



SAN DIEGO STATE
UNIVERSITY

Otterbotics Self-Driving Golf Ball Picker



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Project Objective

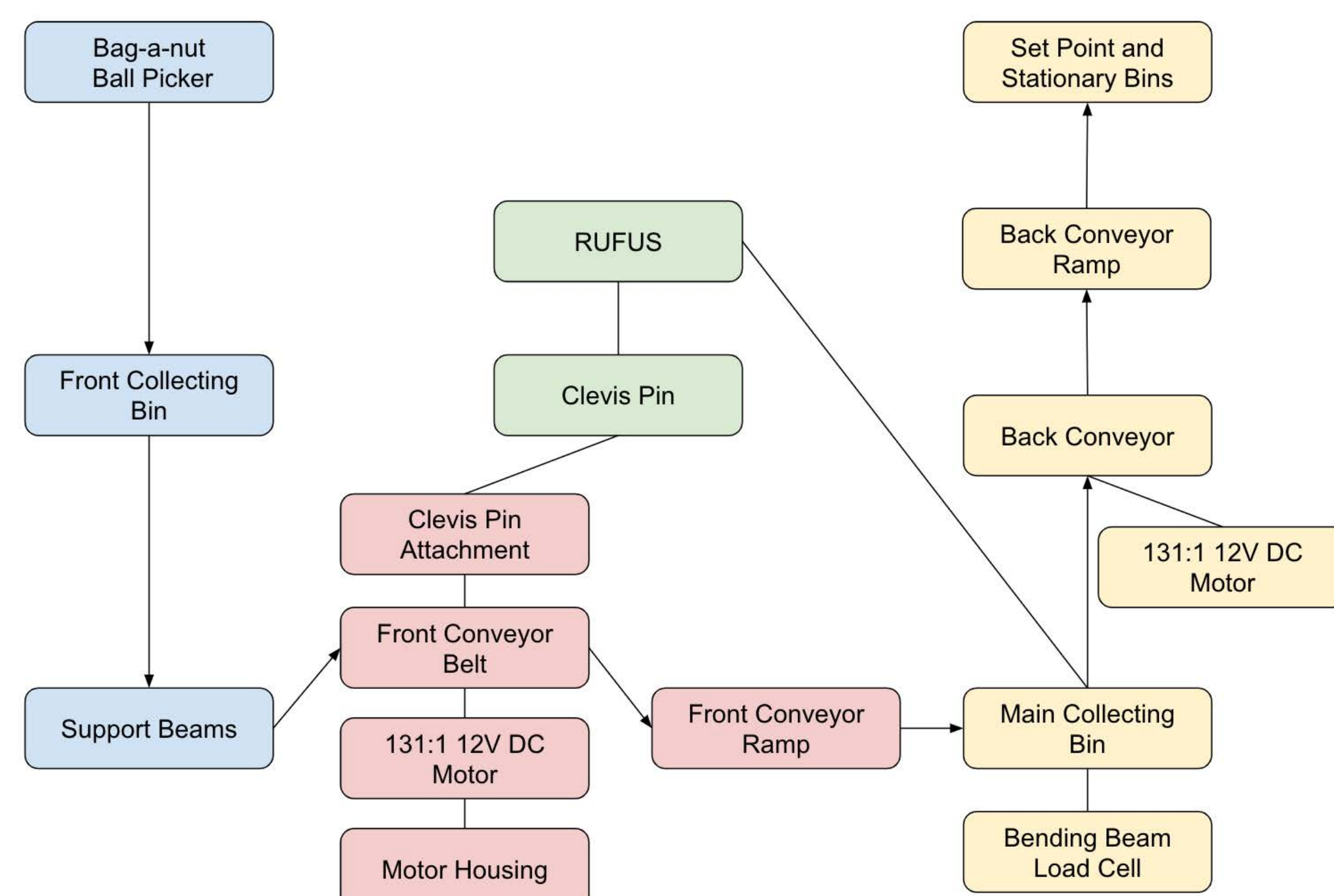
Otterbotics tasked us to design multiple subsystems to contribute to their entrepreneurship idea of an AGV that can be equipped for different functions. The subsystems we designed will allow for the AGV to collect golf balls from a driving range and deliver them to a specific location. The process should require no human interaction on the driving range, while allowing for human interaction with the balls once delivered to the set point as well as for maintenance.

Requirements

The following requirements were given for the project:

- No human interaction will be required while the vehicle is on the driving range
- Golf ball must be picked up in front of the AGV, not underneath it or behind it
- The design must allow for storage of 1,000 balls
- The design width cannot exceed 48 inches

System Level Diagram



Design

We satisfied the requirements with three subsystems that work in conjunction with the Otterbotics AGV. First, the front picker will collect balls from the ground. Second, the front conveyor will move balls from the first subsystem to a collecting bin on top of the AGV. Finally, the collecting bin stores balls while operating, and a rear conveyor transfers the golf balls to a stationary set point when ready.



Fabrication

Our design incorporates a combination of off-the-shelf parts and parts we manufactured ourselves. Our machining operations were performed with the water jet, CNC lathe, and CNC mill all located at the SDSU machine shop. We also used the lathe, mill, 3D printer, soldering iron, and TIG welder located at the Otterbotics facility. Additional welding and metal bending was outsourced to End Results Manufacturing.



Testing

Due to COVID limitations, the following testing was done at the Otterbotics facility and at the home of Mikey Swan

- Firstly, Finite Element Analysis using Solidworks was run on critical components to ensure structural integrity prior to manufacturing
- Curvature of 3D printed fingers was tested by manually moving the picker wheel
- The two conveyors were tested under various loading scenarios to limit clogging under realistic loads
- The Otterbotics AGV was incomplete due to COVID and therefore unusable for testing, requiring us to simulate AGV movements and functions ourselves.

Summary

Despite limitations due to COVID, we were still able to achieve our goals. The sloped bin design stayed within the design envelope and stores at least 1,000 balls. The design allows for the front section to attach to a vehicle using a clevis pin, meaning that the entire front section could be removed and swapped for different functions. While we could not test the final product on a driving range, an on-board Arduino and power supply work in tandem with a load cell located in the storage bin to turn motors on and off when appropriate, avoiding human interaction.

Acknowledgements

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