

3D Mapping Robot

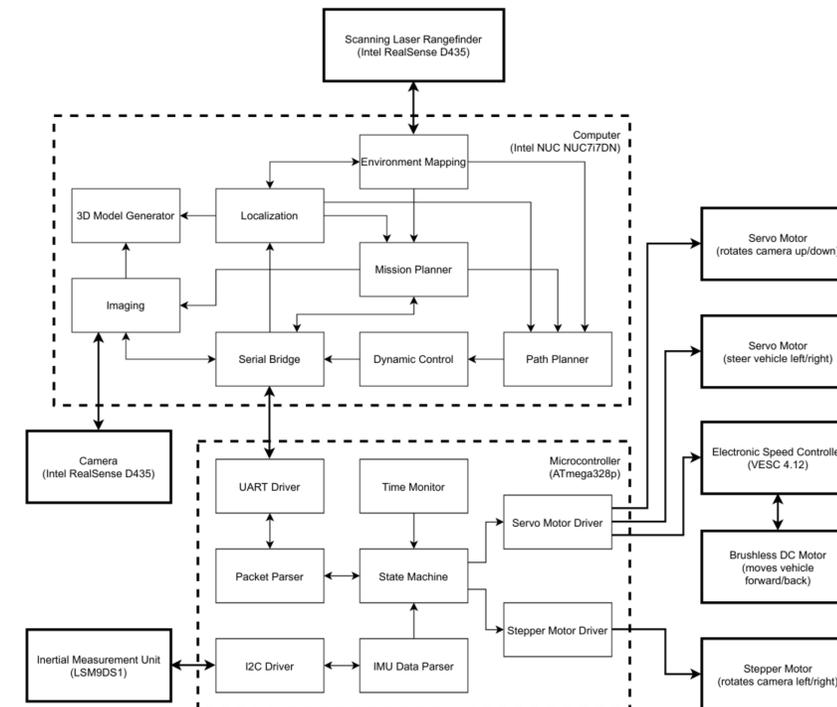
Project

Problem: Current 3D interior mapping methods are cumbersome, complicated, and costly. A consumer typically cannot purchase or operate the existing tools.

However, 3D mapping has a myriad of practical applications, such as interior design, virtual reality environment creation, and robotics research. This project aims to make 3D mapping tools more accessible for consumers.

Solution: This project combines modern control theory and signal processing to create an autonomous robot that can traverse and map unknown indoor areas. This robot can be managed using a simple interface on any device with a web browser. The scan that the robot generates can then be used for future robot navigation or can be exported for general use.

System



Methods

The 3D Mapping Robot has two important pieces, the hardware and the software, each of which have specific components for various functionalities.

Hardware:

1. Body of the robot – modified Traxxas Rally
2. Microcontroller – ATmega328p
3. Onboard computer – Intel NUC7i7DN
4. Power delivery – two 11.1V LI-PO batteries and one 8.3V NiMH battery
5. Sensors – Intel RealSense D435 (camera and range sensor), Sick TIM551 (lidar/obstacle avoidance), and BerryGPS-IMU V3 (IMU and GPS)

Software:

1. Motor Control – timer triggered PWM
2. IMU Driver – I2C communication
3. Motion Model – bicycle motion model
4. Global Planning – wall-follow control finds the area's perimeter in simulation
5. Local Planning – wall-follow and obstacle-avoidance behaviors in simulation
6. Imaging and Model Generation – not currently implemented
7. User Interface – not currently implemented

Conclusion

Due to time constraints, the robot's functionalities are not fully implemented. While the vehicle can navigate via remote control and in simulation, problems with localization prevented the control from being run on the robot.

However, because the robot's hardware components are all chosen and implemented, further work for this project would need only to prepare the software aspects of these functionalities.

Future Work: Software for the localization, imaging, model generation, and the user interface will be implemented. Upon implementation, the 3D Mapping Robot will be ready for consumer use and can be applied to a variety of fields.