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Design and Fabrication of Hybrid-Drift Trike

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ABSTRACT

This project aims to create an inexpensive Hybrid-Drift Trike using a hand-welded steel frame, the front half of a used Bicycle, Powered by a 125cc ATV IC Engine, and an Electrical Hub Motor. Drift trikes are usually said to have originated in New Zealand, where they arose from the popular 'boy racer' culture. Boy racers refer to young people in New Zealand who race manually modified vehicles with loud exhaust systems and showy body packages. The back frame of the trike was welded over several weeks, and components including the axle, front wheel, IC Engine, and braking system were added after the frame's completion. The throttle system and electronics are functional, and the trike is operational. As the Trike is operational, the distance covered with full charge and full tank combined is around 43kms.

KEYWORDS: IC Engine, Drift, Bicycle, Hub Motor, Trike

1. INTRODUCTION

Drift trikes are widely thought to have originated in New Zealand, as part of the country's popular 'boy racer' culture. Boy racers are New Zealand youth who race manually modified cars that often have amplified exhaust and flashy body kits.

While drifting in this application is purely for entertainment purposes, the technique was developed in the 1970s by professional drivers in Japan to save time on turns. Drifting is the controlled slide around a corner while maintaining a firm grip on the gas pedal. Motorcyclists use the "counter-steering" technique to drift; no changes are required.

When a rider sets up a drift turn, he or she steers the bike in the opposite direction of the desired turn for a brief period of time. The rider then sharply adjusts the handlebars to turn the bike in the correct direction, causing the back end of the bike to temporarily lose traction and kick out.

Smooth roads are preferred over coarse chip-sealed roads because coarse surfaces wear out rear wheels faster, create a rougher ride, and even limit drifting ability. Riders gain most of their momentum from gravity, but many trike drifters prefer to use a freewheeling, pedaled front wheel, which results in a more versatile trike.

The freewheel hub allows the rider to pedal and gain forward momentum while also allowing the rider to coast when not pedaling. Another way to get started is to stand on the back of the trike and kick or push backward with one leg. Drift trikes typically travel at speeds ranging from 25 to 50 kilometers per hour.

2. LITERATURE AND REVIEW

Drift trekking necessitates complete chaos control. As you glide across the surface, your back wheels are slick, and you have no control over them. This is known as oversteer. When the rear wheels lose grip and friction on the road before the front wheels, this is referred to as oversteering. Following that, the trike's back end "swings out." This is, of course, a manufactured feat rather than a driving flaw in trekking. Consider how oversteering produces the perfect drift.

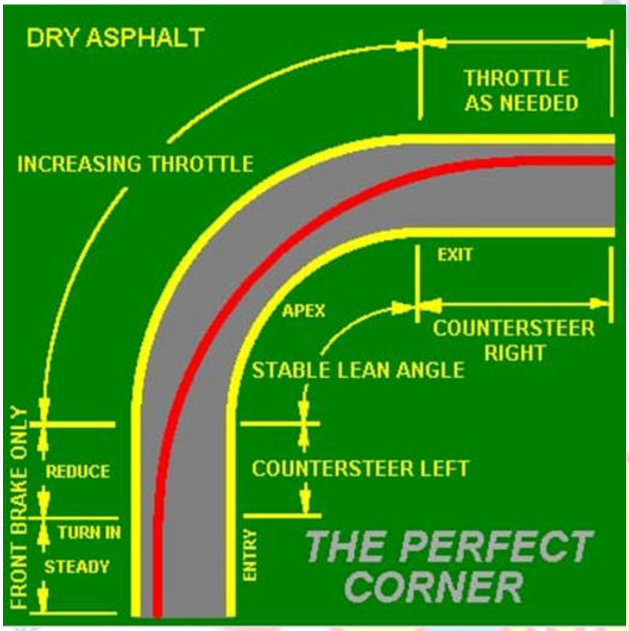

Figure 1: Diagram Illustrating the best way to achieve a controlled Drift by countersteering

Alametal investigated the significance of human-powered tricycle aerodynamic design and comfort. The results of wind tunnel testing were reported in order to determine the key characteristics of this human-powered vehicle. The magnitude of aerodynamic drag varied significantly with the physical profiles of the test vehicles. They discovered that manufacturers of human-powered vehicles did not always consider the importance of aerodynamics in traditional tricycle design. This study found that an appropriately designed vehicle (aerodynamically) reduced aerodynamic drag significantly more than a conventional vehicle. The seating position in such a vehicle is critical. The further backward reclining position allowed for an additional reduction in frontal area, lowering net drag force.

Furthermore, observations at a race event indicate that reclining further backward shifting may provide better physical advantages for endurance. Component add-ons and their positions, as expected, increased drag more at low speeds than at high speeds. Wheel covers reduced total vehicle drag compared to uncovered wheel one.

3. DESIGN

The trike's back end will be handcrafted. The round steel frame will have three pipes attached to the front for structural support. The image below depicts the steel frame as well as the steel mounting strips for the engine. The image labeled the dimensions of the frame.

The engine will be placed at the back of the frame, with the axle in front of it, so that it is not too close to the rider. The axle will be attached using steel hanging bearings welded to the steel pipes as shown below.

The axle will be a live axle configuration, which means that a 3/16" keyway will interlock the axle sprocket and axle.

As a result, unlike a standard axle setup, where the axle is attached to one of the wheels, the axle will rotate with the sprocket. Live axle setups are considered stronger and more reliable, but they make turning the wheels more difficult. Because the back wheels on this trike will not need to turn, there is no obvious disadvantage to using a live axle setup.

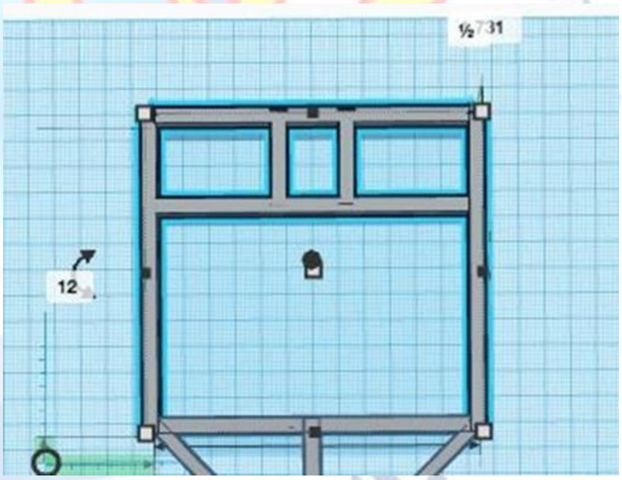
Figure 2: Sketch and design of the frame

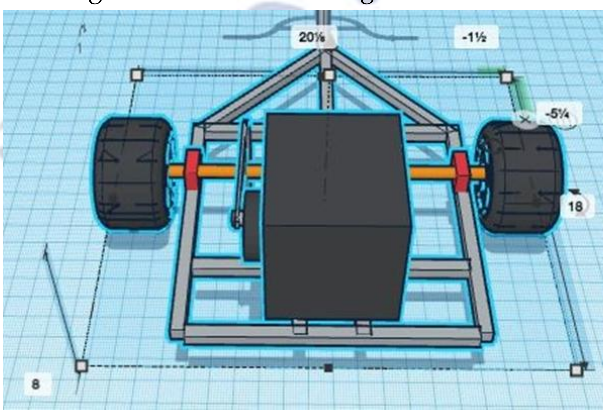
Figure 3: Diagram of the Drivetrain for trike

4. FABRICATION

Although the trike's three-wheel design makes weight distribution less of an issue than a motorcycle, it is still important to ensure that the weight is evenly distributed throughout the bike. The engine was originally located in the back right corner of the trike, but it is now located in the center.

The engine will be bolted to two steel strips welded equidistant from the frame's center. This ensures that the x-coordinate of the center of mass is in the middle of the frame; the weight distribution on both sides of the trike is identical, and the rider sits directly in the middle.The only other possible issue is that the engine is positioned behind the axle, causing the center of mass to be behind the back axle; the engine is relatively heavy, weighing 110 kgs or more. However, because the rider will easily outweigh the engine, the y-coordinate of the center of mass will be in front of the axle, preventing the front wheel from rising.

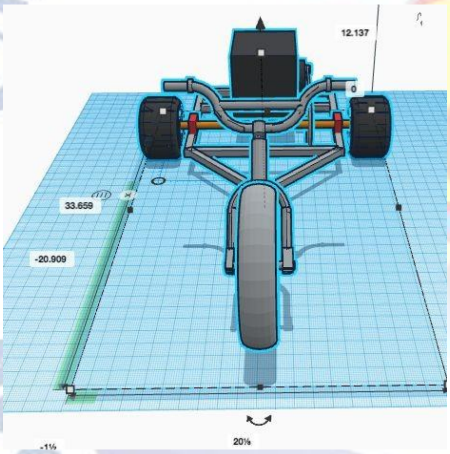

Figure 4: Front view of the Trike.

One significant design flaw is that the mountain bike, and thus the front wheel, can be directly welded to the frame. Steel pipes with inner diameters slightly smaller than the outer diameters of the long Steel pipes will be slid over the bolted on. The steel pipes will then be cut at an angle with a horizontal band saw so that they are flush with the steel frame. The two components can then be welded together.

The benefit of using a mountain bike over a regular bike, which may be a better size and made of steel, is that the mountain bike already has a front-wheel handbrake. This means that a disc brake attached to the rear axle is no longer required. The drift trike in its final form (aside from the seat) is shown below.

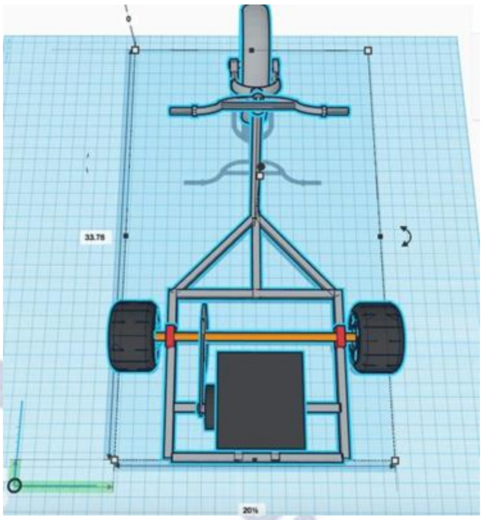

Figure 5: Top View of the Trike.

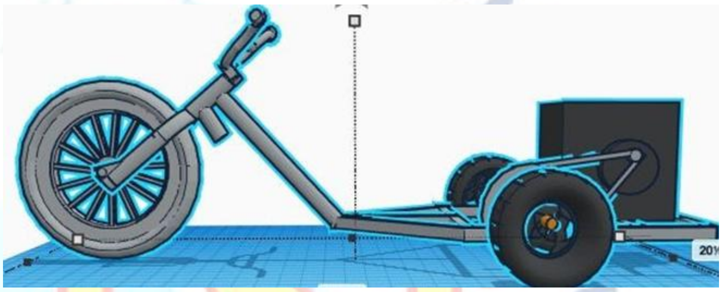

Figure 6: Side view of the Trike

5. MATERIALS AND METHODOLOGY

Hub Motor

Output: 36volts 250watts.
Power Source: DC
Material: Iron
Dimensions: 15x15cm
Weight: 1kg

Electromagnetic fields are supplied to the motor's stationary windings by the hub motor. The motor's outer part follows or tries to follow, those fields by turning the attached wheel. Brushes in a brushed motor transfer energy by contacting the motor's rotating shaft. A brushless motor transfers energy electronically, avoiding physical contact between stationary and moving parts. Brushless motor technology is more expensive, but it is more efficient and lasts longer than brushed motor systems.

A hub motor is typically designed in one of three ways. An axial-flux motor, in which the stator windings are typically sandwiched between sets of magnets, is considered the least practical. The other two configurations are both radial designs with bonded motor magnets to the rotor; in one, the inner rotation motor, the rotor sits inside the stator, as in a conventional motor. The rotor in the outer-rotation motor sits outside the stator and rotates around it. Hub motors are still being used in vehicles, and neither configuration has become standard.

Figure 7: Electrical Hub Motor

IC Engine

Engine type: Single cylinder, 4-stroke, air-cooled
Transmission type: Automatic with reverse
Displacement: 125cc
Max Torque: 7.0N.m/6500rpm
Max Horsepower: 6.0kW/8000rpm (10 HP)
Max Speed: 55 mph
Ignition: CDI
Bore Stroke: 57.4×57.8mm
Starting System: Electric
Fuel Capacity/Oil Type: 5L
Battery: 12V, 9Ah

The GY6 engine is a four-stroke single-cylinder with a nearly horizontal orientation that is found on a variety of small motorcycles or scooters manufactured in Taiwan, China, and other Southeast Asian countries. It has since evolved into a generic technology. As part of their range, Kymco went on to produce Honda clones made to Honda standards.

The 125cc ATV's four-stroke engine. Under Honda's consultation, Taiwan's Kwang Yang Motor Co., Ltd. (KYMCO) modified Honda's KCW150 (the commercial name in Japan is "Spacy") into a standard model called the GY6, which various Taiwan makers imitated and minor-changed. Vehicles of this model were imported from Taiwan by various manufacturers and traders and distributed primarily along China's southern coast.

Figure 8: 125cc 4-Stroke Engine

6. RESULT

As the project neared completion and the trike began to look more and more like a trike, it became clear that this project was just as much an exercise in skill acquisition as it was an end goal-based project. While the ultimate result of the trike is not yet known, all indications point to the trike working within the next few weeks. There are multiple steps in the process of creating the trike that I would do differently given another chance. Firstly, I would have looked for a steel BMX bike to use instead of the mountain bike.

It is true that the front handbrake setup made braking easy but finding the right steel pipes to slide the aluminum was a hassle and it is possible that that time could have been used to implement a superior disc brake setup. Also, the mountain bike is slightly larger than ideal. Secondly, I would have made the frame smaller. While the frame is sturdy, it is apparent that much of the steel piping was not necessarily the same engine that could easily have been mounted onto a frame half the size. The large frame may cause problems once the trike is operational as the back wheels are very far apart.

Finally, I would have purchased an engine mounting plate instead of making my own. Making the holes for the plate took over two days of work near the end of the project, and that time could have been spent attending to small details like footpegs and the safety shield

7. CONCLUSION

The design process of the trike led to a box-shaped frame, a neck tube similar to that of a normal bike, a cross-braced seat, and a motor held in place by two bars centered between the back wheels. The trike is low to the ground, with the rider's feet positioned in the middle of the large front wheel on two pieces of metal, placed there for this purpose - otherwise, the rider's feet would be on the ground. The back wheels have an outer plastic layer that purposely reduces the traction to create the drifting motion. This outer layer was made from two plastic buckets since the ideal material – PVC pipe – doesn't come in the diameter.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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