Designing and 3D Printing PLA Based Universal Charging Adapters for Use In Charging Electric Vehicles

Jonathan Bryant, 10th grade, Renaissance High School

Electric vehicles are vehicles that run using batteries and electricity rather than gas. The global Electric Vehicle market was estimated at $140 Billion USD in 2019 and is expected to increase to $700 Billion by 2026. Around 2.1 Million EV's were made and sold in 2019 in the US and around 6.9 Million EV's will be made and sold in 2026 in the US. Electric vehicles utilize many accessories such as adapters. Electric vehicle adapters are chargers that allow you to use a brand of charging station that differs from your brand of electric vehicle. Charging stations are stations that are made for indoor or outdoor usage that allow electric vehicles to be charged. There a wide variety of EVs on the market-e.g. Chevy Volt, Nissan LEAF, Tesla Model S, Toyota Prius, and many others. Each EV has its own custom charging design. The looming problem is that there will be no standard on EV charging unit causing a disruption in the growth of the EV market and supply chain as well frustration by EV owners that have limited locations for charging up the battery on their car. The purpose of this essay is to discuss ideas on how universal adapters that are created using 3D printing can help electric vehicle owners charge their cars using different charging stations.

The adapter contains a J1772 connector and a Tesla supercharger connector. The Tesla supercharger contains 480-volt direct current technology and a detachable charging connector that powers the Tesla vehicles it is compatible with. The FlashForge Finder (3D printer brand) uses PLA (Polylactic Acid) filament (type of plastic for 3d printing) to print out the adapter through the extruder of the printer. The 3d printer and its software also helps by being able to make complex and organic shapes so that the adapter can look and fit the way that is needed. Different plastics and filaments that can be used are: PLA, ABS (Acrylonitrile Butadiene Styrene, which is a type of thermoplastic), PETG (Glycol Modified version of Polyethylene Terephthalate (PET), which is commonly used to manufacture water bottles), PP (Polypropylene is resistant to many chemicals and has a high resistance to electricity making it useful in electronic components.), Nylon, PVA (polyvinyl alcohol is a 3D printing material commonly used to create water-soluble support structures to achieve complex geometries), and many others. Charging stations are able to charge their cars typically by using the charging connector that comes along with the station. The connector plugs into the port within the car, and it begins to charge. PLA filament differs from other materials such as ABS, because PLA is stronger and stiffer than ABS, while ABS is tougher and lighter than PLA.

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In my opinion, I believe ABS would work best because it has good strength, heat and chemical resistance and printability. Even though PLA is stronger and stiffer, its lack of heat and chemical resistance makes it more likely your object will lose its strength and stiffness at higher temperatures. Since the adapter would be used outside the majority of the time, heat resistance would be a necessity. The adapter will be tested by using an electric vehicle that has a J1772 port with a Tesla supercharger nearby. The material that I would use for the adapter (ABS) can be used for the creation of new parts when it is recycled through a shredding process where the used plastic (the ABS) is converted into shredded plastics. The benefits the adapter can offer to the environment is that it is recyclable. Since it is recyclable, it can be turned into other parts or other things in general without harming the environment.

In conclusion, the problem I saw was that there are many EV's and charging stations, but if you have one brand of EV and there are only differently branded charging stations around, then it's not much you can do. To solve this, I wanted to create an 3d printed adapter that could charge your car using whatever charging station that is nearby. To reiterate, the purpose of this essay was to discuss ideas on how universal adapters that are created by 3d printing can help electric vehicle owners charge their cars using different charging stations. This helps improve the availability of charging your car without the worry of not being close to your cars' specifically branded charging station.

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