How an Electric Skateboard Works

What is an Electric Skateboard?

An **electric skateboard** is a skateboard or longboard modified with additional mechanical and electrical components to make it ride able without having to manually push the board. Electric skateboards have recently evolved into a sustainable form of transportation since startup companies began selling complete boards. The DIY (Do It Yourself) community is making it possible for anyone to build an electric skateboard by compiling an online database describing how to make them. Electric skateboards can reach speeds over 25 MPH and are suitable for local commutes less than twenty miles especially in congested cities where car traffic is an issue. This document overviews the additional components needed to electrify an existing skateboard. The document then goes on to describe how the components of an electric skateboard work together to give a rider the option to go forward, reverse, or brake at the touch of a button.

Components of an Electric Skateboard

The skateboard has been used for decades as a form of transportation, however, in the last decade skateboards have been modified to eliminate the need for pushing. Figure 1[i] shows the few basic components of a skateboard listed below:

- Deck
- Wheels
- Trucks
- Hardware
- Griptape

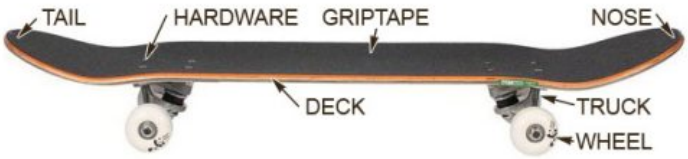

Figure 1 Photo of a Skateboard: Basic parts of a skateboard
Source: Reference [i]Figure 1

Shown in Figure 2, electric skateboards have additional components placed on the underside of the deck that include:

- Motor (1)
- Motor Mount (2)
- Wheel Pulley (2)
- Motor Pulley (2)
- Timing Belt (2)
- Electronic Speed Controller (4)
- Battery (5)
- Bluetooth receiver/controller (6)
- Bluetooth transmitter
- Enclosure (3)
- Additional hardware and wire

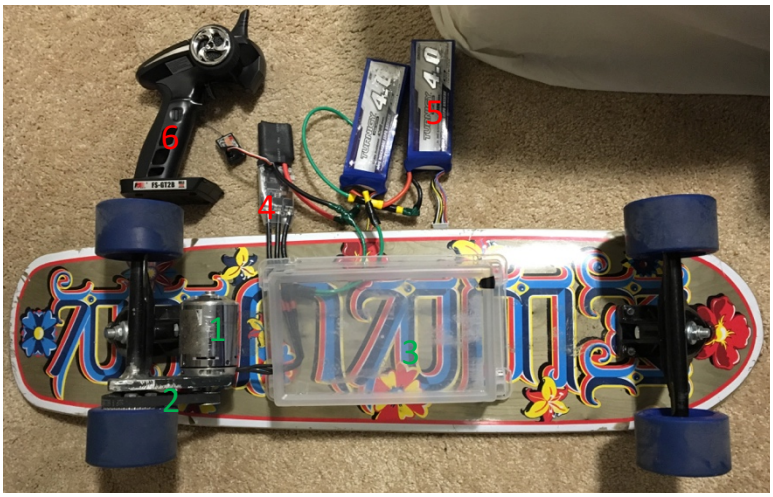

Figure 2 Photo of an Electric Skateboard: Additional components used to create an electric skateboard. Numbers used in image correspond to component list to the left of the image. Mechanical parts are labeled in green, while electrical parts are labeled in red.
Source: Image taken by writer

How the Components of an Electric Skateboard Work

Assuming the reader understands how a normal complete skateboard works, the following paragraphs describe the additional components listed above and how they work together to combine electric power with mechanical motion.

Mechanical Components

Motor
The motor takes the supplied electrical power from the battery and converts it to mechanical motion on the wheel pulley. Motors come in many different sizes and types. Electric skateboards use brushless outrunner motors due to their small light-weight design. The brushless outrunner design is one of the most efficient motor designs, which means it is the best option to get the most of the limited energy stored in the battery.

Motor Mount
The motor mount is welded onto the back skateboard truck to connect the motor to the wheel. Usually, the motor mount is made of a lightweight metal such as aluminum. The motor mount is attached at an angle so that the motor is suspended under the skateboard allowing it to spin freely.

Wheel Pulley, Motor Pulley, and Timing Belt
Pulley's and timing belts are used together to transmit power from one part to another. Pulley's are metallic cylindrical pieces that consist of teeth. Shown in Figure 3[ii], the timing belt is a rubber strip with grooves that connects two pulleys together by sliding the grooves of the belt into the teeth of the pulley. The motor pulley is attached to the shaft of the motor so that rotational motion from the shaft causes the motor pulley to rotate as well. The wheel pulley is bolted through the skateboard wheel. As the motor pulley spins, the timing belt rotates and transmits the spinning motion to the wheel pulley. This configuration allows power from the motor to reach the skateboard wheel and produce forward or backward motion for the rider.

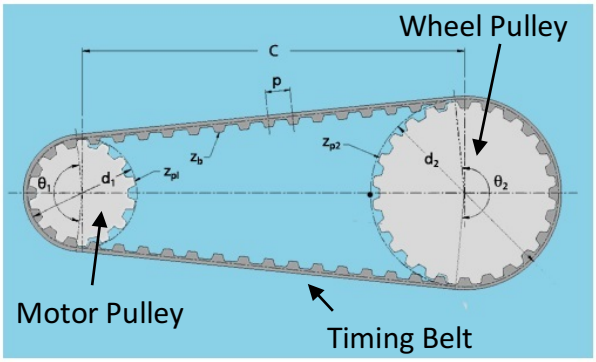

Figure 3 Image of a Pulley System:
Labeled picture of how a wheel pulley, motor pulley, and timing belt come together to transmit power.
Source: Reference [ii]Figure 3

Enclosure
The enclosure is a plastic case used to house the electrical components under the skateboard deck safely and securely. Enclosures are needed to protect expensive electrical parts from everyday riding. Electrical parts can either get wet or damaged without an enclosure. Enclosures protect the rider from being at risk of fires if the electronics malfunction.

Electrical Components

Battery
A battery is an energy storage device that supplies electrical power to the motor via electrical wiring. Batteries come in many different sizes and chemistry to tailor to a particular application. In the case of an electric skateboard, Lithium-Polymer (LiPo) batteries are generally used because they are light-weight, small, rechargeable, and have a fast discharge rate to supply the power needed in this application.

Electronic Speed Controller (ESC)
An ESC can be thought of the brains behind making an electric skateboard function properly. The ESC is connected to the battery, motor, Bluetooth receiver, and has a port to connect to a computer for programming. When a rider chooses to accelerate with the controller, the ESC takes information coming from the attached Bluetooth receiver and draws the correct amount of energy from the battery then supplies it to the motor. ESC's can be programmed to limit the amount of power drawn from a battery. ESC's also have many safeguards built into them to protect a rider in case the controller malfunctions.

Bluetooth Receiver, Bluetooth Transmitter, Controller
The purpose of the controller is to allow a rider to choose if they would like to go forward, reverse, or brake. The transmitter located inside the controller sends a signal to the receiver attached to the ESC via Bluetooth. This allows wireless communication between the controller and the electric skateboard.

Summary of the Electric Skateboard

The electric skateboard is a new innovative way to provide local transportation without polluting the environment such as with gas powered forms of transport. Due to advances in technology, many of the additional components needed to build an electric skateboard are dropping in price. The lowering of costs associated with electric skateboards are making them increasingly popular. Electric skateboards are perfect for local commutes such as a student getting to class at a university. For instance, when a student is going to class they first stand on the board. With the push of a button on the controller, the signal is sent to the Bluetooth receiver on the electronic speed controller. The ESC reads the signal, draws the energy from the battery, then supplies it to the motor. The motor that is mounted on the motor mount spins from the supplied energy and turns the attached motor pulley. The timing belt revolves around the motor pulley and transmits the power to the wheel pulley. As the wheel pulley rotates, the wheel spins as well and the student is off to class without worries because he or she knows the components are protected inside the plastic enclosure under the board.

References

[i] Figure 1 image source:
"Complete Skateboard." Skateboardhere.com, www.skateboardhere.com/skateboard-parts.html.

[ii] Figure 3 image source:
"Pulley System." eSk8 Mechanics, 21 July 2015, www.electric-skateboard.builders/t/beginners-guide-to-building-your-own-electric-skateboard-drivetrain/53.