



Free-Fly Bicycle: A Review.

Amit V Shah ^{1*}, Henil Modi ²

¹Mechanical Department, Shri S'ad Vidya Mandal Institute of Technology, India.

²U. G. Student Mechanical Department, Shri S'ad Vidya Mandal Institute of Technology, India.

ABSTRACT: Global warming & climate changes have triggered a global effort to reduce the concentration of atmospheric Carbon Dioxide (CO₂) & other greenhouse gases. There have also been energy crises, since fossil fuels are limited in resources & are main source of pollution. This has forced people to follow non-conventional sources of energy like solar power, wind energy, etc. but today's economy is addicted to fossil fuels. As economic growth & increasing world population require more & more energy, we cannot stop using fossil fuels quickly. Thus, this is our small effort to create a small recharging electrical system simply attached to any bicycle which converts it into an electrical vehicle & helps to not only to solve the problem of pollution caused because of fossil fuels but also will help people to create an awareness about being healthy plus will also help to control problems related traffic congestion, over speeding, etc. The motive of the system is to generate power from the pedalling system through dynamos & then store it in the batteries & then again supply that power to motor which will run the bicycle. If user doesn't want to run bicycle on motor for a period s/he can simply utilised that generated power to other various purposes.

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1. Introduction

An electric bicycle, also known as an e-bike or booster bike, is a bicycle with an integrated electric motor which can be used for propulsion. There are a vast variety of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power (i.e., peddles) to somewhat more powerful e-bikes which tend closer to moped-style functionality: all, however, retain the ability to be pedalled by the rider and are therefore not electric motorcycles. E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 32 km/h (16 to 20 mph), depending on the laws of the country in which they are sold, while the more high-powered varieties can often do more than 45 km/h (28 mph). In some markets, such as Germany, they are gaining in popularity and taking some market share away from conventional bicycles, while in others, such as China, they are replacing fossil fuel-powered mopeds and small motorcycles. In today's world, the biggest problems that the world is facing are:

1. Pollution.
2. Energy crisis.
3. Increasing fuel prices.
4. Chronic diseases.

The problems which we are trying to solve are: -

* Corresponding author e-mail: amit.shah706@gmail.com
Tel.: +91 9033981505

1. Vehicular emissions.
2. Health problems.
3. Fitness problems.
4. Traffic congestions.
5. Dependency on fossil fuels.

2. Research Paper Review

1. In **2001, Michael Mazgaonkar at all**, performed an experiment in which they generated the power by pedalling by using 40 Amp car alternator produces 6 Amp at 90 rpm speed. Further they again setup a modern design by using 40 Amp/hour with LED indicator & ampere metre with reduced speed to 40-60 rpm. They found that the cost for producing the electricity was somewhat more around Rs. 9500 that group of people can used this system. ^[2]
2. In **2007, Annette Muetze at all**, work on changing electric bicycle system as a platform to improve electric bicycle performance by using new drive systems i.e. key parameters that will result in improvement of the system performance. It also provides brief idea about power requirement, speed & load (Weight of rider & bicycle). ^[15]
3. During **2008-09, Carlos Tovar**, studied various possible designs for the e-bike to make it compact, eco-friendly, budget-friendly & efficient. In this paper, he came up with all the various possible ideas that are suitable as per Swedish citizens. ^[20]
4. In **2011, Brandon Hayes at all**, had experimented on a small-scale bicycle power generation system in which they utilised a Ford 3G alternator (Both 95 & 135 amps) & generate power by combining it with the bicycle & utilise the pedalling power into electricity. They produced a supply of a battery array with a 24-volt DC output with low production cost (around \$ 200) & high safety. They found that for high efficiency of the alternator the speed must be greater than 1500 RPM. ^[1]
5. In **2012, Ian Vince Mcloughlin at all**, were inventing the electric bicycle for the campus mobility in which they inculcated brushless DC motor which is mounted on either front or rear wheels for producing electricity. They also come with a modern technology that they provided navigation facilities for each system for the campus they invented for with android touchscreen. As bicycle required 200-250W continuous pedalling was required. So not accepted by most of the people. ^[6]
6. In **2013, Swapnil Shringarpure at all**, had experimented Automated Bicycle. development of electric bicycles which can be implemented as an alternative to the two wheelers consuming large amount of fuel & polluting the environment. To cope with the lightning speed of life these days quick transportation has been one of the key factor, in one way the fast transport provides us with the modern needs of life, but on the other side the it has resulted in increased consumption of fuels & played a crucial role in increasing pollution. research done in this paper is limited to making a prototype of electric bicycle the same can concept can be applied to a bigger cycle with taking many factors into consideration & keeping the basic logic same. ^[21]
7. In **2013, Minas Roukas**, work on Development of the control system for an electric vehicle as a platform to construct EDV as a demonstration Vehicle & for testing modern technologies. It also provides control allocation for control system by providing desired speed & reduce oscillation. They also performed various simulation test for required trajectory for movement of vehicle. ^[17]
8. In **2014, Ting Zhen Ming at all**, had experimented the Fighting global warming by climate engineering: Is the Earth radiation management & the solar radiation management any option for fighting climate change. The best way to reduce global warming is, without any doubt, cutting down our anthropogenic emissions of greenhouse gases. But the world economic is addict to energy, which is mainly produced by fossil carbon fuels. ^[7]
9. In **2014, Vivek V Kumar at all**, have worked on design & implementation of electric assisted bicycle with self-recharging mechanism. They had used a PMDC motor, flywheel, housing, multi-crank free-

wheel, sprockets, batteries & control system for the purpose. The motor utilizes an effective discharge of 12 V & 14 A from the battery. But it was noticed that with increase in the effective speed the current drops to 1.077 A. ^[8]

10. In **2014, Rahul Sindhwani at all**, have theorized the basic requirement to increase the efficiency of the e-bike. They represented the improvement of 50% in efficiency of e- bike with hub motor incorporated in the rear wheel for producing the initial torque required to set the vehicle from rest to motion & main motor incorporated along with the chain drive for further power transmission. ^[14]
11. In **2014, Dennis Y.C. Leung at all**, has mentioned the global challenge that we are facing due to increase exhaustion of carbon dioxide in world. They setup different technique to clean & use the carbon dioxide present or released from the vehicles. Depending upon the type of fuels the different techniques such as absorption, adsorption, chemical looping, etc. are used to reduce the carbon dioxide getting from the vehicles. By converting to a new energy resources, we can save the earth from global warming. ^[22]
12. In **2014, Chetan Mahadik at all**, work on changing electric bicycle system as a platform to improve electric bicycle performance by using new drive systems. They used 750 W BLDC (BRUSHLESS DC) motor as well as Dry cell Battery (48V 33Ah). They also used PIC16F72 controller to control over current protection, under voltage protection etc. ^[12]
13. In **2015, Arun Alias at all**, worked on energy efficient hybrid electric bike with multi-transmission system conclude that the hybrid bike can be powered by dual source such as gasoline & electricity. Compared to ordinary bikes this hybrid bike is more efficient & economic. This hybrid bike will be an innovation in automotive era. ^[10]
14. In **2015, Ivan Evtimov at all**, had constructed an experimental electric bicycle for evaluation of the energy efficiency. In this experiment, they studied 3 typical city routes of the city Ruse of Bulgaria. It was indicated that depending on the conditions of moving & the slopes of the streets, the regeneration of energy varies from 6 - 14 %. During their experiment, they covered 215 km with the average regeneration of 5.5%. The Less will be the braking & acceleration the more will be the regeneration. They also found that the use of these electrical bicycle by 1 person can reduce pollution up to 15 times compared to the conventional cars. ^[6]
15. In **2015, Chris Cherry**, has researched the safety of E-bike riders. In this study, there is no method of experiment they just study the reasons which leads to maximum E-bike accidents at various places during a day. They set the study research by their own seeing the different intersections on roads. They also determine the speed at which people were driving E-bike by speed sensing devices. They concluded that E-bike rider injuries are more severe than bicyclist injuries due to collisions & high speed not able to control (40% of speed difference was found). They found that head injurious were more so to reduce it they recommend helmets. ^[16]
16. In **2016, Yogesh Jadhav at all**, had proposed 3 diverse ways of self-charging electric bicycle's design, construction & parts. The first method was of the utilization of solar panels & cells, the second method was motor controller with BLDC & the third method was of dynamo system. They discussed all the possible ways & possible outputs of the 3 different methods. They proved that it is possible to build a bicycle with 3 separate charging sources. ^[3]
17. In **2016, Tanja N. Manders at all**, they setup a frame named LTS - (Large Technical Systems) to shift from highly visible artefacts to sociotechnical systems. In this system, they tried to change from nuclear reactors/hydroelectric dams to electric supply system. They produced different MW of electricity from different elevation high for small to substantial number of people. ^[18]
18. In **2016, Mohammad Reza Maghami at all**, had experimented the amount of power loss due to soiling on solar panel. They found that dust reduces output power from PV between 2% to 50% in different areas. Based on daily, monthly, seasonal & annual basic. Thus, they proposed to clean the PV module from dust accumulation on daily basis to reduce the power loss. ^[9]
19. In **2017, S. T. Wankhede at all**, had experimented the Multi Charging Electric Bicycle. Electric bicycles with may be addressed by custom-designed drives that are most efficient over a given operating cycle.

Also, we take PIC16F72 controller & this controller has function of over-current protection. Experiment turned out controller has better dynamic characteristics & run steadily. ^[19]

20. In **2017, Kunjan Shinde**, worked on electric bike as it is a modification of the existing cycle by using electric energy & solar energy if solar panels are provided, that would sum up to increase in energy production. With the increasing consumption of natural resources of petrol, diesel it is necessary to shift our way towards alternate resources like the electric bike & others because it is necessary to identify new way of transport. The operating cost per/km is very less & with the help of solar panel it can lessen up more. ^[13]

Conclusion

Through the study of all the research papers we conclude that the E-bike are the future of vehicles. Brushless DC motors are the most efficient of all the 3 motors (Brushless DC motors, alternators or dynamo) & can be easily retrofitted in any cycle converting the cycles into electric bike. With the help of batteries & a solar panel these motors can be run easily. Use of DC permanent magnet will make the bicycle stationary like a gym cycle, but it generates enough energy to utilize it for various purpose. The big idea about converting the cycles into e-bike is that it will force people to utilize the pedaling system of cycle at certain point of time which will help them to be in shape & be healthy & apart of all these cycles do not consume any fossil Fuels which will help to reduce the vehicular emission.

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