Algorithm Implementation on a Real Mobile Robot

(by Robot Hırsızları)

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Introduction

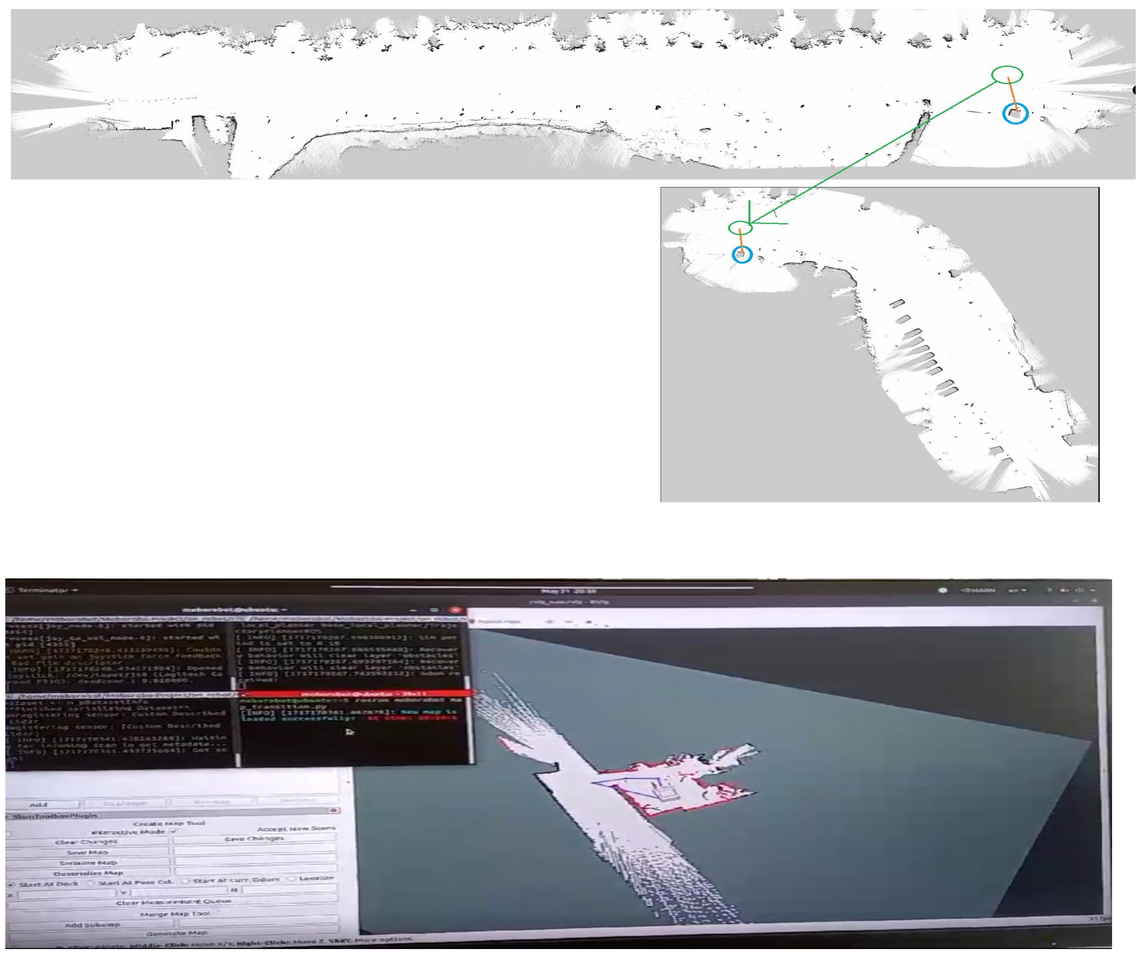
MoboRobot is a robotic project designed for self-navigation on several maps. The robot addresses classical issues of localization, mapping, and real-time obstacle avoidance in a ROS environment. Its touchscreen controls WiFi and the monitoring of the battery level at all times. MoboRobot autonomously creates paths that optimize planning to enhance long-range navigation in complex environments. Possible improvements would be GPS integration and road surface information for more excellent facilities.

Improvements

- We made several Improvement to our mobile robot:
  - Implemented multi-map navigation algorithm.
  - Improved internal cable management.
  - Added Arduino with touch screen for easy control.
  - Installed a new power switch for convenience.

Multi-Map Navigation

- We generated multiple maps using the SLAM Toolbox and LIDAR data to rigorously test the robot's ability to transition between them.
- To ensure accuracy, we meticulously defined the start and end points for each map, taking into account the robot's precise position and orientation. This careful calibration is essential for maintaining continuity and ensuring successful transitions between maps.
- This involves generating a text file containing commands that interact with the map server and publish destinations to the Move Base Simple Goal topic.



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Application Areas

- This project can be used to create unmanned transport drones. Examples include:
- **Campus Coffee Carrier:** Delivers coffee and snacks from a café to students in study zones.
- **Mobile City Shop:** Delivers customer orders directly from a mobile shop in urban areas.
- A**utomated Parcel Delivery:** Transports packages from distribution centers to customers' doorsteps efficiently.

Solution Methodology

- At first, the program reads the commands for map loading and destination publishing from a pre-configured text file.
- The SLAM Toolbox's deserialize map service is then invoked with the appropriate message to load the map and localize the robot within it, ensuring an accurate understanding of its starting position.
- Once the map is loaded and the robot's position is established, the destination is published on the map. This allows the robot to begin its navigation towards the specified target.
- Throughout this process, ROS actions are employed to facilitate smooth navigation while effectively avoiding obstacles.
- As the robot approaches and reaches each intermediate destination, the process is repeated: the SLAM Toolbox's deserialize map service is called again, and the next map is loaded.
- This iterative process continues, with the robot transitioning seamlessly from one map to another, until the global destination is ultimately reached.

Physical improvements

- Internal Cable Management:
  - Fixed and organized internal cables.
- Arduino with Touchscreen:
  - Added a device to measure and display battery level.
  - Included a touchscreen to view battery status and change Wi-Fi connections.
- New Power Switch:
  - Rewired to add a power switch for motor control.

Results and Discussion

- Our work on multi-map navigation for mobile robots represents a significant advancement in the field of robotics, with wide-ranging implications across various sectors.
- By eliminating the need to load entire maps into memory, we've made navigation more practical and adaptable.

Acknowledgements

- This project was completed within the context of AIN490-491 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Artificial Intelligence Engineering.
- We thank Dr. Özgür ERKENT for his invaluable contributions to our project.