**EE198A Senior Project Business Plan**

Spring 2021

**Project Title:** Energy Management System (EMS) for Storage Cells in Electric Vehicles (EVs)

**Executive Summary**

The EMS project intends to shift the conventional industry standard of separated inverting and Battery Management Systems (BMS), into one complete, modular system. This inherently reduces financial stress on the manufacturing company as well as the client company. From a client company perspective, engineers wouldn’t have to design an inverter and battery management system for different EV models. Rather, engineers can buy multiple EMS “blocks” and combine them to achieve the desired behavioral characteristics. On a maintenance level, the EMS project allows EV companies to replace sections of the motor system rather than replacing it entirely. Overall, the EMS project benefits manufacturing and EV companies by reducing the time it takes to develop the motor system and lowering the complexity of maintenance.

**Industry and Marketing**

The automotive industry is one of the largest and fastest-growing industries in the US. However, the cost of manufacturing EVs does not leave much room for profit. Our company intends to create a modular system that combines the battery management system and inverters to effectively lower the cost of manufacturing EVs. Our product is unique because currently there are no other systems in the industry that combine the inverter and the BMS into a single modular system. EV companies always have an engineering team dedicated to designing an inverter and battery management system per model vehicle. Since our product is novel, its reach encaptures the entire scope of the EV market. The marketing demographic would be EV companies looking to move away from the conventional, lesser-efficient method of developing the inverter and battery management system.

The competition includes very little R&D in academia and is practically non-existent in the industry. Thus, there is great potential for growth if the EMS project were to take off. A good business concept that could work with the need for cheaper manufacturing and battery efficiency would be to approach companies like Tesla and Lucid with a sales mindset. This could yield success due to their need to make their batteries either have a higher capacity or last longer as well as drive down the current higher costs of Electric Vehicles. Potential limitations for this idea could involve Intellectual Property and Patent Infringements. The cost of an entire module is not yet concrete, since a lot of it is still in its early design stages, however, we estimate that a single module would cost about $500. This is taking into consideration the multiple parts of each module that are currently being designed. The most appropriate comparison for our product would be the typical BMS and Converters configurations that are mostly used in the EV industry. Ideally, by integrating the systems modularly, we would be able to undercut the costs while maintaining either the same or better efficiency.

**Management Team**

The EMS project is organized into the following teams: embedded systems, simulations, and power module design. In relation to this group’s team members, Jonathan is responsible for debugging, evaluating, and writing code in the embedded systems team while Andrew and Hiromi are responsible for developing PCBs for the current sense and inverter schematics. Communication between the different EMS teams occurs weekly over a general Zoom meeting with the addition of weekly team meetings. Daily communication between this group, Jonathan, Hiromi, and Andrew, happens over the chat app, Discord.

**Risk and Ethics**

A few potential ethical issues that might be involved in our business include the possibility of an increase in electronic waste given the modular design as well as sourcing the materials from ethically moral companies. Due to the potential increase in electronic waste, this can disproportionately affect lower-income and minority communities. There has been a pattern of polluting refineries that have been historically constructed near and around these communities. While this is a prominent part of the overall issue of systematic racism internationally and especially in the United States, this is contingent on the improper management of electronic waste. If our company were to ethically handle the waste and sourcing materials, by not concentrating our business in refineries that are around low-income communities and instead of distributing it to refineries that are properly located, the magnitude of this ethical issue would be reduced. Standards like Restriction on the Use of Hazardous Substances, “the RoHS-like Electronic Waste Recycling Act, and the broader, REACH-like, California Green Chemistry Initiative” have already been adapted and are being followed by many companies like ours would (Greenemeier, 2009). However, if we continued to run into issues of improper waste management, this would be an issue that we would be open to investing a whole division into addressing, which may cost a good chunk of the budget. Ultimately, this business’s goal is to reduce manufacturing costs with a modular design while increasing energy efficiency by creating a well-designed system. While it is important to invest in the product and business, it is equally important to ensure that we are bettering the community around us instead of worsening it.

References

Greenemeier, L., 2009. *U.S. Lags Behind World with Its Patchwork Approach to Curbing*

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