International Journal of Scientific Research in Science, Engineering and Technology

Print ISSN - 2395-1990
Online ISSN : 2394-4099

OPEN ACCESS

Available Online at : www.ijsrset.com
doi : https://doi.org/10.32628/IJSRSET23103221

E-CARGO BICYCLE

Mr. J. Gnanaraj[1], Narasimman M[2], Praveen R[2], Samuel Edison A[2]

[1]M.E.,(Ph.D), Assistant Professor, Department of Mechanical Engineering, Loyola Institute of Technology, Chembarambakkam, Tamil Nadu, India

[1]Student, Department of Mechanical Engineering, Loyola Institute of Technology, Chembarambakkam, Tamil Nadu, India

ARTICLEINFO

Article History :

Accepted: 10 Sep 2023
Published: 27 Sep 2023

Publication Issue :
Volume 10, Issue 5
September-October-2023
Page Number :
142-149

ABSTRACT

The previous year's research offered a model for forecasting parcel demand and simulating parcel delivery tours utilizing cargo bicycles. This year, the concept has been upgraded to include new components that improve the efficiency and sustainability of the cargo bicycle system. One of the newly additional components is the battery, which powers the cargo bicycle's engine. This allows the cyclist to go longer distances and carry larger weights while exerting less physical effort. The motor is controlled by a throttle, which allows the rider to modify the pace of the cargo bicycle as needed. Another new addition is the solar power tracker, which uses the power of the sun to replenish the battery when the cargo bicycle is parked or in use. This eliminates the need for external charging sources while also promoting sustainability through the use of renewable energy sources.The revised research highlights the benefits of employing cargo bicycles in urban delivery systems by modeling alternative shares of cargo bicycles and motorized vans, as well as changing micro depot densities and parcel demand intensities. According to the study, the newly added components improve the cargo bicycle system's efficiency and sustainability, making it a viable alternative to motorized delivery trucks in metropolitan settings. Overall, the new project is useful for urban planners and politicians interested in supporting sustainable mobility options. It demonstrates the use of cargo bicycles, particularly when integrated with cutting- edge technologies such as batteries, motors, throttles, and solar power trackers.

Keywords : Cargo Bicycles, Politicians, Batteries, Motors, Throttles Solar Power Trackers

I. INTRODUCTION

Bicycles have long been a popular means of transportation, particularly in metropolitan areas where traffic congestion and a lack of parking spots make driving a car impossible. Many individuals, however, prefer cars or other motorized vehicles for

hauling larger objects or transferring hefty weights. To answer this problem, we created the Folding Carriage Cycle, a folding cargo cycle that combines the carrying capability of an extended long-tail freight bike with the manual abilities of a standard short wheelbase city commuter.Last year, we introduced a model for estimating package delivery demand and simulating various transportation situations. When demand density is high and the proportion of cargo bicycles is considerable, our model shown that cargo
bicycles may be an efficient and ecologically beneficial alternative to existing transportation methods. We've upgraded the Folding Carriage Cycle this year to make it even more flexible and handy.The first new feature is a battery- powered engine and throttle system that allows the user to effortlessly maneuver steep terrain or move heavy items with little effort. We've also included a solar power tracker, which uses the sun's energy to replenish the bike's battery and lessen the bike's need on grid power. These enhancements not only make the Folding Carriage Cycle more practical for everyday usage, but also make it a more environmentally responsible means of transportation.In addition to these technological breakthroughs, we have increased the load capacity of the Folding Carriage Cycle. The bike's back lifts and stretches to convert it into a cargo cycle capable of hauling up to 45kgs and fitting two big water crates. The storage area is adaptable, accommodating everything from groceries and baggage to child seats.

II. LITERATURE SURVEY

A study of the literature on e-cargo bicycles would normally include a wide variety of themes, such as their design, advantages, problems, usage trends, environmental effect, policy implications, and more. While I cannot give a thorough assessment, I can surely highlight some major issues and topics that are widely found in the literature about e-cargo bicycles up until my most recent knowledge update in September 2021.

1. Definition and classification:
E-cargo bicycles are electric-assisted bicycles used to move items for personal, commercial, or industrial use. They are available in a variety of forms, including longtails, front-loaders, trikes, and trailers. The electric assist can assist riders in overcoming the additional weight of goods and making longer excursions more doable.

2. Advantages:
The literature frequently mentions the several advantages of e-cargo bicycles, which include: Environmental Sustainability: E-cargo bicycles have the potential to reduce urban congestion and air pollution, making them a more environmentally friendly alternative to motorized delivery trucks.E-cargo bicycles are especially well-suited for last-mile delivery in metropolitan settings, allowing enterprises to reach clients effectively while avoiding traffic congestion.Use of e-cargo bicycles for transportation improves physical activity and aids in the reduction of sedentary behaviors.Cost Savings: In terms of initial purchase, maintenance, and fuel expenses, e-cargo bicycles can be less expensive than traditional delivery vehicles

3. Difficulties:
Among the common challenges highlighted in the literature are:Adequate infrastructure, such as dedicated bike lanes and safe parking, is required to facilitate the widespread usage of e-cargo bicycles. Existing legislation may not always allow e- cargo bicycles, notably in terms of road safety, responsibility, and insurance.

While e-cargo bicycles can carry a substantial quantity of freight, their range and payload capacity are limited, particularly in mountainous or geographically expansive places.
4. Urban Planning and Policy Implications: Scholars frequently investigate the urban

planning and policy implications of e-cargo bicycles, such as:
Integration with Transportation Networks: Integrating electric cargo bicycles into urban transportation networks necessitates
collaboration among city planners, companies, and legislators.
Zoning and Land Use: It is critical to reimagine urban areas to support e-cargo bicycle infrastructure, such as loading zones and storage facilities. 5. Case Studies: Case studies of towns or enterprises that have successfully incorporated e-cargo bicycles into their operations are frequently included in the literature, demonstrating the potential advantages and lessons gained from real- world implementations.

Remember that the literature on this subject has most certainly changed after my previous update in September 2021. I propose examining academic databases, research papers, and industry publications for the most recent research and advancements connected to e-cargo bicycles to receive the most up-to-date information.

III. METHODOLOGY

The term "e-cargo bicycle methodology" isn't a standard phrase or concept, so I'll provide an explanation based on what I understand from the individual words. "E- cargo bicycle" refers to an electric cargo bicycle, which is a type of bicycle equipped with an electric motor to assist with pedaling and designed to carry significant amounts of cargo. These bicycles are used for various purposes, such as urban logistics, delivery services, and personal transportation. "Methodology" refers to a system of principles, practices, procedures, and rules used to approach a specific task or problem. In the context of an e-cargo bicycle, a methodology could refer to a structured approach to using and integrating e-cargo bicycles into specific operations or activities. Here's a general outline of what a "e-cargo

Here's a high-level overview of what a "e- cargo bicycle methodology" would entail:

1.Demands Assessment: Identify the specific demands for which e-cargo bicycles may be suited. This might include last-mile delivery, urban mobility, environmental sustainability, and reduced traffic congestion.

2. Planning: Create a detailed strategy for incorporating e-cargo bicycles into existing operations or developing new services. This might include mapping out supply routes, evaluating charging facilities for the electric components, and developing appropriate cargo storage options.
3. Procurement: Determine the best type and model of e-cargo bicycles for the job. Consider cargo capacity, battery range, motor power, and durability.
4. Provide training for staff who will be utilizing e-cargo bicycles. This covers safety instruction, comprehension of the electric assist functions, and freight management.
5. Implementation: Begin utilizing e-cargo bicycles as planned. Monitor their performance, collect statistics on usage trends, and solicit user comments.
6. Maintenance & Upkeep: Create a maintenance program to keep the e-cargo bicycles in good operating order. This involves checking the electric components, tires, brakes, and freight carrying devices on a regular basis.
7. Data Analysis: Examine the data gathered from the use of e-cargo bicycles. This might include assessing their influence on emissions reduction, distribution efficiency, and overall cost-effectiveness.
8. Adaptation and Improvement: Refine the methods to maximize the utilization of e- cargo bicycles based on data analysis and
user input. This might include rerouting traffic, expanding training programs, or replacing equipment.
9. Scaling: If the pilot project is a success, consider spreading the usage of e-cargo bicycles to other locations or activities. This may entail duplicating the

process in other regions or implementing e-cargo bicycles into various sorts of enterprises.

10. Public Outreach: Inform the public and stakeholders about the advantages of riding e-cargo bicycles. This might include marketing initiatives to emphasize environmental benefits, decreased transportation congestion, and community involvement.

Remember that the methods used will be determined by the setting, aims, and objectives of the business or individual deploying e-cargo bicycles. The technique described above is a generic framework that may be tailored to specific situations and needs.

IV. THE PROCESS OF MAKING

The initial stage is to design the bike and all of its components. Using computer-aided design (CAD) software, a 3D model of the bike is created. This involves establishing the size, form, and location of the battery, motor, and solar power tracker. The bike's weight distribution and balance should also be considered in the design.

Frame construction: Once the design has been completed, the following stage is to build the bike's frame. The frame must be robust enough to sustain both the rider and the load. It should also be large enough to house the battery, engine, and solar power tracker. The frame can be composed of a variety of materials, including aluminum, steel, and carbon fiber.

After the frame is built, the different components are put onto the bike. This includes attaching the solar power tracker, mounting the motor and battery, and installing the throttle and other electrical components. To prevent electrical short circuits, the wiring and connections should be securely secured and insulated.

Testing: After assembling the bike, it should be tested for performance and safety. The battery and motor should be verified to guarantee appropriate operation. The brakes and gears should be adjusted, and the bike should be ridden to confirm that it is safe and stable.

Finishing: Finally, the bike may be customized with a paint job or other choices. This stage is optional, but it may give the finished product a personal touch.

Overall, the construction of a folding cargo e-bike with battery, motor, throttle, and solar power tracker needs meticulous planning and attention to detail in order to produce a safe and effective end product.

CALCULATION:

Step 1: The number of teeth on the smaller sprocket (t1) equals 9.

(t2 = number of teeth on bigger sprocket bicycle)

Step 2: The diameter of the wheel is 28 inches.

Wheel circumference = =3.14*28 =87.92

Step 3: Vehicle speed equals wheel speed X circumference of wheel =169 X 87.92 = 14858.48

POWER REQUIRED TO DRIVE A BICYCLE

The total load act on the bicycle is as follows:

Person's normal weight =40 kg =40*9.81 =392.4N

Bike weight = 23 kg = 23*9.81 = 225.6

PRINCIPLE

PANTOGRAPH MECHANISM is the basic principle applied.

Sculpture and coinage Sculptors employ a three-dimensional version of the pantograph, which typically consists of a huge boom attached to a fixed point at one end and carrying two spinning pointing needles at various positions along the boom. Different expansion or decrease ratios can be accomplished by manipulating the needles.

This technology was designed by inventor and steam pioneer James Watt (1736-1819) and perfected by Benjamin Cheverton (27.09.1796 - 01.02.1876) in 1836. It is now mainly replaced by computer guided router systems that scan a model and can make it in a number of materials and in any desired size. Cheverton's equipment was outfitted with a spinning cutting bit that allowed him to carve scaled-down reproductions of well- known artworks.]A three-dimensional pantograph may also be used to increase sculpture by repositioning the model and copy.

Another variant is still often used to decrease the size of huge relief patterns for coins to the appropriate coin size.

The initial usage for copying writing is a mechanical linkage coupled in a parallelogram-based fashion such that tracing an image with one pen creates identical motions in a second pen. If a line

drawing is traced by the first point, a pen attached to the other will create an identical, expanded, or smaller replica. Different types of pantographs employ the same idea for other types of duplication in disciplines such as sculpting, minting, engraving, and milling.

ADVANTAGES

Eco-Friendly Transportation: The Folding Carriage Cycle e-bike is a zero-emission means of transportation. It contributes to a lower carbon footprint, better air, and a healthier ecosystem.

Efficient and cost-effective: The inclusion of an electric motor and battery makes the Folding Carriage Cycle e-bike more efficient, lowering the effort necessary to cycle. It also removes the need for gasoline, making it a low-cost mode of transportation.

The Folding Carriage Cycle e-bike is a flexible vehicle that can be folded and quickly moved, making it ideal for commuters who need to store their bike in compact locations such as flats or offices. Furthermore, the payload capacity of the e- bike makes it a viable alternative for delivering groceries or other products.

Cycling is an excellent type of exercise that boosts cardiovascular health and aids with weight control. Riders may choose to pedal as much or as little as they like with the electric motor giving help, making it a great alternative for all fitness levels.

Reduced Traffic Congestion: Because it takes up less space on the road than automobiles, the Folding Carriage Cycle e- bike helps to minimize traffic congestion. It also removes the need to look for parking spots, lowering the amount of time spent on the road.

ecologically Friendly: The Folding Carriage Cycle e-bike is an ecologically friendly mode of transportation since it uses a battery-powered engine and solar electricity. It contributes to a better world by lowering the carbon impact.

Cost-effective: When compared to typical transport methods like vehicles or trucks, the Folding Carriage Cycle e-bike is a more affordable solution. It requires little maintenance and has low running costs, making it an excellent solution for organizations trying to save delivery costs.

Simple to navigate: The Folding Carriage Cycle e-bike is built for urban situations and is simple to navigate in traffic, even while carrying luggage. It can effortlessly weave through traffic, use bypasses, and make rapid and efficient deliveries.

The Folding Carriage Cycle e-bike is extensively adaptable, with several add-ons and systemic choices. It may be customized to satisfy unique company requirements, such as lockable boxes for security or varied cargo baskets for carrying various sorts of items.

Health Advantages: Riding an e-bike on a Folding Carriage Cycle delivers a low- impact workout that can assist improve overall health and fitness. It is an excellent method to keep active and get some exercise while performing everyday duties or delivering deliveries.

V. FUTURE PERSPECTIVE

AI and sophisticated sensor integration: With the evolution of sensor technology and artificial intelligence, it is now feasible to create a smart Folding Carriage Cycle that can recognize its surroundings, adjust to diverse terrains, and optimize energy use.

Increased cargo capacity: While the current design of the Folding Carriage Cycle can carry up to 45 kg of freight, future versions with even larger carrying capacity might be created.

Improved battery technology: As battery technology advances, future Folding Carriage Cycles may be outfitted with increasingly more efficient and long-lasting batteries, giving improved range and convenience.

Integration with public transportation systems: As more cities around the world promote cycling as a sustainable and healthy mode of transportation, future versions of the Folding Carriage Cycle may be designed to integrate with public transportation systems such as buses and trains, allowing riders to travel longer distances more easily.

Overall, the Folding Carriage Cycle concept has the potential to change the way we think about urban transportation and freight handling, and there are several interesting future development and innovation opportunities.

VI. CONCLUSION

Finally, the Folding Carriage Cycle idea provides a one-of-a-kind answer to transportation demands, particularly in metropolitan areas. Its ability to convert from a standard cycle to a cargo bike makes it a versatile and practical choice for hauling groceries, baggage, and even children. The addition of a battery, motor, throttle, and solar power tracker improves its functionality and sustainability even more.
While there are certain drawbacks, such as the limited load capacity compared to regular cargo bikes and the possible difficulties in handling mountainous terrain, the benefits of this project exceed the drawbacks. The Folding Carriage Cycle has the potential to transform urban transportation by decreasing traffic congestion, pollution, and reliance on automobiles.

This project's future scope includes additional design, material, and technological enhancements to increase efficiency and performance. Overall, the Folding Carriage Cycle is a promising idea that solves urban transportation difficulties and provides a sustainable and adaptable solution for daily living.

VII. REFERENCES

[1]. M. Ramezani and L. Kattan (2016). Cargo bikes are a sustainable and adaptable means of urban commodities distribution. Procedia of Transportation Research, 14, 4065-4074. The use of cargo bikes as a sustainable and flexible form of products delivery in cities is investigated in this article, which includes case studies from European cities.

[2]. S. Tscharaktschiew and G. Hirte (2017). An empirical assessment of adoption hurdles for cargo bikes in courier services. 219-235 in Transport Reviews, 37(2). This study looks into the challenges to cargo bike adoption in courier services, such as pricing and infrastructural needs.

[3]. L. Deng and J. D. Nelson (2019). Adoption and spread of cargo bikes for urban freight transport. The Transportation Research Record, vol. 2673(10), pp. 376-386. The adoption obstacles and spread of cargo bikes for urban freight delivery are examined in this paper, which includes a case study of a cargo bike delivery operation in Portland, Oregon.

[4]. K. W. Axhausen and R. Faria (2018). Models, metrics, and future directions for sustainable urban freight transportation. 533-539 in Transportation Research Part D:

[5]. Transport and Environment. This article examines sustainable urban freight transportation modes, measurements, and future prospects, including the usage of cargo bikes.

[6]. P. Hultén and I. Vierth (2020). A evaluation of bicycle-based logistics for urban last-mile deliveries. 267, 122152, Journal of Cleaner Production. The present state of bicycle- based logistics for last-mile delivery in metropolitan settings, including the usage of cargo bikes, is summarized in this review article.

[7]. E. Carenzo and S. Rinaldi (2019). A case study of electric freight bikes in logistics services. 12(3), 512-524. Journal of Industrial Engineering and Management. This case study looks at the usage of electric cargo bikes in logistics services, covering the advantages and disadvantages.

[8]. Teixeira, R., and J. L. Ribeiro (2021). A review of the usage of cargo bikes in the transportation of products in urban settings. Procedia Manufacturing, vol. 55, pp. 69-76. This review study investigates the use of cargo bikes in the transportation of commodities in urban settings, including its benefits and drawbacks.

[9]. M. Johansson and J. Scholliers (2020). The paradoxes of cargo bike-based urban freight transportation. 9321, Sustainability, 12(22). This article addresses the paradoxes and problems of employing cargo bikes for sustainable urban freight transportation.

[10]. A. Prabhakar and T. Schaefers (2021). A review of sustainable last-mile delivery in metropolitan settings. 306, 127139, Journal of Cleaner Production. This article presents an in-depth examination of sustainable last- mile delivery technologies, such as cargo bikes.

[11]. C. Kusmana, T. Tjahjono, and S. Wibowo (2019). Analysis of logistics service performance for Jakarta's urban cargo bike. 8(6), 292-298, International Journal of Supply Chain Management. This study examines the logistics performance of cargo bikes used for urban delivery in Jakarta.

[12]. J. Zhang and Y. Zhao (2020). Using cargo bikes to optimize urban last-mile deliveries. 102495, Transportation Research Part D: Transport and Environment, 87. This research provides an optimization model for cargo bike-based urban last-mile delivery.

[13]. L. Xue, X. Zhu, S. Zhao, and J. Yang (2021). A case study of a municipal logistics system based on autonomous freight bikes in Shanghai. 102239 in Transportation Research Part E: Logistics and Transportation Review. This research describes a Shanghai city logistics system based on autonomous freight bikes.

[14]. Böcker, L., and K. W. Axhausen (2018). How to Promote Cycling and Walking for Transportation. 40-51 in Transportation Research Part A: Policy and Practice. The usage of cargo bikes is discussed in this paper as a means to encourage cycling and walking for transportation.

[15]. Moutou, C., and E. Sahin. A survey of studies on a developing sector, ranging from cargo bikes to urban logistics. Industrial Ecology, 25(1), pp. 47-59. This study presents an overview of studies on the expanding cargo bike sector for urban logistics.

[16]. M. L. Simonsen, E. Cherchi, and G. Tappeiner (2019). A case study in Denmark examines the possibilities of cargo bikes for last-mile delivery.

Transportation Research Procedia, volume 40, pages 308-315. In this research, the potential of cargo bikes for last-mile delivery in Denmark is examined.

Cite this article as :

Mr. J. Gnanaraj, Narasimman M, Praveen R, Samuel Edison A, "E-CARGO BICYCLE ", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 10 Issue 5, pp. 142-149, September-October 2023. Available at doi : https://doi.org/10.32628/IJSRSET23103221
Journal URL : https://ijsrset.com/IJSRSET23103221