

Heals On Wheels

Senior Design

Moses, T., Kansagra, R., Doerfler, N., Rahhal, D., Brown, C.



Background

Hospitals are high-pressure environments where staff must balance patient care with numerous routine tasks. One such task is retrieving supplies like gauze or syringes from distant storage rooms, which often pulls nurses away from their patients and reduces efficiency during critical moments.

To help alleviate this burden, our team developed the Hospital Medical Equipment Transport Vehicle (HMETV) — an autonomous cart designed to handle internal deliveries. By automating supply transport, HMETV allows healthcare professionals to stay focused on patient care and improves overall workflow in hospital units.

Key Requirements

The core goal is to automate hospital supply delivery using a lightweight, cost-effective autonomous vehicle. This includes:

1. **Efficient route navigation with real-time obstacle avoidance.**
2. **A secure and intuitive user interface for order placement.**
3. **Full-range mobility using omnidirectional wheels.**
4. **Integration with hospital Wi-Fi and secure encrypted communication.**
5. **Emergency stop functionality.**
6. **Lightweight frame.**

Architectural Design

Offsite Computing Layer

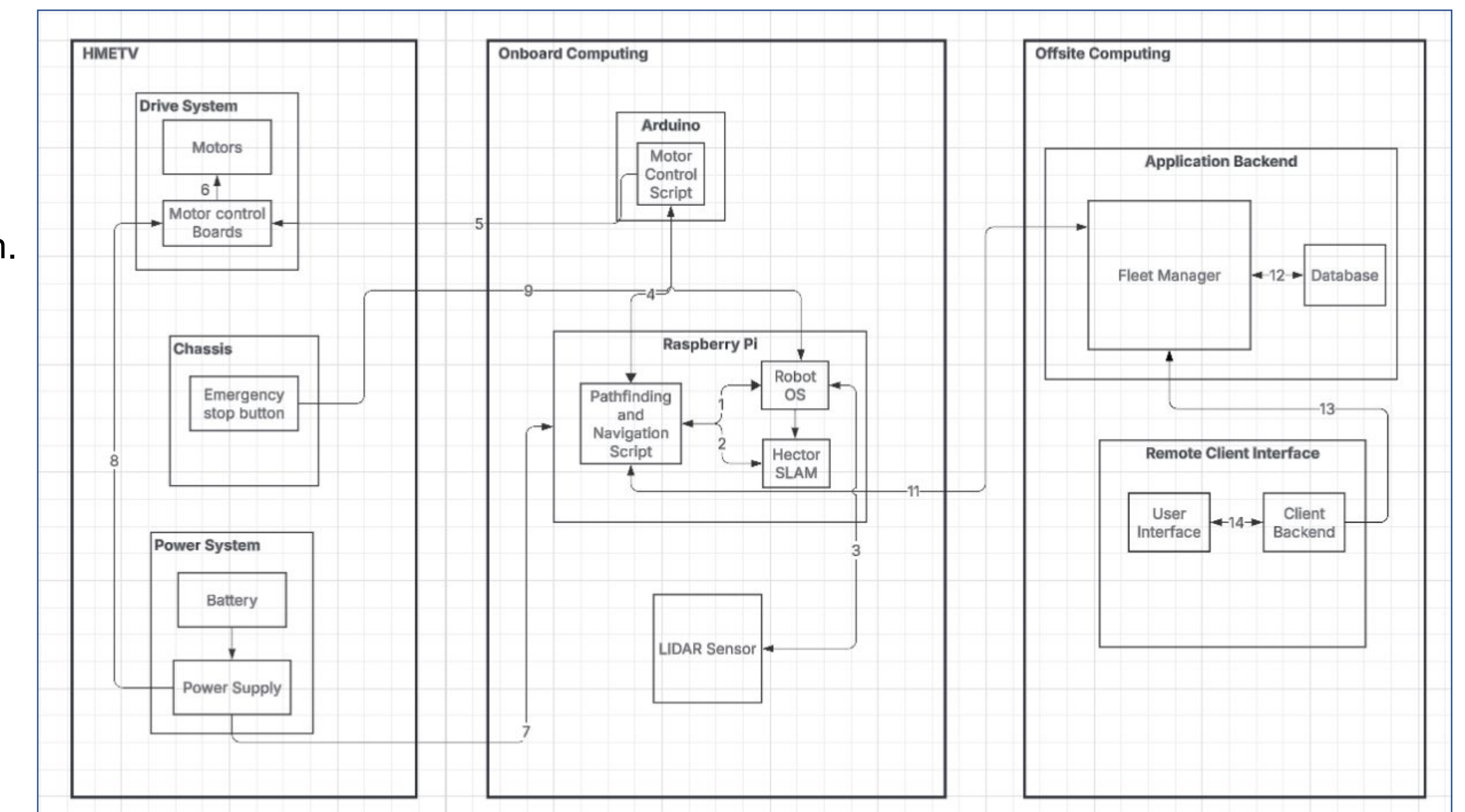
The Heals on Wheels system includes a local Offsite Computing layer that acts as the command interface for interacting with the cart. This layer runs on a laptop connected to the same hospital Wi-Fi network as the Raspberry Pi onboard the HMETV. It provides a simple graphical interface allowing staff to send movement commands, which are transmitted directly to the onboard system for execution.

Onboard Computing Layer

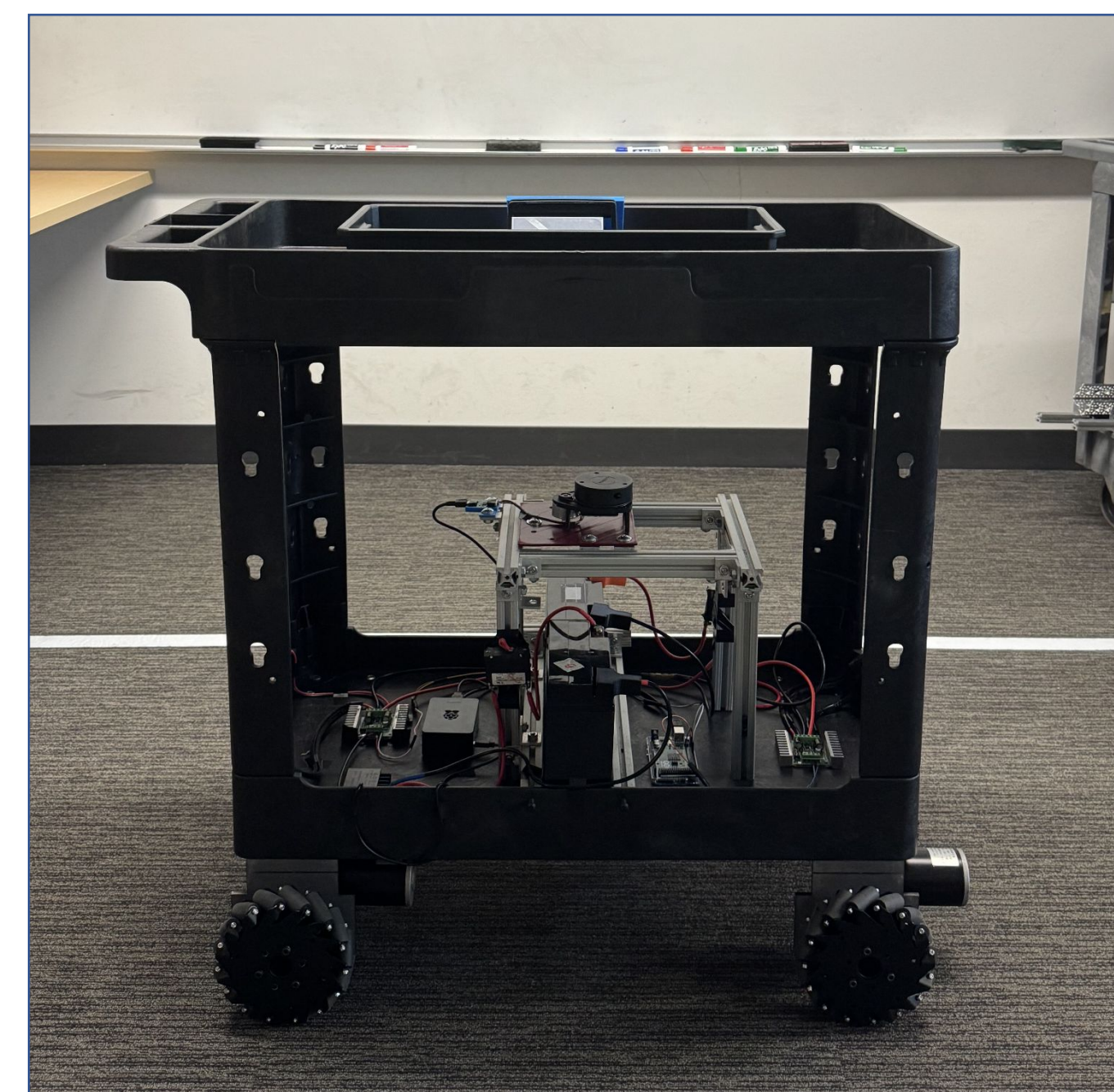
At the core of each delivery cart is the Onboard Computing layer, powered by a Raspberry Pi 4. This unit acts as the vehicle's brain, receiving commands from the offsite interface and managing the cart's motion through motor control. While the LiDAR sensor is connected and functional, full integration for real-time obstacle detection and autonomous navigation is planned for future development.

HMETV Layer

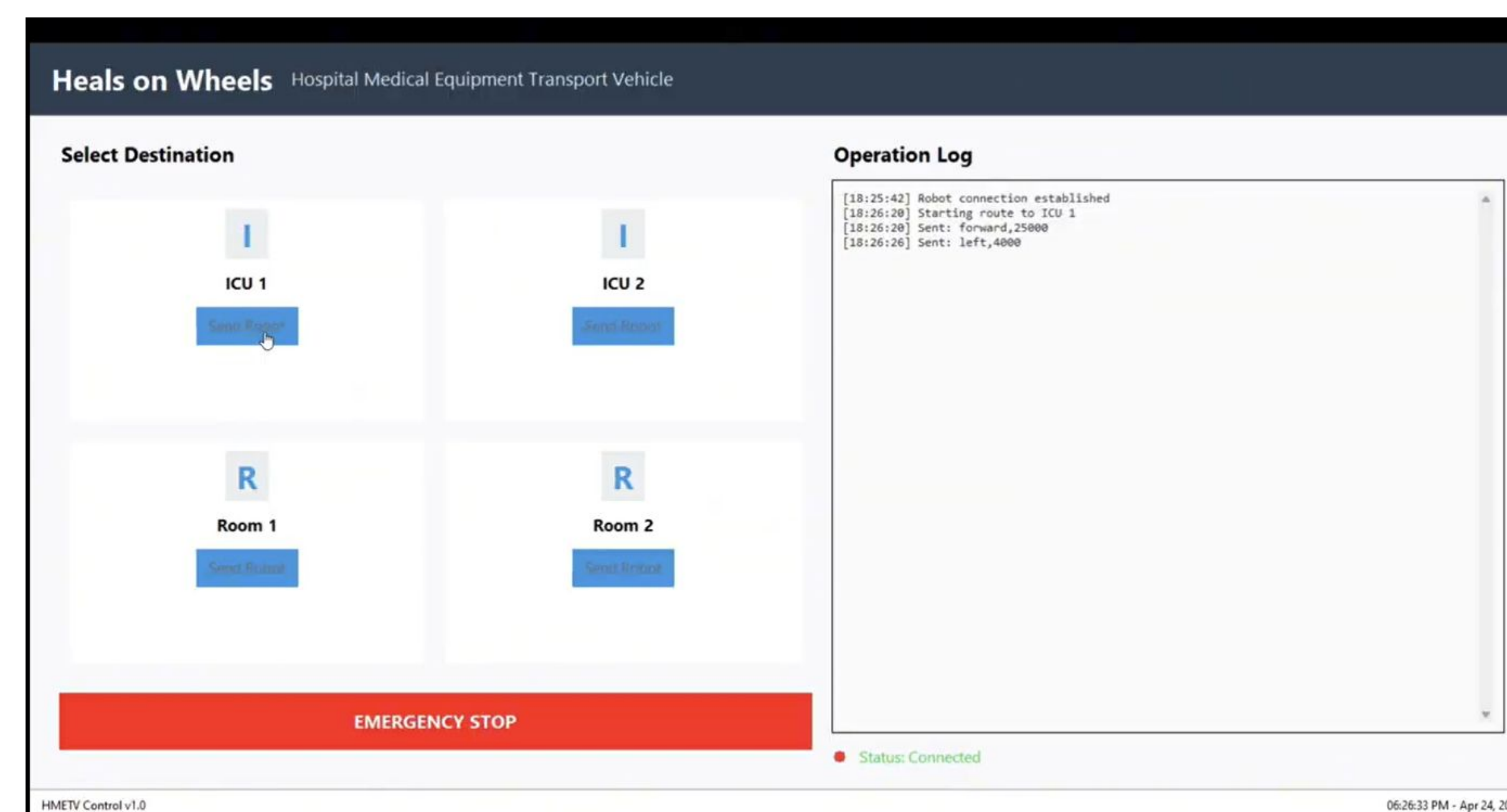
This layer includes the cart's motorized drive system and omnidirectional wheels, which precisely execute the planned routes. This layer enables the cart to move smoothly and safely through hospital corridors, ensuring timely and accurate delivery of critical medical supplies to their designated locations



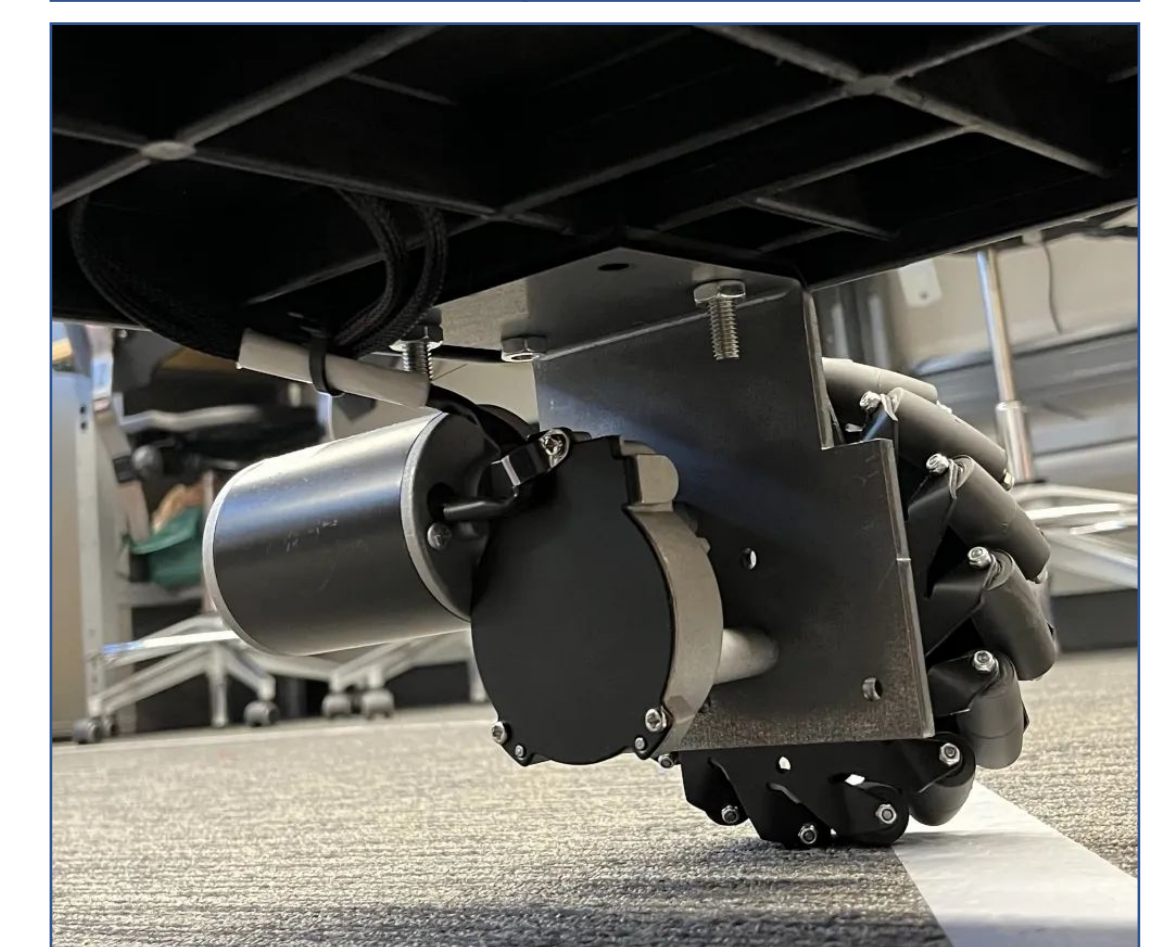
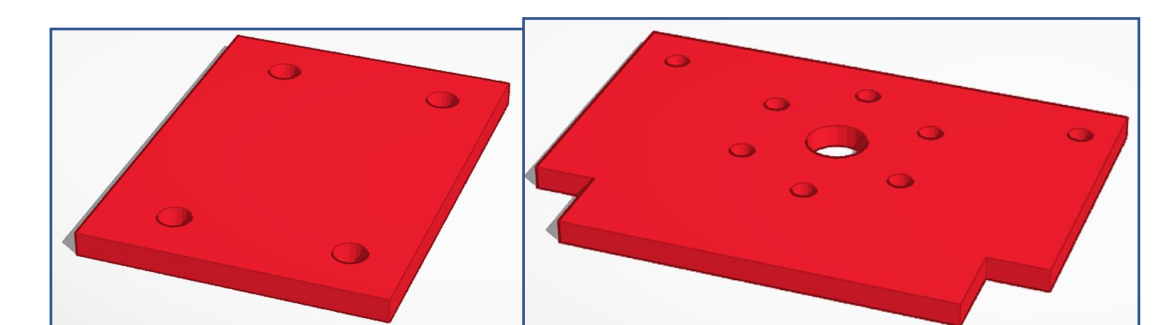
Visualization of HMETV Design



HMETV



GUI Interface



Wheel & Motor Mount

Conclusions and Future Work

Conclusion

The HMETV onboard system successfully enables autonomous path-based navigation with remote wireless control. Future enhancements such as improved sensor integration and more robust power management will further optimize reliability and operational efficiency.

Future Work

- Implement mobile application for easier remote scheduling
- Implement LiDAR-based obstacle avoidance

References

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2. Ahtiainen, Hanne Katriina, Miia Marjukka Kallio, Marja Airaksinen, and Anna-Riia Holmström. "Safety, Time and Cost Evaluation of Automated and Semi-Automated Drug Distribution Systems in Hospitals: A Systematic Review." *European Journal of Hospital Pharmacy* 27, no. 5 (September 1, 2020): 253–62. <https://doi.org/10.1136/ejhp-2018-001791>.
3. "Robotic Couriers at the Jena University Hospital in Germany | Britannica." Accessed September 30, 2024. <https://www.britannica.com/video/179553/use-robots-meal-delivery-hospitals-tasks>.