7.1 Conclusion

The research successfully integrated various components into a cohesive design, emphasizing the importance of material selection and structural analysis. The chosen materials, such as AISI 4130 steel for the chassis and 7076 T6 Aluminium alloy for the swing arm, provided a balance between strength, weight, and manufacturability. The study extensively analysed vehicle dynamics, focusing on parameters like wheelbase, track width, centre of gravity, and suspension system. The design aimed to optimize these parameters for better stability, handling, and efficiency.

A pivotal finding was the significant impact of vehicle weight on range. Reducing weight was identified as a key strategy for enhancing efficiency, particularly in tadpole electric vehicles, where it directly translates to extended range capabilities. While less influential than weight, camber and tire width were found to have measurable impacts on vehicle range. Proper balancing of these factors is crucial for optimizing performance, as they affect tire wear, rolling resistance, and vehicle stability.

From the main effect plot and experimental test results we have optimized parameters which has maximum range are as follows.

Table 7.1 : Optimized Parameters

Weight (N)	Camber (Degrees)	Tire Width (mm)
2400	1	90

In this study weight parameter dominates the efficiency of the vehicle in the form of range as compared to camber and tire width. Camber and Tire width have little influence on range but these wheel alignment parameters also affect the range of the vehicle.

The research included prototype development and testing, which validated the theoretical models and simulations. The experimental results closely aligned with the design values, affirming the efficacy of the design process and methodologies employed. The study utilized regression analysis to quantify the relationships between range and factors like weight, camber, and tire width. This model provides a tool for predicting vehicle performance and guiding future design improvements. The thesis also discussed the development of advanced steering and braking systems, tailored to the specific needs of the vehicle. These systems were designed to enhance maneuverability, safety, and overall driving experience.

The final vehicle design achieved a balance between performance, efficiency, and safety. The vehicle's maximum range and speed were consistent with the design objectives, demonstrating the success of the optimization strategies employed. This thesis presents a comprehensive approach to the design and optimization of tadpole electric vehicles, emphasizing the importance of weight management, dynamic performance, and component integration. The methodologies and findings from this research contribute valuable insights to the field of automotive engineering, particularly in the development of efficient and high-performing tadpole electric vehicles.

7.2 Future Scope

Development of a More Comprehensive Model: The regression analysis has identified an inverse relationship between vehicle range and variables like weight, camber, and tire width. However, it also suggests that the model's moderate explanatory power could be enhanced by incorporating additional variables. Future research can focus on developing a more inclusive and comprehensive model that accounts for a broader range of factors impacting vehicle range. This approach would offer a more nuanced understanding of the dynamics influencing vehicle efficiency and performance.

Exploration of Unaccounted Factors: The current findings indicate that there are other unaccounted factors that might significantly influence a vehicle's range. Future studies could delve into identifying and analyzing these factors. This exploration could include elements like aerodynamic design, material science advancements, battery technology improvements, and the impact of different driving conditions on vehicle performance.

Balancing Design Elements for Optimal Performance: The study underlines the complexity of vehicle design and the need for a balanced approach to various design elements. Future work could focus on optimizing this balance, particularly in the context of tadpole electric vehicles. This could involve experimental designs that test different configurations of vehicle components to find the most efficient combination.

Practical Applications and Design Innovations: The insights gained from this study are not limited to theoretical understanding but have significant practical implications. Future scope includes applying these insights to guide design improvements and innovations in the automotive industry. This could lead to the development of new vehicle models that are more efficient, sustainable, and better suited to meet the evolving demands of consumers and environmental standards.

Integration with Emerging Technologies: There's a growing intersection between vehicle technology and other emerging fields like artificial intelligence, IoT (Internet of Things), and renewable energy sources. Future research could explore how these technologies can be integrated into vehicle design and operation to enhance performance, safety, and user experience.

Sustainability and Environmental Impact Studies: As the automotive industry increasingly moves towards sustainability, future studies could focus on the environmental impact of different design choices. This could include life cycle assessments of vehicle components, exploration of alternative materials, and the development of more eco-friendly manufacturing processes.

These future directions are aligned with the ongoing trends in automotive technology and the need for continuous innovation to meet both markets demands and environmental goals.