

# DESIGN & DEVELOPMENT OF MECHANICAL VARIABLE TRANSMISSION SYSTEM WITH HIGH STARTING TORQUE FOR ELECTRICAL VEHICLES

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**Abstract** - This paper presents a study of Mechanical variable drive systems which are specific transmission gear systems to get high torque and relatively high speed. This system is generally applicable in Electric vehicles for high acceleration and to achieve high speed. IN this venture, we are going to strategize and develop a variable gear transmission arrangement to replace the fixed gear drive that is conventionally castoff in an electric vehicle. A mechanical transmission system will help in reducing the load on the Electric motor.

**Key Words:** BLDC Motor, Hub motor, Belt drive, mid-drive, CVT, Swing arm, IC Engine.

## 1. INTRODUCTION

### 1.1 Development of an electric drive train for cycles as a sustainable means of transportation for a green environment

The investigation pointed engrossed in rising an inexpensive plug-in drive train for bicycles by earning the worth of Continuously Variable Transmission (CVT) that delivers an endless sum of speed proportions by changing pulley spans. The planetary mechanisms stayed considered and fit privileged the CVT cavity provided that a locking mechanism meant for the ring gear on the way to run frontward transmission toward the rear wheel and the wave was trodden up over an exposed differential gear aimed at pushing the cycle onward. For constancy and ease of production and assembly.

Three possible substitutes were generated to mollify the research objectives. The advantages and boundaries of each concept were investigated to come up with and progress the optimal and justifiable solution. The binary dominance matrix was cast-off for concept rating and the best solution was carefully chosen from the three possible concepts.

1. FLYWHEEL
2. DUAL power system
3. VARIABLE speed Transmission

The third idea with variable speed transmission was nominated.

This study intensive on examining available choices for an enhanced version of a cycle over the conformist one, about several criteria such as efficiency and ease of manufacture and maintenance. In the selected design, the continuously variable transmission was analyzed and developed further and is proposed as a sustainable means of transportation.

### 1.2 Evaluation of Factors for Sustainable Manufacturing of Electric Vehicles in India

This study indicates developing and authenticating the issues affecting the justifiable engineering of electric automobiles in India that power is used by original apparatus constructors and facility providers in the electric automobiles industry. Grounded on a systematic mixture of the works on electric automobiles, seven influences of technological, communal, edifying, financial, radical, topographical, and ecological justifiable engineering of electric automobiles and agreeing 67 variables have been developed. The authenticated instrument of issues affecting the justifiable industrializing of electric automobiles may be cast-off by novel equipment constructors, facility providers, and innovative players powerful in inflowing the electric automobile marketplace to measure the possible areas of growth in the electric automobile manufacturing. Visions increased from this assessment can be obliging for EV technologists in including customers' buying aims in the engineering plan. The authenticated consequences are in the Indian situation, nevertheless, the tool established can be castoff in a worldwide context as well.

### 1.3 ELECTRIC MOTORCYCLE POWERTRAIN ANALYSIS

The piece offerings the technical explanations and possessions of an electric powertrain considered for a motorbike. Design contemplations of powertrain, as glowing as an inverter and battery-operated pack through BMS scheme optimal, are discoursed. The consequences of road examinations of the electrical powertrain ample on public roads are comprised. The electric motorbike was planned and raised by the Gdynia Maritime University.

#### **1.4 Performance of Low-Speed Electric Two-wheelers in the Urban Traffic Conditions: A Case Study in Kolkata**

The current learning deliberates the presentation of electric-powered two-wheeled automobiles based on their consecutive circumstances in existing-daytime rush-hour road traffic in municipal parts. In this learning, review-based consequences and trial outcomes were associated with that conformist IC engine complement for the surroundings in the town of Kolkata. The specific vigor ingesting of the electrical alternates remained instituted to be 155.64 kJ/km and 114.5 kJ/km since trial and review results, correspondingly, associated with 810 kJ/km for conformist two-wheelers. The exact vigor price and the precise CO<sub>2</sub> release were also found in the learning.

#### **1.5 Mathematical modeling of Electric vehicles - A survey**

This grants an evaluation of the standing precise depictions of electric automobiles tracked by state-of-the-art approaches to model the interbreeding of the umph foundations. The mathematical design of the electric vehicle (EV) spreads from the unsure single Degree of Freedom (DOF) replicas to multifaceted multi-body dynamic replicas converses in point. Compact dynamic replicas appropriate for various regulator design industries have conversed which simplifies the collection of the best model for the plan. In the accumulation of vehicle dynamic forces, the broadside combines dynamic replicas of the dissimilar mechanisms of an electric vehicle counting the transmission, brake, battery, wheel, and tire dynamic forces. Relative analysis of dissimilar forms of the replicas for each module is also offered, concentrating on their submission in supervisor design. The paper thus turns into a chaperon for any EV control design necessity, so long as the best models for a specific application.

#### **1.6 Hybrid Electric Bike with Three Speed Transmission System an Energy-efficient bike for next-generation**

With the eternally-growing, petroleum prices, and duty scheme, the endeavor to enterprise and engineer a petroleum-effective motorcycle is of small price and in height competence. It is upcoming to stunned the problems of current plug-in motorbikes, which stay presently accessible in the marketplace. They propose 'The Hybrid Bike using 3-speed transmission system' is an electro-mechanical structure that contains two stages. In the primary stage, the thing works as an eco-approachable plug-in motorbike and in the additional stage, it operates on an IC engine. The next phase is castoff individual when the battery is squared totally and throughout the fast submission.

#### **1.7 Extracting Requirements for Design a Two-Wheels Electric Vehicle and proposing a design procedure**

With always- adding, petroleum prices, and financial policy, the attempt to strategy and mastermind an energy-effective motorbike of low cost and high effectiveness. It's proposed to overcome the downsides of being electric bikes, which are presently available in the request. They propose the Hybrid Bike with 3- speed transmission system is an electromechanical system that consists of two phases. In the first phase, it works as an eco-friendly electric bike and in the alternate phase, it works on an IC machine. The alternate phrase is used only when the battery is discharged entirely and through high-speed submission.

#### **1.8 PETRO ELECTRIC BIKE**

They say ... A Petro electric bike or mongrel bike is a proposed vehicle that can operate not only on an IC machine but also on batteries that drive a motor to give electricity and may also drive a wheel. It has great advantages over the preliminarily used battery system that drives the power from the charged battery. IC machine is a major source of air pollution. The ideal is to design and fabricate a two-wheeler mongrel electric vehicle powered by a battery and IC machines. The combination of both powers makes the vehicle dynamic in nature. It provides its proprietor with advantages in energy frugality and environmental impact over conventional motorcars. Mongrel electric vehicles combine an electric motor, battery, and power system with an internal combustion machine to achieve better energy frugality. In PEV, the battery alone provides power for low-speed driving conditions where internal combustion machines are the least effective. In accelerating, along roadways, or hill climbing the electric motor provides fresh power to help the machine. This allows a lower, more effective machine to be cast-off. Also, it operates the idea of regenerative retardation for enhanced use of energy. Therefore, the vehicle is best suited for the growing civic areas with high business. Outfit and their cost analysis are done. It deals with the fabrication of vehicles. This includes the assembly of the IC machine and its factors. The coming phase consists of enforcing the electric bike and designing the chopstick. The final stages would correspond to adding the effectiveness of the vehicle in profitable ways.

#### **1.9 Selection of Motor for an Electric Vehicle: A Review**

In this study, five kinds of drive train systems of the electric motor drives for EVs are banded. Likewise, the conditions of EVs on electric motor drives are presented. Hence, a review on motor types and their drives used in EVs has been made. The relative disquisition on the effectiveness, cost, maximum speed, and tractability is carried out for switched disinclination motor, induction motor, endless attraction motor, DC motor, an axial flux endless attraction brushless dc motor, to find out the most applicable electric motor drives for electric vehicle operations. According to these

inquiries, some conclusions have been attained. The study shows that axial flux endless attraction brushless dc motor drives are the previous choice for electric vehicles mission.

### 1.10 Next Generation Electric Bike E-bike

The main idea of this project is to design a doable yet largely compliant bike. As the amount of motor automobiles on the roads during the world rises at a stunning amount each period, the requirement for canvas Grounded energy produces nearly unbounded. The amplified usage of renewable reactionary energies carries with it conservational problems similar to the "hothouse effect", health hitches for megacity fetches, and worry over the solidity of energy force. To change down from this dependency on canvas, a massive quantum of plutocrat is an existence spent on the growth of electrical vehicles (EVs) that might be shaped. This paper dowries learning of electrical motorbike design. This learning aims to probe in what way to plan a simple, cost operative prototypical of an electric motorbike with a smart control system. This can be enforced by eliminating the IC machine, the exhaust arrangement, and additional gratuitous factors from the motorbike are replaced by a motor, a smart regulator, a battery pack, a wiring system, and covering devices.

### 1.11 Electric Superbike Racing – the Design and Construction of a Championship Winning Electric Superbike

The electric super-bikes lately prepared (2017) at The University of Nottingham were well-thought-out to be high-recital vehicles, contending thru their IC machine-driven matching part. This paper offers the provocations for this effort and details the plan of the motorbikes which, is a course that has secured maximized race concert. The expansive model has also given a good sympathy for the scheme of commerce. The information recorded through races and on a progressing, road is obtainable to authenticate the imitation work.

### 1.12 A comparative study of energy consumption and costs of battery electric vehicle transmissions

Notwithstanding the extensive-term advantage of battery electric vehicles (BEVs) for guests and the ground, the sole cost and inadequate lashing array current substantial walls to extensive commercialization. Integrating multi-speed transmissions to BEVs' powertrain arrangements rather than fixed-rate reduction transmissions to ingeniously a doable scheme to ameliorate powertrain effectiveness and spread the restricted driving assortment of static battery size. This paper is focusing on allowing the experimenters for BEV creators, particularly for transmission and drives, to approximate if their harvests are valuable for the client in footing of the worth/ presentation association to others' project results. To do that an all-purpose battery electric vehicle was demonstrated in MATLAB and Simulink for prognosticating electric motor effectiveness and power

ingesting for single stage speed reduction, two pets Binary Clutch-Transmission (DCT), and Continuous-Variable-Transmission (CVT) equipped in a battery-electric (BEV) vehicle. A believable supposition is grown, over the investigational authentication of sole speed and 2 pets' DCT scripts and sensible hypotheticals to the provision of the CVT script, mutually 2 pets' DCT and elementary CVT ameliorate the inclusive powertrain efficacy, safeguard battery energy and decrease client prices. Still, individually the formations have an inimitable cost and power ingesting-related trade-offs.

## CONCLUSIONS

After reviewing all the papers, I found that a hub motor for a scooter is less appropriate when we consider the power and speed together, and making a new vehicle from scratch will be costly, were converting an old IC engine vehicle is quite effective for low investment and grate impact to introduce pure EV. the existing market for parts availability can make it much easier to complete the demands, we can develop a hub that can be used to attach the wheel and the pully and brake can be fastened in it to get a drive train ready to propel a scooter. the flexibility of a midriver arrangement will be gained and a single design can be used to attach any power rating motor to get a desirable result. limitation of hub motor and the problems associated with its service can be eliminated

## REFERENCES

- [1] <https://doi.org/10.1016/j.promfg.2019.04.013>
- [2] <https://www.sciencedirect.com/science/article/pii/S2212827121001724>
- [3] [M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.](#)
- [4] [R. Nicole, "Title of paper with the only first word capitalized," J. Name Stand. Abbrev., in press.](#)
- [5] [K. Elissa, "Title of paper if known," unpublished.](#)
- [6] <https://www.infona.pl/resource/bwmeta1.element.iecee-art-000005485320>
- [7] <https://ieeexplore.ieee.org/document/8343841/>
- [8] [7\\_petro-electric-bike.pdf](#)
- [9] <https://www.sciencedirect.com/science/article/pii/S2214785320323865>
- [10] <https://ieeexplore.ieee.org/document/8392123/>
- [11] <https://ieeexplore.ieee.org/document/8277747>
- [12] <https://www.sciencedirect.com/science/article/pii/S0306261915016542>

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