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Electric Vehicle

Mohamed Salman M[1], Divakkar VP[2], Koushik Sekar[3], Rahul L[4], Srivathsan K[5], Mufaddal Attarwala[6]

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Abstract - The goal of this product design record is to create all the documentation had to construct the prototype. Through iterative evaluation and optimization, the layout has been superior from beyond design reports. The prototype has been designed to ensure that it complies with standards and is secure to experience on Indian roads

1.INTRODUCTION

The most important part of motorbike designing is figuring out the geometry of the chassis. It outcomes in the usual behavior of the bike. The geometry determines the general stiffness, aerodynamics, rider position and luxury, and also impacts dealing with, manoeuvrability and responsiveness. The parameters that on the whole dictate the geometry consist of:

The parameters that primarily affect the geometry include :

- Castor angle (Rake angle)
- Trail
- Wheelbase
- Steering Offset

These parameters give the foundation to our motorcycle geometry. The interdependence of theseparameters are given by the following equations:

1. $a = a_n/\cos\varepsilon$

   Where 'a' is the ground trail , 'ε' represents the rake or castor angle and 'a_n' is the normaltrail

2. $b_n = (p + a)\cos\varepsilon$

   Where 'b_n' is the rear normal trail and 'p' is the wheelbase

3. $a_n = R_f \sin\varepsilon - d$

   Where 'R_f' is the front wheel radius and 'd' is the steering offset.

Each parameter impacts the performance and managing of the bike otherwise as a consequence there may be no top-rated price for each parameter. The sort of geometry required relies upon at the characteristics anticipated from the motorbike.

1.1 Castor angle

The caster perspective varies in keeping with the form of bike: from 19° (speedway) to 21-24° for competition or sport motorcycles, up to 27-34° for journeying motorcycles. From a structural factor of view, a completely small perspective reasons incredible strain at the fork all through braking. Since the the front fork is alternatively deformable, each flexionally and torsionally, small values of the perspective will result in more strain and therefore extra deformations, that could motive dangerous vibrations inside the front meeting (oscillation of the front meeting around the axis of the steering head, referred to as wobble). The fee of the caster angle is carefully associated with the price of the trail. In fashionable, with a purpose to have an awesome feeling for the motorbike's maneuverability, an growth inside the caster angle must be coupled with a corresponding increase in the trail. The cost of the trail depends at the sort of motorcycle and its wheelbase. It ranges from values of 75 to ninety mm in competition motorcycles to values of 90 to 100 mm in travelling and sport motorcycles, up to values of 120 mm and past in merely visiting motorcycles.

1.2 Trail

If the cost of the trail have been poor (the contact point in front of the intersection point of the steerage head axis with the road aircraft) and thinking about that friction force F is continually inside the contrary path of the speed of slippage, a moment across the guidance head axis that could tend to growth the rotation to the left would be generated. One can take a look at how friction force F would amplify the disturbing effect, severely compromising the motorcycle's equilibrium. The avenue profile can make the trail bad, as an instance, whilst the wheel goes over a step or bump. This is the cause why we avoid having a terrible path price. Since the load at the front wheels is high because of the burden of the motorcycle, the choice of a small path lowers the price of the torque that the rider ought to apply to the handlebars to execute a given maneuver. In addition, it's miles well worth pointing out that these bikes are commonly used at as an alternative low velocities, and that they do now not consequently want lengthy trails, which, as formerly noted, assures a excessive directional stability at high velocities. The cost of the path depends on the form of motorbike and its wheelbase. It levels from values of seventy five to ninety mm in opposition bikes to values of ninety to one hundred mm in journeying and sport motorcycles, up to values of 120 mm and past in in basic terms journeying motorcycles.

2. WheelBase

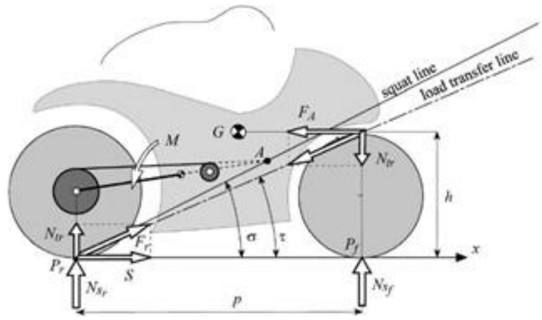
In general, an increase in the wheelbase, assuming that the other parameters remain constant, leads to:

1. An unfavorable increase in the flexural and torsional deform-ability of the frame. These parameters are very important for maneuverability (frames that are more deformable make the motorcycle less maneuverable).
2. An unfavorable increase in the minimum curvature radius, since it makes it more difficult to turn on a path that has a small curvature radius, in order to turn, there must be an unfavorable increase in the torque applied to the handlebars.
3. A favorable decrease in transferring the load between the two wheels during the acceleration and braking phases, with a resulting decrease in the pitching motion.
4. A favorable reduction in the pitching movement generated by road unevenness
5. A favorable increase in the directional stability of the motorcycle.

The value of the wheelbase varies according to the type of motorcycle. It ranges from 1200 mmin the case of small scooters to 1300 mm for light motorcycles (125 cc displacement) to 1350 mm for medium displacement motorcycles (250 cc) up to 1600 mm, and beyond, for touring motorcycles with greater displacement.

2.1 Steering Offset

The steering offset is the measurement of the lateral deviation, from the middle of the tyre contact surface, to the trace point. Offset of the wheel spindle from the steering axis is measured at right angles to that axis. With a negative steering offset, (see figure) the track point lies outside of the center, and with positive, inside. If the trace point lies dead center, its value is zero. Considering the effects of above parameters we conducted multiple iterations to arrive at theideal vehicle geometry for or prototype



In the rear suspension the squat ratio 'R' is an important parameter to consider as it decides how the rear suspension reacts to the different moments generated, both static and dynamic We define the squat ratio R as the ratio between the moment generated by the load transfer and the moment generated by the sum of the chain force and the driving force:

R=(Ntr L cos φ)/(S L sin φ + T L sin(φ – n)) where

Φ= swingarm angle L=swingarm length

S= moment generated by driving force T= moment generated by chain force Ntr= load transfer

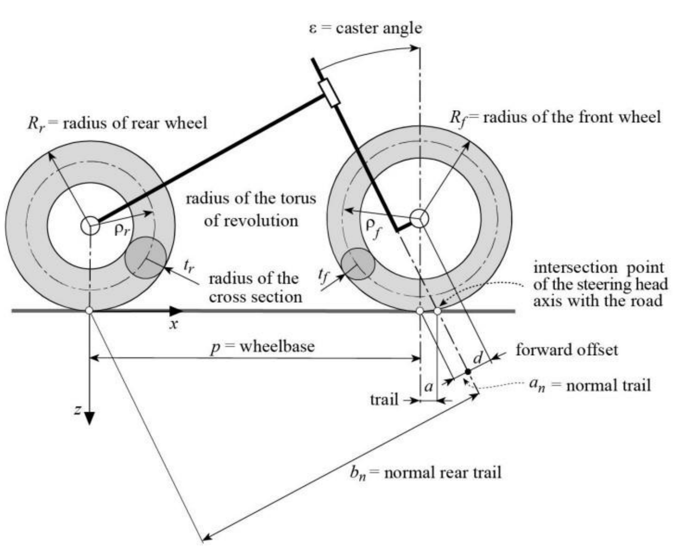
n is given by n= arcsin[(L sin Φ + yp-(rc-rp))/Lc)

Where yp is the vertical coordinate of the drive sprocket shaft rp and rc represent the radii of the power sprocket and the rear sprocket, b represents the vertical distance among the axes of the sprockets, Lc is the length of the instantly line section of the chain.

Expressing the weight switch as a function of the using force, the ratio is a characteristic of only the geometric characteristic.

R= (h*cos Φ)/(p[sin Φ + Rr*sin(Φ-n)/rc

According to the squat ratio 3 instances can arise:



1. Point A lies at the directly line of the weight switch, this is σ=τ ; in this example R = 1. During the thrust phase there are no extra moments working on the swinging arm, so the suspension spring is now not careworn compared with the static situation.

2. Point A lies beneath the instantly line of the burden switch, this is σ<τ ; in this case R >1 : the moment generated via the consequent force Fr reasons a compression of the spring in addition to the one created by way of the static load.

3.Point A lies above the straight line of the load transfer, that is σ>τ ; in this case R<1 :The moment generated by the resultant force Fr causes the extension of the spring.

The squat ratio 'R' can also be expressed as R=tan τ/tan σ Where,

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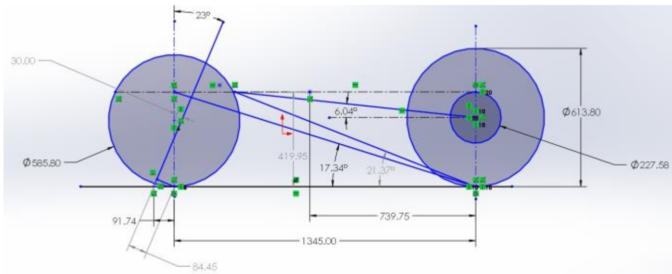
The squat ratio 'R' can also be expressed as R=tan τ/tan σ Where,

1. τ(load transfer angle) = 17.34°
2. σ (squat angle) = 21.37°

Therefore R=0.79, and thus R<1, This helps the anti-squat nature of the motorcycle.

Detailed static load cases



As dynamic analysis was not conducted a factor of safety of 1.5 - 2 is favorable as per previous experience to compensate for fatigue and to compensate for random factors a factor of safety of around 2 was considered appropriate.

The following forces act on a motorcycle:

- The weight mg acts at its center of gravity.
- The driving force T, which the ground applies to the motorcycle at the contact point of the rear wheel.

Steering system

Steering is a governing subsystem that's a set of mechanical linkages to help the rider to guide the car in desired course or to barter a flip along round pathway. Steering gadget of a wheeler involves critical parameters which determine the steadiness and manoeuvrability of the vehicle. A guidance gadget for a motorcycle includes a head pipe, a steerage stem, a pinnacle bridge, a backside bridge, a front fork, and a steerage handlebar.

The motorbike steerage behaviour relies upon on diverse geometric parameters: 1.Wheelbase

2. Offset three.Rake/castor angle four.Wheel radii 5.Turning perspective

6. Roll angle

7. Tire properties (slide slip angles)

The motorcycle steering mechanism for a given offset

When turning the handlebars, retaining the motorbike flawlessly vertical, the steerage head lowers and simplest begins to rise for extremely excessive values of the steering attitude

The vertical displacement of the wheel centre:

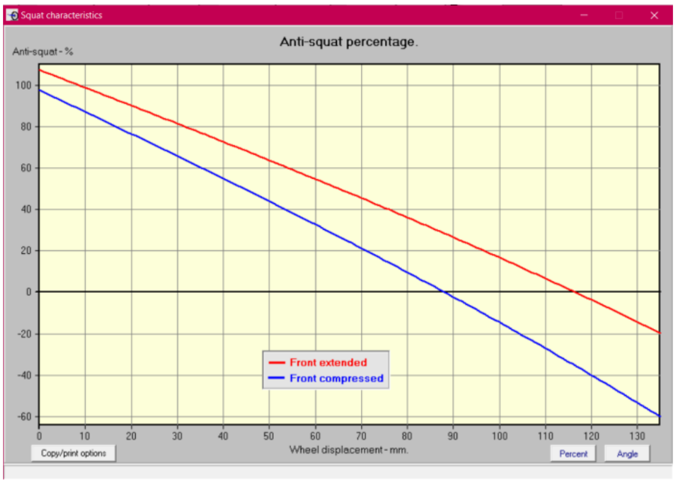
$$\Delta h = R_f\left(1-\sqrt{1-\sin^2\delta\ \sin^2\varepsilon}\right)-d\cdot\sin\varepsilon\cdot(1-\cos\delta)$$

=.2929(1-SQRT(1-sin^2(22)sin^2(23))-0.03(sin23(1-cos22)

=0.002301 mm

Turning Radius

Radius = Wheel base/Sin(90-Steering angle)



= 1.345/sin(90-22) =1.45 m

Wheel Flip Flop factor:

Wheel flip flop factor = trail*sin(head angle)*cos(head angle)

= 91.74*sin(67)*cos(67)

=32.9 mm

Motorcycle parameters while in a curve

The motorcycle while going about a steady turn is subjected to two forces i.e the tilting effect (Rolling) and the restoring moment generated by the Centrifugal force that tends to keep the vehicle in a balanced state i.e prevents it from falling into the curve.

$$\lambda_r \approx \frac{1-k_{\varphi_r}}{k_{\lambda_r}}\varphi$$

Effective Roll Angle:

=arctan(23.5^2/9.81*40)+arcsin(55*arctan(23.5^2/9.81*40)/419.95-55

=60.97 degrees

V= forward velocity of the motorcycle Ω= Angular yaw rate (yaw velocity)

Rc= the radius of the turn

g= Acceleration due to Gravity (9.81 m/s^2) h= Centre of gravity height

2t = Tire thickness (120mm) Yaw velocity:

Ω = V/(Rc)

= 23.23 / (40)

= 0.58 m/s Where,

V= Forward velocity, Rc= Radius of Curve

Lateral Slip (slip angle) :

It is defined as the angle formed by the direction of forward motion and the plane of the wheel. When sideslip angles approach zero, steering is called kinematic steering.

We consider neutral steering condition for which we have taken the values of the camber andcornering coefficients as 0.6 and 12 respectively

Neutral steering : Steering ratio is '1' i.e front slip = rear slip

$$N_f = mg\frac{b}{p} - F_A\frac{h}{p}\cos\varphi$$

Front slip angle:

$$\lambda_f \approx \frac{1-k_{\varphi_f}}{k_{\lambda_f}}\varphi$$

=(1-0.8)*60.97/12

=1.0161

Rear Slip Angle:

$$\varphi = \varphi_i + \Delta\varphi = \arctan\frac{V^2}{gR_c} + \arcsin\frac{t\cdot\sin\left(\arctan\frac{V^2}{gR_c}\right)}{h-t}$$

=(1-0.8)*60.97/12

=1.0161

while cornering:

Aerodynamic Forces:

Drag force = (d * V^2 * Cx * S) / 2

= (1.225 * 14.38^2 * 0.5 * (0.6x10^-6))/2

= 3.79x10^-5 N

Where:

d = air density V = velocity

Cx = Drag coefficient

S = Frontal surface area

Vertical Load on tires while cornering:

Front Tire

=161*9.81*(739.75/13445)-78*(419.95/1345)*cos(60.97)

= 856.85 N

Rear Tire

=161*9.81*(739.75/13445)-

(78*(419.95/1345)cos(60.97)

=856.85 N

Lateral Forces on both tires:

Front tire:

= (12*1.0161+12*60.97)*856.85

= 637353.47 N

Rear Tire:

=(12*1.0161+12*60.97)*722.55

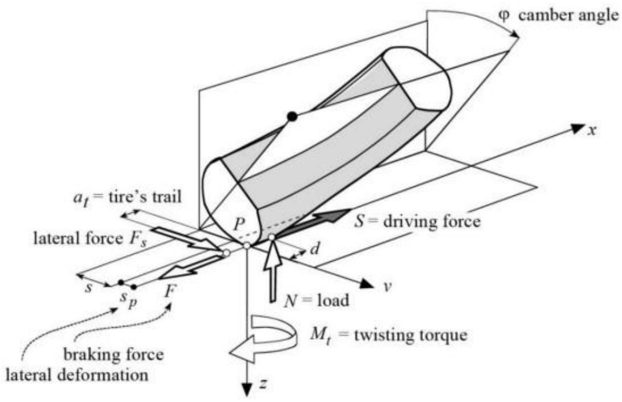
=543318.08 N

Effective steering Angle :

$$\Delta^* = \Delta + \lambda_r - \lambda_f \cong \frac{\cos\varepsilon}{\cos\varphi}\delta + \lambda_r - \lambda_f$$

= Steering angle + 1.0161-1.0161

= 22 degrees



$$N_r = mg\frac{p-b}{p} + F_A\frac{h}{p}\cos\varphi$$

Tire Setup

Model of the tire

The model of the motorcycle tire takes into consideration the forces acting on points near the theoretical contact point defined by the tire's geometry.

The forces under consideration are as follows:

1. Normal force: Normal force is applied at a point that precedes, by the distance d, the position of the theoretical contact point.
2. d = fwR = 4.39 mm

Where, fw = rolling resistance coefficient = 0.015 R = tire's radius = 292.9 mm

2.Longitudinal force: The force is applied to a point displaced laterally from the theoretical contact point because of the tire's lateral deformability. The lateral displacement sp, depending on the lateral stiffness of the tire, is generally negligible with respect to the geometric displacement s deriving from the roll inclination of the wheel.The moments acting around the x, y and z -axes are generated by the forces described above and by the twisting moment.

3.Overturning moment: The overturning moment Mx is generated by the vertical load N whose arm is the lateral deformation sp. Mx = −spN =1580 Nmm

4.Rolling resistance moment: Rolling resistance moment is generated by the asymmetric distribution of normal stresses that causes a forward displacement of vertical load. The tire's rolling resistance moment is: My =d*N = 4.39 * 161 * 9.81= 6933.6 Nmm

5. Yawing moment: Yawing moment includes two contributions. The first term, due to the lateral force, tends to align the plane of the tire in the direction of velocity. The

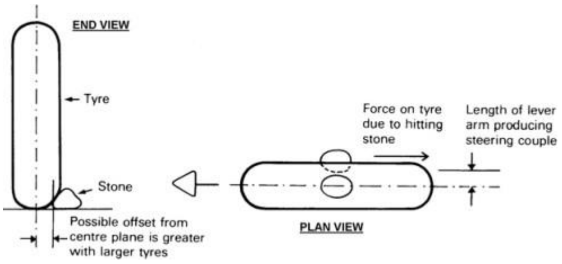
second term increases with the camber angle and works against alignment. Mz = −atFs + Mt

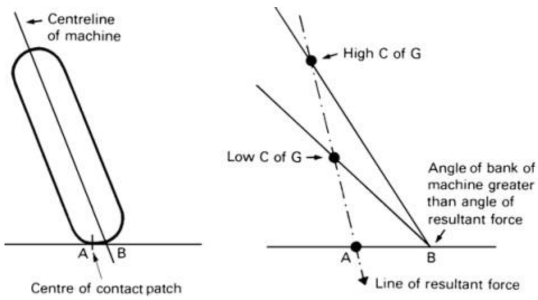
Factors taken while tire selection:

1. Large tires increase the un sprung mass too, to the detriment of roadholding. Larger tires also increase precessional forces.

2. Road disturbance such as a stone can cause a couple tending to steer the wheel to that side. A wide tire is found by more stones and produces a higher couple.

3. Wide tires may impair handling and stability, even though grip may be improved. The contact patch moves away from the centre plane of the wheel or the steering axis as the machine is banked. A greater angle of lean is necessary to balance centrifugal force, and this may require aslightly higher centre of gravity to restore cornering clearance.





It was decided to go with a of following tire profiles: 1. Front - 110/70 R17

2. Rear - 130/70 R17

The tires selected are Michelin pilot street radial tires and comply with requirements specified in AIS:044 (Part 1 to 3) : 2004 as applicable till the corresponding BIS specifications are notified under the Bureau of Indian Standards Act, 1863 (63 of 1986).

Electrical System

1.Electrical vehicle model

A model of the vehicle was created in Matlab Simulink to analyse the various parameters required for the battery pack. The parameters that we calculated are battery pack capacity and SOC for a required range. This is achieved by the following methodology:

Vehicle model

A physical model of the vehicle was created in Simulink. In order to calculate this multiple resistive forces like rolling force, aerodynamic force, gradient force and acceleration force is calculated using coefficient of rolling friction, gross vehicle mass, inclination of road surface, drag coefficient, frontal area, density of air and wheel radius as input parameters.

I.Rolling force = Coefficient of rolling resistance * 9.81 * gross mass of vehicle

II. Aerodynamic forces = 0.5*density of air*frontal area*drag coefficient*u2 Where u is vehicle velocity from drive cycle

III. Gradient force = 9.81* mass of vehicle*sin(theta)

Where theta is inclination angle of road surface

IV. Acceleration force = mass of vehicle * d2u/dt2

1. Drive cycle facts

Drive cycle supply is furnished to the car model to decide the internet power required to satisfy the cycle. FTP-75 (Federal check process) force cycle facts become applied for providing power cycle input to the vehicle model. Drive cycle source block consists of velocity-time facts for the automobile.

2.Motor

Motor efficiency and equipment ratio statistics is input to calculate power required to reap favored torque to the rear wheel to conquer the resistive pressure on the rear wheel which is calculated from the above sub-system.

3.Battery percent

After calculating the energy requirement of the motor we calculate the battery ability. Total quantity of cells in battery p.C., no. Of cells in series and parallel can be calculated with cell ability and battery back ability. SOC is calculated the use of battery modern discharged by using the motor and the capability of the battery p.C..

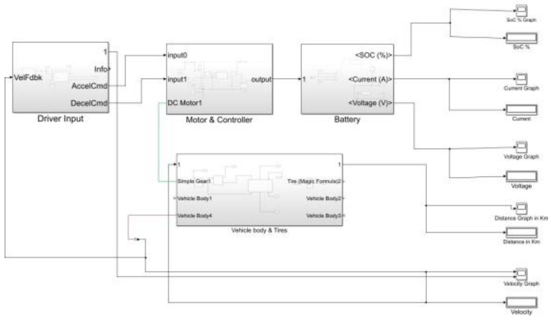


Fig: Simulink Model

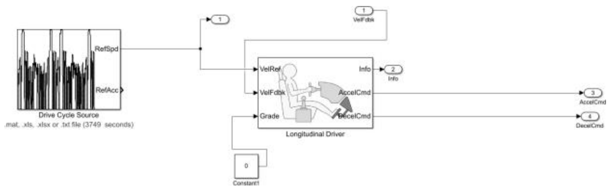


Fig: Driver Input Block

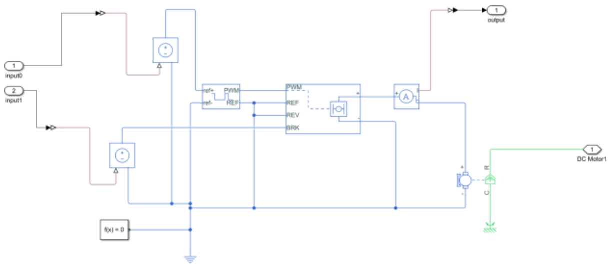


Fig: Motor and Controller Block

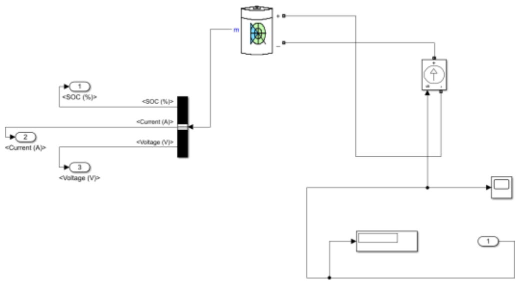


Fig: Battery Block

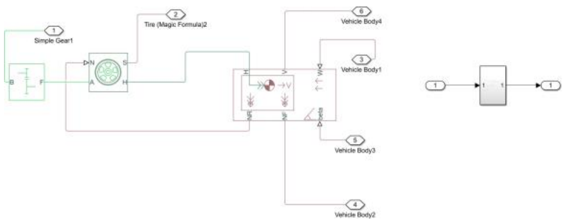


Fig: Vehicle Body and Tires Block

SOC was reduced from 100% to 10.5% after completing the drive cycle.

2. Cell : LG CHEM 18650 MJ1

Here we have chosen lithium ion cells over other cells due to following reasons:

1. High energy density
2. Low self-discharge
3. Low maintenance
4. Many options to choose in terms of capacity and geometry
5. Flexibility and high power to weight ratio
6. High life cycle

In cell selection we had many different types of cell chemistry and dimensions. So we did a thorough research on which chemistry to choose among Lithium-Ion cells. The below tablegives the specification of the chosen cell.

Item	Condition / Note	Specification
2.1 Energy	Std. charge / discharge	Nominal 3500 mAh Minimum 3400 mAh
2.2 Nominal Voltage	Average	3.635V
2.3 Standard Charge (Refer to 4.1.1)	Constant current Constant voltage End current(Cut off)	0.5C (1700mA) 4.2V 50mA
2.4 Max. Charge Voltage		4.2 ± 0.05V
2.5 Max. Charge Current		1.0 C (3400mA)
2.6 Standard Discharge (Refer to 4.1.2)	Constant current End voltage(Cut off)	0.2C (680mA) 2.5V
2.7 Max. Discharge Current		10A
2.8 Weight	Approx.	Max. 49.0 g
2.9 Operating Temperature	Charge Discharge	0 ~ 45℃ -20 ~ 60℃
2.10 Storage Temperature (for shipping state)	1 month 3 month 1 year	-20 ~ 60℃ -20 ~ 45℃ -20 ~ 20℃

1.2.Standard Discharge:

“Standard Discharge” shall consist of discharging at a constant current of 0.2C to 2.50V. Discharging is to be performed at 23 ºC ± 2 ºC unless otherwise noted (such as capacity versus temperature).

1.3. High Drain rate Charge/discharge condition:

Cells shall be charged at constant current of 1,500mA to 4.20V with end current of 100mA. Cells shall be discharged at constant current of 4,000mA to 2.50V. Cells are to rest 10 minutes after charge and 20 minutes after discharge.

Electrical Specification

Item	Condition	Specification
4.2.1 Initial AC Impedance	Cell shall be measured at 1kHz after charge per 4.1.1.	≤ 40 mΩ, without PTC
4.2.2 Initial Capacity	Cells shall be charged per 4.1.1 and discharged per 4.1.2 within 1h after full charge.	≥ 3400 mAh
4.2.3 Cycle Life	Cells shall be charged and discharged per 4.1.3 400 cycles. A cycle is defined as one charge and one discharge. 401st discharge power shall be measured per 4.1.1 and 4.1.2	≥ 80 % (of C_{min} in 2.1)

Mechanical Specification

Item	Condition	Specification
4.4.1 Drop Test	Cells charged per 4.1.1 are dropped onto an wooden floor from 1.0 meter height for 1 cycle, 2 drops from each cell terminal and 1drop from the side of cell can (Total number of drops = 3).	No leakage No temperature rising
4.4.2 Vibration Test	Cells charged per 4.1.1 are vibrated for 90 minutes per each of the three mutually perpendicular axis (x, y, z) with total excursion of 0.8mm, frequency of 10Hz to 55Hz and sweep of 1Hz change per minute	No leakage

Environmental Specification

Item	Condition			Specification
4.3.1 Storage Characteristics	Cells shall be charged per 4.1.1 and stored in a temperature-controlled environment at 23°C ± 2°C for 30 days. After storage, cells shall be discharged per 4.1.2 to obtain the remaining power*.			Power remaining rate ≥ 90% (P_{min} in 2.1)
4.3.2 High Temperature Storage Test	Cells shall be charged per 4.1.1 and stored in a temperature-controlled environment at 60°C for 1 week. After storage, cells shall be discharged per 4.1.2 and cycled per 4.1.3 for 3 cycles to obtain recovered power**.			No leakage, Power recovery rate ≥ 80%
4.3.3 High Temperature and High Humidity Test	Cells are charged per 4.1.1 and stored at 60°C (95% RH) for 168 hours. After test, cells are discharged per 4.1.2 and cycled per 4.1.3 for 3 cycles to obtain recovered power.			No leakage, No rust Power recovery rate ≥ 80%
4.3.4 Thermal Shock Test	65°C (8h) ← 3hrs → -20°C (8h) for 8 cycles with cells charged per 4.1.1 After test, cells are discharged per 4.1.2 and cycled per 4.1.3 for 3 cycles to obtain recovered power.			No leakage Power recovery rate ≥ 80%
4.3.5 Temperature Dependency of Capacity	Cells shall be charged per 4.1.1 at 23°C ± 2°C and discharged per 4.1.2 at the following temperatures.			
	Charge	Discharge		Capacity
	23℃	-10℃		70% of P_{ini}
		0℃		80% of P_{ini}
		23℃		100% of P_{ini}
		60℃		95% of P_{ini}

1. Battery Accumulator

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode.

Item	Condition	Specification
4.5.1 Overcharge Test	Cells are discharged per 4.1.2, and then charged at constant current of 3 times the max. charge condition and constant voltage of 4.2V while tapering the charge current. Charging is continued for 7 hours (Per UL1642).	: No explode, No fire
4.5.2 External Short - Circuiting Test	Cells are charged per 4.1.1, and the positive and negative terminal is connected by a 100mΩ-wire for 1 hour (Per UL1642).	: No explode, No fire
4,5.3 Overdischarge Test	Cells are discharged at constant current of 0.2C to 250% of the minimum capacity.	: No explode, No fire
4.5.4 Heating Test	Cells are charged per 4.1.1 and heated in a circulating air oven at a rate of 5°C per minute to 130°C. At 130°C, oven is to remain for 10 minutes before test is discontinued (Per UL1642).	: No explode, No fire
4.5.5 Impact Test	Cells charged per 4.1.1 are impacted with their longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm diameter bar (Per UL1642).	: No explode, No fire
4.5.6 Crush Test	Cells charged per 4.1.1 are crushed with their longitudinal axis parallel to the flat surface of the crushing apparatus (Per UL1642).	: No explode, No fire

Battery accumulators of electric vehicles, also known as traction batteries, are the fuel centreof the vehicle. A battery pack is the collection of cells arranged in series-parallel combinations as a whole. Various types of energy storage devices are developed like flywheel, gravity storage, lithium ion, nickel metal hydride cells, Lead acid battery etc. In our proposed prototype we are using lithium ion cells having cylindrical geometry.

TOTAL	3
CELLS	1
CELLS IN	2

MAXIMU	58
MAXIMU	2
MAXIMU	9

2. Battery Management System: Orion Jr 2 BMS

The battery management system (BMS) for an electric vehicle can vary immensely dependingon which manufacturer and model you decide to design around. One of the major factors that drove our decision was whether the BMS had a centralized topology. A centralized topology means that all of the voltage and thermistor tap information is processed within a single BMS.This is beneficial since you will only have two possible points of connection failure and do not need to design, manufacture individual cell PCBs in order to process the information before sending it to the BMS. Many other factors were considered, including whether it could communicate over CAN, how many cells it could monitor both with voltage and temperature, and whether it was isolated from its voltage taps.

Specification Item	Min	Typ.	Max	Units
Supply Voltage	10		60	Vdc
Supply Current—Active		1.1		W
Operating Temperature	-40		80	C
Digital Output Voltage (Open Drain)			60	V
Digital Output Sink Current (60v max)			175	mA
Analog Outputs Voltage	0		5	V
Cell Voltage Measurement Range	0.5		5	V
Cell Voltage Measurement Error (over 1-5v range)		0.25		%
Cell Balancing Current			150	mA
Cell Voltage Resolution		0.1		mV

Optional Specifications	
Item	Value
CANBUS speed (on supported units)	125, 250, 500, or 1000 Kbps
Current Sensor Values Supported +/- (Hall Effect)	200A, 500A, 800A and 1000A Dual current sensors can be used to achieve up to 2000A

Current Limiting via the digital CANBUS

5. Data Collection

The Orion Jr. 2 BMS collects information from several distinct sensors for use in calculations and decision making.

5.1. Cell Voltages - Each cellular's voltage is measured approximately every 30 mS via sensing the voltage on the cell voltage tap connector. The BMS measures the distinction in voltage from one tap wire to the subsequent to measure a cellular's voltage. Unless busbar repayment has been configured, the BMS will display and use the actual measured values for cell voltages (otherwise compensated values are used). Only the cellular voltages which the BMS has been programmed to monitor in the mobile populace desk inside the settings profile are monitored while the opposite cell voltages are ignored.

5.2. Current (Amperage) - The present day entering into and out of the battery percent is measured every 8ms the use of the external corridor effect sensor. The hall effect sensor is clamped around a twine carrying all cutting-edge into and out of the battery percent and converts the measured amperage into 0 - 5 volt analog voltages. One channel is used for measuring smaller amperages to ensure high resolution for small currents and the opposite channel is used for measuring larger currents. These analog voltages are measured by way of the BMS and transformed into an amperage cost which the BMS makes use of for numerous calculations.

The present day sensors sold with the Orion Jr. 2 BMS are available in sizes as much as 1000A. The BMS can be configured to use 2 parallel cutting-edge sensors to measure amperages up to 2000A, but the most advocated length is 1000A. Current sensors bought with the BMS are capable of degree amperages as much as one hundred twenty% of their rated most, even though accuracy is reduced above 100%. Current sensor data is utilized in calculating the battery percent's nation of charge (thru coulomb counting) and ensuring that the connected utility is staying inside the perfect contemporary limits. The measured current is also utilized in calculating the inner resistance and health of the cells in the battery percent.

Five.3. Temperatures - The BMS measures battery temperatures immediately from up to 3 thermistors to determine the average temperature of the battery percent. If additional

temperature sensing, which include measuring the temperature of each character mobile, is required, the Orion Jr. 2 BMS can be linked to a thermistor growth module that may permit measuring up to 80 thermistors. Thermistors on both the main unit and any expansion modules can be left 'unpopulated' meaning that the BMS will forget about the value of these thermistors. This permits the BMS to be configured to use as few or as many thermistors as important. The thermistor growth module is attached to the Orion Jr. 2 BMS via two of the analog thermistor inputs at the BMS or via CANBUS if the BMS is CAN enabled.

Five.4. Total Pack Voltage - The Orion Jr. 2 BMS measures the overall percent voltage by summing up the individual cellular voltages.

5.5. Other Inputs - The BMS has the potential to experience the fame of the CHARGE power supply. The BMS uses this input to determine what mode the BMS is in. The BMS additionally has a multi-purpose enter which may be used for diverse functions, which includes monitoring the popularity of the READY electricity supply if essential.

6. Thermal Management and Fan Control

The Orion Jr. 2 BMS measures the battery temperature through three main thermistors linked without delay to the BMS with the option of extra thermistors thru a thermistor enlargement module. The BMS calculates the minimal, maximum, and average temperatures of the battery percent primarily based at the connected thermistors. These temperature readings are used in the calculation of most possible fee and discharge current limits, which are used to determine while and at what amperage a battery p.C. May be charged or discharged. The multi-purpose outputs may be programmed to turn on or off at particular temperatures, which can be beneficial in some packages.

7. Cell Balancing

The BMS takes an wise method to balancing that seeks to hold and improve stability from cycle to cycle. Li-ion batteries tend to live in stability not like the lead acid ones. Differences in self discharge costs, cellular temperature and internal resistance are the number one causes of an unbalanced battery p.C.. The BMS must be capable of add or subtract charge from the bottom or maximum cells to make amends for the difference in discharge charges to preserve the cells balanced.

The Orion Jr. BMS makes use of passive balancing to remove rate from the best cells in an effort to keep the stability of the % the usage of passive shunt resistors.

The BMS has a safety function to save you over-discharging any cell during balancing in the event of a defective or dead mobile

8. CANBUS

The Orion Jr. BMS has an non-compulsory CAN (controller region network) interface. The interface has a programmable frequency (baud-rate). The BMS capabilities up to 15 programmable CAN. These messages are designed to be bendy to interface with other digital manipulate gadgets, computer structures, shows, or any number of different devices. Virtually all BMS parameters are able to be transmitted in those CAN messages. Please see the "Editing CAN Messages'' section of the Software Utility guide for information on programming custom CAN messages. In a CANBUS community there are always precisely two terminator resistors. It is as much as the person to make certain that there is the proper quantity of terminator resistors on every CAN community. By default, the Orion Jr. BMS has a terminator resistor already loaded at the CAN interface. The CAN interface can also be used to upload settings. Howev

Conclusion –

The Main Aim of this paper is to layout a electric powered bike that is efficient and it must be suitable to Indian roads. In this paper we have researched approximately all the additives that desires in electric bike which make it capable of get pushed by using person on roads. We have compared numerous tire length appropriate and concluded by way of selecting one additionally on this paper we've got also researched approximately suspension seats and the whole thing this was a complete blueprint of a electric vehicle that we want

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