DEVELOPMENT OF SYNCHRONISE DRIVETRAIN EVOLUTION FOR ELECTRIFYING TWO-WHEELER MOBILITY

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ABSTRACT - The transition to electrified mobility is reshaping the automotive industry, particularly in the two-wheeler segment. This paper presents a comprehensive study on the development of a synchronized drivetrain evaluation system tailored for electrified two-wheelers. The research encompasses various aspects such as drivetrain design, performance evaluation metrics, synchronization techniques, and real-world applicability. Through experimental validation and simulation studies, the effectiveness of the proposed synchronized drivetrain evaluation approach is demonstrated, highlighting its potential to enhance the efficiency, reliability, and performance of electrified two-wheeler systems.

The electrification of two-wheeler mobility presents significant opportunities for enhancing efficiency and reducing environmental impact. This paper presents a novel approach for the development of a synchronized drivetrain evaluation system tailored specifically for electrified two-wheelers. Through a comprehensive analysis of drivetrain design, performance evaluation metrics, synchronization techniques, and real-world applicability, the study aims to address critical challenges in optimizing the efficiency, reliability, and performance of electric drivetrains. Experimental validation and simulation studies demonstrate the effectiveness of the proposed approach, highlighting its potential to accelerate the adoption of electrified two-wheeler mobility while meeting the demands of modern urban transportation systems.

KEYWORDS – DC Geared Motor, Controller, Throttle Kit, Batteries, Swing Arm, Bushes and Bearings.

INTRODUCTION - Unlike a traditional internal combustion engine vehicle, which is powered by gasoline, an electric bike is powered by electricity stored in batteries. The energy from the batteries is used to spin the electric motor, which then rotates the motorbike's wheel, allowing it to move forward. The motor's speed can be used to regulate the motorcycle's speed. The wheel's mechanical energy is used to power the alternator, which generates electrical energy. When the wheel spins, the alternator spins as well, producing electrical energy that can be stored and used later, extending the range.

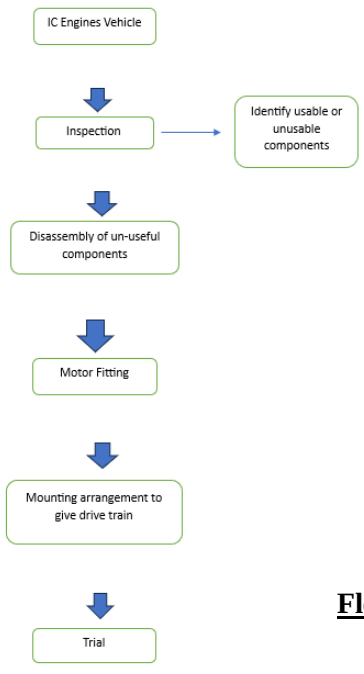
I. Retrofitting an internal combustion engine (IC) vehicle into an electric vehicle (EV) is a transformative process that holds great promise in the transition toward sustainable transportation. This conversion involves replacing the traditional gasoline or diesel powertrain with an electric motor and battery system, reducing emissions and reliance on fossil fuels. In this paper, we'll explore the key aspects of retrofitting IC engine vehicles to EVs, including the environmental benefits, technical challenges, and the growing demand for such conversions.

I. EV retrofitting means converting existing petrol or diesel-run vehicles into an electric vehicle. The process involves changing the original engine and other related components and a new alternative energy source to be transplanted into the existing vehicle body. It can either be an additional system added to the existing vehicle motor or to completely replace the existing engine with a new motor and drivetrain. All other components remain the same on the vehicle, which makes it easier to replace or repair parts like suspension, brakes, headlights, etc.

I. For example, in the market, there are various types of Electric bikes like, HT Auto, Ola Electric S1 Pro, Ather Energy 450x, Revolt Motors, Revolt RV400, Bajaj Chetak, Ola S1 Air, TVS iQube, Simple Energy One, Vida V1 Pro, PURE EV EPluto 7G, etc. Seeing the market of electric bikes & scooters picking an imaginary value is cost goes up to 1.15 lakhs around, taking a side from the cost estimation we can use the retrofit kit which will cost up to 50,000/- as we can see a stable Retrofit kit brand it is of GRAUDAA it costs up to 56,000/- per unit. As the kit which we are using in our project is of Robodo Electric Kit-MY1016Z2 250W it costs up to 30,999/- our model is of Mahindra Rodeo.

EXPERIMENTAL SETUP -

- Taking a petrol engine scooter, then decided to use this vehicle by observing its wheels and chassis condition.
- Because we needed a strong chassis, and engine without any breakdown and rusting particles.
- In the inspection, we identified the required components. Unusable components like the carburetor, fuel controller, crankshaft, and fuel tank. As for removing the unusable parts, the space will be used for the fitment of the battery and controller panel.
- After disassembling the unusable components from the engine.
- Then the placement of the motor.
- Arranged the mounting of the motor in the engine using studs of 12mm and an MS Plate for managing the height of the tire shaft and motor shaft we used some visors as per height order.
- After all the fitment our vehicle is been ready for the trial.



Flow Chart

SCOPE OF PAPER -

If the Retro-Fit to a petrol engine vehicle becomes successful then it can be used for Scooters or bikes and also it can be used in the future for a car. Creating an EV bike at an affordable price will become easy by fitting the retrofit. The life of the vehicle is 15 years but seeing the chassis and body if they are in good condition so replacing the IC Engine with the retrofit can expand the life of the vehicle.

Clearly state the primary objective of the project, which is to develop a synchronized drivetrain for electrified two-wheelers. This could involve improving efficiency, performance, or range.

components required for the synchronized drivetrain, such as electric motors, batteries, and control systems.

DESIGN AND DEVELOPMENT: Develop detailed designs for the synchronized drivetrain, including specifications for each component. This may involve mechanical and electrical engineering.

PROTOTYPING: Create prototypes of the synchronized drivetrain to test its functionality and performance. This may include multiple iterations to fine-tune the design.

TESTING AND VALIDATION: Conduct extensive testing to validate the drivetrain's performance.

COST ANALYSIS: Evaluate the cost of production and determine pricing strategies to make the electrified two-wheelers competitive in the market.

ENVIRONMENTAL IMPACT: Consider the environmental impact of the drivetrain and explore ways to make it more sustainable.

COMPONENTS USED –

1. DC Geared Motor.

FIG. 1

The motor has a rated power of 250w capacity with Max 300 rpm per minute, Rated voltage – DC 24V Rated current - 20 amp

SPEED AND TORQUE CONTROL: Geared DC motors are known for their ability to provide high torque at low speeds. The speed reduction is achieved through the gear assembly, which contains gears of different sizes.

APPLICATIONS: These motors are commonly used in various applications that require precise speed and torque control. Examples include robotics, automation, conveyor systems, and electric vehicles.

EFFICIENCY: The gearbox can improve the overall efficiency of the motor system. It allows the motor to operate in its optimal speed-torque range, reducing power consumption and heat generation.

GEAR RATIO: The choice of gear ratio is crucial in determining the motor's output speed and torque. A higher gear ratio provides more torque but reduces speed.

SIZE AND WEIGHT: Geared DC motors can be relatively compact and lightweight, making them suitable for applications with space constraints.

MAINTENANCE: Proper maintenance, including lubrication of the gears, is important to ensure the longevity of geared DC motors.

VOLTAGE AND CURRENT REQUIREMENTS: The voltage and current requirements of the motor will vary depending on the specific model and application. It's essential to match the motor with an appropriate power supply.

NOISE: The gear assembly can introduce some noise due to the interaction of gears. Noise levels can vary depending on the quality of the gear assembly and lubrication.

COST: Geared DC motors come in a range of prices, with higher-quality and more precise models generally costing more.

2. Battery.

24V 20 AH LION BATTERY PACK
24V 3AH CHARGER

FIG. 2

A Li-ion battery is a rechargeable battery that is used in many electric vehicles nowadays days during this battery the lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. It is more efficient because it is a smaller amount in weight, has high speed, no pollution, more reliable. Lithium-ion (and the mechanistically similar lithium polymer) batteries, were initially developed and commercialized for use in laptops and consumer electronics. With their high energy density and long cycle life, they have become the leading battery type for use in EVs. The first commercialized lithium-ion chemistry was a lithium cobalt oxide cathode and a graphite anode first demonstrated by N. Godshall in 1979, and by John Goodenough, and Akira Yoshino shortly thereafter. The downside of traditional lithium-ion batteries includes sensitivity to temperature, low-temperature power performance, and performance degradation with age. Traditional lithium-ion batteries pose a fire safety risk if punctured or charged improperly due to the volatility of organic electrolytes, highly oxidized metal oxides, and the thermal instability of the anode SEI layer. These early cells did not accept or supply charge when extremely cold, so heaters can be necessary in some climates to warm them. The maturity of this technology is moderate. Recent EVs are using new variations on lithium-ion chemistry that sacrifice specific energy and specific power to provide fire resistance, environmental friendliness, and rapid charging have been shown to have a much longer lifetime, with A123 types using lithium iron phosphate lasting at least more than 10 years and more than 7000 charge/discharge cycles, and LG Chem expecting their lithium-manganese spinel batteries to last up to 40 years.

3. Controller.

FIG. 3

Manufacturer: IDUINO
Item Weight: 26 g
Net Weight: 1.00 count
Included Components: 1 x Electric Motor Controller, 24V 250W Motor

The controller gathers electricity from the battery and delivers an acceptable amount of electricity to the electrical motor. The motor receives the facility from the battery and converts the electricity into mechanical energy.

THROTTLE: Most e-bikes have a throttle that allows the rider to control the speed by twisting a handle or using a thumb lever. The controller interprets the input from the throttle and adjusts the motor's power accordingly.

DISPLAY: The controller often connects to a display on the handlebars, showing information like speed, battery level, and assist mode. Riders can sometimes adjust settings through the display.

WIRING: The controller is connected to the battery, motor, throttle, and other electrical components through a series of wires.

PROGRAMMING: Some controllers allow for programming to customize settings like speed limits and power delivery to suit the rider's preferences.

4. Swing Arm.

SPLENDOR PLUS. N/A.
Material: ERW Steel Tube.
Size: 25.4X1.6.
Weight: 0.289 Kg.

FIG. 4

1/2 X 3/32.
The First number (1/2) is the chain pitch; The latter numbers (3/32, respectively) indicate the inner width in inches.

FIG. 5

6. Sprocket.

FIG. 6

A sprocket is a simple mechanical wheel with teeth or small notches that are designed to rotate and engage with the links of a chain or belt. To be compatible, though, they both need to have the same thickness and pitch. The basic design of this device has been used all over the world for a long time. They look very similar to gears; however, they aren't designed to be meshed together. Sprockets are used for various applications including bicycles, cars, motorcycles, tools, and other machinery. They're often made from steel, which is hardwearing so it increases longevity. Sometimes they're made from aluminum as it's lighter, making it ideal for motorbikes or push bikes, however, it does wear quicker than steel.

7. Disassembly Components.

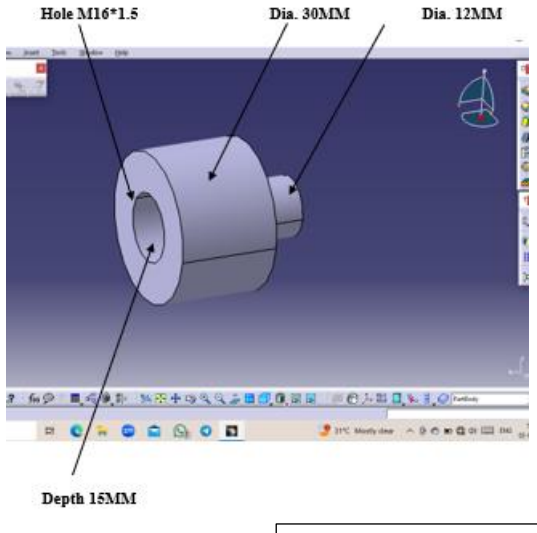
- Cylinder Block.
- Carburetor.
- Fuel Controller.
- Crank Shaft.
- Fuel Tank.

The only motive for removing the unusable parts of the IC Engine Vehicle was to create space for the fitment of the retrofit kit in the Aluminum body. Only after observing the whole setup, did we choose the parts that were unusable for the work. Parts like cylinder block, carburetor, fuel tank, crankshaft & etc. The parts that are totally 0% valuable in EV vehicles.

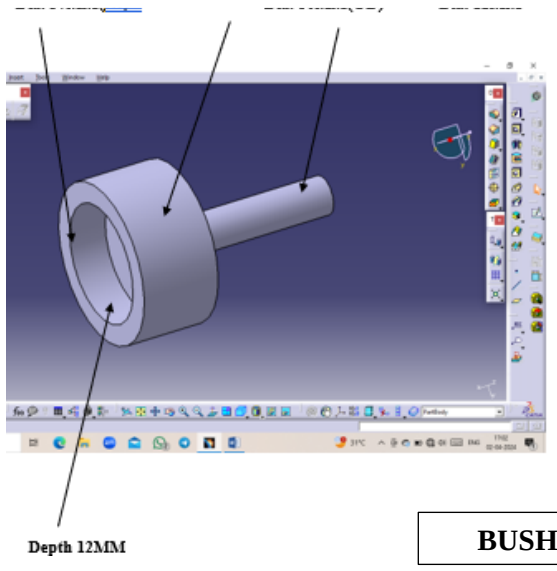
8. Bearings and Bushes.

I. 6203(LHS).

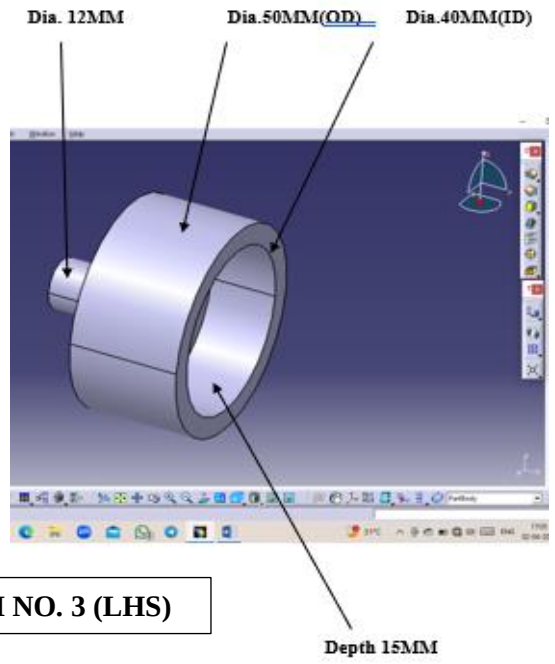
II. 6301(RHS).



BUSH NO. 1 (RHS)



BUSH NO. 2 (RHS)



BUSH NO. 3 (LHS)

Benefits of using Retrofit Kit: Retrofit kits offer a range of benefits for building owners' operators and the environment. Some of the key benefits of using retrofit kits include the following.

Cost savings: Retrofits can help to reduce energy consumption and operating costs, which can result in significant cost savings over time. For example, upgrading an outdated lighting system with a retrofit kit may reduce energy consumption and lower electricity bills. Similarly, replacing an old furnace with a newer, more efficient model may reduce fuel consumption and lower heating bills.

Increased energy efficiency: Retrofits can help to improve the energy efficiency of a building or system, which can reduce energy consumption and greenhouse gas emissions. Energy efficiency retrofits such as insulation and energy-efficient windows can help to reduce the amount of energy needed to heat and cool a building while lighting retrofits can reduce energy consumption and improve the quality of light.

Improved performance and functionality: Retrofits can help to improve the overall performance and functionality of a building or system. For example, upgrading an HVAC system may result in improved indoor air quality, increased comfort, and better temperature control. Similarly, upgrading a plumbing system may result in improved water efficiency, reduced water waste, and better overall performance.

Environmental benefits: Retrofits can positively impact the environment by reducing energy consumption and greenhouse gas emissions. This can help to mitigate the negative impacts of climate change and contribute to a more sustainable future.

In addition to these benefits, retrofits can also help to improve the overall value and appeal of a building or property. For example, upgrading a building's energy efficiency may make it more attractive to potential buyers or tenants and may also result in a higher resale value.

building or system. By investing in retrofits, building owners and operators can save money, improve the performance of their systems, and contribute to a more sustainable future.

DIFFERENCE BETWEEN EV KIT AND RETROFITTED KIT -

Electric Vehicle (EV)	Retro-fitting kit
Ev's are vehicles that were originally designed and manufactured to run on electricity.	Retrofitting involves the process of converting an existing petrol or diesel vehicle into an electric vehicle.
They come from the factory with an electric motor, a large battery pack, and other electric components.	It requires removing the IC Engine and replacing it with an electric motor, battery pack, and associated components.
Ev's do not use gasoline for other traditional fuels and produce no tailpipe emissions.	Retro-fitting allows older, conventional vehicles to be transformed into electric ones, reducing emissions and reliance on fossil fuels.
An EV kit typically refers to a package or set of components designed to convert a conventional, gasoline-powered vehicle into an electric vehicle. It includes components like an electric motor, battery pack, charging system, and other necessary parts to electrify a vehicle.	A retrofit kit, in the context of electric vehicles, refers to a set of components or upgrades designed to improve or update specific features or systems of an existing electric vehicle.
EV kits are often used for custom electric vehicle conversions, where enthusiasts or professionals modify an existing bike to run on electricity.	Retrofit kits can include enhancements for battery systems, charging capabilities, software updates, or other components to make an older EV more efficient, powerful, or compatible with newer technologies.
Examples, include OLA S1 PRO, Okinawa, etc.	The converted vehicle retains its original chassis and body but gains an electric powertrain.

APPROXIMATE EXPENDITURE –

Sr.No.	Equipment	Description	Qty	Price
1.	Retro Fit Kit	Battery, Motor, Throttle And Controller Panel.	1	30,999/-
2.	Swing Arm	Splendour Swing Arm	1	980/-
3.	Suspension	-	1	310/-
4.	Rear Wheel Shaft	Three Bushing And Two Bearings.	5	700/-
5.	Sprocket And Chain	-	2	480/-
6.	Wiser And Nuts	Wiser(6) And Nuts(4)	10	180/-
Total-	-	-	-	33649/-

In conclusion, the evolution of synchronized drivetrain technology represents a pivotal advancement in the electrification of two-wheeler mobility. This innovation not only enhances the efficiency and performance of electric vehicles but also promises a smoother and more dynamic riding experience for users. the synchronized drivetrain holds great promise for shaping the future of sustainable mobility.

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