VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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A PROJECT REPORT
ON

"Conversion of conventional motorcycle into Electric Motorcycle "

Project report submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING

Submitted by

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CERTIFICATE

It is certified that the Project work entitled **"Conversion of conventional motorcycle into Electrical motorcycle"** carried out by **Hemanth B P (1NH18ME045), Harshal Kashyap (1NH18ME044), Jaywant Kamal (1NH18ME051), Krishna Pandit (1NH18ME059),** the bonafide students of **New Horizon College of Engineering, Bengaluru**, in partial fulfillment for the award of **Bachelor of Engineering in Mechanical Engineering** of the **Visvesvaraya Technological University, Belagavi** during the year **2020-2021**. It is further certified that all corrections/suggestions indicated for internal assessment has been incorporated in the report deposited in the department library. The Project has been approved as it satisfies the academic requirements in respect of Project Work prescribed for the **Bachelor of Engineering** degree.

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CHAPTER-1

INTRODUCTION

Motorcycle/Bikes are most preferable transportation machinery in developing countries. We have hybrid vehicle, Hydrogen Fuel Cell vehicles, Electric Vehicles in most of the countries but they are still far away of the reach of general public, in developing countries because of their heavy cost. Electric vehicles are failing in the due to lack of reliable technology to meet their daily life use.

Fuel prices hiking day by day- So they require a fuel efficient vehicle. But Fuel cost is just a factor affecting directly to their life.

Others factors like Air pollution due to smoke exhausting from the Engines of those millions of vehicles.

But in finding solution process I found that the feature lacks in current electric/hybrid technologies in bikes are "Smartness".

So working on it I have found a way to solve that problem as "Smart Electric Bike" and "Smart Electric vehicle Kit-(Convert existing vehicle into smart Electric/Hybrid)".

- Developing Countries like India, huge traffic and narrow roads are one major issue. Especially for city drive you always have to face those traffics. In cities where roads are wide but have traffic signals at regular intervals gives the major pain.
- During this all condition most of the time people forgets to turn off the bike engine, this results in producing excessive power then require, and hence energy gets wasted, Air gets polluted during all this time.
- So the "Smart Hybrid Bike" has a feature to recognize this kind of situation and smartly handle it.
- Compared to Petrol Engine, Electric motors are easy and efficient too for instant start and stop. Moreover Electric Motor requires no idling as in case for Petrol Engine for bike at rest in traffic.

There is a "Smart Control Unit" which consequently perceives this circumstance and likewise moves the force source to Series or Parallel Hybrid or No Hybrid Drive (in instance of Batteries Dead).

During city drive generally the max speed is 30kmph and average speed 60kmph on highway. By practical test we Found that electric motor is more reliable and efficient for the speed range of 0 to 35kmph, Further more for more power and speed Petrol Engine will perform its roll. Smart Control Unit will shift power source to Electric motor to Engine depending on speed of the Bike which will explain the traffic situation to the SCU by means of Speed Sensor signal.

Three Main Modes (in control of Driver)

1). Smart Hybrid (Motor Remain ON for speed under 30kmph, and Engine come in real life as speed goes past 30kmph)

2). Boost (Motor and Engine Power are joined to meet any powerful prerequisite like getting on messy street)

3). Off Mode (Turn off the Hybrid element and vehicle fill in as customary vehicle, No Aid from Electric Motor, if there should arise an occurrence of Dead Batteries).

Electric Motor (Hub Motor) can be situated either at Front or Rear Wheels. For first Experiment we are putting engine at Front wheel of the Bike.

Batteries are battery-powered. They can be charged from Home electric gracefully when bicycle is in non-use.

What are the types of Motors used on an E-Bike?

Generally, there are three types of motors used to power an e-bike, and they can be placed in the wheel hub or mounted to the bike. Here's what you can expect to find when it comes to e-bike motor placement:

- Hub motors:
  Hub motors are located inside the hub of the front or rear wheel of the bike.

- Mid-drive motors:
  Mid-drive motors are located in the center of the bike's frame between the bike's cranks.

- Friction motors:
  Friction motors mount directly to the seat post. It's unlikely you'll find a friction motor on a new e-bike because they usually aren't as efficient as mid-drive or hub motors, and are more often available in kits to transform a traditional bike into an e-bike.

Understanding an EV

In layman's language, an EV (electric vehicle) runs on power rather than fuel. This isn't totally obvious however as there are half and half vehicles in the market which run on both ordinary fuel and power. In any case, an appropriate EV will get its capacity from at least one electric batteries. Obviously, the batteries are battery-powered like those of our cell phones.

The idea of EV isn't completely new. We have had power utilized for driving the vehicles in the past going similarly as the 1800s. In the past numerous decades, electric force has been utilized for vehicles. Yet, the driving force for its utilization in the traveler vehicles has been given in the most recent decade just since the mechanical progressions have permitted the EVs to be moderate to the regular people.

Focal points of electric vehicles

The absolute first bit of leeway, as referenced above, is no contamination. The traditional vehicles radiate gases and smoke noticeable all around which is inconvenient to the earth. The eco-accommodating EVs won't do that. As the quantity of vehicles will increment on streets, the air quality will deteriorate. EVs are probably the best wagered against it.

The fuel cost has expanded across family units as the quantity of individuals with vehicles is expanding. As there is further here and there in the expense of petroleum and diesel inferable from changes in the global market value, the electric vehicles seem to be a reasonable method to set aside cash

Another contamination that is managed by the utilization of EV is commotion contamination. As the EVs run on batteries, there is practically zero clamor created when they are running. This goes far in checking clamor contamination which has become another bane for the drivers and travelers on occupied streets of India.

Limitations in India

Numerous nations, particularly created ones with foundation set up, are embracing EVs at a quick pace. For example, in Norway a year ago, EVs and cross breed vehicles represented more than 50 percent of the new vehicle deals. Indeed, China is additionally blasting ahead in the selection of electric vehicles. That is the reason the Govt. this year chose to boost the creation and deals of EVs. In any case, there are a few difficulties ahead.

The expense of EVs is still entirely high when contrasted with that of traditional fuel vehicles. The significant explanation for it is the utilization of Li-particle

batteries. It will at present require some investment before the expense of EV will draw in the purchasers.

We don't have a foundation set up for the charging stations. In addition, the charging movement itself expends a ton of time. So it offers a major conversation starter mark over the speedy appropriation by the purchasers remembering the comfort of fuel stations which can be found without any problem.

At long last, it is as yet far to go before these vehicles can be required to go on long constant outings comprising of a run of more than 300 km or progressively a day as the mileage is still low at around 150-200 km with completely energized batteries.

In this way, more or less, even with a great deal of points of interest set up, it will in any case take at any rate 5 to 7 years for the EVs to locate a sizeable offer in the Indian car showcase.

Advantages of Electric Vehicles:

1) No fuel, no outflows

This is the key point that pulls in numerous individuals to electric vehicles. On the off chance that you need to diminish your own effect on the earth through vehicle, at that point an EV is the route forward. The electric motor inside an EV works on a shut circuit, so an electric vehicle doesn't transmit any of the gases frequently connected with an Earth-wide temperature boost. No petroleum or diesel is required in a completely electric vehicle, which is extraordinary for your carbon impression.

Far and away superior - on the off chance that you charge your electric vehicle at home, and your grand slams on sustainable power source from Good Energy, at that point your carbon impression shrivels significantly!

2) Running expenses

Since you're not paying for petroleum or diesel to keep your vehicle running, you can set aside a great deal of cash on fuel. At the hour of composing, it costs around £63.80 to fill the normal unleaded petroleum tank for drivers of medium-sized vehicles in the UK. By correlation, contingent on the electric vehicle you own and the duty you are on, a full charge of your electric vehicle could cost as meagre as 96p. With Good Energy's Electric Vehicle Tariff, you could even spare £60 per year versus the Big Six's Standard Variable Tariffs, with the extra reward of the power going into your EV being 100% sustainable.

3) Low support

We as a whole realize vehicles need a touch of TLC every now and then. Petroleum and diesel motors can require costly motor support over their lifetimes – electric vehicles don't.

Why would that be? In a conventional ignition motor there are many moving parts which can possibly turn out badly, while an electric engine has less than 20. This implies your EV is probably going to have lower long haul upkeep costs than different vehicles.

4) Performance

The greater part of the fun of possessing a vehicle originates from getting out on the streets and giving it something to do. Before, electric vehicles haven't had the sleekest picture; many have had low desires concerning how well an electric vehicle can do versus customary motors. As more producers have packed into the market with their own interpretation of the electric vehicle, the exhibition levels of EVs has soared. Electric vehicles are lighter, and – as the entirety of their capacity is created from a standing beginning – their speeding up ability can shock. Certain brands, for example, Tesla, have done a great deal to improve individuals' impression of electric vehicles – the Tesla Model S is one of the quickest quickening vehicles available, doing 0 – 60mph in simply 2.5 seconds.

Obviously, this isn't the main proportion of execution for a vehicle. On the off chance that you're searching for something all the more family-accommodating, at that point you'll be satisfied to realize that numerous EVs are more open than ordinary vehicles because of the absence of an enormous motor; they likewise offer a smoother drive with lower levels of commotion.

5) Popularity

On the off chance that you like to catch everyone's eye than maybe realizing that electric vehicles are turning out to be progressively increasingly well known may be a negative for you, yet for some it's an enormous positive. As more EVs discover their direction onto our streets, we will see the supporting foundation extend. There are as of now more than 4800 charging areas in the UK, offering about 7500 individual charging focuses – and these numbers are developing at an ever-expanding rate.

To analyze, in 2016, there were 8,459 gas stations and this number has been declining since 2000. With the expansion in electric vehicles out and about, we are

probably going to see this number keep on falling while the quantity of charging areas will increment further.

Notwithstanding all the more charging focuses, the expanded prominence of EVs additionally implies more choices to look over for the vehicle itself. There are more reasonable electric vehicle choices accessible now than any other time in recent memory, similar to the Nissan Leaf and the Renault Zoe, with the absolute most well-known petroleum and diesel models likewise accessible in an electric variant, for example, the Volkswagen eGolf.

Essential Components of an Electric Vehicle

An electric controlled vehicle has three essential segments. These are the electric motor, engine controller, and battery.

❖ Battery

The battery of an electric vehicle can be charged using conventional framework power at a specific force station. Be that as it may, beside the ordinary lithium-particle battery advances, there are additionally other significant battery advances which can be utilized for electric vehicles.

Lithium-Ion Batteries: This battery innovation gives additional exhibition and range. Notwithstanding, it likewise conveys the most significant expense tag. Lithium-particle batteries are lighter than Lead corrosive and Nickel metal. These are likewise the batteries utilized in computerized cameras and cell phones.

Lead Acid Batteries: This battery innovation is the most famous. It is likewise the least expensive among the battery advancements. What's acceptable about it will be its 97% recyclable.

Nickel Metal Hydride Batteries: This battery innovation gives higher yield and better execution yet it costs considerably more than lead-corrosive batteries.

❖ Engine Controller

The engine controller of an electric vehicle manages its total activity and the dissemination of its capacity at some random second. It goes about as a conduit between the engine and batteries. It helps screen and controls all key exhibition signs, for example, the vehicle's administrator, engine, battery, and quickening agent pedal. It has a microchip which can constrain or divert current. It is utilized

to either improve the mechanical exhibition of the vehicle or suit the administrator's driving style. There are additionally progressively refined controllers which are equipped for more noteworthy precision and hence, higher productivity.

❖ Electric Engine

Not at all like a fuel motor with bunches of moving parts, an electric motor or engine just makes them move part. This makes it an entirely solid wellspring of rationale power. Picking an electric motor relies upon your vehicle's framework voltage. They can be organized to utilize either AC or DC current. Air conditioning engines are more affordable and lighter contrasted with DC motors. They are likewise progressively normal and they will in general experience the ill effects of less mechanical mileage. Be that as it may, AC innovation requires a progressively refined or complex engine controller.

Different Components of an Electric Vehicle

Beside the three essential segments of an electric vehicle, it is additionally comprised of different parts which are significant too. These are the regenerative slowing down and the drive framework.

❖ Regenerative Braking

As the electric vehicle moves, the electric engine produces a forward energy and it tends to be utilized to charge the batteries when you apply the brakes, which are ordinarily alluded to as regenerative slowing down. It can recuperate up to around 15% of utilized vitality for speeding up. In spite of the fact that this part is to be sure compelling, it can't produce enough to completely revive an electric vehicle.

❖ Drive System

The capacity of the drive framework is to move mechanical vitality to the footing wheels, creating movement. An electric vehicle doesn't require a traditional transmission. Notwithstanding, it has a few inner setups relying upon the segments being used. For instance, there are a few structures which utilize different littler engines that power each wheel independently. Enormous electric engines, then again, might be coupled to the back wheels utilizing a differential lodging.

The segments of an electric controlled vehicle are a lot less difficult contrasted with the segments of a fuel fuelled motor. Be that as it may, electric vehicles can't

go as quick as fuel controlled vehicles can. Electric vehicles, then again, can decrease vitality utilization in various ways like naturally killing the motor when the vehicle is inactive.

Types of Batteries Used for Electric Vehicles

Motived by the expanding natural concerns and furthermore the accessible asset constraints of oil, the car business has kept on creating different elective fuel vehicles. Out of all the potential arrangements that don't use oil, battery electric vehicles (BEVs) are among the boundless and most well-known alternative. One of the primary focal points of BEVs is that these vehicles have zero outflows (producing no ozone harming substances or poisons). Thus, BEVs help add to cleaner air and they are better for the earth. Likewise, these vehicles run on power, which can be produced through progressively sustainable and earth amicable methods.

From the more prudent Nissan Leaf to the top of the line Tesla Model S , there are various models of financially fruitful BEVs out and about. Besides, as there have been extraordinary interests on the side of foundation, battery electric vehicles have become enormously suitable and plausible choice in car showcase for customers. Not at all like ordinary oil driven interior ignition vehicle, BEV is impelled by a huge electric engine, which is fuelled through a battery-powered installed battery framework.

❖ Lead Acid Batteries and Nickel Metal Hydride Batteries

Both lead corrosive batteries and nickel metal hydride (NiMH) batteries are full grown battery innovations. These kinds of batteries were initially utilized in early electric vehicles, for example, General

Motor's EV1. Be that as it may, they are currently viewed as out dated with respect to their utilizations as the principle wellspring of vitality stockpiling in BEVs. Lead corrosive batteries have seen utilized in regular oil driven vehicles and are generally modest. Be that as it may, this sort of battery has a poor explicit vitality (34 Wh/kg). NiMH batteries are viewed as prevalent, as they can have up to twofold the particular vitality (68 Wh/kg) contrasted and lead corrosive batteries. This permits electric vehicles that use NiMH batteries to be fundamentally lighter, prompting diminished vitality cost for impelling the BEVs. Likewise, NiMH batteries additionally have more noteworthy vitality thickness contrasted with lead corrosive batteries, which will permit the battery framework to be contained inside

a littler space. However, NiMH batteries do have a few disadvantages, for example, having lower charging efficiencies than different batteries. There is additionally a significant issue with self-release (up to 12.5% every day under ordinary room temperature conditions) that is exacerbated when the batteries are in a high temperature condition. This makes NiMH batteries less perfect for more blazing conditions.

Besides, there have been legitimate contention with respect to enormous organization NiMH batteries, which has influenced the utilization of NiMH batteries in battery electric vehicles.

❖ Lithium Ion Batteries

Lithium particle (Li-particle) batteries are currently viewed as the standard for present day battery electric vehicles. There are numerous kinds of Li-particle batteries that each have various attributes, yet vehicle fabricates are engaged variations that have fantastic life span. Contrasted with other develop battery innovations, Li-particle offers numerous advantages. For instance, it has superb explicit vitality (140 Wh/kg) and vitality thickness, making it perfect for battery electric vehicles. Li-particle batteries are additionally astounding in holding vitality, with a self-release rate (5% every month) that a request for extent lower than NiMH batteries. Be that as it may, Li-particle batteries have a few downsides too. Similarly, Li-particle batteries have been an over the top expensive battery innovation. There are additionally significant wellbeing concerns with respect to the cheating and overheating of these batteries. Li-particle can encounter a warm out of control, which can trigger vehicle flames or blasts. There had been several cases where the Tesla Model S, which used Li-particle batteries, had scandalously burst into flames because of issues with fluctuating charging or harm to the battery. However, incredible endeavours have been made to help improve the security of vehicles that utilization Li-particle batteries.

CHAPTER-2

LITERATURE REVIEW

1. THE DEVELOPMENT OF FUEL CELL ELECTRIC VEHICLES – A REVIEW

M. Muthukumar, N. Rengarajan, B. Velliyangiri, M. A. Omprakas, C. B. Rohit, U. Kartheek Raja

The natural petroleum by-product will come into in-existence and unavailable in future. The emission from IC engine vehicles is also a critical problem. So the new technologies depending on electrical powered conveyance are developing. In that way, a fuel cell concept has been introduced for various applications along with electric vehicles. The various efforts are being taken to implement the fuel cell systems in automobiles. Still there is a technological gap in success of such fuel cell electric vehicles due to the problem in handling hydrogen, high cost of battery and fuel cell components, water management etc. In this paper, the type of fuel cell used in automobile, various supporting components and flow diagram of fuel cell systems, the implementation of fuel cell systems in automobiles, the design and development of Fuel Cell Electric Vehicles (FCEV) by various automobile companies are discussed. Further the related issues in FCEV and the methods to improve performance of FCEV are discussed.

2. HYBRID ELECTRIC VEHICLE USING PHOTOVOLTAIC PANEL AND CHEMICAL BATTERY

Rajat Kumar Dwibedi, R. Jayaprakash, T. Siva, N. P. Gopinath

This paper shows very reliable, extended range power supply for electric vehicle with PV panel with battery to overcome the battery oriented vehicle issues like rapid charging and discharging of battery rapidly. Better acceleration performance, controlled regenerative braking, longer driving range, longer battery life and smaller battery pack are the benefits of this model. This work tried to minimize the stresses on battery during acceleration and braking of permanent magnet brushless dc motor. Boost converters are used for the proper flow of power to motor during various stages of driving cycles with higher reduction of THD.

3. EVOLUTION OF ELECTRIC VEHICLE AND ITS FUTURE SCOPE

P. M. Sneha Angeline, M. Newlin Rajkumar

Electrification is one of the appropriate way to establish a clean and energy efficient transportation. The impact of electric vehicle on the environment is considered as a serious issue. The locomotive industry as well as power sector gets benefitted by the reliable technology provided by the electric vehicle. This green vehicle also helps in creating an alternative power source for household applications and provides ancillary services to the grid. It also helps in integrating the intermittent resources for vehicle charging. As this vehicle generates prominent feature of less maintenance and ease of charge at residential premises.

4. PASSIVE HYBRID ENERGY STORAGE SYSTEM BASED ON LITHIUM-ION CAPACITOR FOR AN ELECTRIC MOTORCYCLE

Alain Gaussian, Félix-Antoine LeBel, João P. Trovão, Loïc Boulon

This paper presents the multiple energy storage system usability for an electric motorcycle focused on passive hybrid topology. The studied hybridization is based on a passive parallel topology connecting lithium manganese nickel 18650-type cells and lithium-ion-capacitor to supply the motorcycle powertrain. The passive hybrid energy storage system design is fully addressed based on an extension of *Ns*/*Np* battery pack sizing maps to passive hybrid topology using lithium-ion-batteries and lithium-ion-capacitors.

The benefits and performance improvements obtained by the *Ns*/*Np* hybrid design for a case study involving an electric motorcycle are presented and discussed based on root-mean-square and mean value of the current cell, standard deviation of the C-rate and instantaneous current peaks variation coefficient. The proposed configuration could reduce the stress on the battery cells by 42% on standard deviation and 36% on variation coefficient with a decrease of 9% in average current while reducing the root-mean square value by 15% on a specific motorbike race simulation.

5. POWER ELECTRONICS AND MOTOR DRIVES IN ELECTRIC, HYBRID ELECTRIC AND PLUG-IN HYBRID ELECTRIC VEHICLES.

Ali Emadi, Young Joo Lee, Kaushik Rajashekara

With the necessities for reducing emissions and improving fuel economy, automotive companies are developing electric, hybrid electric, plug-in hybrid electric vehicles. Power electronics is an enabling technology for the development

of these environmentally friendlier vehicles and implementing the advanced electrical architectures to meet the demands for increased electric loads. In this Journal, a brief review of the current trends and future vehicle strategies and the function of power electronic subsystems are described. The needs of power electronic components and efficient electric motor drives for the successful development of these vehicles are additionally introduced.

6. ELECTRIC VEHICLE WITH WHEEL ANTILOCK SYSTEM

Giovanni Gherardi, Giampiero Testoni, Simone Martinelli, Eleonora Montanari

The main aim of the project is to provide an electric motorcycle with a wheel anti-lock system which allows us to avoid the locking of the wheels even after deceleration of the motorcycle caused by the braking action of the electric motor, during an electric battery regeneration phase.

Another object of the present invention is to provide an electric motorcycle with a wheel anti-lock system which allows to overcome the mentioned drawbacks of the prior art within the ambit of a simple, rational, easy and effective to use as well as affordable solution.

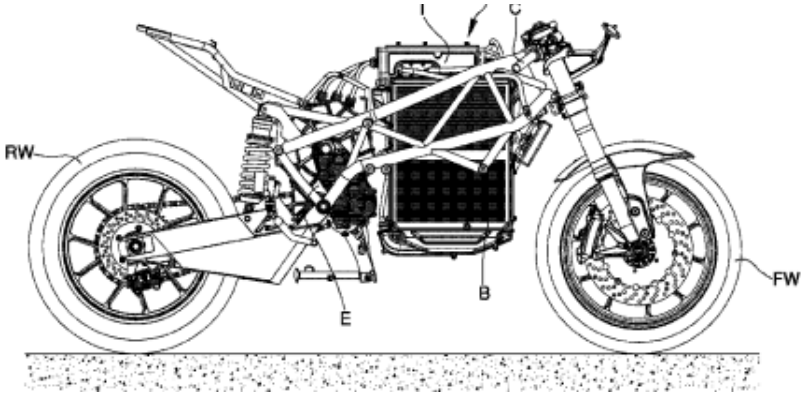


FIG. side view of a possible electric motorcycle according to the invention

The use is known and more and more common of electrically-propelled motorcycles. Electric motorcycles of known type comprise an electric motor, typically consisting of a single-phase AC motor or of a brushless motor, a rechargeable electric battery and an inverter connected to the electric battery and able to control the electric motor.

In practice, the inverter receives a signal from the throttle grip of the electric motorcycle, and converts this received signal into a corresponding supply current/voltage of the electric motor.

Therefore, during this phase of power supply to the electric motor, the inverter draws a predetermined current from the electric battery and appropriately converts it into power supplied to the electric motor.

7. A NOVEL SMART ENERGY MANAGEMENT SYSTEM IN PURE ELECTRIC MOTORCYCLE USING COA

Alireaz Farzaneh, Ebrahim Farjah

The Greenhouse Gases outflows heavily populated urban areas, air quality issues, and depleting fossil fuel concerns motivated motorcycle producers in crowded countries to explore electric propulsion systems. Due to energy storage system constraints, Pure Electric Motorcycles (PEM) range is restricted, so an effective Energy Management System is required to optimize PEM consumed energy. As street shape is an inescapable piece of genuine streets, this article, proposes a novel Smart Energy Management System (SEMS) in view of street geometry which first investigations street information to recognize ebb and flow and straight parts.

At that point, SEMS takes care of advancement issues independently and ideal speed is determined in direct and bend parts autonomously. The proposed SEMS can communicate to the driver as an eco-driving system by receiving trip time importance and presenting each road point optimal speed. Because of fast response necessity, Cuckoo Optimization Algorithm (COA) is used in this article to solve SEMS optimization problem. For evaluation purposes, three scenarios are defined: The test road is travelled at motorcycle maximum allowable speed in the first scenario. In the 2nd one, PEM speed is also constant but it equals to direct road optimal speed instead of max. speed.

Independent optimal speed in direct and curvature parts is considered in 3rd scenario. Simulation results show the significant effect of road curves on consumed energy and SEMS good performance in optimization of PEM consumed energy.

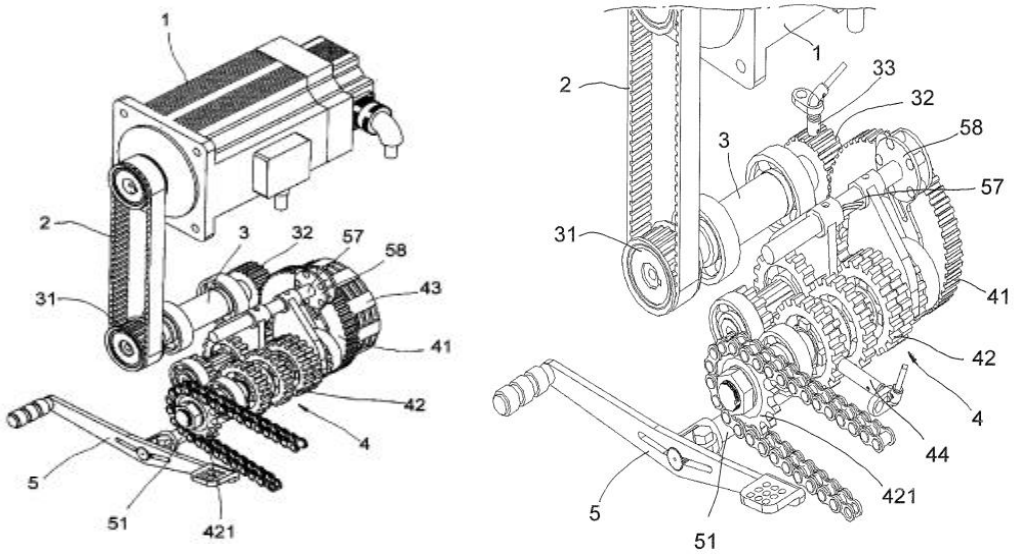
8. ELECTRIC MOTORCYCLE WITH IMPROVED MOTOR PERFORMANCE

Kuo-Hsin Su, Ta-Yu Su

The present invention relates to motorcycle technology and more particularly, to an electric motorcycle, which directly uses a gearbox of a used or new fuel engine-based vehicle for power transmission, and an electric motor for driving the gearbox so that, subject to the optimal power transmission performance of the gearbox, the electric motor is capable of producing the most appropriate driving speed in the starting state or any of a variety of travelling state, achieving optimal

output efficiency and significantly reducing power consumption and enhancing endurance.

Direct drive: This drive mode is widely used in electric vehicles for the advantages of simple structure, no complex transmission system and low-cost, however, this mode shows the largest drop in the actual use. Due to the use of low horsepower motor, the start time is relatively prolonged, and the motor will draw a large amount of battery power from the battery in the initial stage in order to overcome inertia. During this period, the gear shift position cannot be changed to increase torque output, reducing the cruising range of the electric vehicle. Increasing the horsepower of the motor can improve the aforesaid problem; however, it will also increase electricity consumption and the risk of red burst in the vehicle initial stage, making the driver difficult to manipulate normal driving.



Reduction gear drive: This mode improves the performance during the stage from start-up to low speed by using a high-speed motor to match a reduction gear; however, due to the limitation of fixed gear ration, this drive mode cannot meet high-speed and low-speed driving needs at the same time (when an electric vehicle is running at a high speed, the driver can simply increase the rotating speed of the motor, however, increasing the rotating speed of the motor will simultaneously produce high temperature, increasing electricity consumption and significantly reducing the cruising range of electric vehicle).

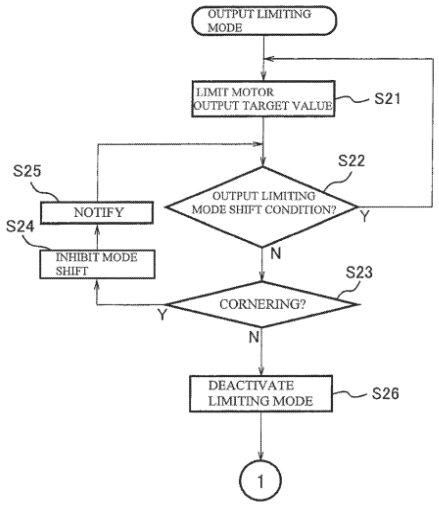
Belt type CVT drive: This mode uses two V-grooved turntables to clamp a transmission belt there between, and changes the centrifugal force of the V-grooved turntables by changing the rotating speed of the motor; further the expected reduction ratio can be achieved by changing the diameter ratio between the V-grooved turntables. However, in order to prevent relative sliding between the transmission belt and the V-grooved turntables, the V-grooved turntables must clamp the transmission belt there between positively, however, keeping the V-grooved turntables to clamp the transmission belt positively will produce high frictional heat, resulting in substantial energy loss and reducing the cruising range

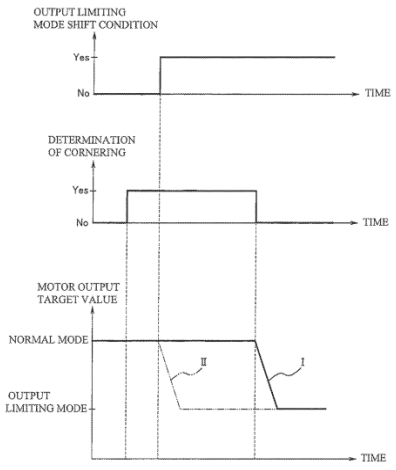
of electric vehicle.

9. ELECTRIC MOTORCYCLE, VEHICLE CONTROLLER AND VEHICLE CONTROL METHOD

Yoshimoto Matsuda, Kawasaki Heavy Industries Co Ltd

The present invention has been made in view of the above mentioned circumstances, and an electric motorcycle of the present invention comprises: a driving command detecting device for detecting a driving command input by a driver; a state value detecting device for detecting a state value different from the driving command; an electric motor for generating driving power transmitted to a drive wheel; a control unit capable of executing a normal mode for controlling an output of the electric motor in response to the driving command detected by the driving command detecting device and a non-normal mode for causing the output of the electric motor in the non-normal mode to be different from the output of the electric motor in the normal mode, the control unit being configured to shift the electric motorcycle from one of the normal mode and the non-normal mode to the other of the normal mode and the non-normal mode, when the state value detected by the state value detecting device satisfies a predetermined shift condition, in the one of the normal mode and the non-normal mode; and a cornering determiner unit for determining whether or not the electric motorcycle is cornering; wherein the control unit causes a change in the output of the electric motor to be less, when the cornering determiner unit determines that the electric motorcycle is cornering and the shift condition is satisfied than when the cornering determiner unit determines that the electric motorcycle is not cornering and the shift condition is satisfied.





In accordance with this configuration, when it is determined that the electric motorcycle is cornering and the shift condition is satisfied, the electric motor is controlled such that a change in the output is suppressed. This makes it possible to suppress a great change in driving power during the cornering. Therefore, in the

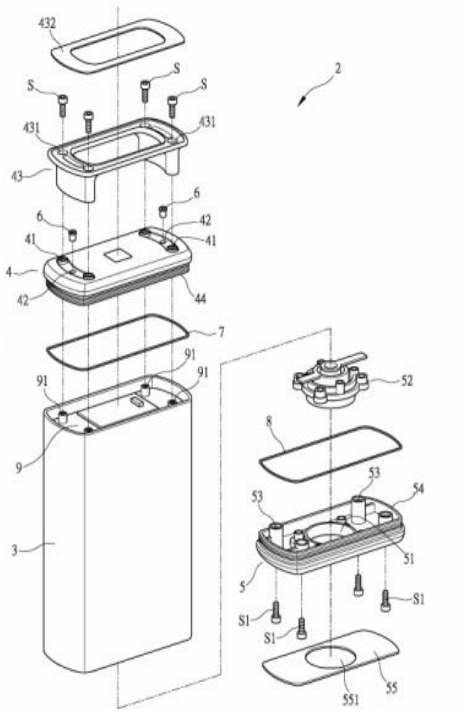
electric motorcycle which shifts the driving mode based on the state value different from the driving command, driving feeling during the cornering can be improved. The control unit may inhibit the electric motorcycle from shifting from the one of the normal mode and the non-normal mode to the other of the normal mode and the non-normal mode, when the cornering determiner unit determines that the electric motorcycle is cornering and the shift condition is satisfied.

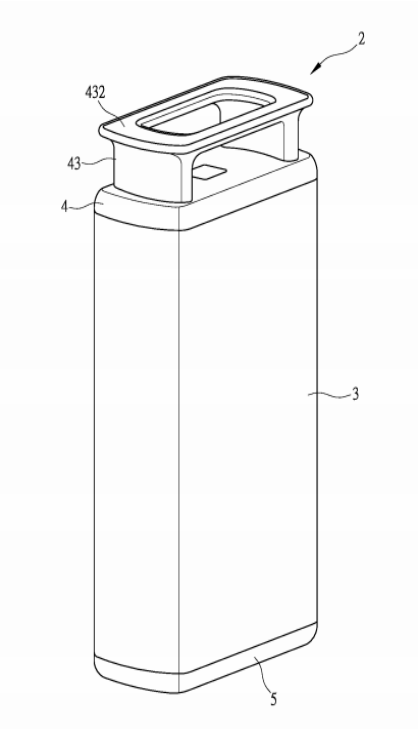
10. BATTERY STRUCTURE OF ELECTRIC MOTORCYCLE

Chien-Hung Lai, Jen-Chieh Cheng

This invention provides a battery structure of an electric motorcycle, wherein a battery comprises a casing, a top lid mounted to a top of the casing, and a bottom lid mounted to a bottom of the casing. The casing receives a battery core arranged therein. The top lid is provided, in a circumferentially arranged manner, with a coupling flange on a side thereof facing a direction of combination with the casing and the coupling flange is provided at least one fitting groove, the fitting groove receiving a sealing ring to fit and embed therein, so that an outside surface of the sealing ring is in tight engagement with an inside surface of the top the casing.

The bottom lid is provided, in a circumferentially arranged manner, with a coupling flange on one side thereof facing a direction of combination with the casing and the coupling flange is provided with at least one fitting groove, the fitting groove receiving a sealing ring to fit and embed therein, so that an outside surface of the sealing ring is in tight engagement with an inside surface of the bottom of the casing.





CHAPTER-3

METHODOLOGY

Step 1: Arrangement of materials

Frame: We looked at many different bike styles and decided on a Single Cradle Diamond frame bike as it is more common in rural areas, Construction is not very complex, cost savings and such frames are mostly light in weight.

eg : Bajaj Pulsar 135LS , TVS Sport, Star City ,etc.

Motor: After reading other EV bike specs (and knowing that we wanted to go faster than a moped), we chose a 1000W 48V BLDC motor:

Batteries: We went with 4 12V at 8AH batteries because they are sealed and have received great reviews. 3 batteries connected in series will give us the required output 12x3=36V and 4th battery should be connected in parallel.

Controller: The controller we have 48V 500W 24A BLDC motor controller, it's a square wave controller, as the sine wave controller was out of budget, it even consists 3 gear management system.

Rated Power	500W
Rated Voltage	48V
Brake	Low/ABS
Speed	3 variable
Auto Identification of the Hall Sensor	YES

Charger: We had to match the charger with the voltage but the speed of charge in Amps is also up to budget. We went with a 48V 5A charger for Li-ion battery, which is capable to charge all 4 12V batteries in 2.5-3 hours (as one of the battery is connected in parallel).

Battery cable and connectors- I bought about 10 feet of 2 GA wire and cut it to length. Using Lugs we soldered and used heat shrink tubing on each end. We highly Recommend battery terminal covers for safety.

Instruments: E-meter (Link 10) w/ Prescaler add on for 12V use instead of a bunch of different meters. As an added feature we wired up the ignition switch to the neutral indicator to show me when the bike was on.

Other parts

Wire - 12GA different colours and heat shrink tubing (large and small sizes)
Electrical tape
Throttle
Wire connectors
Wire wrap

Tools

Basic shop tools such as a socket set, screw drivers, wire stripper, etc. Additionally a volt meter, metal grinder and crimper are used.

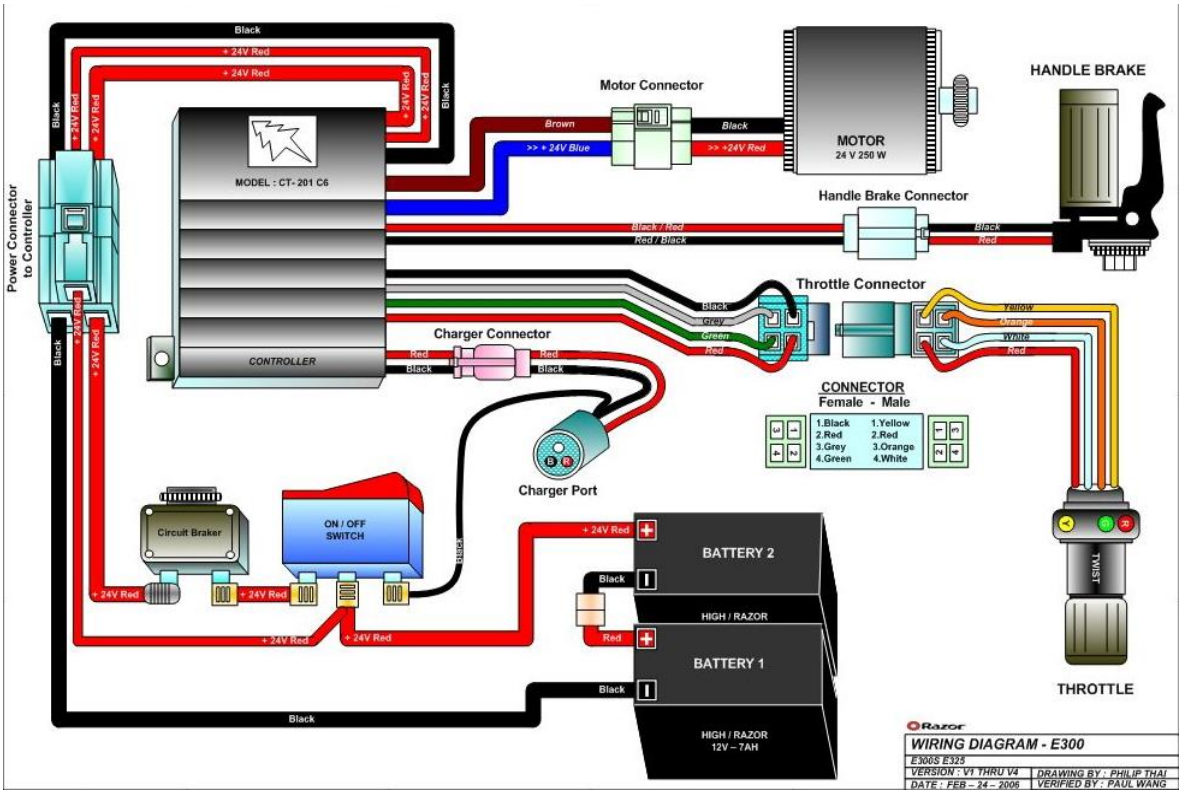
Step 2: The Build

Start by removing internal combustion engine parts, gear filter box, carburettor, exhaust pipe, kick-starter, etc.
Take out the engine and gearbox.
Remove the fuel compartment and using a grinder or other cutting tool to cut out the bottom. This makes room for extra batteries or components.
(*Make sure all gas is out before cutting*) don't cut any necessary wires.

Next, make attachment plates with screw holes using metal sheets to fix motor, batteries, controller and electronic components to see how and where things are going to fit.
Fix the motor above the gear panel,
Fit everything, according to the space make accurate metal mock ups, clamp it with the help of screws.

Make two custom gears one with 30 teeth to be fixed on the motor and another small one with 14 teeth which should be attached to the shaft on the gearbox. 30/14 gear ratio will provide more speed.
Fix both the gears in their respective places and put the chain across the two gears.

Step 3: Wiring



Do the wiring and connections as per the circuit diagram.
Connect the wires of motor, battery, throttle and gears to the controller with respective wires.

Step 4: Last Few Things

Check all the connections and tighten every bolt.
Check whether the chains aren't loose, all gears

CHAPTER-6

ANALYTIC CALCULATIONS

Calculate the weight of motor, for two adults to ride, let the maximum weight applicable be considered. Assumed weight need to be considered as load.

Required speed = 60 kmph

Kerb weight = 100 kg

Gross weight (m) = 100 + 70 = 170 kg

Tyre specs (standard) : 130/70 ; R17

Tyre Rim dia = 17 X 25.4 = 432 mm

Tyre height = 130 X 0.70 = 91 mm

Tyre dia = 432 + 91 + 91 = 614 mm

Tyre rad (r) = 614/2 = 307 mm

Linear wheel travel (or) tyre circumference = $2\pi r$

= 2 X 3.14 X 307

= 1928 mm ≈ 2m

Front area of Bike (A) = 715 X (1115 + 600) ≈ 1.2 m^2

Speed (exptd.) = 60 kmph = (60 X 1000)/3600 = 16.7 m/s

in RPM = speed/wheel travel = (16.7 X 60)/2 = 501 rpm

Standard values :

Accl^{n} due to gravity (g) = 9.81 m/s^2

Coeff. Of rolling resistance (R) = 0.02

Air density = 1.2 kg/m^3

Air drag = 0.82

Total force (F_t) = $F_r + F_d + F_a + F_g$ *where , F_r = rolling force*

F_a = accel^{n} force

F_d = drag force

F_g = gradient force

$F_r = m \times g \times C_r$ $F_d = ½ \times$ air density $\times C_d \times A \times V^2 = 160$ N

$= 170 \times 9.8 \times 0.02$

$= 33$ N

{ neglecting accel^{n} force (F_a) and gradient force (F_g) }

so,

$F_t = 33 + 160 = 193$ N

Power (P) $= F_t \times V = 193 \times 16.7 = 3223$ Watt ≈ 3.2 kW

Torque

We know, $P = 2\pi NT/60000$

$T = 60000 \times 3.2 /(2 \times 3.14 \times 501)$

$= 61$ Nm

BLDC motor std. RPM = 3000,

Required RPM = 501

Reduction Ratio = 3000/501 = 6:1 *(motor to wheel sprocket)*

We have, torque at wheel T = 61 Nm

According to reduction ratio, torque on motor $T= 61/6 \approx 10$ Nm

Now, for motor power $P = 2\pi NT/60$

$=(2 \times 3.14 \times 1000 \times 10)/60$

$=1047$ Watt ≈ 1 kW

So,

*the selected motor should have **1 kW** rated power.*

CHAPTER-7

COST ESTIMATION

COMPONENTS	ESTIMATED PRICE
1000W 48V BLDC motor	₹ 5200
48V batteries	
500W controller	₹ 1200
36-72V DC converter	₹ 500
E-Bike throttle	₹ 200
Battery cable & connectors	₹ 200
Key switch	₹ 150

TOTAL PRICE: ₹ 7450 /-

CHAPTER-8

APPLICATIONS

- E-scooters, E-moped, E-bikes etc.
- Cost efficient.
- Conservation of fossil fuels
- Short distance travelling.
- Traffic reduction.
- Reduces human efforts.

CHAPTER-9

FUTURE SCOPE

The major challenge in future will be the high demand of electric vehicle, which will result in the increase in the cost, this can be overcome by using conversion of pre-existing vehicles, hence the future scopes for this project are:

- Availability of electric vehicle in rural areas.
- Balancing the demand of electric vehicles.

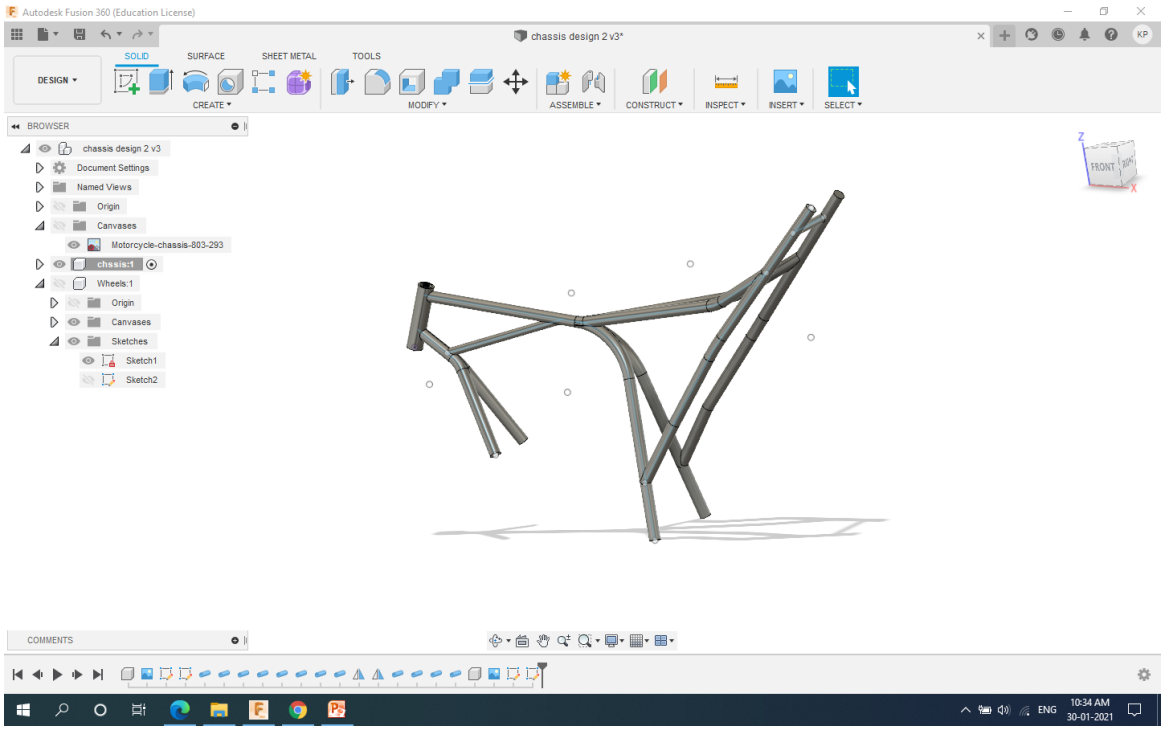
CHAPTER-10

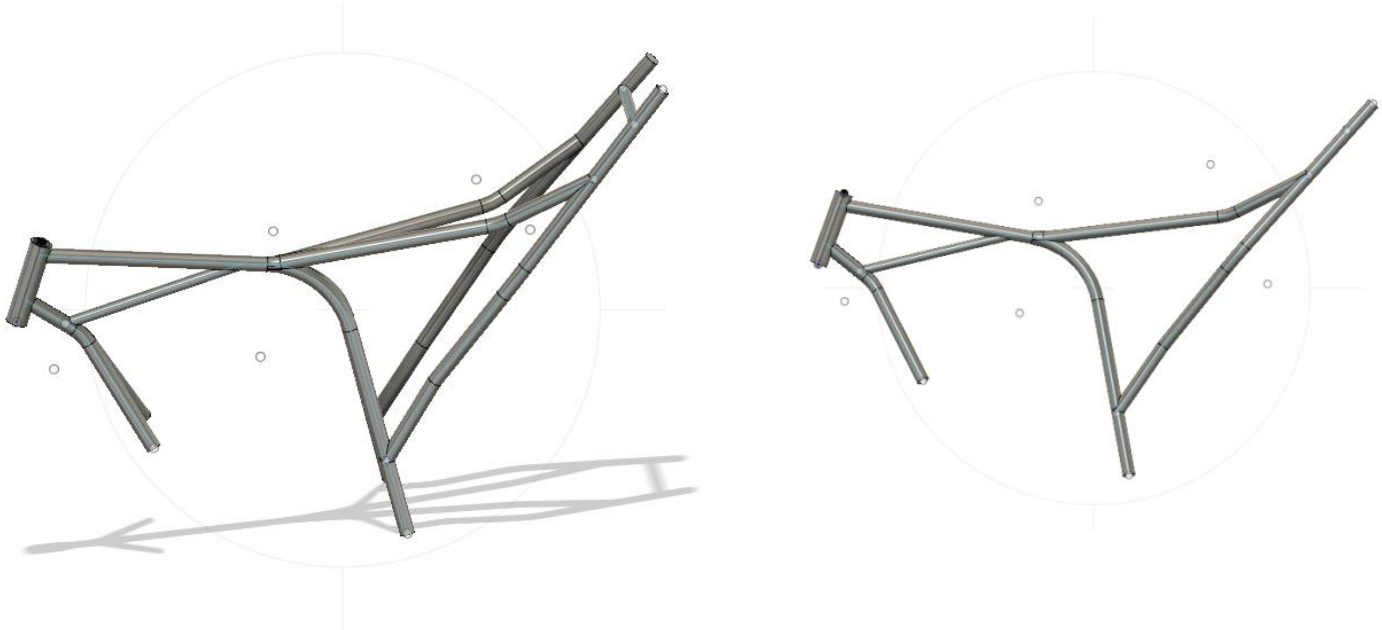
SUMMARY AND CONCLUSIONS

The conversion of electric motorcycle is characterized by:

- Low energy consumption in relation to conventional motorcycles.
- Very low noise emission, especially during start and acceleration.
- Low operating costs in relation to conventional motorcycle at average fuel consumption.
- High performance delivering rich experience while driving.
- No emission of harmful gases and no oxygen consumption.

Design in Progress





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