Senior Design Proposal 2020-2021

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Abstract:

This senior design is concentrating on developing a robot platform that has auto-driving and auto-navigation functions in an indoor environment. This idea -- essentially a self-teaching hardware rapid prototyping/testing aid for those interested in autonomous driving. The platform serves as a starting point for engineers to develop more interesting features on top of this robot. In other words, this product targets engineers who are interested in autonomous navigation and planning to use such platforms to achieve set tasks. The Design will include hardware related to sensors, motors, 3D printed chassis, compute boards, and tires. On the software side, includes a backend algorithm for SLMA and obstacle avoidance and classification. Besides the product, in this proposal, there are estimations of the project's cost, plan for market launching, and extended thoughts on the expansions of this product idea.

Introduction

Our idea is to create a "hardware SDK" for Auto driving R&D for education purposes. Students with experience of robotics and autonomy can extend the functionality of the robot for their own interests. As an example of the platform, the ultimate goal is to demonstrate more credibility so that it can attract more requests from different groups of people who want unique features added on the robot or rebuild a new one.

Background

Autonomous driving in R&D demonstrated an early startup in early prototyping during one's seed funding stage. As from the capability to accomplish simple tasks towards harder ones, the

investors can gradually discern the potential from the early design. Then more funding could be acquired for later development.

Work Schedule

Considering the current situation, we estimated to garner all the essential 3D-printed body parts, motors, sensors, and control boards by the end of the fall term. After that, we planned to finish the software development by the winter. The final prototype will be launched around spring.

Methodology

Hardware:

3-D printed model

ODrive, Nano, Arduino, Lidar

Modular design.

Software:

Ideas: Make sub-modules that only achieve a simple goal.

Test each module with everything we can think of.

Put them together to achieve the final goal.

Bottom level :

Arduino that Handel drives control, communication between sensors(encoder data, ultrasonic, bottom, and so on) and top-level computer.

Mid-level:

lidar base mapping and positioning. a board that handles SLAM (Simultaneous localization and mapping) will connect with the lidar and preferably also handle TOF input that double-checks with SLAM data. I have a pi 4 that may be able to do that.

Top-level:

visual input that needs to be handled with a neural classifier can run on Nano and the move command can be issued to Arduino.

Costs

1. Nvidia jetson Nano - $100.00
2. Odrive - $75.18
3. Arduino Mega - $33.00
4. Signal Line Lider DB2 - $70.64
5. …etc.

Results

After the design, our group is looking for an extension from this design to be a R&D solution-platform which provides materials and experience for helping educational institutions to create their own DIY robot.

Conclusion

In this proposal, our group will be working on designing an autonomous driving robot for research and development purposes. There are similar competitors in the markets that provide R&D, K-12 education, and body temperature detection. And we believe there are a lot of new ideas we can learn from them in terms of developing our robot at the early stage.