iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50959

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Fabrication and Assembly of Electric Formula One Car

Prof. M. S. Shelke[1], Anurag Shahare[2], Swapnil Katole[3]
[1, 2, 3]*Mechanical Department, KDK college of Engineering, Nagpur*

Abstract: ***The formula one electric car running and constantly growing new concept of all over the world wide. This paper reviews the developments in a racing supra electric car in recent years. formula one electric car is four wheel vehicle to design and fabricating the racing purpose. This electric vehicle it has a very low to zero carbon emission, high efficiency and flexibility. The formula one electric car racing is most economics from of racing. We have design, manufactured and fabricated FSAE racing application. this electric vehicle project include design of idea, analysis, teamwork, imaginary concept, development, budgeting and costing. But the most time is wasted in design, fabrication and manufacturing. But we can maintain the performance of this project and achieve desirable project within the time.***
Keywords: fabrication, electrical, F1, components, lithium-ion, power, controller, batteries, motor, testing,

I. INTRODUCTION

This paper is describethe summary of fabrication of formula one electric car for the 2023 session. the development of low-cost metal fixture to high cost metal fixture. The fabrication of this vehicle construction according to the human relation with the electric vehicle. This promotes the use of new technologies and practical application to provide the best vehicle performance. the idea of electric vehicle first emerged during the 19th century and studies have been ongoing today. It has now become possible to see in future electrical, light electrical and hybrid vehicle with electric vehicle technology up and running on the road. This electric vehicle car of the automobile industry, reducing carbon dioxide emission and introducing hybrid and electric system. This formula one e-car had a power of 2HP (1.5kW). The batteries are powered by lithium-ion and are rechargeable, the battery supplies electric power to the motor through a motor controller, which help in input and output parameter of the motor. The electric motor selected for this vehicle must have the ability to provide sufficient power, torque and speed overcomes the force due to load and other opposing forces acting on the vehicle. The electric vehicle has many components like a charging module, converter, controller, batteries, electric motor, knuckle, hub, suspension, and steering etc. controller is the electronic package that operates between the batteries and motor to control the electric vehicle speed and acceleration. The shearing system involves in controlling the car. The steering of this electric car is rack and pinion based steering mechanism that converts the rotational motion generated at the steering wheel into the linear motion at the end of the rack. During the process, we must achieve a compromise between design, fabricating and manufacturing time so that the electric car will be competitive in all aspect.

II. PART OF THE FORMULA ONE ELECTRIC CAR

A. Knuckle and Hub

The maximum distance between the upper and lower ball joints is kept in mind when designing the knuckle (which lessens the weight on the A-arms). The knuckle-hub assembly is made in a way that helps reduce the weight of the unspring.

B. Suspension

All of the components in a road car's suspension are also present in a Formula One vehicle. These parts include arms, anti-sway bars, dampers, springs, and dampers. High loads must be supported by the suspension. The suspension of an F1 car must be sturdy and rigid to manage the pressures placed on it while it travels through a curve at high speeds without being damaged. Suspension's primary function is to join a car to its wheel. Because moving a heavy requires a sophisticated system with many parts, this is not necessary.

C. Steering

Making sure the wheels are pointed in the right directions is the basic goal of steering. Usually, a number of links, rods, pivots, and gears are used to accomplish this. A shaft from the steering column rotates a steering gear when the driver turns the steering wheel. Tie rods that are connected to the front wheels are moved by the steering gear. To turn the car left or right, the tie rods move the front wheels.

D. Ackermann Principle

The problem of wheels needing to trace out circles with different radii on the inside and outside of a turn led to the development of the Ackermann steering geometry, a geometric design of connections in the steering of an automobile or other vehicle. The Ackermann steering geometry that all automobiles employ prevents the proper turning angle of the steering wheel from being produced when navigating a bend or a curve.

Steering Calculations
1710 mm is the wheel base.
Track widths at the front and back are 1250 mm and 1150 mm, respectively.
Track Rod (d) equals 910 mm.
350 mm for the track arm (r).
Lock to lock angle equals 180 degrees, with inner steering angle equal to outer steering angle.

- Steering mechanism:-

Slip angle = sin = b - d/2 sin = 1150 - 910/2 sin = 350 = 0.3428.
Slip angle = 20.04 degrees

1) Motor

Front hub, rear hub, and mid-drive motor are three completely different locations for electrical bicycle motors, each with their own advantages. The motor's primary function is managing force. The electrical motor offers more force the more advanced it is. The more force you exert, the more power you'll get from the bike.

2) Battery

The battery on an electric bike can be located in varying places on the bike, which depends on frame. Each battery makes, model and type mean that they will need to charge for different times, an average charging time is 6-8 hours. Charging your battery is easy, just like a mobile phone you plug it into the wall. As we are using 48v ,t1500 w motor to run the cycle, we are required to supply a voltage of 48v, a rated current of 15.6A and to make the e-bike run more efficiently for a long duration of time, we have connected 4 batteries (each 12v) and with a capacity of 18ah in series to get the supply enough power to run the motor.

3) Controller

An electronic circuit serves as the speed controller in a Formula One electric vehicle. This controller unit feeds the motor with electricity from the battery pack. Different controller types are utilised with brushless and brushed motors. The controller is the key component of the conversion kit used for adaptive electric vehicles. this electronic the formula car motor receives signals from the car speed controller at various voltages. These signs indicate how a rotor should be pointed in relation to the starter coil. The usage of many mechanisms is necessary for a speed management to operate well.

4) Acceleration Pedal

The acceleration pedal is connected to the controller through wiring whose function is to regulate or control the speed of the motor.

5) Battery Charger

A rechargeable battery is given energy by a device called a battery charger that pushes an electric current through it. This charger connects to a controller's charger plug and draws electricity from the main supply to provide the battery with current. The four batteries in a pack connected in series can be charged with this power charger in 5-7 hours.

6) Wheel

The wheel helps the car distribute its weight. Additionally, it aids in shifting the car's gears. The wheel size for an F1 racing car is 13 inches in diameter, with a combined tyre and rim diameter of 26.4 inches (67 cm). Both the front and rear measurements are 30.5 cm.

7) Differential Assembly

A drive shaft connecting the final drive unit with the differential receives torque from the engine through the gearbox. The final drive unit's housing contains a spiral bevel pinion gear that receives power from the propeller shaft's end. This meshes with the crown wheel, a sizable spiral bevel ring gear. The hypoid arrangement of the crown wheel and pinion is possible. The differential carrier or cage, which houses the "sun" and "planet" wheels or gears—a cluster of four opposing bevel gears in a perpendicular plane—contains the crown wheel gear. Each bevel gear meshes with two of its neighbours and rotates anticlockwise with the third that it faces.doesn't fit in with. The two sun wheel gears drive the axle half shafts attached to the driven wheels of the vehicle and are positioned on the same axis as the crown wheel gear. As the ring gear rotates, a perpendicular axis on which the other two planet gears are mounted shifts position. The planet gear spins in addition to rotating, allowing the left side gear to slow down with an equal increase in speed for the right-side gear if the left side gear runs into resistance.

8) Braking System

- *Drum Brake:* One of a Formula One car's strongest points is its braking system. Formula 1 cars use composite brake discs that include carbon fibre reinforcement. When the brakes are warmed up, the coefficient of friction between the pads and the discs might reach 0.6. At these high temperatures, steel brake discs would have a higher rate of wear. They are heavier as well.

III. STUDYS AND FINDING

The material's strength, toughness, and machinability are the first things we research. Then, software was used to check the suspension and steering designs. Then we concentrated on battery selection and their connection while also examining the battery charging requirements. the use of computer modelling and mathematical calculations in the design of components, as well as the use of pre-designed assemblies. The calculation must be done in order to get the pack's ideal volumetric and gravimetric energy properties

IV. CONCLUSION

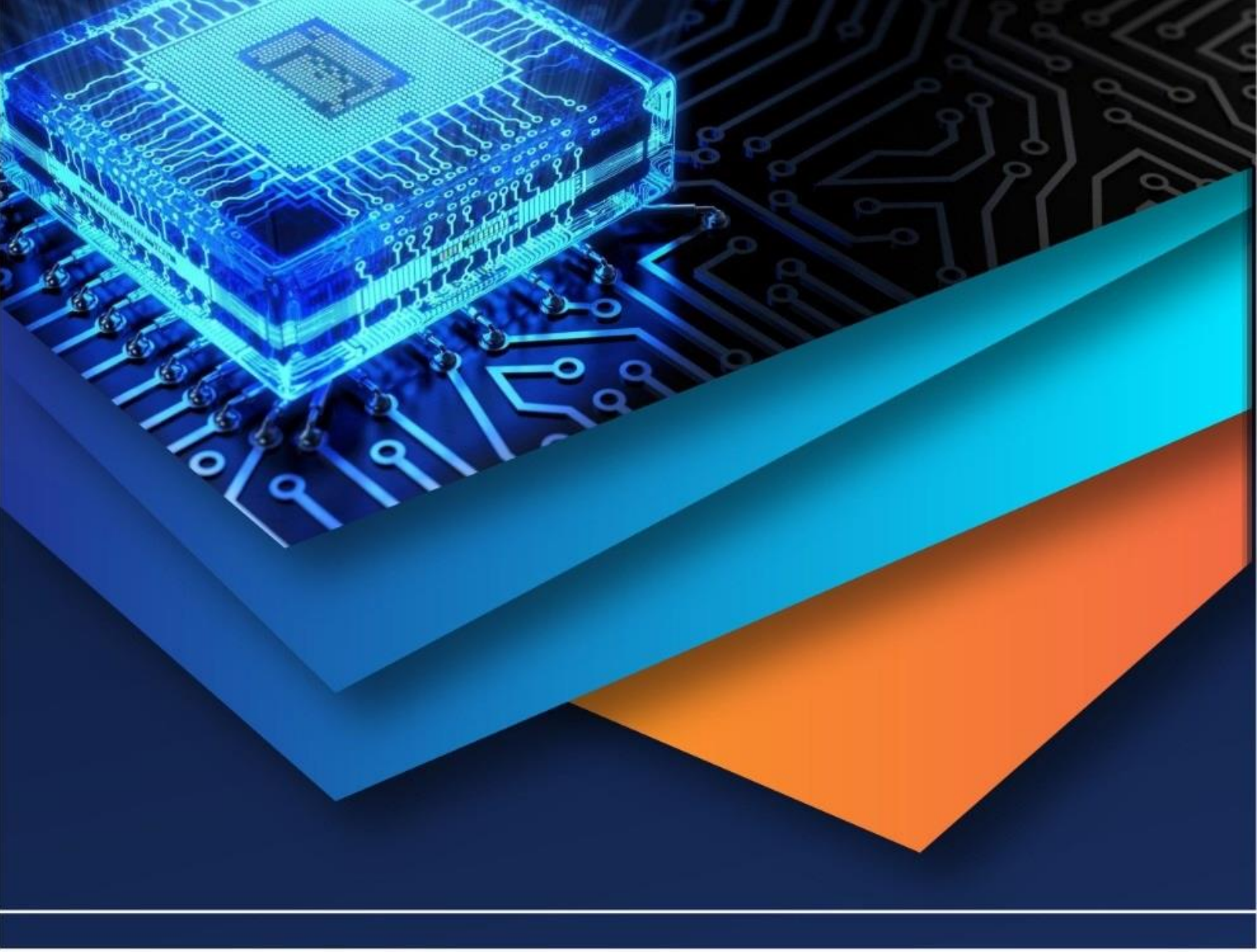
The designs were finalised following comprehensive validation in terms of structural analysis, forces, meshing, prices, resources, and most importantly safety. The method for selecting the battery cells for the electric race car battery, selecting their connection pattern, and computing the battery pack's properties was devised. The idea provided in this essay is highly comprehensive and addresses issues with racing car design, rule knowledge, and fundamentals of vehicle chassis design. In this study, the idea of analysis for design validation is thoroughly developed.

V. ACKNOWLEDGMENT

My appreciation for my professor's patience and comments, as well as that of my committee chair, is beyond words. In addition, I could not have made this voyage without the rich knowledge and experience my defence committee supplied. I am also appreciative of their emotional support, late-night feedback sessions, and editing assistance. Thank you also to the study participants who served as our inspiration. I should not forget to acknowledge my family, especially my parents, as a final point. Their confidence in me helped me stay positive and motivated during this process.

REFERENCES

[1] “Review on Design and Fabrication of Race Car Chassis” by Saurabh Sirsikar1, Ajay Bhosale2, Akshay Kurkute3, Sumedh Ghawalkar4, Ketan Sahane5 published on Volume: 07 Issue: 03 | Mar 2020.
[2] “Development of high-density motor for formula SAE electric race car” by Xuanyang Hu, Hong Guo, Hao Qian, Xiaofeng Ding, Yanling Yang published on IEEE, October 2017
[3] “Development of Formula Student Electric Car Battery Design Procedure” by V.A. Kalmakov, A.A. Andreev*, G.N. Salimonenko pubished on Elsevier ltd.
[4] “Design and Analysis of Suspension System with Different Material for SUPRA SAE INDIA” 2018 Ankit Patil, Sahil Patil, Monik Shah, Nitin Sall published on International Journal of Scientific & Engineering Research Volume 9, Issue 3, March-2018
[5] “Formula One Safety: A Review” by Shubham R. Ugle, Shweta D. Kate, Dhananjay R. Dolas published by International Research journal of engineering and technology, vol.2,7 Oct 2015
[6] “Mathematical Study and Design of Ackermann Steering Geometry in Four-wheeler” by Mr. Varad Sanjay Kumbhar1, Mr. Mangesh Vijaykumar Mali2, Mr. Nitin Parasram Banne published on IRJET e-ISSN: 2395-0056 Volume: 07 Issue: 07 July 2020
[7] “DESIGN & MANUFACTURING OF FSAE CHASSIS” by Mohammed Tazeem Khan Volume:03/Issue:02/February -2021
[8] Design, build, and test drive a FSAE electric vehicle” by Meah1, Donald Hake II1, Stephen Wilkerson published by the IET under the Creative Commons Attribution License J. Eng., 2020, Vol. 2020 Issued. 10, pp. 863-869
[9] “A Review of Speed Control of BLDC Motor with Different Controllers” by Anurag Dwivedi
[10] “Design and fabrication of a student competition racing car by Faieza, S.M. Sapuan, M.K.A. Ariffin, B.T.H.T. Baharudin and E.E. Supeni” published by Scientific Research and Essay Vol.4(5) Pp. 361-366, May, 2009



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY