Queen's Relectric Sub-Team Overview

Thermal Sub-Team

Logistics Sub-Team

QRCT Sub-Team Report

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Chapter 1: Introduction to Relectric and Thermal Sub-Team

1.1 Overview of Relectric

Relectric focuses on sustainable transportation by converting conventional vehicles into electric vehicles (EVs). This initiative is driven by a mission to pioneer advancements in electric mobility, enhancing its accessibility and prevalence. The process involves retrofitting existing combustion engine vehicles with advanced electric systems, thereby minimizing waste and prolonging vehicle lifecycles. Central to Relectric's mission are its overarching goals to mitigate environmental impacts by reducing reliance on fossil fuels and cutting emissions. Through these efforts, Relectric actively contributes to the creation of sustainable transport solutions that are both economically sensible and environmentally sound.

1.2 Role and Focus of the Thermal Sub-Team

Relectric's Thermal Sub-Team is crucial to our mission of converting conventional vehicles into electric vehicles (EVs) and championing sustainable electric transportation. They manage the heat from critical EV components like batteries and motors, ensuring vehicle safety and efficiency. Their expertise in thermal management prevents component damage, boosts performance, and extends EV lifespan.

The team's main task is to design and implement advanced cooling systems that efficiently dissipate heat and integrate seamlessly with vehicle architecture. They enhance cooling system efficiency and effectiveness, aligning with Relectric’s objectives to reduce environmental impact and extend vehicle lifecycles. Their innovations make EVs more accessible and environmentally friendly.

Through ongoing improvements to their cooling solutions, the Thermal Sub-team enhances both the safety and performance of our EVs, reinforcing Relectric’s leadership in electric transportation. Their commitment to high safety and efficiency standards is vital for promoting eco-friendly transportation solutions, positioning our electric vehicles as reliable, efficient, and sustainable options for consumers.

Chapter 2: Goals and Objectives

2.1 Annual Goals

Within Relectric, the Thermal team and other sub-teams have set well-defined annual goals to ensure that their progress is tangible and aligns seamlessly with the organization's broader objectives. This year, the Thermal team is dedicated to optimizing the cooling systems of electric vehicle conversions to boost both efficiency and safety. These goals are underpinned by precise timelines and measurable outcomes, ensuring rigorous progress tracking. Key

performance indicators include system integration enhancements, efficiency improvements, and comprehensive safety assessments. Milestones are strategically placed throughout the year to drive continuous advancement and ensure accountability within the team.

2.2 Long-Term Vision

The long-term objectives of the Thermal Sub-team at Relectric focus on enhancing the development and efficiency of cooling systems essential for electric vehicles (EVs). This team's primary aim is to innovate advanced cooling technologies that elevate safety and operational efficiency across our EV conversions. The work involves the meticulous optimization of crucial components such as radiators, coolant reservoirs, and tubing, which are essential for managing the significant heat output from EV batteries and other critical systems. Ensuring that these systems operate within safe temperature limits is paramount.

In addition, a significant goal includes integrating comprehensive air conditioning systems that do more than provide passenger comfort; they play an integral role in the overall thermal management strategy. This effort involves using advanced refrigerants coupled with efficient compressors and condensers, tasked with improving cooling for both the cabin and vehicle components.

Ongoing research to refine our understanding of thermal dynamics is also a cornerstone of the Thermal Sub-team’s activities. Focus areas include studying heat flow rates and adapting cooling solutions to meet diverse operational demands, essential for creating highly effective and efficient cooling systems.

Documenting innovations and technical knowledge for seamless knowledge transfer to future teams is another critical objective. This approach ensures continuity and fosters sustained innovation in thermal management technologies. Such documentation supports smooth transitions and the upskilling of new team members effectively.

The Thermal Sub-team dedicates itself to the practical implementation of these systems, going beyond theoretical research. Activities include prototype development, system integration, and rigorous testing to meet stringent safety and performance standards. These efforts are vital to achieving Relectric’s broader goal of making EVs a more sustainable and practical alternative to traditional vehicles, as outlined in this handbook entry. This effort ensures that our team remains at the forefront of thermal management technology, driving the future of electric mobility.

Chapter 3: Project Management and Description

3.1 Major Projects Overview

Relectric’s portfolio of major projects showcases its dedication to advancing sustainable transportation through the conversion of conventional vehicles into electric models. This effort

encompasses several key projects, notably the conversions of a Jeep and a go-kart, each highlighting the organization's innovative approach to sustainable transport.

Jeep Conversion Project: This project focuses on transforming a traditional Jeep into an electric vehicle. It represents a significant technical challenge, requiring comprehensive system overhauls. The Thermal Sub-Team is pivotal in this project, tasked with developing advanced heat management systems to ensure the electric components perform optimally and safely. Their work involves detailed thermal analysis and the implementation of effective cooling solutions to manage the heat generated by the new electric drivetrain.

Go-Kart Conversion Project: Operating on a smaller scale, this project aims to convert a standard go-kart into an electric model. The challenges here, while similar to those of the Jeep project, require unique solutions tailored to the compact nature of go-karts. The Thermal Sub-Team again plays a crucial role, adapting their strategies to fit the smaller scale without compromising on the efficiency and effectiveness of thermal management.

These projects underscore Relectric's technical capability and serve as practical demonstrations of how electric conversions can provide viable and environmentally friendly alternatives to traditional combustion-engine vehicles.

3.2 Minor Projects and Initiatives

Beyond its headline-grabbing major projects, Relectric undertakes various minor projects and initiatives across its sub-teams, each contributing to the organization's overarching mission of promoting electric mobility.

Electrical Sub-Team Initiatives: This sub-team is integral to the success of all projects, handling the design, testing, and implementation of critical systems like battery management and motor controllers. Utilizing sophisticated tools such as SolidWorks Electrical, the team ensures all electrical components meet the highest standards of functionality and safety, adhering to strict high-voltage protocols.

Mechanical Sub-Team Projects: This team is responsible for the physical aspects of vehicle conversions, including the design and manufacturing of component mounts and casings. They utilize detailed engineering drawings and CAD software to ensure that all parts are precisely integrated into the vehicle’s new layout, maintaining structural integrity and operational reliability.

Interior Sub-Team Projects: Focused on the user experience, this sub-team implements advanced technologies within the vehicle's interior. Tasks include programming and configuring digital dashboards and other interactive elements, requiring in-depth knowledge of low-voltage interfacing and system integration.

Each of these projects, though smaller in scale than the major conversions, plays a vital role in supporting Relectric's strategic objectives. They contribute to the organization's reputation as a leader in sustainable transportation, pushing the boundaries of what is technically possible while also fostering community engagement and educational outreach.

Chapter 4: Progress and Achievements

4.1 Semester Progress Report Fall Term (2024)

Week 1: Project Planning and Goal Setting
- The fall term began with meticulous planning for the Jeep and go-kart conversion projects. The Thermal Sub-team set a clear objective: to develop sophisticated heat management systems customized for each vehicle type. This week was crucial in outlining the project's scope and setting expectations. Meetings were held to assign roles and delineate responsibilities, ensuring all team members understood their tasks. The leaders emphasized the importance of clear communication and robust planning to align everyone with the project's goals. The goals set during this phase were centred around integrating advanced cooling solutions capable of managing the significant heat outputs expected from the new electric drivetrains. Establishing a solid foundation was essential, providing team members with a clear roadmap of expectations, crucial for coordinated efforts throughout the project lifecycle.
Week 2: Finalizing Design Specifications
- In the second week, the team finalized the technical specifications for the Jeep and go-kart conversions. Focus was placed on selecting essential components such as high-capacity batteries and high-performance electric motors, which are vital for meeting the project's technical and performance standards. The Thermal Sub-team conducted thorough thermal analyses to predict the heat generation and dissipation dynamics expected during operation. These analyses were crucial in designing the cooling systems to ensure they could efficiently handle the expected thermal loads, setting the stage for successful integrations later in the project.
Week 3: Vehicle Teardown and Safety Training

- In Week 3, the team started the physical work by dismantling the Jeep and go-kart, readying them for their conversions. Recognizing the risks associated with handling high-voltage systems and heavy machinery, the team underwent comprehensive safety training. This session covered emergency procedures, proper handling techniques, and safety protocols, emphasizing the importance of a safe work environment due to the hands-on nature of the project. Prioritizing safety ensured the project would not face delays from preventable accidents or mishaps.
Week 4: Procurement and Custom Part Design
- By Week 4, all major components necessary for the conversions had been procured. The Electrical Sub-team started assembling the battery management system, coordinating closely with the Thermal Sub-team to ensure seamless integration and avoid compatibility issues. The custom parts design phase also started, with the main goal of making sure that these parts would fit well with the existing vehicle structures and work well with other systems. This period was a big step from just thinking about changes to actually making them happen.
Week 5: Assembly of Electrical Systems
- The team made significant progress in assembling the electrical systems. The team focused on establishing robust connections and ensuring system stability—key for the reliable operation of electric vehicles. A continuous monitoring workflow was set up, incorporating feedback mechanisms to address assembly issues promptly. This proactive approach helped maintain project momentum and quality. Additionally, the integration of the digital dashboard in the go-kart significantly enhanced its user interface.
Week 6: Battery Management System Testing
- Initial testing of the battery management systems yielded crucial data, necessitating minor adjustments in design and function. The Thermal Sub-team used these results to improve their cooling methods so that they were more in line with the actual heat outputs that were seen. These changes made the battery systems work better and last longer when they were in use.
Week 7: Integrating Thermal Management Systems
- The integration of the thermal management systems into the vehicle designs officially began. Initial problems with cooling effectiveness led the team to rethink the design of heat exchangers and look into other materials with better thermal management properties to make sure the system would work well even when it was under a lot of stress.
Week 8: Refining System Integration
- With major system integrations underway, the focus shifted to refining the assembly of

mechanical and electrical components. The team diligently worked to enhance the precision of part fits and ensure all systems functioned harmoniously within the vehicle frameworks, a critical step for the successful integration of complex systems.
Week 9: Mid-Term Project Review Preparation
- The team dedicated this week to preparing for the mid-term project review. They compiled detailed progress reports and developed presentation materials to highlight key achievements and learning points from the first half of the term. Rehearsals ensured that team members were prepared to effectively communicate their progress and address challenges to stakeholders.
Week 10: Mid-Term Review
- The mid-term review served as a crucial checkpoint for the project, offering a platform to demonstrate progress to stakeholders. The feedback received was immensely constructive, providing insights that the team used to refine the direction of the project for the remaining weeks, emphasizing the project's adaptive management approach.
Week 11: Iterative Testing and Optimization
- Iterative testing and optimization of installed systems began earnestly. Based on the feedback and data collected during the midterm review, the team worked on making the systems more reliable and efficient. This was important for resolving any problems that were still there and getting them ready for longer operational testing.
Week 12: Finalization of Phase One
- The first phase of vehicle conversion concluded this week, with both vehicles ready for enhanced testing and further developments in the winter term. Comprehensive documentation of all progress was completed, ensuring continuity and knowledge transfer for ongoing project phases.

4.2 Challenges and Resolutions

Throughout the Fall term, Relectric's Thermal Sub-team faced a series of significant challenges that necessitated prompt and effective resolutions to maintain project momentum. Each obstacle was met with customized solutions, often requiring adjustments to the project timelines.

Challenge 1: Component Compatibility and Integration Issues

In Week 3, the team encountered compatibility issues between the newly sourced high-capacity batteries and the Jeep's existing electrical architecture. The initial thermal management system was inefficient at dissipating the heat generated by these new batteries, posing a serious risk of overheating.

Resolution:

The Thermal Sub-team responded by conducting additional thermal simulations and redesigning the system to include more robust heat exchangers and improved airflow management within the vehicle's chassis. This redesign resolved the overheating issues and enhanced the overall efficiency of the thermal management system. These adjustments introduced a two-week delay in the project timeline, which was offset by accelerating subsequent phases of the integration process.

Challenge 2: Supply Chain Delays

Significant delays in the delivery of custom-manufactured parts essential for the go-kart conversion emerged in Week 6, threatening to derail the scheduled testing phase for the mid-term review.

Resolution:

The project manager negotiated expedited shipping with suppliers and adjusted the project timeline to prioritize other development areas not dependent on the delayed parts. This period also allowed the team to enhance the integration of the digital dashboard within the go-kart, which was initially planned for later in the term.

Challenge 3: Safety Concerns During Vehicle Teardown

The teardown process in Week 5 revealed unexpected structural weaknesses in the Jeep's frame, presenting significant safety concerns for installing heavy electric components.

Resolution:

The mechanical sub-team quickly designed additional reinforcement structures to strengthen the frame. Although unplanned, this crucial step ensured the safety and durability of the conversion, extending the teardown phase by an additional week but securing a safer platform for future installations.

Challenge 4: Inadequate Testing Facilities

Initially, the team's testing facilities were inadequate for comprehensive testing of the new electric systems under simulated environmental conditions.

Resolution:

Project leadership secured additional funding from corporate sponsors, showcasing the project's potential impact and innovation. This funding was allocated to upgrade the testing facilities, allowing for more rigorous and extensive testing. The upgrade was completed by Week 10, facilitating detailed performance analyses before the mid-term review.

Strategic and effective solutions addressed these substantial challenges, resolving immediate issues and contributing to the project's long-term success. Each solution required meticulous consideration of resource allocation, timeline adjustments, and, occasionally, additional funding, demonstrating the team's resilience and adaptability in overcoming unforeseen difficulties.

Chapter 5: Planning and Strategy

5.1 Short-Term Objectives

For the current academic year, Relectric is focused on achieving significant milestones in its electric vehicle projects, particularly concerning the integration and testing of cooling systems with the vehicle's battery and cooling pad. The main goal is to make sure that important parts, like the radiator, tubing, and coolant reservoir, are installed and working together to keep the vehicle from overheating and running well. This integration is pivotal as it represents a crucial achievement in the project timeline for the thermal subteam, marking the readiness of the vehicles for extended testing phases.

Additionally, the team is dedicated to advancing its parts research into the selection and procurement stages. All of the work will be focused on improving the choice of important parts, such as finding the best radiators and other related parts through thorough research. This step is crucial as it involves finalizing specifications and arranging the purchase of these parts, setting the stage for their subsequent installation. The goal is to optimize the vehicle's thermal management system for improved performance and safety, guaranteeing the vehicle's ability to withstand real-world operating conditions.

5.2 Preparing for the Future

As Relectric looks toward the next academic year, the team is laying down robust plans to ensure the continuity and success of their projects. A major aspect of this planning involves the thorough documentation of all current research and development activities. This effort is critical as it will provide the incoming team with a detailed foundation of the project's current status, enabling them to continue the work with precision and understanding.

Moreover, the team is focused on finalizing all necessary components and establishing a comprehensive testing schedule for the newly integrated systems by the end of the fall semester. This proactive approach will provide next year's team with the necessary tools and insights from the start, enabling them to excel immediately. The ongoing development will include refining and enhancing the vehicle's thermal management systems, a key area of focus that will require the incoming team members to be well-prepared. This preparation will not only facilitate a seamless transition but will also ensure that the projects continue to advance at the forefront of technological innovation in electric vehicle conversions.

Chapter 6: Events and Community Engagement

6.1 Sub-Team Specific Events

Although there are no detailed records of past events specifically hosted by Relectric's Thermal and Electrical sub-teams, there are compelling opportunities for future activities that could significantly enhance their projects and professional growth. Particularly beneficial would be organizing technical workshops, guest lectures, and industry panels.

1. Technical workshops would provide immense value for both subteams. Envisioned as hands-on sessions, these workshops would allow team members to directly engage with the systems they are developing—such as thermal management systems for the Thermal Sub-team and battery management systems for the Electrical Sub-team. In addition to providing practical experience, participating in these workshops would enable real-time troubleshooting and spontaneous innovation. This hands-on approach is essential for deepening technical understanding and enhancing the practical engineering skills necessary for team members' future careers.

2. Guest lectures and industry panels present another strategic opportunity. By inviting industry experts and academic professionals to discuss the latest advancements in electric vehicle technologies and sustainable transportation solutions, team members could gain valuable insights into current research and emerging industry trends. These events would serve as excellent platforms for networking, fostering collaborations, and potentially unlocking opportunities for internships and employment. Additionally, such interactions are likely to spark new ideas and innovative approaches, ensuring that the team's projects remain at the forefront of technological and design advancements.

Initiating these events would not only address the absence of past specific sub-team events but also establish a robust framework for ongoing professional development and

community engagement. Such activities would align seamlessly with Relectric’s overarching goals of promoting sustainable transportation solutions and cultivating a culture of innovation and excellence within the academic community. This strategic approach to community engagement and professional development would elevate the team's profile and solidify its position as a leader in academic contributions to the electric vehicle space.

Chapter 7: Additional Resources and Documentation

7.1 Timeline and Key Milestones

By the end of 2024, Relectric's Thermal Sub-team aims to complete and rigorously test the integration of advanced cooling systems with the vehicle’s battery and cooling pad to ensure they function optimally under real-world conditions. This critical phase is dedicated to ensuring the cooling systems are both robust and efficient, crucial for preventing overheating and thereby safeguarding the safety and performance of the electric vehicles.

Moving into 2025, a significant milestone will be the preparation for the market introduction of these advanced systems. The team plans to scale the technology across different vehicle types and enhance its adaptability for wider commercial use. These efforts are designed to demonstrate the systems’ viability and scalability.

Throughout this timeline, the Thermal Sub-team is committed to conducting thorough research and making precise calculations concerning heat discharge and flow rates, as detailed in their project documentation. This organized and scientific method is necessary to precisely adjust the cooling systems to meet the needs of different vehicle models. This approach is in line with Relectric's main goal of promoting environmentally friendly transportation options. This strategic planning and execution underline the team's dedication to innovation and excellence in the evolving landscape of electric vehicle technology.

7.2 Definitions and Key Concepts

Thermal Management Systems	- Thermal management systems in electric vehicles are essential for regulating the temperatures of crucial components like batteries and motors. These systems prevent overheating, ensuring operational safety and efficiency. For instance, a common thermal management approach involves liquid cooling systems, where a coolant is circulated near or around battery cells to absorb and dissipate heat. This process helps in maintaining optimal battery performance and prevents thermal runaway, which could otherwise lead to rapid degradation or failure.

Battery Management Systems	- Battery Management Systems (BMS) are advanced technologies designed to manage the charging and discharging of electric vehicle batteries, optimizing their longevity and safety. A practical example of the BMS function is its ability to balance the charge across battery cells, prevent overcharging, and manage power output during high-demand scenarios such as acceleration. Such functionality not only helps extend the battery's life but also ensures it doesn't deplete to dangerously low levels, maintaining vehicle reliability and safety.
Sustainability in Transportation	- Sustainability in transportation involves adopting technologies and practices that minimize environmental impact. A key example is the shift toward electric vehicles (EVs), which significantly reduce emissions compared to traditional combustion engines. Utilizing renewable energy sources like solar or wind to charge EVs further decreases their carbon footprint, supporting broader environmental goals like reducing greenhouse gas emissions and conserving finite resources.
System Integration	- System integration in electric vehicles involves combining various subsystems, such as the electric motor, battery pack, and thermal management, into one cohesive unit. An example of effective system integration is ensuring that the battery management system works seamlessly with the vehicle's drivetrain, optimizing energy usage and enhancing the driving experience. Proper integration is crucial as it ensures that modifications in one subsystem do not adversely affect the overall vehicle functionality.
Scalability	- Scalability refers to the ability of electric vehicle technologies to increase production or adapt to growing demands without compromising performance. For example, a scalable aspect of EV technology might involve designing battery systems that can be easily modified for different vehicle sizes

	or power needs, allowing for quick adaptation to market demands without extensive redesign.
Electric Drivetrain	- The electric drivetrain includes components that convert electrical energy from the battery into mechanical energy at the wheels. This section includes the electric motor and transmission. A notable application is the use of regenerative braking systems, which harness kinetic energy during braking to recharge the battery, thereby enhancing energy efficiency and increasing the vehicle's range.
Coolant Reservoir	- In electric vehicles, the coolant reservoir holds the fluid necessary for the thermal management system. This reservoir ensures there is a sufficient coolant supply during vehicle operation, especially under high-temperature conditions. For example, during extended operation or in hotter climates, the coolant reservoir plays a crucial role in maintaining consistent cooling to prevent engine or battery overheating.
Radiator	- Radiators in electric vehicles act as heat exchangers to cool the fluid that has absorbed heat from the engine or battery. Typically composed of a series of tubes and fins, radiators maximize contact with air to dissipate heat effectively. This technique is vital in maintaining optimal battery and engine temperatures, particularly in performance-oriented EV models where heat generation is significant.
High-Voltage Systems	- High-voltage systems in electric vehicles include components that operate at higher electrical voltages, such as the main drive motor and battery pack. These systems are pivotal for efficient power delivery to the vehicle's drivetrain, enabling capabilities like faster charging and longer ranges, which are essential for making EVs a practical option for daily use.
Prototyping	- In the context of electric vehicle development, prototyping involves creating early models or assemblies to explore design concepts and test their functionality. This task could involve experimenting with various configurations of battery placement or thermal management solutions to assess their impact on vehicle performance, safety, and efficiency.

Feedback Mechanisms	- Feedback mechanisms in electric vehicles provide essential data on the performance of key components like battery health, motor efficiency, or thermal system effectiveness. Utilizing sensors to monitor and adjust operational parameters, these systems help in optimizing vehicle performance and diagnosing potential issues early.
Project Lifecycle	- The project lifecycle of an electric vehicle encompasses all stages, from initial design and concept development to final production and market launch. Each phase, including design, prototyping, testing, and validation, is critical for ensuring that the final product meets all technical specifications and market expectations. This structured approach aids in effective resource management and stakeholder engagement throughout the development process.

7.3 Team Composition

The Thermal Sub-team at Relectric is meticulously structured to optimize electric vehicle cooling systems, ensuring efficient heat management and safety. The team is headed by a thermal lead, supported by a co-captain, and further divided into smaller, specialized groups, each focusing on specific aspects of thermal management.

Thermal Lead Responsibilities: The Thermal Lead spearheads the technical side of the team, focusing on the analysis of coolant flow and heat calculations to enhance battery cooling efficiency. This role involves modelling heat transfer using advanced fluid dynamics and PID control mechanisms—crucial for maintaining optimal battery temperatures. The thermal lead also works closely with the electrical and assembly subteams to make sure that cooling parts are seamlessly integrated into vehicle designs. They do this by making sure that development is in line with the overall project requirements.

Co-Captain Responsibilities: The Co-Captain plays a vital role in steering the team in line with Relectric's organizational and technical goals. This position involves managing internal project timelines and resource allocation to meet critical deadlines. Additionally, the co-captain engages with both affiliated organizations and off-campus parties to align operations with stakeholder interests and to advance funding or sourcing partnerships. They also represent and promote Relectric's mission and technical achievements at various events, providing essential support and guidance to sub-teams as needed.

Sub-Groups

Beneath these leaders, the team is segmented into smaller groups, each tasked with distinct functions that contribute to the development and implementation of the thermal management systems. These subgroups make sure that the finer points of system design and function get the extra attention they need, which leads to new ideas and better Relectric thermal solutions.

The Thermal Sub-team at Relectric is meticulously organized to address the complex challenges of managing heat within electric vehicles, with a particular focus on optimizing the vehicle's cooling systems. The team is segmented into specialized groups, each responsible for key aspects of thermal management, ensuring comprehensive coverage of all necessary functions.

Tubing Team: This team is responsible for managing essential tubing for the cooling system. Their primary responsibilities include selecting tubing that ensures optimal coolant flow and efficiency. Key considerations involve the tubing's diameter, material, and routing, all of which are chosen to maximize system efficiency and reliability. The tubing must also be durable enough to withstand thermal stresses and chemical exposure from the coolant, preserving system integrity throughout the vehicle's lifespan.

Radiator Team: This team focuses on the radiator, a crucial component for dissipating heat from the engine and battery. They are tasked with selecting, designing, and testing the radiator to ensure it meets specific thermal load requirements. Their goal is to enhance heat exchange efficiency while also minimizing the radiator’s size and weight, thereby optimizing overall vehicle performance.

Heat and Flow Rate Team: Experts in calculating the necessary cooling requirements and flow rates, this team plays a critical role in maintaining optimal temperatures for the battery and engine. Their analyses determine the appropriate size and type of components needed for the cooling system, including radiators and pumps, ensuring the system is both effective and efficient.

Coolant and Coolant Reservoir Team: Dedicated to managing the coolant and its reservoir, this team selects the coolant type that best suits the vehicle's operational demands and designs the reservoir to accommodate thermal expansion and contraction. They ensure the coolant maintains consistent properties under various temperatures and conditions, crucial for the system’s long-term performance and safety.

Together, these groups form a cohesive unit that drives the development of advanced, efficient, and reliable cooling solutions for Relectric’s electric vehicles. By delineating

responsibilities in this structured manner, the Thermal Sub-team leverages specialized expertise and fosters a collaborative environment, enhancing problem-solving capabilities and innovation. This approach streamlines the development process and ensures that all components are integrated seamlessly, providing superior thermal management across all vehicle projects.

7.4 Future Needs and Opportunities

As Relectric's thermal sub-team continues to innovate cooling systems for electric vehicles, they've pinpointed several critical areas requiring expansion and new talent to meet increasing project demands. Enhancing capabilities in system integration, thermal modelling, and project management is essential for managing the growing complexity of a project as it scales. Opportunities for new roles are particularly significant in system integration and project management. System integrators will ensure seamless operation across all cooling system components, while project managers will handle resource allocation and timeline management.

Furthermore, the team's plan introduces the need for specialists in advanced thermal management and regulatory compliance as they broaden the application of their cooling technologies across various vehicle models. These jobs are critical for navigating the technical and legal landscapes of commercial automotive markets. They make sure that Relectric's innovations meet a wide range of standards and can be easily put into different car environments.

7.5 Lessons Learned

Throughout its current developmental phase, the thermal sub-team has extracted valuable insights that are shaping its strategic approach to electric vehicle cooling systems. Key among them is the importance of precise thermal modelling and integrating robust feedback mechanisms to ensure system reliability and efficiency. Addressing challenges like component compatibility and efficient heat dissipation has highlighted the necessity of extensive testing and iterative design processes.

The team has underscored the effectiveness of proactive communication, and regular interdisciplinary meetings are crucial in addressing these challenges. These kinds of practices help make it easy for feedback to be quickly incorporated into the development process. This leads to better designs and fewer problems during system integration.

Moreover, the thermal sub-team has emphasized the critical role of detailed documentation and effective knowledge transfer, which is especially important as team members transition between academic terms. This practice ensures that new members are well-prepared, preserving project continuity and maintaining momentum from year to year.