Review Progress, Plan Next Steps, Create Stakeholder Map & Observe Users

EN2160 - Electronic Design Realization

Expandable Battery Management System (BMS)

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1. Introduction

Our chosen project involves the development of an expandable battery management system with key features including:

- Battery level control
- Temperature monitoring
- Overcharge monitoring.
- Overcurrent protection

This system plays a vital role in ensuring the safe, reliable, and efficient operation of battery-powered systems in various industrial applications, such as Electric Vehicles (EVs), Hybrid Electric Vehicles (HEVs), Industrial Automation and Robotics, Renewable Energy Storage Systems, Industrial Backup Power, Off-Grid Applications, and Industrial Transportation and Heavy Machinery. Our demonstration will focus on utilizing lithium-iron batteries. Given the criticality of batteries in numerous industrial settings, battery management systems are indispensable tools.

2. Review Progress

After the project was approved, we proceeded to plan the product architecture. The product will comprise two main circuits:

- BMS cell module
- BMS controller module

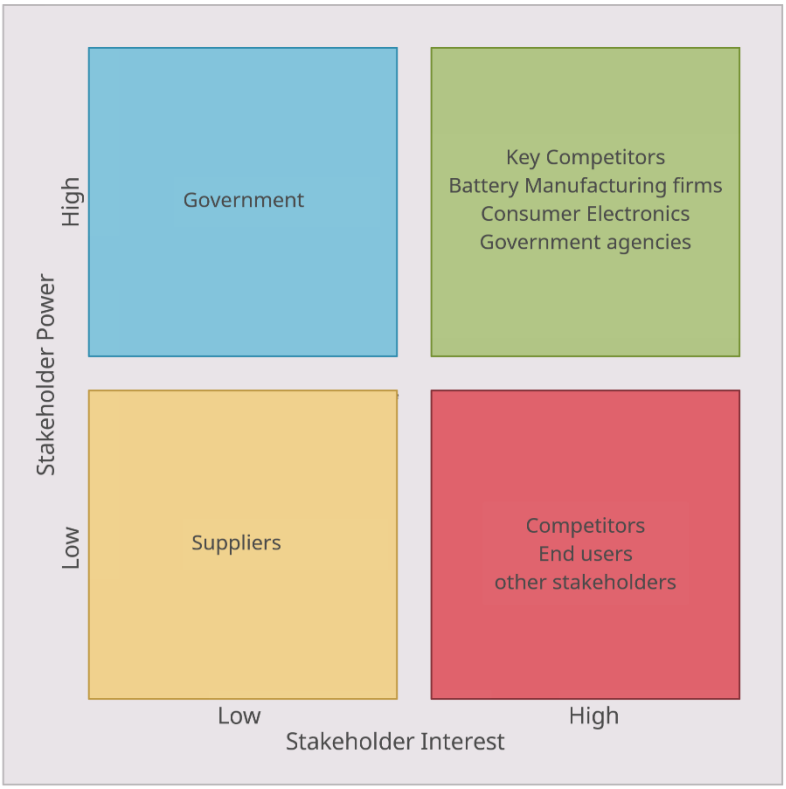
Each battery in the BMS will have its own dedicated cell module. As we are demonstrating the project using 20 lithium-iron batteries, we have arranged to produce 20 individual cell modules. The BMS controller module serves as the central control unit for each cell module. Additionally, we offer users the flexibility to choose their preferred battery configuration, whether in series or parallel.

3. Plan Next Step

Our initial step for the project is to design the circuit schematic and simulate it in order to verify that we can accomplish the targeted goals of the product. Currently, we have begun drafting the schematics for these two circuits. Progress with the controller module circuit is satisfactory; however, we have encountered some issues within the BMS cell module circuit, such as the necessity to utilize bulky power resistors and transistors. As a result, we are strategizing to further optimize the cell module circuit. Upon successful circuit design, our next steps involve implementing the circuits on prototype boards and conducting testing in the laboratory. Subsequently, we aim to develop printed circuit boards and utilize surface-mounted electronic components to enhance the compactness of the PCBs, making them more suitable for industrial applications. Following the PCB design, an enclosure compliant with industry standards would need to be created and manufactured. Furthermore, we are striving to provide all BMS outputs through a mobile application interface.

4. Create Stakeholder Map

Our primary stakeholders include companies that manufacture products utilizing batteries. Additionally, battery manufacturing firms are stakeholders in our Battery Management System (BMS) as they require it for testing battery health and ensuring battery quality prior to market placement. Furthermore, stakeholders in our product encompass consumer electronics manufacturers, industrial automation, and robotics companies, as well as government agencies. Given our emphasis on lithium-iron batteries, we can optimize the lithium-iron battery management aspect for these manufacturing companies. Competitors represent a key stakeholder group as they are apprehensive about potential business disruptions. Suppliers, who provide essential components and raw materials, are also important stakeholders in the product's development. Key players are stakeholders with substantial power and interest in the project. Stakeholders with low power but high interest should receive regular updates, while those with high power but low interest should be kept content. Stakeholders with minimal power and interest require limited attention.



5. Observe Users

A set of companies and their product which are using in the industry are given below:

- Texas Instruments - bq76PLxxx (For Li-FePO4 batteries)
- Maxim Integrated - MAX16061 (For Li-FePO4 batteries)
- NXP Semiconductors - TDA4050 (For Li-FePO4 batteries)
- TI Automotive - A complete BMS solution for electric vehicles and other industrial applications, including Li-FePO4 batteries.

Following videos show some industrial battery management systems/ICs and some details:

- https://www.youtube.com/watch?v=z_ZpyGfgORU&ab_channel=NXPSemiconductors
- https://www.youtube.com/watch?v=tZDk_qlCZZU&ab_channel=ElektronikaSalesPvtLtd
- https://www.youtube.com/watch?v=L2URbD2qyQs&ab_channel=PluginIndiaElectricVehicles
- https://www.youtube.com/watch?v=3ZX5Bfa4TuU&ab_channel=DigiKey

6. Conclusion

In conclusion, the development of an expandable lithium-iron battery management system for various industrial applications holds significant importance in ensuring safe and efficient operation of battery-powered systems. The project's approach to designing separate BMS cell modules and a centralized controller module enables customization and scalability for users in different battery configurations. By addressing challenges in circuit design optimization and emphasizing the use of surface-mounted components for compact PCBs and mobile application integration, the project aims to deliver a robust and user-friendly BMS solution. Stakeholder analysis highlights the diverse range of entities benefiting from such a product, including battery manufacturers, industrial automation firms, and consumer electronics manufacturers. The industry examples provided, along with the identified BMS products, showcase the existing market landscape and opportunities for innovation and collaboration in the field of lithium-iron battery management systems.