Electric vehicle Outriggers—External Mount

Patrick Roulston & Senlin (Max) Zhang

Problem Statement and Customer Needs

Our team is to design Outriggers (external mount) for a two-wheel electric vehicle. The outrigger is to consist of two small wheels that will go up and down quickly for when the bike comes to a complete stop. The outriggers will help the vehicle keep its balance while waiting at traffic lights and/or parking. The system must come down fast in case of emergency stopping and has to be able to keep the bike up right and stable when deployed.

Constraints

- Had to fit in the 100mm space behind the seat
- Had to be light weight
- Had to be Completed by the 10/11/2020
- Cost had to under $400.
- Had to be constructible in the EPIC enter Work shop

Primary problems

Design a system that will lower and rise the outrigger wheels. So, when they are up, they are out of the way and when deployed they hold the bike up right and stable.

Secondary problems

1.The speed at which the wheels will extend and retract. This needs to be fast ideally for emergency stopping.

2.The strength of the system needs to be able to hold the bike up.

3.A self-levelling system that will allow the bike to stay up right when on angles.

4.Find a way to mount the system on the bike that does not interfere with the rear suspension and the other out riggers system.

5.Make it mall enough that it will fit behind the set of the bike

Figure 1—Drive Motor (Runs on 12 V DC)

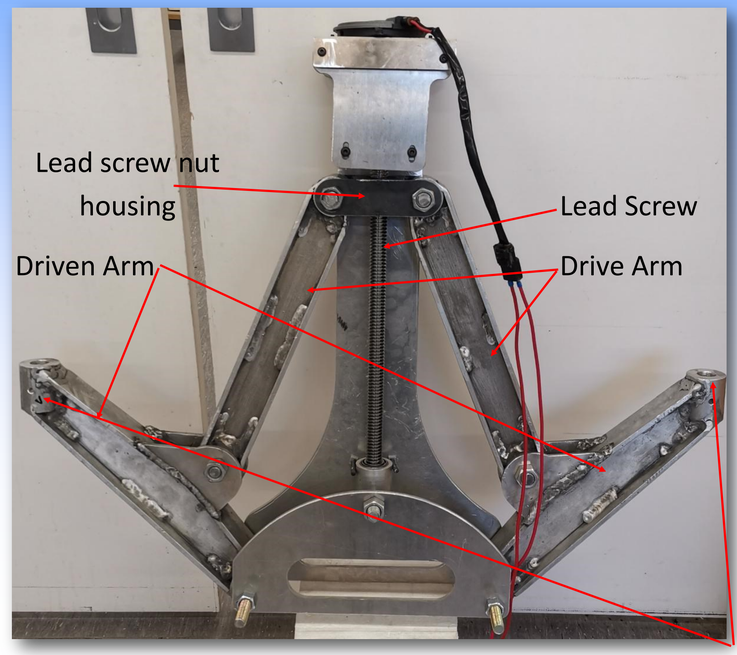

Figure 2 - Full assembly of outrigger

How it works.

The drive motor in Fig 1 spins the lead screw which is Shown above this drives the Lead screw nut housing. This in turn drives the two drive arms down into the driven arms forcing them to fold downwards Deploying the out riggers. When the motors polarity is switched the motor drives in the opposite direction pulling the

Recommendation

Connection with Lighting system

It is recommended that the outrigger is connected to the lighting system. So that there are two lights on each side that flash when the outrigger is going up or down. It would also be good to have indication lights to tell the driver whether the outriggers are up or down.

The mechanism

The mechanism arms system could be improved if the arms where welded in a jig to keep the bushes in the arms square. The tolerances on the pivot joints could also be larger to reduce fiction on the system allowing for smother operation.

The arms could also be made lighter and not so heavy duty as they were a little bit overkill compared to the rest of the bike.

Conclusion

The project lasted nearly 16 weeks. During those 16 weeks, the team collected different design ideas and ideas through the first stage of brainstorming. In the second stage, the feasibility, force, budget, and application of these design concepts were analysed . Each item was scored using a design matrix and the alpha prototype was finally confirmed. In the third stage, we improved the prototype and conducted stress analysis of the 3D model in SolidWorks software. At the same time, we also calculated the friction force and traversing speed of the model by hand calculation. Then, we determined the bill of materials and completed the production of the prototype. In the process of assembling the outrigger in the vehicle, some difficulties were encountered. For example, the drive arm and the driven arm connection were to tight and would seize up and the mounting to the car needed lots of modifications to make the outrigger function as expected.

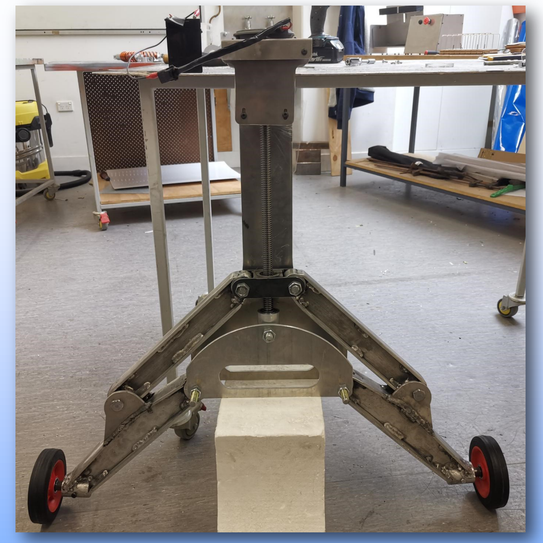

Figure 3 - Outrigger with wheels attached