Design of an SAE Baja Vehicle Steering

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Progress

The project involves the designing and construction of the steering column and control arms of a vehicle that abides to the Society of Automotive Engineers (SAE) design constraints. This project's focus is on the design of the steering component, which is a critical part of the vehicle that allows the driver to steer and operate. Progress on the project are:

1. Designed and built a functional 1-to-1 scale model of the steering column and control arms for the vehicle that meets the SAE design constraints.
1. Tested and verified the performance of the components using various testing, such as simulated motion study stress test.
1. Documented the design and construction process in a report that includes details such as design approach materials used, testing, results, and project outcomes.

Figure 1: Frame

Figure 2: A-Arm Connection Spot

Figure 3: Steering Knuckle

Achievements

- Created a finalized design with highest number of pros to cons using SolidWorks
- Constructed a 1-1 scale model of the final right half A-arm assembly design
- Reduced the total cost of the project
- Achieved the correct measurements for scale model
- Enhanced design functionality from original designs
- Implemented risk management strategies
- Final design within SAE parameters

Challenges

Some obstacles faced by the team were limited funds, as the provided grant is almost completely used. Fitments to the frame and steering knuckle was another, as more measurements needed to be taken. 3-D printing was also difficult as the ones in the Maker Space were not capable of printing the large sized A-arms. This could only have been done by printing multiple smaller pieces but wasn't due to the amount of time required.

Column #	1	2	3	4	5	6	7	8	9
Direction of Improvement	▼	▲	▲	▼	▼	▼	◇	▼	▲
Customer Requirements (Explicit and Implicit) / Functions / Requirements	Turning Radius (in)	Distance of steering wheel from the frame or side panel (inches)	Maximum steering wheel rotation angle (degrees)	Weight (lbs)	Cost ($)	Steering column angle with respect to the ground (degrees)	Horizontal distance from the back of the seat to the center of the steering wheel (inches)	Ackerman angle (degrees)	Strength of Material (psi)
Durable	○	○	●	●	●	○	○	▽	●
Good Maneuverability	●	▽	●	●	○	●	○	●	○
Mate existing roll cage design	○	○	○	○	●	○	○	○	○
Easy to turn the steering wheel	●	●	●	●	○	●	●	●	○
Design must keep driver safe	○	●	▽	●	○	▽	●	○	●
No exposed links for steering	○	●	●	○	●	○	▽	○	○

Problem Identification

Analyzing the grant amount and purchased items, it was realized that manufacturing in house would be an issue. The fitment issues were discovered when adding the A-arm assembly to the buggy frame in SolidWorks as they didn't line up or were incorrect dimensions.

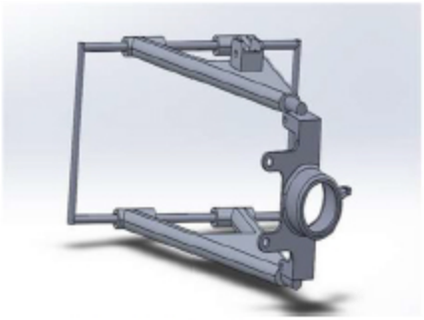

Figure 4. A-Arm Assembly in SolidWorks

Proposed Solutions

- 1-1 Scale Model
- Better 3-D Printer, provided by Dr.Bruton
- Redesign of A-arm Assembly
- Redesign of connection points
- Additional Grant Money

Evaluations

- 1-1 Scale Model, very effective
- 3-D Printer, effective
- A arm assembly, very effective
- Connection points, very effective
- Additional Grant Money, not effective

Figure 5: Bottom A-arm

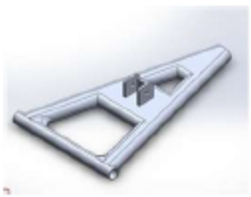

Figure 6: Top A-arm

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