Positron "Post Driving" Rover

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Team's Website

Summary

Positioning Partners has created an Unmanned Ground Vehicle (UGV) called Positron. The Positron "Post Driving" Rover is a robotic solution to survey marking GPS locations, and then assist in placing markers in the ground. This solution would be particularly helpful on construction sites, where locating precise points and driving rebar into the ground can be very tedious. The rover maneuvers autonomously to given GPS coordinates or it can be controlled manually.

Figure 1. Positioning Partners Logo

Background

There are many useful applications for a rover with Positron's abilities including in constructing fencing and guardrails. Our project sponsor has a special application in mind that would save hundreds of volunteer man hours. Every Veterans Day our sponsor helps plant thousands of flags in front of the tombstones of our war Veterans. This UGV will assist the volunteers by increasing the speed and efficiency of flag placement. Nevertheless, the rover can be repurposed for surveying applications by marking specific location and painting straight lines

Figure 2. Positron Rover

High Level Design

To implement a solution, Positioning Partners will modularize the functionalities given by the requirements of the project. Each functionality will be managed by the central Control Module. This system will coordinate the interaction and behavior between all the other components and functions. This modular implementation would help with the design and the easy allowance of components' substitution and debugging. A representation of the high-level system diagram can be seen below.

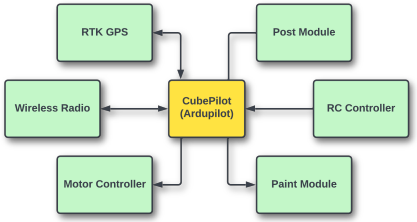

Figure 3. High Level Diagram (Rover)

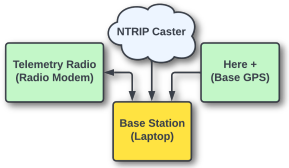

Figure 4. High Level Diagram (Base Station)

Hardware Design

Hardware wise the Positron rover uses a wheel-chair base controlled by an Ardupilot auto pilot system on the Pixhawk platform. This system, which is part of the control module, also controls the spray paint module, which consists of a servo attached to a mechanism around a spray paint can. To ensure the safety of the main electronics components of the robot, a black plexiglass cover has been added to the top and designed in Fusion360. On the outside of this cover are sitting the GPS and the antenna, as well as an easy access to the emergency switches to the motor and an emergency stop button. A detailed electrical schematic can be seen below.

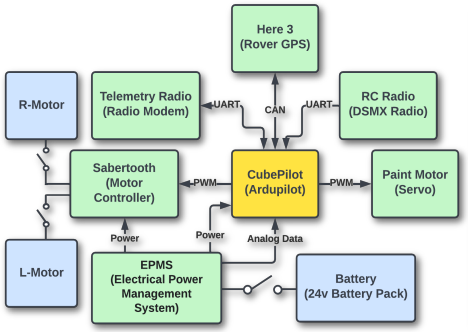

Figure 5. Electrical Diagram

Figure 6. Positron Side view Design

Figure 7.Spray Paint Can Mount Design

Software Design

Software wise a user interface has been developed to facilitate the interaction between the rover and user. The interface allows said user to locate the rover's current location, as well as add and remove waypoints for the rover, stopping the rover, and telling it to mark a location. The communication to the rover is implemented through MavLink and developed using Python. Below is shown the UI and the map displaying assigned waypoints for paint jobs.

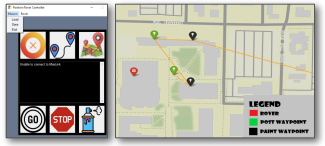

Figure 8-9. User Interface

Conclusion

Positron's design matches our project sponsors original goals and Positioning Partners is close to meeting all the specifications we initially derived for this application. There were many lessons that were learned throughout the duration of the project to overcame all obstacles providing an invaluable experience in handling these setbacks. Positioning partners would like to thank Dr. McMurrough and the CSE Senior Design GTA for all their support during the project.

Figure 10. Positron Painting Dot on the Ground

POSITRON

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