International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

Range Extension In Electric Scooter Through Front Wheel Power Generation

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Abstract - The increasing demand for sustainable transportation has led to the exploration of innovative solutions to extend the range and efficiency of electric vehicles (EVs). This paper proposes a conceptual framework for utilizing front-wheel power generation as a means to augment the range of EVs. The concept revolves around the integration of regenerative braking systems with specialized generators or alternators installed in the front wheels to capture kinetic energy during deceleration and convert it into electrical energy. This harvested energy is then stored in the vehicle's battery pack for later use, thereby extending the vehicle's range.

The abstract outlines the key components and principles of front-wheel power generation, emphasizing its potential to enhance the performance and viability of EVs in the face of growing environmental concerns and energy efficiency targets. Additionally, it highlights the need for further research and development to optimize the efficiency, reliability, and integration of such systems into existing vehicle architectures.

Key Words: hub motors, range extension

1.INTRODUCTION

Range extension in electric scooter through front wheel power generation. The developing worry for ecological supportability has prompted a flood in the prevalence of electric vehicles (EVs) as a cleaner option in contrast to customary gas fueled vehicles. Electric bikes, specifically, have acquired far reaching reception for their effectiveness, moderateness, and eco-accommodating nature. In any case, one of the tireless difficulties looked by electric bikes is the restricted reach on a solitary charge.

To address this restriction, analysts and specialists have been investigating creative answers for broaden the scope of electric bikes. One promising methodology is the mix of a front-wheel power age framework, pointed toward outfitting energy during movement and taking care of it back into the bike's battery.

The idea includes preparing the front wheel of the electric bike with a power age instrument, like a regenerative stopping mechanism or an installed generator. As the bike moves, the front wheel's pivot initiates the power age framework, changing over active energy into electrical energy. This reaped energy can then be put away in the bike's battery, actually expanding its general reach.

1.1 BACKGROUND OF THE WORK

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This development more efficient and environmentally friendly Electric two-wheeler for increasing range of the electric vehicle which will help in reducing pollution in environment. This bike can give the financial support for the normal person. Clearly define the objectives of the project is create the economic and environmentally friendly electric vehicle and also increase range of scooter then other vehicle.

1.2 SCOPE OF THE PROPOSED WORK

Improve plan boundaries such as material selection and load distribution by using advanced computer-aided design and finite element analysis tools. Fabricating combines traditional and modern approaches for ease of fabrication and mechanical efficacy. Extensive real testing validates strength and load-bearing capacity. Our work improves electric bike proficiency and well-being by creating a robust, lightweight body shape that contributes to practical urban commuting.

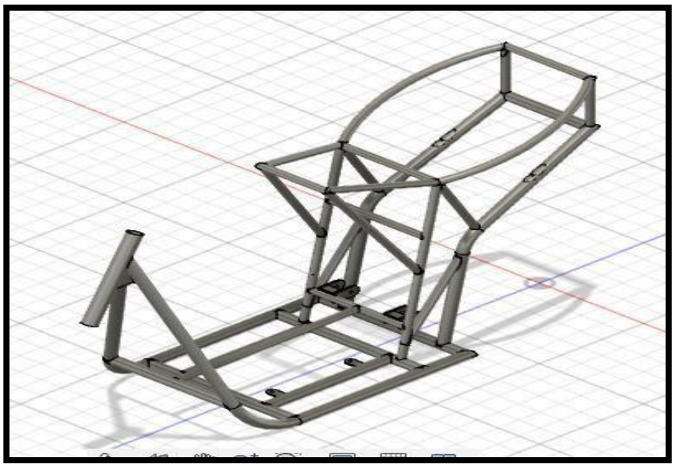

FIG 1.1 INCONEL 625

2. OBJECTIVE AND METHODOLOGY

2.1. Objectives of the proposed work

The goal of this project is to provide more range by using front hub motors which will store energy by converting kinetic energy into electrical energy. This concept's primary goal is to provide extended range for vehicles in form of generator. In this project, we'll make it possible for people to use this system for increasing the range of vehicle using hub motor. The normal people who ride in this vehicle find this device to be of great use in sense of extended range. This dual hub motor vehicle is constructed with basic braking and accelerating mechanisms that allow the user to operate the vehicle.

3.1.1 Primary Objective

- **Accessibility**

- Design the vehicle suitable to hold both hub motors to be mounted correctly and perfectly.
- Implement alternative driving and control systems that do not require more change for its function.

- **Comfort and Usability**

- Create a comfortable and ergonomic driving environment that minimizes fatigue and strain.
- Design the controls and interface to be intuitive and easy to use for individualswith not more weight.

- **Affordability and Sustainability**

- Develop the vehicle using cost-effective materials and manufacturing processes to make it commercially viable and accessible to a wider range of users.

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2.2 Material selection\

Element	Content (%)
Iron(Fe)	97.3 – 97.22
Chromium (cr)	0.80 – 1.10
Manganese (Mn)	0.40 – 0.60
Carbon (C)	0.280 – 0.330
Silicon (Si)	0.15 – 0.30
Molybdenum (Mo)	0.15 – 0.25
Sulphur (S)	0.040
Phosphorus (P)	0.035

Properties	Metric
Ultimate tensile strength	670 Mpa
Yield tensile strength	435 Mpa
Modulus of elasticity	205 Gpa
Bulk modulus	162 Gpa
Shear modulus	79.4 Gpa
Poisson's ratio	0.29
Density	7.85 g/cm³

3.2 OBJECTIVE OF THE MODEL

Based on the heat source employed, there are typically three prevalent types of WAAM processes: those reliant on Gas Metal Arc Welding (GMAW), Gas Tungsten Arc Welding (GTAW), and Plasma Arc Welding (PAW). Among that CMT which stands for Cold Metal Transfer is a type of gas metal arc welding (GMAW) that utilizes a controlled circuiting arc to transfer metal from the wire to the substrate. Its notable advantage lies in its ability to generate heat input during the process. This characteristic is highly beneficial as it reduces the likelihood of distortion and residual stress in the product. When it comes to the WAAM (Wire Arc Additive Manufacturing) process.

CMT offers advantages over techniques:

● Low heat input: CMTs capacity for low heat input plays a crucial role in WAAM. It effectively mitigates issues such as distortion and residual stress in the manufactured part.

● Precise and uniform bead profile: CMT ensures a fine. Even bead profile, making it ideal for creating complex shapes with superior surface quality.

● Weldability: CMT can be employed to weld metals, including steel, aluminum, and copper. This versatility makes it a preferred choice for WAAM applications.

● High deposition rate: One of CMTs features is its ability to achieve deposition rates. As a result, large parts can be manufactured using this technique.

● Spatter Reduction: CMT is known for its minimal spatter, which reduces the need for post-weld cleanup and contributes to a cleaner work environment.

Overall CMT proves itself as a technique for WAAM due to its capability of producing high quality welds with distortion and residual stress. Additionally, its versatility in welding metals further enhances its appeal. While maintaining deposition rates. The use of CMT (Cold Metal Transfer) technology helps to minimize distortion and residual stress in the manufactured part by reducing heat input.

3.3 FABRICATION

3.3.1. EXPERIMENTAL METHOD

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The experimental procedure involved creating a wall using Inconel 625 alloys. This was done using the WAAM CMT system, which consists of a Fronius CMT power source, a wire feeder, a robot controller and a CMT torch connected to a six axis Fronius robot Inconel 625 welding wire with a diameter of 1.2 mm was used as the filler material. The base metal used was stainless steel measuring 100 mm x 100 mm with a thickness of 10 mm. Argon gas was used for shielding purposes with the torches flow rate set at 15 LPM. Various welding parameters were adjusted including wire feed rate, flow rate, travel speed and current details mentioned. For the experiment three plates were prepared with three different modes depicted in (A) Continuous Mode; This mode allowed welding as it eliminated the need for the robot to return to its starting position after each layer. The welding process continued smoothly. Resulted in a sample measuring 160 mm in length and an 80mm height. (B) Discontinuous Mode; In this mode the robot briefly pauses for one second to return to its starting position before continuing with the welding process. During this time a sample measuring 100 mm in length and 80 mm in height is successfully created. This pause happens between each layer of welding. (C) Cycle Step; In this mode after 30 seconds the robot takes a break for a period until the layer is completed, and the sample reaches a length of 100 mm and height of 80 mm. The visual representation of the sample can be seen. To extract specimens for material testing from these samples, an electric discharge machining (EDM) process was utilized.

3.3.2. Data Processing

Inconel 625 which's a nickel-based superalloy with features like resistance to hot corrosion endurance, against fatigue wear and excellent weldability has been chosen as the filler material. The chemical composition of Inconel 625 shown in Table 1. Furthermore Inconel 625 demonstrates durability when subjected to elevated temperatures. This has made it a preferred choice, for fabricating components in demanding industries such as aerospace, chemical, petrochemical, marine sectors and other applications that require both temperature resistance and corrosion resistance.

In comparison with conventional drive concepts that revolve around a central engine, the wheel hub motor or wheel hub drive is a drive system that is installed directly into the wheel or rim of a vehicle. These units are electric motors. The hub motor (also called wheel motor, wheel hub drive, wheel hub motor, or in-wheel motor) is characterized by the integration of power, transmission and braking devices into the wheel hub, thus greatly simplifying the mechanical part of electric vehicles.

4. PROPOSED WORK AND MODULES

- The application of wire electric discharge machine (WEDM) in the preparation of test specimens to assess mechanical properties is a widely adopted practice within the field of materials science and engineering. Wire electrical discharge machining (Wire EDM) is a manufacturing technique that employs electrical discharges to form or cut materials.
- The workpiece and the wire are immersed in a dielectric fluid, commonly deionized water, to act as a conduit for the electrical discharges and to carry away the material that has been eroded. Additionally, the dielectric fluid serves to regulate temperature and prevent the wire from becoming excessively hot.
- Wire Electric Discharge Machining is Known for its exceptional precision and capability to craft intricate and elaborate forms in a variety of materials,

encompassing metals and alloys. This precision is of utmost importance when fabricating specimens for mechanical testing.

- It is a clean and precise method of machining, which reduces the risk of contamination, or impurities being introduced into the specimen during the process.
- WEDM can be used to create customized specimen shapes and sizes, which is particularly useful when designing specimens for specific mechanical tests, such as tensile testing, hardness testing, or fatigue testing.
- The use of a wire electric discharge machine (WEDM) for machining specimens intended for mechanical properties testing offers several advantages, including precision, reproducibility, minimal material distortion, and compatibility with various materials.

5.RESULTS AND DISCUSSION

In our project the final conclusion is to Extend the range by the help of front wheel hub motor. The front wheel hub motor is use for regenerate the waste kinetic energy from the front wheel is converted to electric energy. After regenerated Electric energy is stored in another one split Battery. Finally, we got 9.5km Range from the Regenerated electric current.

If the 48V BLDC Hub motor runs above 30Kmph it produces a 0.5kw of current the regeneration current is stored in another one split battery. After the drive battery voltage goes under 30%. Automatically the regenerated battery supplies the power to the controller.

CALCULATION:

Current (A) = 1000*Kilo watt/Voltage

A = 1000*0.30/48

A = 1000*0.075

Current (A) = 6.25

Here we calculate the regeneration current in ampere

Then calculate the total charging current of the regeneration system and calculate the range of the stored regeneration current.

The total running time of single charge is 1.10 Hours it's the same time for regeneration of another one split battery.

Current (A) = Regeneration time*Charging current

A = 1.10*6

Current (A) = 6.6

RUNNING TIME OF REGENERATION CURRENT:

Time = remaining current*Voltage/Kilo watt

Time = 6.6*48/1000

Time = 0.3168(decimal to hours)

Time = 19 minutes

FINAL RANGE CALCULATION:

Speed = distance/time

30 =? /19 minutes (minutes to decimal 0.3167)

d = 9.5Km

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