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Design and Analysis of a New Mini-Bike Prototype Using Fabrication Techniques

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***Abstract*—**Elicitation of creative conceptual designing and fabrication of mini bikes is the primary aim of this study. Miniature bikes or pit bikes or simply mini bikes are found to be the recently prevalent trendsetters amongst the younger population around the globe, be it for commuting and sports. This study also focuses on the steps to be put forth in building a self-designed mini bike concept and showcases similar instances.

***Keywords*—**Miniature bikes, design methods, creative styling.

I. Introduction

RECONSIDERATION and recreation of concepts and innovative ideas in such emerging automotive trends play a very vital role in today's Automotive field and also prevail as knowledge feeders for the thoughts of present and future designers. Styling a product with one's own creative ideas in the first place has undergone dramatic changes over time. The producers have to attract more customers by meeting all their needs. Creative concepts may not always give way to customer needs. Product development has various phases.

Phase 1: The first phase is understanding and identifying customer needs which can be addressed through various aspects like customer survey and interviews about customer's needs.

Phase 2: The next phase is conceptual design and finding solutions to solve the problems from various points of view.

Some leading mini bike manufacturers include Arctic-cap, Gilson, and Fox. Wherein many young customers' preferences are for self-specified and self-built vehicles. This study concentrates on a demonstrative discussion on building mini bikes on one's own ideas.

Pit bikes are original concepts of small scooters. They look like sized down motocross motorcycles that are also used in some motocross competitions. Recently the sport of pit bike racing in go-kart tracks has gained popularity, especially in the United States. The Las Vegas is the biggest pit bike event of the year 2014 [1].

II. Literature Review

Literature review in electronic media such as journal publications, case studies, books, and reports give a brief explanation of the various inventive measures taken and a diluted history of the subject studied. Here are some facts about mini bikes [2].

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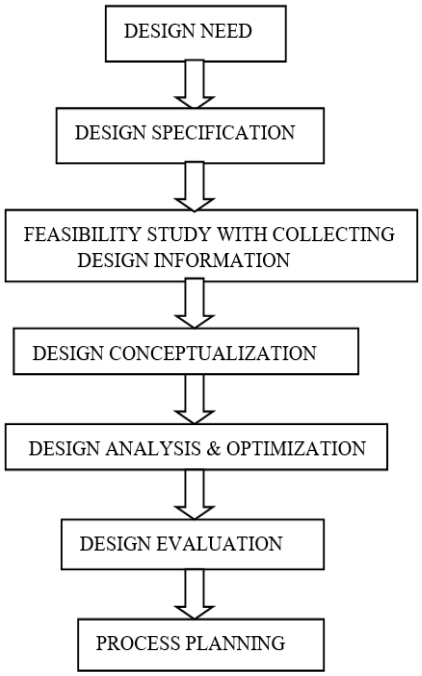

Fig. 1 Design of modern development process

In 1950, the first mini bike was made by the enthusiasts from spare parts found in their garages. In 1960, A market for mini bike developed in many cottages based and major industries. The early mini bike usually had a power train with four stroke and horizontal crankshaft, flathead engine.

Fig. 2 Model- Pit Bike

Mini bikes are the true compact concepts of smaller scooters used to maneuver on uneven surfaces with ease. In 1985, some well-known Chinese mini bike models such as the X7, X15, X18, X19, and X22 were introduced at cheaper costs.

III. Methodology

A. Creative Designing

Creative designing is divided into two domains namely (i) Research-oriented approaches and (ii) Practice-oriented approaches. Research-centered approaches present a top-down view of the design process. The focus is often on quantifying design knowledge and creativity by looking at what designers said rather than what designers do. Designers can have different preferences about the criteria of design. These types of criteria might be determined partially by the design problem; background knowledge might also play a non-trivial part in shaping the design course of actions. While presenting a problem for given design, it has to satisfy different criteria and to involve different types of knowledge in different capacities [3].

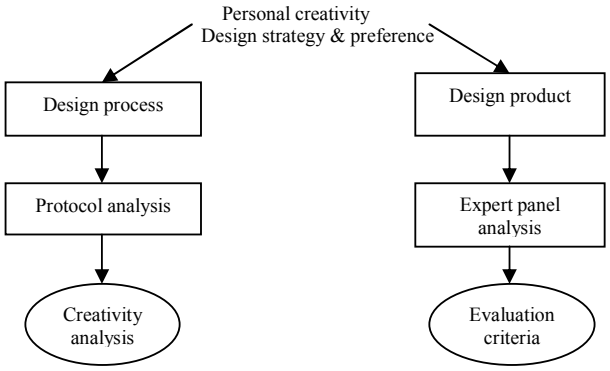

Fig. 3 Design Process

The Practice Center approach is mainly focused on the practical experiential part of design. To verify this claim, there is a need for some rational thinking on design. To start with the nature of design problem need to be scrutinized, and investigation needs to be held. These types of the creative designing domain that help for thinking of creative ideas and design.

B. Idea Generation

Hertzberger [4] once said that "Everything that is absorbed and registered in your mind adds to the collection of ideas stored in the memory: a sort of library that you can consult whenever a problem arises. So, essentially the more you have seen, experienced, and absorbed, the more points of reference you will have".

This saying finds truth in the field of engineering design, where designers transform, combine, or adapt elements of existing designs in order to generate new ideas. Every individual has a different level of expertise in design fixation. The potentially modern fixation is through product dissection, as dissection shows increased creativity of the product [5]. Vehicle parts dissection is often utilized during the design process as a way to systematically uncover opportunities for re-design. Designers take apart or analyze all components and subcomponents of a vehicle. By taking analysis, it can improve maintainability and reliability of a vehicle.

Likewise, every individual has different types of creative ideas and an adaptive element of existing design in order to bring new ideas. It is the two example model A & model B that we can fabricate with our own creative ideas with different actual parts like engine, chassis, brake, suspension, etc. of different bikes which we prefer [6].

Below shown are some of the examples of custom designed mini bikes modified and fabricated by collective efforts of college students using the components of some Indian-spec motorcycles and scooters

TABLE I
Components and Model – A Parameters

MODEL – A		
	Components	Model used
1.	Engine	Two stroke, 50cc (Bajaj Sunny)
2.	Chassis	Double cradle frame (Custom made)
3.	Brakes	Drum brakes (TVS 50)
4.	Fuel tank	TVS 50 (Modified)
5.	Handle bar	TVS 50 (Modified)
6.	Front suspension	Telescopic forks (TVS 50)
7.	Rear suspension	Mono coil (Bajaj Sunny)

Fig. 4 Model- A Bike

The above and below shown mini bikes were modified with respect to the dimensions of the occupant and custom made components like the chassis were designed and constructed in accordance with the dimensions and positioning of the engine and other sub-assembly parts.

TABLE II
Components and Model – B Parameters

MODEL – B		
	Components	Model used
1.	Engine	Two stroke, 60cc (Bajaj Spirit)
2.	Chassis	Double cradle frame (Custom made)
3.	Brakes	Drum brakes (Bajaj Spirit)
4.	Fuel tank	TVS Flame (Modified)
5.	Handle bar	Yamaha FZ (Modified)
6.	Front suspension	Telescopic forks (TVS 50)
7.	Rear suspension	Mono coil (Bajaj Spirit)

C. Analysis of Frame

Designing and analysis of various components of the concept are a virtual step in any aspect of engineering. Ansys software was used to carry out various methods of analysis. The Analysis is done for examining and establishing the structural integrity of the design. The frame is a double cradle type with tubular pipe members for achieving higher load bearing capacity.

Fig. 5 Model- B Bike

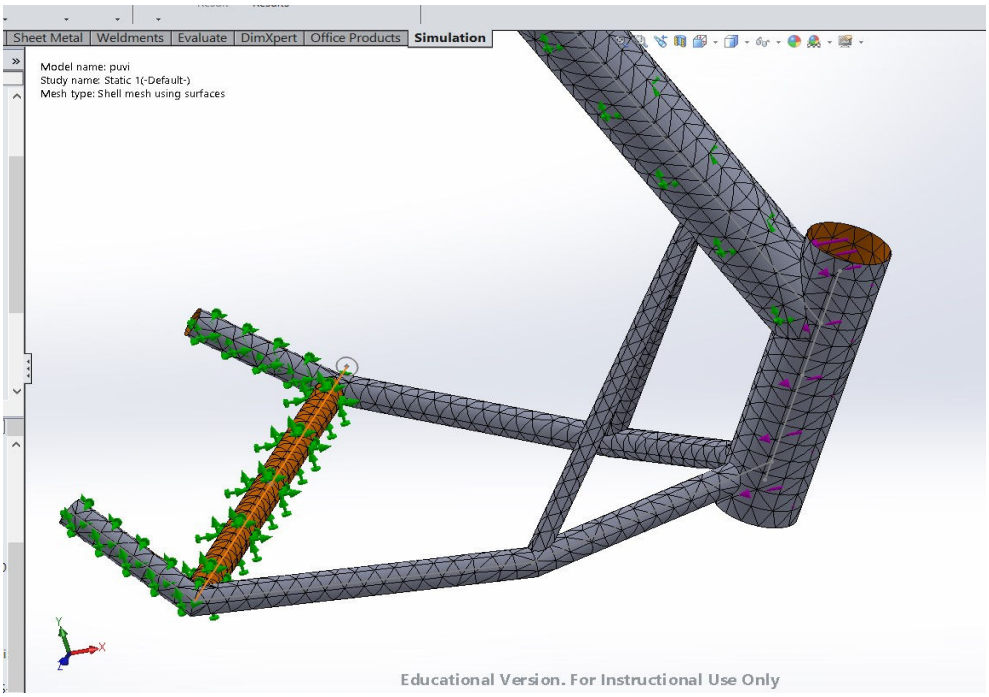

Fig. 6 Shell mesh using surfaces

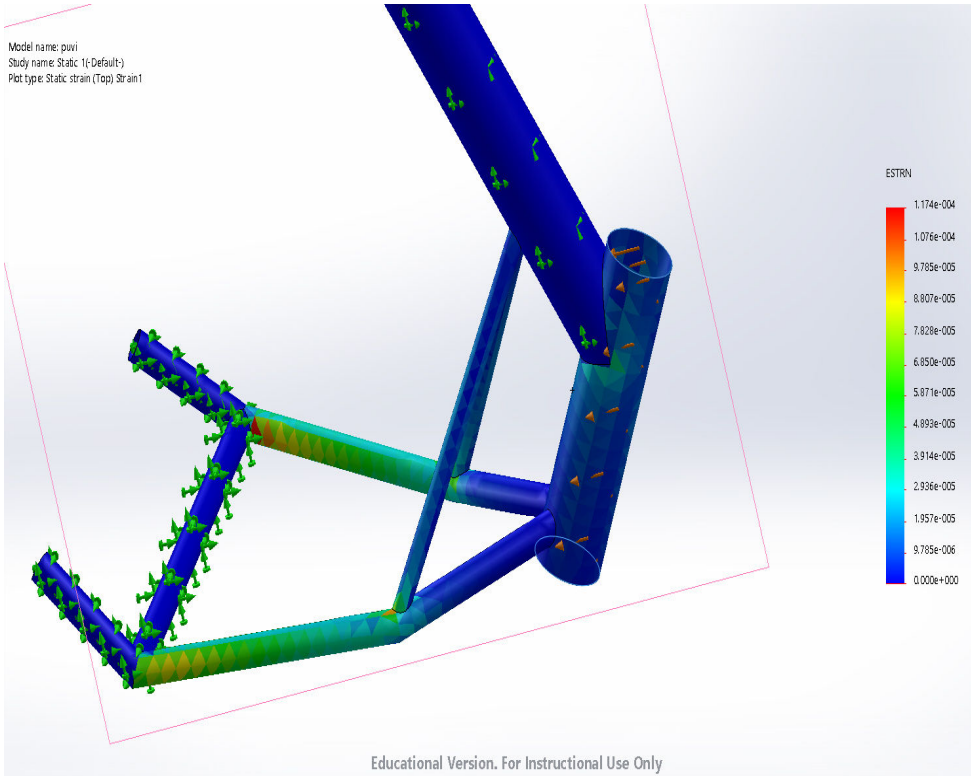

Fig. 7 Analysis of strain

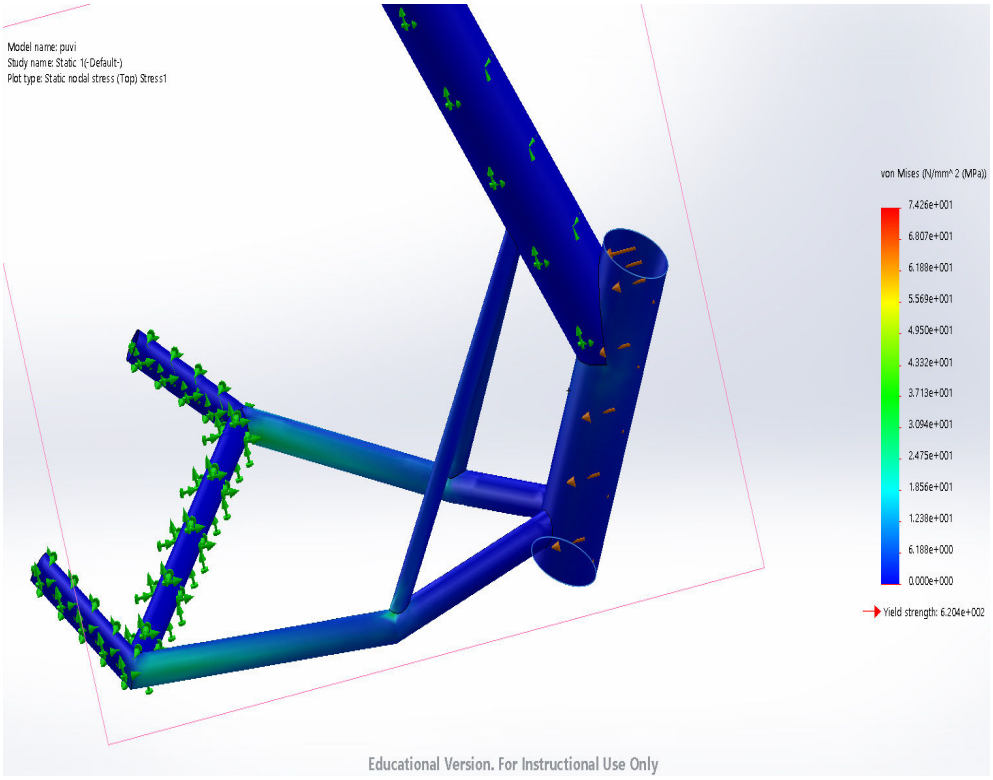

Fig. 8 Analysis of stress

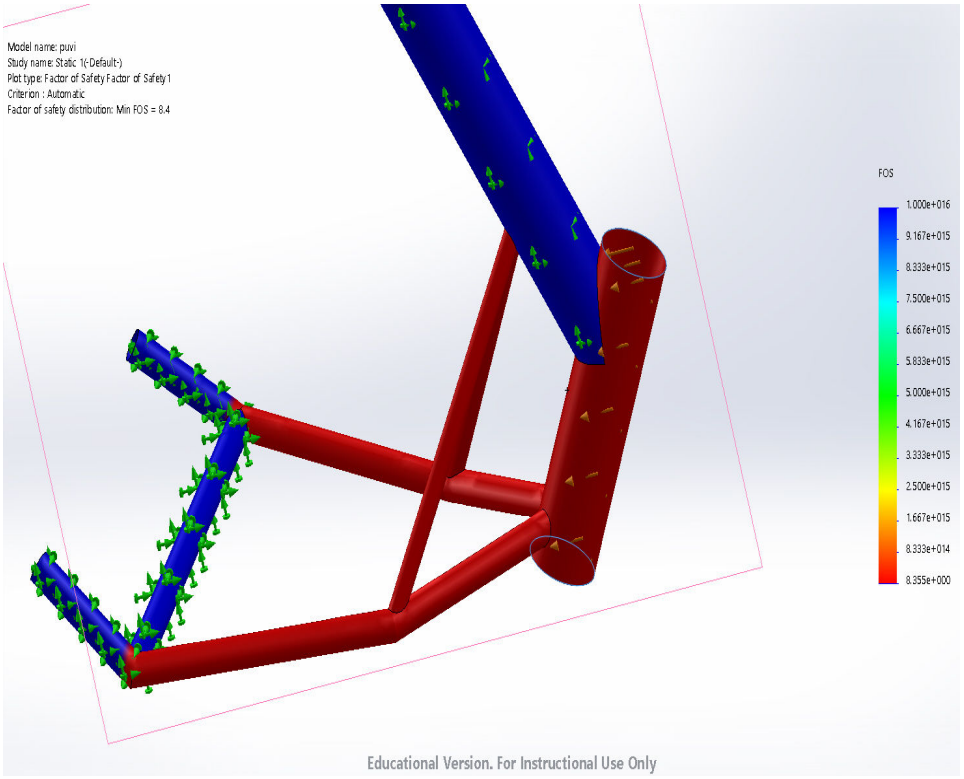

Fig. 9 Factors of safety

IV. Assembly Methods

In general, assemblies are simply groups of parts, which are brought together in some fashion so that it can perform intended purposes. Creating the assembly from its part requires specifying the spatial and mating relationships between the parts. Assembly of a product may be done in a variety of methodologies such as parts may be welded together, or they may be fastened together using bolts and nuts [7].

A. Assembly Planning

Assembly planning is a key to creating successful assemblies, especially the large ones that are typically encountered in practice. As with models of individual parts, an assembly model should be fully parametric and flexible. This means that the relations between the assembly parts should be easy to change and update.

B. Assembly Tree

In a review study, the most natural way to represent the hierarchical relationships between the various parts of an assembly is an assembly tree. An assembly is divided into several subassemblies at different levels. Each subassembly at depth (n-1) is composed of various parts. The leaves of the tree represent individual parts or subassemblies. The nodes of the represent parts or subassemblies and its root represent the assembly itself. The assembly is located at the top of the tree at depth 0 or at the highest hierarchy n of the assembly sequence possible seeing that many of such variables are qualitative rather than quantitative.

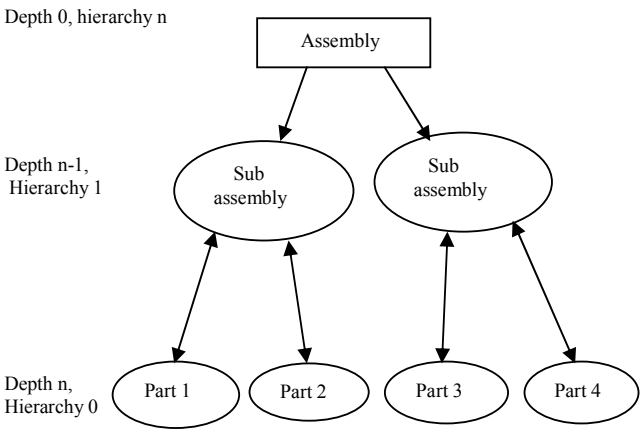

Fig. 10 Assembly Process

V. Conclusion

This paper tells about the divergent thinking, creativity of reconstructing and reinventing the process of own parametric design of the mini bike. To accomplish this task, there are wide varieties of methodologies and design. It clearly explores different concept variations in the design. On a conclusion, the above model A & model B mini bikes were designed and

fabricated in different parameters. It paves the way to understand the key concept of creativity in parametric design.

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