DESIGN AND DEVELOPMENT OF FOLDABLE ELECTRIC VEHICLE

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Introduction

The foldable electric vehicle (FEV) market is an emerging segment in the automotive industry, driven by the need for sustainable transportation solutions and advancements in battery technology, motor power, and fold mechanisms. This market carries various types, including stand-up scooters, hoverboards, and others. Appealing to users of all ages for recreation, short commutes, and transportation needs. The market is segmented by age, with the primary consumer group being individuals aged 18-50.

Foldable scooters and bicycles are well known for decades. In flat metropolitan regions like Berlin, Hamburg or Cologne a light foldable vehicle is used instead of walking or using a bicycle between the apartment or working place, the industry shop floor or train station.

The Foldable Electric Vehicle Market encompasses an extensive examination of the market dynamics, patterns, potential avenues for expansion, and anticipated future states. The market is segmented by product type and application in the report, which also offers a thorough summary of the significant findings and recommendations from the market.

The Foldable Electric Vehicle in this project is expected to have a range of 15-25 Km on a single charge. With a battery capacity of about 420W. It is powered with a 350W BLDC motor which can carry a total load of around 120Kg at a speed of 20-25 kmph. Regulatory and legal factors specific to the FEV market are taken into consideration.

Objectives and Scope

To design and develop an electric vehicle that can provide solution in the following ways.

- **Urban Mobility Alternative**: Foldable e-bikes are an excellent option for urban commuters with limited storage space and several modes of transportation.
- **Last-Mile Connectivity**: Foldable e-bikes address this issue by providing an effective way to travel short distances, lowering stress on motor vehicles and contributing to sustainable mobility.
- **Storage and portability**: Their folding design allows for easy storage in homes, offices, and public areas.
- **Multimodal Transportation**: Because of their ability to fold and unfold quickly, these bikes easily fit with many modes of transportation, such as buses, trains, or cars.
- **Tourism and Recreation**: They are ideal for exploring new locations because of their mobility, as they do not require massive bike racks or specialized transportation.

Our main objective is to design, fabricate and to perform static analysis on critical members of a foldable electric vehicle.

Methodology

Cutting-edge engineering, materials science, and design ideas must be merged to produce a folding electric vehicle in order to create a tiny and portable transportation solution. Although there aren't many well-known folding electric vehicles on the road

yet, the concept is consistent with the growing trend of electric mobility and small-space urban transportation.

We have included materials that attain the criteria of cost and properties of material considering it to be the first priority. We have also followed the standard workflow of the project design and development, starting from recognition of the problem statement, designing of the concepts and evaluation of the concepts. Finally after evaluation of the concepts we have started with the detailed design and finally fabrication of the detailed design of our solution.

Firstly, a project plan was made ready which included the total plan of the project. Initially multiple concepts were made and evaluated based on a checklist made by based on the literature review and the best of the project design was selected. Then detailed design and type and style of fold ability were also determined. Finally once the detailed design was complete, the raw material was purchased for the frame as well as the folding design and electronics was given to a purchase order. Furthermore the remaining components required were procured and eventually was fabricated at the college premises.

Fig 1: Isometric view of Detailed Design

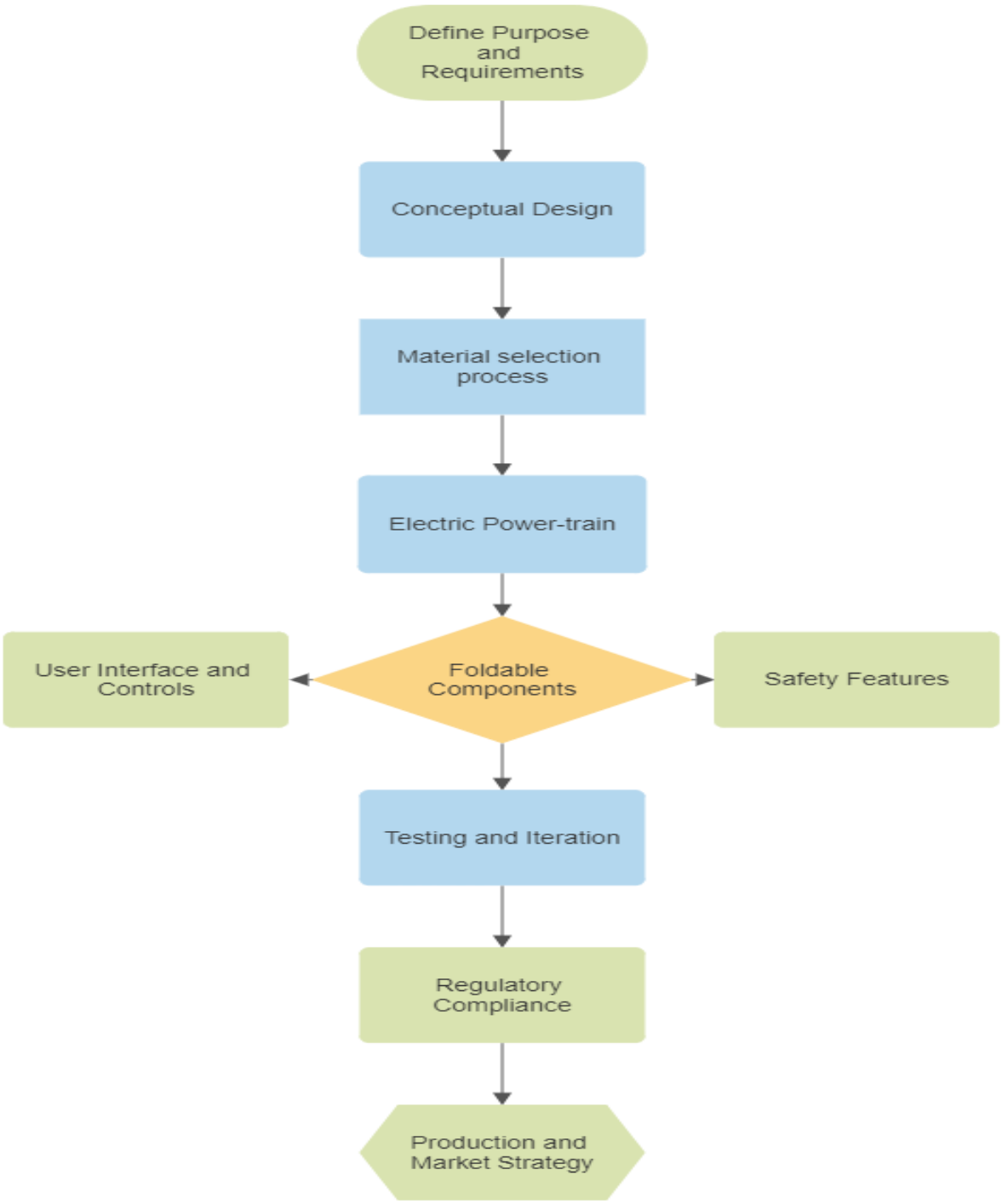

Fig: 2: Methodology to produce a folding electric vehicle

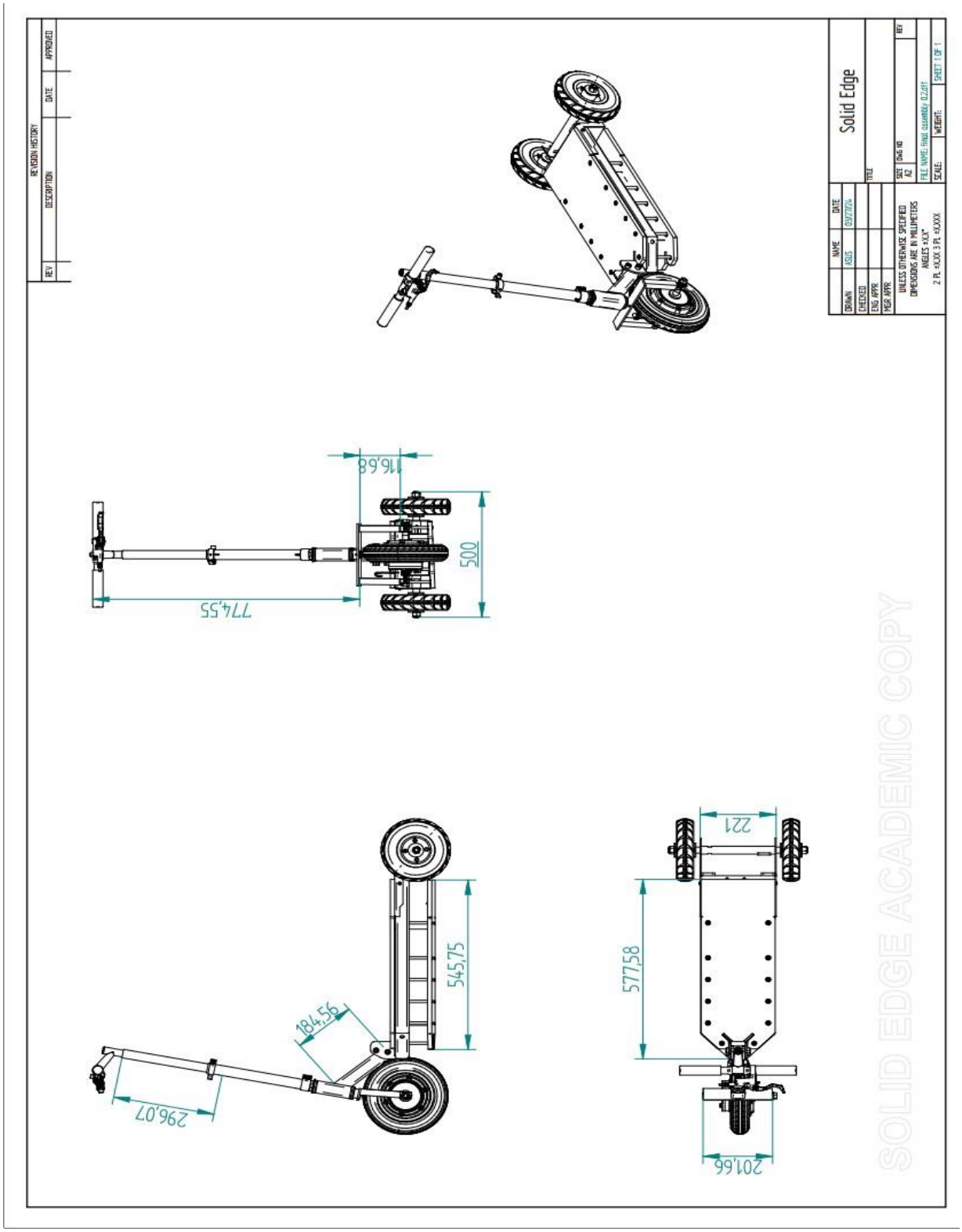

Fig 3: Detailed design of Foldable Electric Vehicle

Results And Conclusion

The Foldable Electric Vehicle (FEV) in this context can provide a range of 12–15 kilometers with a 420W battery capacity and has a 350W BLDC motor that can move 20–25 kmph and support a total load of about 200 kg at the most. Legal and regulatory aspects unique to the FEV market are taken into consideration.

Our foldable electric vehicle project has successfully been developed. We have achieved the primary objectives, including compactness and functionality. Our successful development of the prototype underscores the potential for this innovative transportation solution to address urban mobility challenges. Its compact dimensions and efficient construction enable easy folding and unfolding, enhancing portability and storage convenience. Performance testing was also carried out, revealed satisfactory speed and range capabilities. User feedback highlighted positive responses to the vehicle's usability and comfort, affirming its potential for practical use. Overall, the foldable electric vehicle project lays a solid foundation for continued research and development in this promising field and benefiting the society and the target audience.

Scope For Future Work

Scope for future work foldable electric vehicles (FEVs), the future holds vast potential for advancement. Priorities include refining folding mechanisms for durability and user-friendliness, alongside researching advanced batteries for increased range and faster charging. Integrating smart features such as autonomous driving and connectivity enhances FEVs' functionality and appeal. Material innovation is critical for optimizing weight and structural integrity, while urban mobility solutions offer opportunities to address congestion and emissions. Environmental impact assessments are necessary to quantify FEVs' ecological footprint, and regulatory compliance ensures safety and market access. Strategic marketing and distribution strategies are key for widespread adoption, supported by collaborative partnerships for innovation. Safety features enhancement, user experience refinement, and scalability for mass production remain focal points. Additionally, energy efficiency, autonomous functionality, and consumer education initiatives further shape the future landscape of FEVs.