS2 Nav2 with SLAM Toolbox, the robot achieves real-time mapping and reliable navigation.
- A vision system enables cube identification and plant disease detection, while servo-powered tipper supports payload offloading. Our design emphasizes robustness, modularity, and cost-effectiveness, addressing key shortcomings from previous prototypes.

02. OBJECTIVES

- Achieve autonomous navigation on diverse terrains.
- Implement real-time SLAM & localization.
- Detect colored cubes & diseased plants using Computer vision.
- Offload payload via servo tipper.
- Ensure sufficient runtime & system reliability.

03. DESIGN STRATEGY

- Reliability prioritized over
- complexity & speed.
- Skid-steer drive for torque & simple mechanics (individually-driven motors)
- Sensor integration: LiDAR + encoders + Pi Camera
- Iterative testing guided design choices.

MECHANICAL DESIGN

- **Chassis**: laser-cut acrylic rigid & modular.
- **Wheels**: all-terrain, tuned RPMs (200 front, 110 rear).
- **Custom parts**: LiDAR mount, camera holder, servo tipper (1 kg, 45° tilt).

ELECRICAL DESIGN

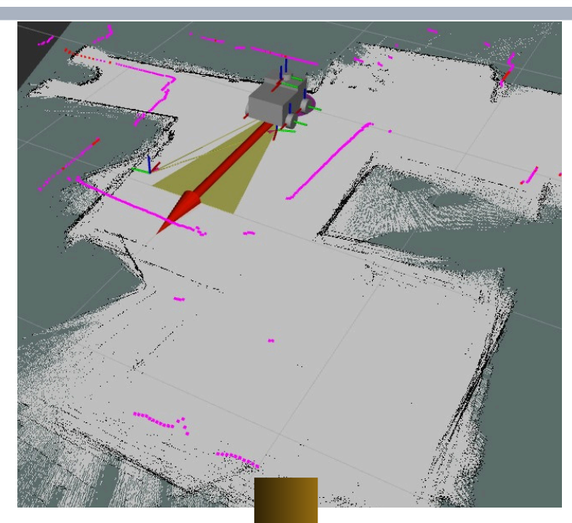
- **Power:** 20V 2Ah battery, longer runtime.
- **Voltage regulation:** XL4015 converters for motors, sensors
- **Control:** Arduino Mega.
- **Drivers:** L298N H-bridge.

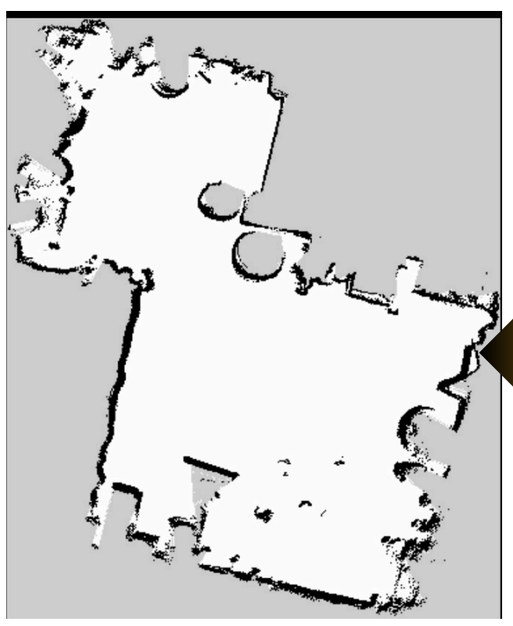
SOFTWARE DESIGN

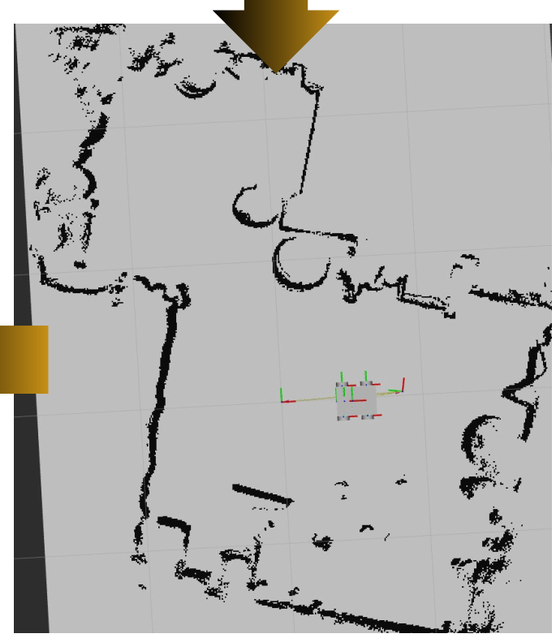
- **ROS2** for stable real-time control and sensor-actuator coordination
- **SLAM Toolbox for** accurate mapping & localization.
- **Nav2 for global and DWB local planner** for safe navigation.
- **OpenCV vision** for cube color & plant disease identification.
- **Arduino** for motor control

04. RESULTS AND ANALYSIS

ENVIRONMENTAL MAPPING RESULTS FROM LIDAR AND MAPPING ALGORITHM







The DEKUT AMR was tested in simulation and real terrain.
It achieved reliable navigation with minimal slippage, consistent SLAM maps , and payload offloading.
The 20V 2Ah battery provided more than longer runtime,
Vision tasks were successful

05. CONCLUSION

The DeKUT AMR design goals are a reliable, modular, and affordable mobile robot for the Robotics Dojo 2025. It successfully navigates rough terrains, builds maps in real time, and can perform tasks like cube handling and plant disease detection. By addressing earlier problems with underpowering, overheating, and localization drift, the robot now delivers stable performance for longer, making it both competition-ready and a strong base for future improvements.

06. ACKNOWLEDGEMENTS

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07. REFERENCES

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