



# The Rise of Electric Foldable Cycles: A Sustainable and Efficient Solution for Urban Commuting

Aakash Goel<sup>1</sup>, Vishwjeet Singh<sup>2</sup>, Harsh Kumar<sup>3</sup>, Mr. Arun Kushwaha<sup>4</sup>,

Dr. Shailendra Tyagi<sup>5</sup>, Dr. Amit Saxena<sup>6</sup>

Student<sup>1,2,3</sup>, Assistant professor<sup>4</sup>, Head of Department<sup>5</sup>, Professor and Principal<sup>6</sup>

Mechanical Engineering Department

<sup>1,2,3,4,5</sup>Meerut Institute of Engineering & Technology, Meerut, Uttar Pradesh, India

<sup>6</sup>IPS Academy, Jhabua, Madhya Pradesh, India

**Abstract:** With the increase in urbanization, traffic congestion and environmental pollution have become significant issues in many cities worldwide. Electric foldable cycles are an innovative solution that provides a sustainable and efficient mode of transportation for urban commuting. Electric foldable cycles have become a popular mode of transportation due to their versatility, convenience, and eco-friendliness. This paper provides an overview of electric foldable cycles, including their history, design, features, and benefits. The paper also discusses the current market trends and future outlook for electric foldable cycles. This paper aims to examine the rise of electric foldable cycles as a popular and viable option for urban mobility. The paper reviews the current market trends, advantages and disadvantages, technical specifications, and future prospects of electric foldable cycles.

**Keywords:** Electric Foldable Cycle, Pollution, Urban Commuting.

## Introduction:

Electric foldable cycles are a type of electric bike that can be easily folded and stored in small spaces. They are becoming increasingly popular due to their convenience and eco-friendliness. Electric foldable cycles are ideal for urban commuters, college students, and travelers who need a compact and portable transportation solution. Urban commuting has become a significant challenge due to the increasing population, limited road space, and environmental pollution. Traditional modes of transportation, such as cars and motorcycles, are not sustainable and efficient for daily commuting. Electric

foldable cycles have emerged as a practical solution to address the challenges of urban mobility. Electric foldable cycles are compact, portable, and eco-friendly, making them an ideal choice for short-distance commuting.

Foldable bicycles are available within the market, but are expensive since they're being imported. There are only a few recognized foldable bicycle manufacturers in India. Hence we seized the chance to produce a coffee cost, locally manufactured foldable bicycle. The study on the aspects of materials, properties and style of folding bicycle frames was performed. The fatigue

problem is usually considered because of the main problem regarding the properties of the materials.

## History:

The concept of a foldable bicycle dates back to the late 1800s. In 1892, Mikael Pedersen invented a folding bike that used a triangular frame design. This design became the basis for many of today's foldable bikes. However, it was not until the 21st century that electric foldable cycles became a reality. With advancements in battery technology, electric motors, and lightweight materials, electric foldable cycles have become more practical and efficient.

## Literature Review:

Shishir S, Manjunath P, Pavanasudan R, Ravi Sathyajith (June 2015) “Design and Fabrication of Foldable Bicycle”.

Shlok Desai, Kavan Mehta, ZinalKheni, Naitik Bhatt, Rahul Patel (May 2019) “Design, Analysis and Fabrication of Foldable Electric Bike”.

Morteza Hanifezade and Arian Ashrafi (April 2014) “Folding and Self-Propelling Bicycle”.

AnopMundel, Ashwani Gupta, Devansh Dixit, Ganesh Patel, Mayank Aggarwal, Ajay Kumar Dhanopia (2017) “An Introduction to the Design of Foldable E-Bike for Clean& Safe Travelling in Smart Cities”.

Design and Fabrication of Foldable E-Cycle with Self Rechargeable Battery, IRJET , Volume: 08 Issue: 07 | July 2021

## Recent Developments

A foldable bicycle was patented by Keun. Soo Yun of Seoul in 2011. The objective of this invention is to provide a foldable bicycle in which folding structures are formed in such a way that volume get reduced to high extent. Also, to improve riding comfort through the interaction of weight of human body and weight. In 2016, Ford Global Technologies patented a foldable electrical bike which seems to be a combination of three parts, viz. front wheel assembly, rear wheel assembly and frame. The front wheel gets folded into the frame and the whole frame slips into the rear wheel assembly on folding. In this way, the cycle is compacted. But this mechanism is very precise and needs high level of calibration. Then in 2017, a company named Beijing Onemile Technology Co. Ltd. patented a foldable bike which worked on very complex mechanism. It also consisted of a separate foldable frame. This cycle is the most recent patent in the field of foldable bikes, though it is not electric.

### 1. Raleigh Stow E Way

This bike can be folded into 90x50x70cm<sup>3</sup> and can run up to 24 miles in single charge. It uses Lithium ion battery and it is inside the frame, also it is very good looking. It costs around £1350 (approx. 1 lakh INR).



## 2. Whoosh Gallego

This cycle comprises of a 270 WH Li-ion battery. It takes just 15 seconds to fold up and it can be rolled after folding. Two smaller wheels are attached for this purpose. It is a value bike and costs about half of the previous one. Cost - £669 (about 53000 INR).



## 3. A2B Kuo

This bike is quite advanced than the previous ones. It consists of an electronic display which shows the level of battery used. The battery is placed inside the seat tube and it takes about 6 hour to charge for 25 miles. It costs £999 (about 80000 INR).



## 4. BH Emotion Neo Volt Sport Lite

This bike looks very simple but it has very good power. It can also be assisted by pedals and it can reach up to 20mph speed. But this model is very costly, around £2199 (around 175000 INR).



## 5. Free Go Folding

This model is focused at large distance travel. It consists of a 16Ah battery. Some of the salient features are head lamp and front disc brake. Though, it is very heavy around 22 kg. It costs £1,099 (around 88000 INR).



It is also observed that Foldable Electric Bikes are quite popular in foreign market but in Indian market this product is not that popular. But with time it is becoming popular in India also. Considering the affordability by Indian markets, the bike we have fabricated is hybrid i.e. manual and electric both. This would save money and reduce the overall price of the bike.

**Design:** Electric foldable cycles come in a variety of designs, but they all share the same basic features. They typically have a lightweight aluminum frame, small wheels, and a foldable handlebar and pedals. The battery and motor are usually located in the center of the frame or in the rear wheel hub. Some models also have suspension systems to improve ride comfort. So after reviewing many papers we have fabricated this electric foldable cycle, whose design is as follows (in real image)

Cycle Dimensions are: - 162 X 112 X 62 cm.

Price: - 25000 INR.





Fig: Unfolded Electric Foldable Cycle



Fig: Folded Electric Foldable Cycle

### Technical Specifications:

Electric foldable cycles come in different sizes, shapes, and technical specifications. Most electric foldable cycles have a compact design, with wheels ranging from 16 to 20 inches in diameter. They are powered by a lithium-ion battery that can provide a range of 20 to 60 km per charge, depending on the model. The motor power ranges from 250 to 750 watts, with a top speed of 25 km/h. Most electric foldable cycles come with features such as LED lights, digital display, and adjustable seat height.

## Comparison of Material Properties:-

	Modulus of Elasticity (Gpa)	Yield Strength ( MPa)	Tensile Stength (MPa)	Fatigue Strength at 50,000 Cycles (MPa)	Density (Kg/M <sup>3</sup> )	Weldability and machinability	Cost (Rs Per Kg)
Aluminium ( 6061-T6)	71	192-290	240-321	74	2700	Good	310
Steel - 4130	204	782-1010	645	245	7800	Good	200
Titanium - G9	90-95	432-610	620-745	250	4490	Fine	6000
Carbon Fiber	274-420	Vary	Vary	Vary	1800	Fine	Depends

## Benefits:

Electric foldable cycles offer several benefits over traditional bicycles and cars. First, they are faster than traditional bikes, thanks to the electric motor. Second, they are easier to ride, particularly uphill or over long distances. Third, they are more convenient than traditional bikes, thanks to their foldability. Fourth, they are more cost-effective than cars or traditional electric bikes, both in terms of purchase price and ongoing maintenance costs. Fifth, they are eco-friendly and emit zero emissions. Electric foldable cycles have several features that make them a popular transportation option. First, they are eco-friendly and emit zero emissions, making them a great option for people who are concerned about the environment. Second, they are convenient and portable. They can be easily folded and stored in small spaces, making them ideal for people who live in small apartments or dorm rooms. Third, they are cost-effective. Electric foldable cycles are cheaper than cars or traditional electric bikes, and they require less maintenance.

## Market Trends:

The global market for electric foldable cycles has witnessed significant growth in recent years. The market for electric foldable cycles is growing rapidly. According to a recent report by ResearchAndMarkets.com, the global market for foldable electric bicycles is expected to grow at a compound annual growth rate of 8.6% from 2021 to 2026. The report cites the increasing demand for eco-friendly and portable transportation solutions as the primary driver of the market growth. According to a report by Grand View Research, the market size for electric foldable cycles was valued at USD 15.4 billion in 2020 and is expected to reach USD 28.6 billion by 2028, growing at a CAGR of 8.6% from 2021 to 2028. The rise in demand for sustainable and eco-friendly transportation options is one of the primary factors driving the growth of the electric foldable cycle market.

## Advantages and Disadvantages:

Electric foldable cycles have several advantages over traditional modes of transportation. They are portable, easy to store, and require minimal space for parking. They are also eco-friendly and do not emit harmful pollutants into the environment. Additionally, electric foldable cycles are cost-effective, as they do not require fuel, and have lower maintenance costs compared to cars and motorcycles.

However, electric foldable cycles also have some disadvantages. They have limited battery life and range, which restricts their usage to short distances. They are also not as fast as traditional modes of transportation and may not be suitable for long-distance commuting. Additionally, they may not be comfortable for riders with specific physical conditions.

### **Future Outlook:**

The future prospects for electric foldable cycles look promising and bright. With the increasing demand for sustainable and eco-friendly transportation options, electric foldable cycles are likely to gain more popularity in the future. The development of advanced battery technology and lightweight materials is expected to enhance the performance and portability of electric foldable cycles. As battery technology continues to improve, electric foldable cycles will become more efficient and have longer ranges. Additionally, the integration of smart technologies such as GPS tracking and mobile connectivity is likely to increase the convenience and safety of electric foldable cycles.

In addition, as more people adopt eco-friendly and portable transportation solutions, the market for electric foldable cycles is expected to continue to grow.

### **Conclusion:**

Electric foldable cycles are a sustainable and efficient solution for urban commuting. Electric foldable cycles are a versatile, convenient, and eco-friendly transportation option. They offer several benefits over traditional modes of transportation bikes and cars, including faster speeds, easier rides, and lower costs. They offer several advantages over and are becoming increasingly popular worldwide. Although they have some limitations, the future prospects for electric foldable cycles look promising, with the development of advanced technology and increasing demand for sustainable transportation options. With the market for electric foldable cycles growing rapidly, and improvements in battery technology on the horizon, the future of electric foldable cycles looks promising.

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