AEV Design Project

Team G:Andy Kaminski, Manny Jannazo, Jake Cantin, Roger Kassouf

The Ohio State University

HONORS & SCHOLARS
Green Engineering Scholars

Background

- We are designing an AEV because the owners of Jurassic Park have decided that they need an unmanned transportation system to allow the tour guides to focus completely on guest safety.
- Our designs are intended to be models of a design that would actually be created for the transport of passengers and cargo.
- The overall goal of the project is create an energy efficient form of transportation that is powered by propellers which in turn get their power from a Li-PO battery.

The Objective

- The goal of the AEV is to traverse half of an oval shaped track, making stops at a dinosaur safety gate, and then at the end of the track to pick up dinosaur eggs which are on a separate caboose that must be brought back to the start with the AEV.
- The AEV must complete this half circuit within 2.5 minutes and must stop for at least 7 seconds at the end of the track as well as both passes of the safety gate.
- Some design restrictions include that the arduino controller may not be placed on the vertical support arm, and be positioned at least 2 inches from the magnet that is used to connect the AEV to the caboose.

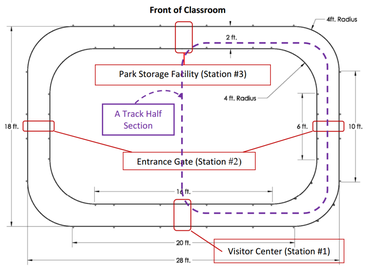

Figure 3: AEV Test Track

Initial Design

- Wings on a cross shaped plate
- Bend in wings at 45° angle
- Motors attached to wings on flat portion
- 3-D printed “beak” to balance weight
- Design was chosen because of balance and aerodynamic look
- All other screened designs were fairly similar, and this one had the most promise based on initial observations

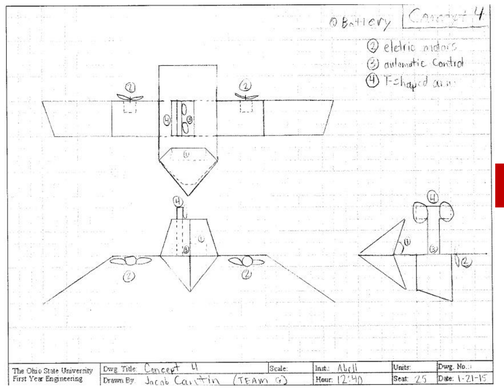

Figure 1: Preliminary Sketch of AEV

Final Design

- Reduced weight as much as possible by removing uneeded parts and attaching the Arduino to the bottom of the AEV
- Most balanced of all the designs tested
- Moves very efficiently in the forward direction, however its major shortcoming is its movement in reverse
- The location of the propellers close to the body of the AEV makes them as efficient as possible

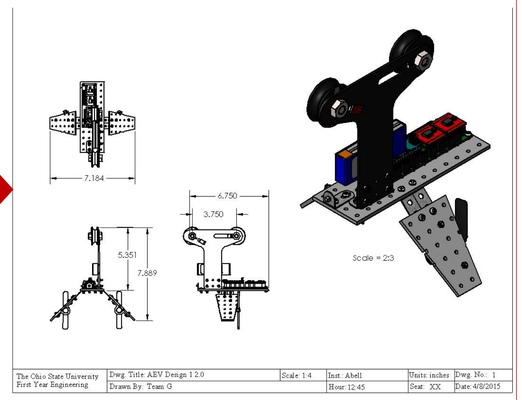

Figure 2: AEV Solidworks Design 1

Changes to Initial Design

- Never developed “beak” part. Determined it was too difficult to make, and would add unwanted weight.
- Switched to a rectangle base reduced weight
- Moved motors onto angled wings which kept them away from base
- Tested another possible design that would reduce weight and energy input, but failed test runs.

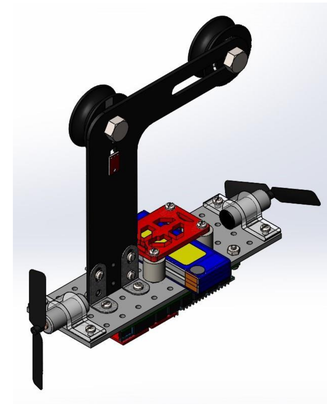

Figure 4: AEV Solidworks Design 2

Results

Design one could be seen to improve upon the sample AEV in efficiency through testing, using the AEV data analysis tool (Example figure to right), and balance by observation

Phase	Arduino Code	Distance (m)	Time (seconds)	Energy per Phase (Joules)

1	reverse(4);
	motorSpeed(4,30);
	goToAbsolutePosition(365);
	brake(4);
	reverse(4);
	motorSpeed(4,25);
	goFor(3);
	brake(4);
	goFor(8);
		0 - 7.936
		(7.936 m)
			0 - 15.301
			(15.301 s)
				49.75310661

2	reverse(4);
	motorSpeed(4,30);
	goToAbsolutePosition(990);
	reverse(4);
	motorSpeed(4,25);
	goFor(3);
	brake(4);
	goFor(7);
		7.936 - 15.8844
		(7.948 m)
			15.301 - 29.281
			(13.980 s)
				47.77645408

3	motorSpeed(4,45);
	goToAbsolutePosition(800);
	reverse(4);
	motorSpeed(4,15);
	goFor(3);
	brake(4);
	goFor(9);
		15.8844 - 27.032
		(11.1476 m)
			29.281 - 46.981
			(17.700 s)
				70.52492851

4	reverse(4);
	motorSpeed(4,45);
	goToAbsolutePosition(150);
	reverse(4);
	motorSpeed(4,15);
	goFor(3);
	brake(4);
		27.032 - 30.938
		(3.906 m)
			46.981 - 57.721
			(10.740 s)
				55.5706399

Table 1: Energy Consumption

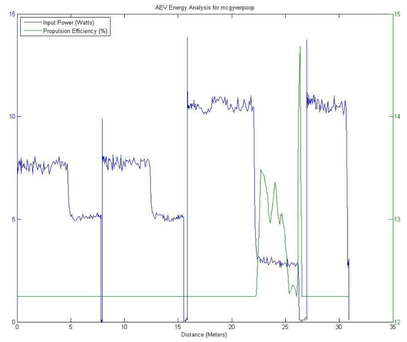

Figure 1: AEV Energy Analysis vs Distance

Design two (pictured top right) was an attempt to improve the efficiency of the AEV by placing a propeller on both sides of the AEV, as the propellers work much better for pushing than pulling. However testing this design proved to be very complicated and ultimately never worked as intended because of complications with coding the motors to go in opposite directions at the same time. Because of these complications this design was scrapped.

Acknowledgement: Annie Abell, Jeff Chastel, Alexia Leonard, Joey McEnery, Colin Kenney

Conclusions

- Examining our results our group concluded that our design was relatively efficient while moving forward, and less efficient moving in the opposite direction. Even with the lack of efficiency in reverse our design was superior to the alternative, which was very inefficient
- This conclusion was reached by testing each design using the same code and gathering data on efficiency as well as observations from the overall performance
- Unfortunately much of the data was inconclusive or did not differ significantly enough over multiple runs to prompt any change to the design

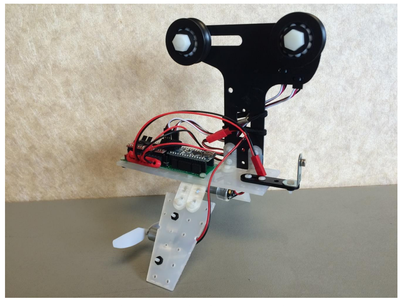

Figure 5: Final AEV Design