Problem Statement
One of the biggest limitations for urban aerial mobility (UAM) vehicles is the battery life of the vehicle. One proposed solution is to implement charging stations where a battery replacement vehicle will swap out the old battery for a charged one.

Concept of Operations
- The battery replacement vehicle is a ground vehicle
- A trained operator pilots the BRV
- The cart is driven to the vehicle, when it is close enough the operator initiates the battery swapping sequence
- The cart auto-docks with the UMV, removes the discharged battery, and turns around
- The cart loads the charged battery
- The cart then transfers control back to the operator
- Each swap is completed in less than 5 minutes
- The BRV can perform 60 swaps per day in a single 12-hour shift

Structural Design
- 4 wheeled cart with a steel Chassis
- Supports 2 batteries
- Mecanum Wheels for flexibility - powered by electric motor

Alignment Subsystem
3 step Alignment Subsystem
1. First uses long range alignment for parallel alignment of cart
2. Then uses a 2D array of sensor lights for battery cradle alignment
3. Finally uses alignment pins and strain gauges for precision

Sensors and System
- 4 wheeled cart with a steel Chassis
- Supports 2 batteries
- Mecanum Wheels for flexibility - powered by electric motor

Future Work, Acknowledgements, and References
Due to COVID-19 we were not able to build the actual vehicle. Therefore we have outlined our detailed design, completed the sensor code, and simulated the design using Matlab/Simulink. The next step would be to complete a physical build of the BRV.

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