Mechanics of a DIY Electric Skateboard

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Objective

- Build and design a working DIY electric skateboard kit.
  - This kit will be a student educational tool for those that wish to learn more about design, CAD, coding, and electronics.
  - There will be three different kits consumers can choose from depending on their skill level: beginner, intermediate, and advanced. The beginner kit will require no previous experience while the advanced kit will offer a more challenging and involved project.
  - Depending on the skill level of the kit, the consumer will either be provided with the parts required to put the board together or will be provided the information to design and build the parts themselves.
- Design a cheaper alternative to other electric skateboards on the market.
- Be competitive to other similar products in terms of charge time, max distance, top speed, etc.

Construction

Manufacturing

Figure 1: Conceptual Design of motor mount

The motor mount is planned to be manufactured out of aluminum. A sample of aluminum will be shaped using a mill and a drill. The sample will then be inspected to ensure no visible fractures are present.

This process will be greatly detailed in the instruction booklet; however, our kit will include premade mounts as access to the tools necessary to create this are very limited. These will likely come from a manufacturer as we will not mass produce these mounts.

Computer Aided Software

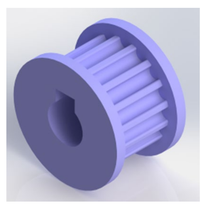

Figure 2: Conceptual Design of Gear

ABS, or acrylonitrile butadiene styrene, is a very strong thermoplastic that is often used in 3D prints for its durability and strong resistance to heat. Both properties will be extremely valued in this application.

There are three components of the board that will be 3D printed with ABS. These include the gear, the pulley, and the casing of the board. These three components will be designed in Solidworks.

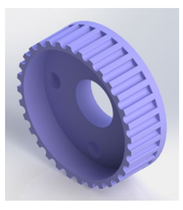

Figure 3: Conceptual Design of pulley

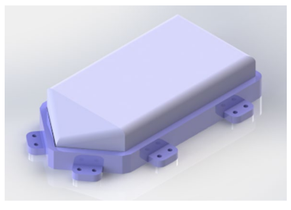

Figure 4: Conceptual Design of case

Within the kit, there will be very detailed instructions as to how to create these geometries and how to print them. This will allow young aspiring engineers to become with one of the most powerful tools engineers use in the workforce.

References

[1] Jensen, James “EdisonTechCenter” Edison Tech Center, 26 October 2019.

Background

One of the first electric motors was created in the 1930s by Michael Faraday and Joseph Henry. This motor however had very little practical applications and was very limited in what it was able to accomplish. Rather, it paved the path of the creation of far more powerful and practical electrical motors.

The modern electric motor can generate work by running a current through a wire in a winding. This then generates a magnetic flux that drives the rotation of the shaft of the motor. The rotation of the shaft creates mechanical energy that can be used for many different mechanical applications. [1]

Discussion

The focus of this project is the construction and manufacturing of the DIY electric skateboard. This will include creating all CAD models as well as machining the motor mount components. Hardware will also be selected.

Kurt Bennett will be designing all electrical components. He will be also be constructing and programming all the circuits within the project. Communication has been key as the direction and design choices of the board are both discussed in high detail with the other.

The motor that will be used is the Alomejor Brushless Motor 6354-270KV Outrunner Brushless Motor Controller. This is a very popular motor used for similar projects. This motor was primarily chosen because of the KV rating 270KV. With lower KV values, more torque is sacrificed for less speed. With higher KV values, more speed is sacrificed for less torque. The higher the torque, the easier it will be to travel up inclines. For electric skateboards, the KV value should typically fall in a range of 180KV-270KV.

Figure 5: Motor

The KV value of the selected motor is on the upper limit of the range. This means that a greater capability to travel uphill is being sacrificed for a larger maximum speed.

All testing will be done on smooth concrete as to have an accurate and consistent mode of testing. Since this will be our only mode of testing, the ability to travel inclines is not relevant to our project.

Conclusion and Future Work

The next step in the process is to complete the 3D prints and assemble the final product. Once these steps are completed, testing will need to start in order to benchmark the board’s capabilities as well as compare these values to the theoretical values. These values will then be compared to be similar skateboards on the market. Our board needs to be competitive both in terms of price and ability.

With the current progression of the project, the price is expected to be at or slightly below the average cost of an electric skateboard with similar capabilities.

The last step of the project is to finalize with instruction manual and packaging of the project. Once this is finalized and the DIY electric skateboard is completed, possible improvements to the project will be discussed and possibly implemented into the next revision of the project.

A possible revision to a second iteration of this project would be to select a motor with a lower KV value to give the DIY electric skateboard the ability to travel inclines with a larger slope. This will allow for greater mobility of the board at the cost of speed.