Baker International Group A

Section 9000, Group A
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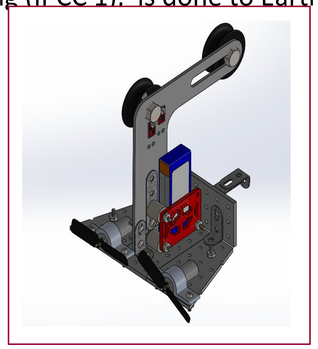
Results of Final Performance

Objective:
The AEV had to go through the sensors, attach to the caboose, come back through the sensors and stop in a safe manner on the other side.
Initial Problem Areas:
The AEV was never capable of connecting to the magnet because of faulty engineering with the base design. This lead the magnet to tilt down too far to reliably attach.
Final Results:
The AEV was inconsistent in its ability to go through the gate during the final testing. This coupled with the struggles attaching to the caboose impacted the performance.

Overview

After winning a $50 million-dollar grant in 2016, Columbus has set out to create more environmentally friendly options for public transportation. Since the world has only 11 years to control climate change before irreversible damage due to a wide variety of catastrophes, ranging from droughts and wildfires to harsher hurricanes and frequent flooding (IPCC 1), is done to Earth, the initiative has significant backing by the public.
For the advanced research and development, the group explored how to preserve energy, the most efficient propeller configuration, and the best way to break the AEV in order to consistently pass through the gates.

After the completion of this research, a final design was created which incorporated all findings from the testing. The code for the Arduino also utilizes the results of the testing, focusing more on lower, safer speeds for longer times, and deceleration loops.



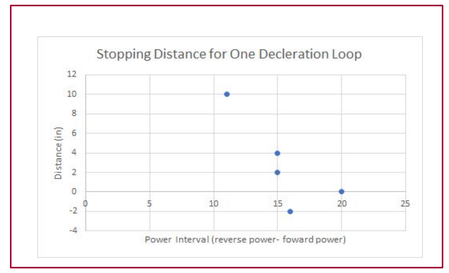
The Final Design for the AEV

References: IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, Maycock, M. Tignor, and T. Waterfield (eds.)]. *World Meteorological Organization, Geneva, Switzerland, 32 pp.*

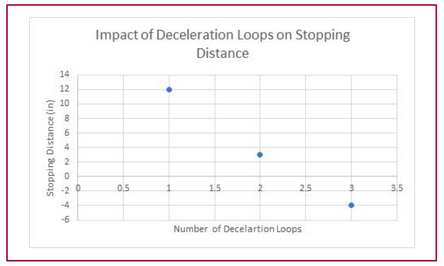
Power Breaking

General Procedure
-Determine the minimum stopping distance for each power interval with one deceleration loop
-Determine the minimum stopping distance using one power interval and different numbers of deceleration loops
Goal of Testing
-To determine a way to stop the AEV so that it moves the least distance after the propellers reverse
Outcome
-The most effective way to stop an AEV at 39% power is 2 deceleration loops at 54% power

Note: A deceleration loop consists of reversing the motors at a high speed for a short amount of time in order to brake the AEV.



Stopping Distance for one Deceleration Loop



Stopping distance for numerous loops at 15% power

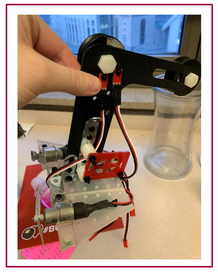
Battery Testing

General Procedure
-Compare the difference in voltage between running the AEV at 20% vs 15% for 15 seconds
-Compare the difference in voltage after running the AEV at 15% at 15 and 30 seconds
Goal of Testing
-To determine which is more energy efficient, running the battery longer at a shorter power, or at less time in at a stronger power level.
Outcome
-It is more energy efficient to use a shorter power over a larger time period.

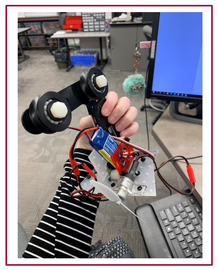
	Test 1	Test 2	Test 3
Initial Voltage Level	8.6 V	8.6 V	8.6 V
Power Level	15%	20%	15%
Run Time	15 s	15 s	30 s
Final Voltages			
Trial 1	8.4 V	8.1 V	8.2 V
Trial 2	8.3 V	8.1 V	8.1 V
Trial 3	8.4 V	8.0 V	8.2 V

Propeller Configuration Testing

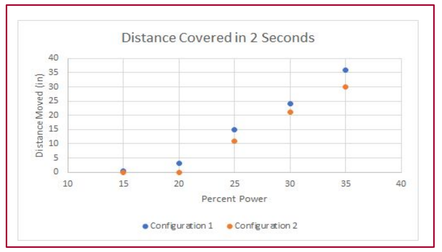
General Procedure
-Determine the lowest power percentage required to make each configuration move forward
-Record the distance each configuration moves from their lowest power to 35%
Goal of Testing
-To determine the most energy efficient configuration for the propellers that does not inhibit the Performance Test Objectives
Outcome
-The propeller that least inhibits the attaching of the caboose, as well as moves the furthest at any given power is configuration 1.



Propeller Configuration 1



Propeller Configuration 2



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