G.O.A.T.(s)

2016 Naval Academy Robot Football Team

Team Members

MIDN Brandon Ward	Systems Engineering
MIDN Cameron Baird	General Engineering
MIDN Jose Benitez	General Engineering
MIDN Adrian Castro	Systems Engineering
MIDN Ben Jacobsen	Systems Engineering
MIDN Kevin Tamayo	General Engineering
MIDN Alex Heille	General Engineering
MIDN Brendon Troutman	Mechanical Engineering

Faculty Advisors

Prof. Stephen Graham	Mechanical Engineering
Asst. Prof. Kevin Galloway	Electrical Engineering
LCDR Kristin Carter, USN	Systems Engineering

Project Sponsor

Bastian Solutions

Background:

The University of Notre Dame has been hosting an intercollegiate Mechatronic Football game and combine since the Spring of 2012. Robotic football has, since then, become quite popular amongst the engineering programs of various universities, including the Naval Academy. Thus the goal for this project is to build a fully functional robotic football team that will represent USNA at the next robot football competition in the spring of 2016.

To participate and win in this event, every robot will be expected to perform its individual task better than the competition. For this project, the Navy G.O.A.T.(s) have come up with a playbook that they expect to use against other universities' teams in a scrimmage next year. From this playbook came a vision of three critical robots; a center, a quarterback, and a wide receiver which would work in conjunction to successfully execute passing plays. From these roles came customer requirements for each robot, which will define the roll of each robot in the play and guide the team in constructing successful robots.

Objectives: The goal of this project is to design, build, and test a system of three robots that can individually accomplish a series of “combine events” testing the robots performance, as well as work with one another to successfully complete passing plays in a robot football game.

Results:
Though the 2016 robot football team was left with the 2015 robots, these robots were shoddily built and not in working order. The team’s first agenda was to rebuild the robots and test their performance. Having done so, the team learned where the robots could be improved for the coming year. The next step was to consult the combine and gameplay rules to create a playbook that would define the role and capabilities necessary for each robot. From these stemmed the customer requirements, which were unique to each robot and dealt with that particular robot’s role.

The team translated the customer requirements into engineering characteristics and executed the steps of the design process, including brainstorming and creating a house of quality, a functional decomposition, and a weighted decision matrix to create and select a design. Given the poor performance of the 2015 robots, the 2016 team decided to design and build the new robots from the ground up. Using a variety of engineering models to inform the decision process, the team created a series of successively more detailed designs until a final design, from which manufacturing could begin, was established.

The final product for this project is at least three robot football players, to include a center, quarterback, and wide receiver, as well as a vision system to allow the quarterback to communicate with and throw to the wide receiver. The three robot designs are shown in Figure 1 below.

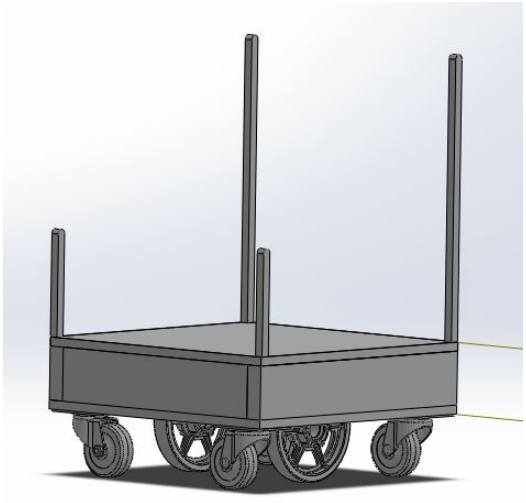

Figure 1: Wide Receiver design (vertical posts mount a net to catch the ball, not shown)

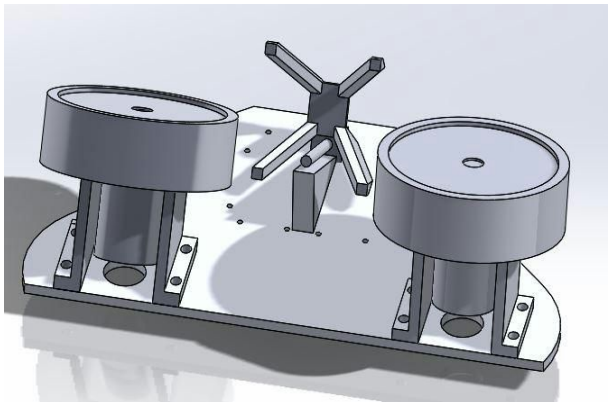

Figure 2: Throwing portion of quarterback; uses rotating wheels to launch a miniature football

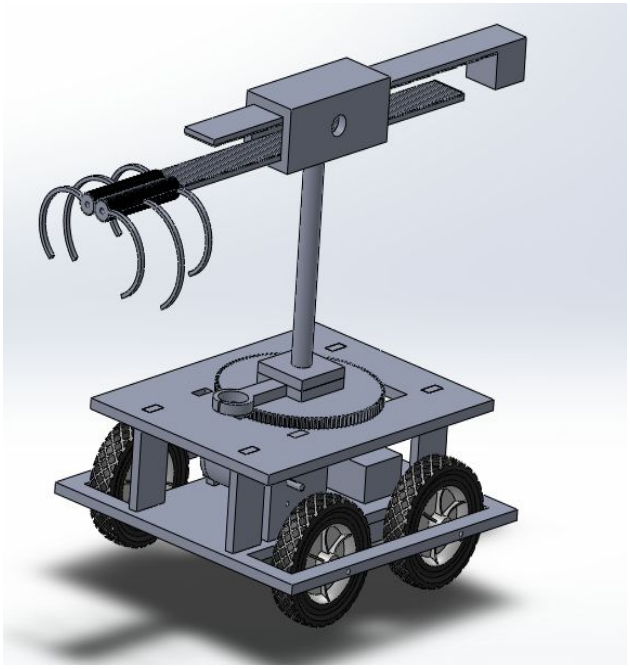

Figure 3: Center design; “hikes” ball to quarterback

The team also hopes to bring home a victory in the 2016 Notre Dame Robot Football Competition.

Figure 4: 2016 Robot Football Team, ready for competition