Senior Design Proposal 2020-2021

# Project Advisor:

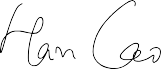
# Dr. Bruce Eisenstein

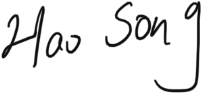
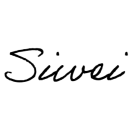
**Members:**

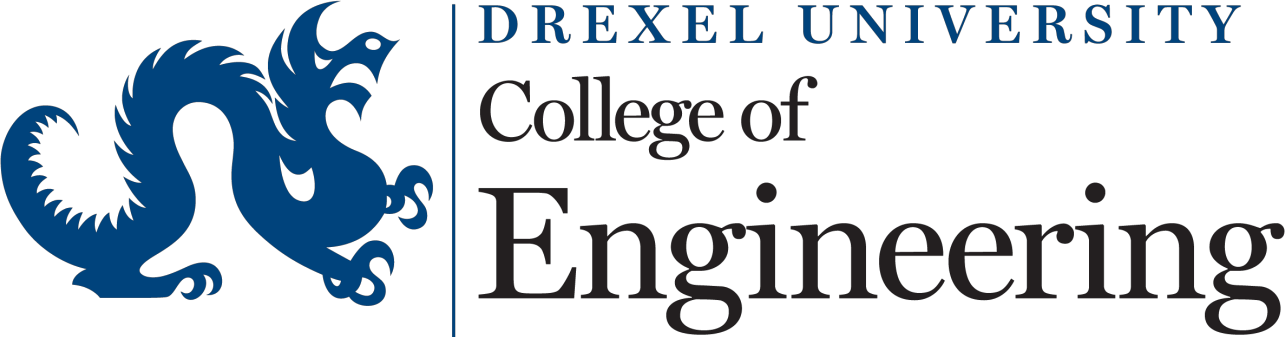
**Siwei Cai Bruce Jiang Hao Song**

**Han Cao**

**Manjun Li**







# 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, 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 extend of the platform, the 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. simplified the difficulty when user try to rapidly build their prototype on top of our original one, or by using it entirely without changing.

**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.

Fall:

Week1-2: Submit this proposal

Week4-5: Finishing evaluations of CAD drawings

Week6-7: Complete the written Proposal and presentation of it

Week8-9: Shopping the required materials for 3d-printing and building

Week10-11: Having a model build for testing or prepare for shipping

Winter:

Week1-2: With the available physical model, groups members should all agree to develop on the same platform of interface.

Week4-5: Testing out basic scripts to let robots recognize the surroundings.

Week6-9: Trying to build a system for robot to walk autonomously within indoor space

Week10-11: Fixing the potential failure on the mechanical structures of the robot.

Spring:

Week1-6: Refrain and tune the robot for its optimal performance.

Week7-8: Final presentations and final technical report.

**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.

# Budget

|  |  |
| --- | --- |
| Name of the products | Price in USD |
| Nvidia Jetson Nano | $100.00 |
| O-drive | $75.18 |
| Arduino Mega | $33.00 |
| Signal Line Lidar DB2 | $70.64 |
| D-w-maker Z6 3D printer | $671.00 |
| Electrical Motor (two counts) | $298.50 |
| Battery (two counts) | $30.00 |

# 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.