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BICYCLE FOR TRANSPORTATION – PAST, PRESENT, FUTURE

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Abstract - *Bicycles, being an integral part of our lives provide an easy and reasonably-priced method of transportation for a number of people all over the world. And to fulfil this demand every year about 50 million bicycles are manufactured. But, this mode of transport is no longer as widespread as it used to be because many inventors worked hard on the manufacturing of various two-wheeled vehicles in the past years that proved to be easier and effortless to use. However, due to vast usage of such vehicles in the recent times there are various other issues and threats that are attached to their usage. Some of them are depletion of natural resources, environmental harm, unhealthy lifestyle and cost ineffectiveness to meet demand. Due to these reasons the bicycle trend is regaining with many advancements and improved technology giving it a new outlook as an electric bicycle to stand out as a transportation method used. This paper studies the different trends bicycles have taken over time and throws light on how the latest of these can be a solution to today's issues of vehicular usage. It also highlights the approach to adapting to the future on a basic scale.*

Key Words: **electric bicycle, two-wheeled vehicle, transportation, bicycle trends, future.**

1. INTRODUCTION

Bicycles have been present since the 1500's, but the new generation bicycles were invented only in the late 1800s. In 1817, Karl Drais designed a new generation of bicycles which has been developed and readjusted by other designers over time. The big evolution was in the 1860s which let bicycles become more common around the world. In the 1880s and 1890s, safety bicycles were invented whose main aim was to decrease the danger of bicycle accidents. [1] In the 20th century, more developments have been applied to bicycles in chain and gear mechanisms. In the recent times, due to technological advancements the manufacturing of bicycles has become more effective and efficient in design based on aerodynamics and materials used by usage of CAD and Analysis Software's. [2].

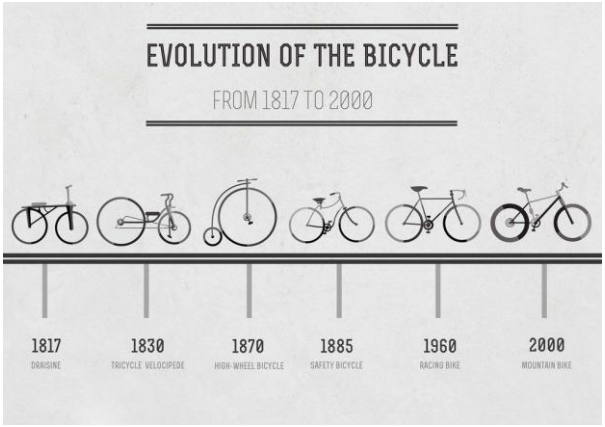

Fig - 1: Evolution of Bicycle from 1817 – 2000 [3]

1.1 . Bicycle development in India–

The Bicycle industry in India took birth in about 1938, when the 2nd world war was on the verge. Initially the Indian cycle manufacturing companies were set up for producing spares and accessories. Till the indigenous production was started in 1943, the British cycles were used by the Indians. In 1943, it was decided to establish a Cycle Manufacturers' Association, to co-ordinate activities for the production problems, and to freeze foreign competition and made it mandatory to standardize Indian manufacture to help boost the economy. [4] India now is the second largest manufacturer of bicycles in the world behind China, with around 12 million units produced annually with new designs, colors, features and schemes coming out almost every day. Also, India produces around 10% of the overall global production.

Major bicycle industries in India are Hero Cycles, Avon and Atlas with Hero Cycles being the largest bicycle manufacturer in the world.

Because of the vastness of the country, the congestion in cities, the threat of population growth and the chaos in urban transport, bicycle is an ideal mode of transport from the point of view of cost and convenience to a number of people in cities and villages. In this view, the bicycle is an easy on pocket vehicle which every Indian household should have.

1.2 Trends in bicycle usage

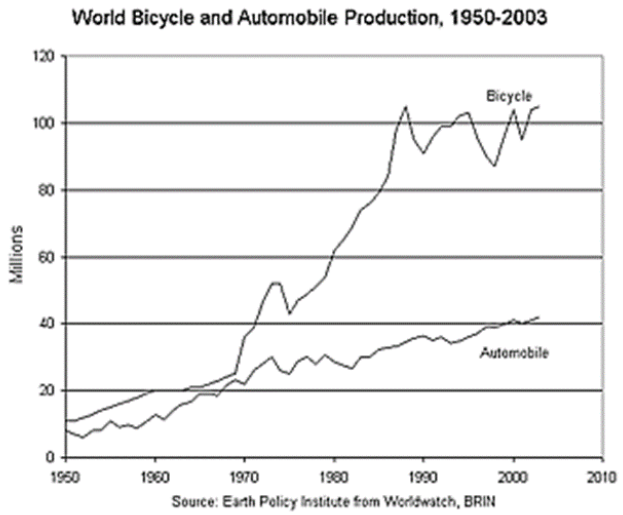

Chart - 1: Comparison between Production of Automobile and Bicycle [3]

Country	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
India	5.3	8.4	8.8	9.0	9.9	10.5	11.5	11.3	11.0	10.5	11.0	11.0
China	41.0	31.9	36.8	40.3	41.0	42.0	41.0	38.0	30.0	23.1	42.7	52.2
Germany	2.9	3.9	4.9	4.6	3.5	3.2	2.9	2.8	3.2	3.2	3.2	3.2
Italy	1.6	3.5	3.6	4.1	5.2	5.8	5.3	4.0	4.0	3.0	3.3	3.2
Japan	7.8	8.0	7.5	7.3	6.9	6.7	6.6	6.1	6.0	5.9	5.6	4.7
Taiwan	9.9	6.8	7.7	7.5	7.9	9.2	9.7	7.4	11.9	10.1	8.3	7.5
United Kingdom	1.2	1.3	1.2	1.2	1.1	1.2	1.2	1.2	1.3	1.2	1.3	1.2
United States	5.8	5.6	7.6	8.9	7.7	7.3	8.8	8.0	6.0	2.5	1.7	1.1

Fig - 2: Bicycle Production of few selected countries (in millions) [3]

The above graph shows, in around 1965, global production of cars and bicycles were essentially the same with both at nearly 20 million. The irregularity in sales between 1980 and 2000 was caused by a world-wide drop in economy due to famines hit in various parts of the globe and many countries raging in war, but in 2003 bicycle production had climbed to over 100 million annually compared to 42 million of cars. Bicycle production was 105 million units globally in 2004, which was 1.5% increase over 2003. The use of bicycles has made it easier for day-to-day travel also due to the increase in fuel prices, pollution and the sense of keeping oneself healthy and fit has made this industry boom. [5] But between 2006 and 2010, there's been a casual drop in the conventional bicycle sales since it was viewed as a recreational vehicle rather than for transportation. People only use recreational vehicles for a short bit before they move onto something else. [6]

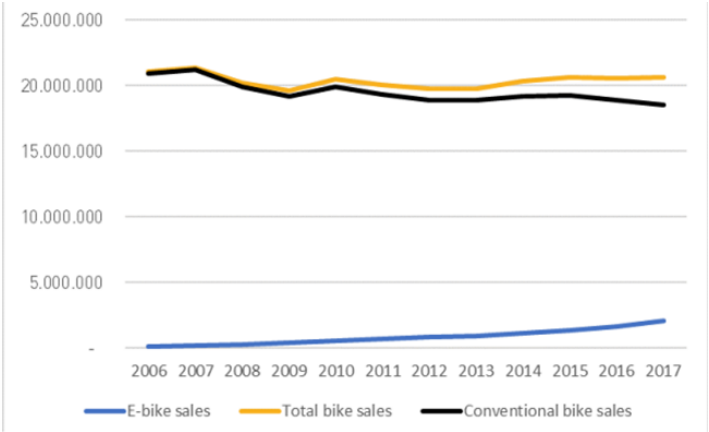

Chart – 2: Units of E-cycles sold vs Bicycle sales over a period of time [6]

Since then the incorporation of the batteries and motor on conventional bikes has been preferred and the production of what is known as "e-cycle" has accelerated to use it for transportation.

Hence, E-cycles are the current trend in use, not only for recreational activities but also for day-to-day activities which has made it popular amongst all age groups.

The following section describes about e-cycles and the ways to obtain it, in brief.

2. ABOUT e-CYCLE

In the recent trend of transportation, major issues in most of the countries are: dense population and environmental hazards that affect movement. The key solution to address the environmental issue is the use of electricity to power the mode of commute and the answer to tap the issue of high population is space compactness. So it goes without say that electric bicycle usage is the most optimum solution to combat both these issues.

Electric cycle or more popularly known as e-bike is nothing but an ordinary bicycle provided with an additional electric power assist to propel the bicycle. [7]

The growing success of use of e-cycles by people, in comparison to conventional bicycle sales, is explained by different factors:

- Effortless to travel longer distances
- Possible to transport and carry greater loads
- Easier to overcome natural obstacles, such as inclines
- Offers a cheaper alternative to company cars
- Saves time spent on travel
- Ideal for recreational activities

3. PROCURING an e – CYCLE

An electric cycle consists of an electric motor which runs it, a battery source which powers it and a controller to balance the output from the battery and the input to the motor based on the requirement. Variations among these can give different versions of electric cycles.

There are two main ways to procure an electric bicycle:

1) Buy a new market ready e-bike.
2) Convert an existing bicycle into an electric bicycle by use of the following components that are compatible:
   a) electric motor
   b) battery for electricity source
   c) electronic controller
   d) throttle sensor and wiring

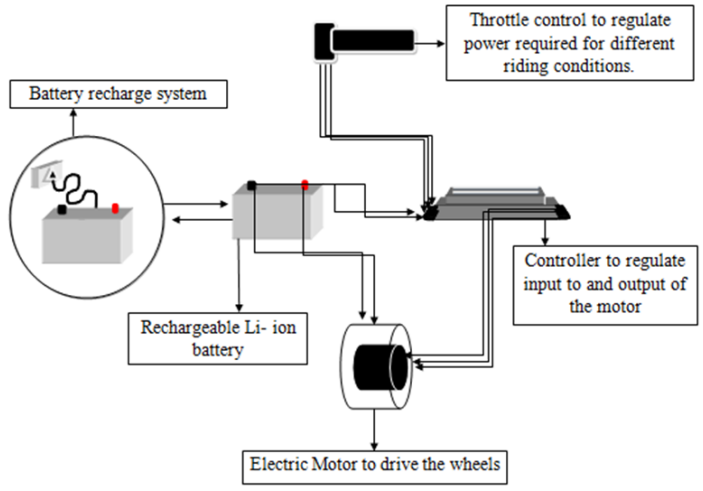

FIG – 3: ELECTRIC PROPEL SYSTEM

- Considering the motor, there are two ways to obtain an electric cycle:
  a) By the use of a motor to drive the driver sprocket.
  This type of system uses a Brushless Direct Current (BLDC) motor to power the bicycle ride. Here an additional sprocket from the motor is used along with the pedal sprocket to rotate the driven sprocket that runs the cycle.

Fig - 4: Mid/ sprocket drive motor

(image courtesy: YouTube - Technical Partha)

(https://www.youtube.com/watch?v=POdQ0vTKt7c)

  b) By use of a motor to rotate the drive shaft at the wheel.
  In this system, an electric hub motor is used that fits into the existing rear wheel of the cycle. Since the motor is connected directly to the drive shaft, when the motor is run the wheel rotates automatically.

FIG - 5: WHEEL HUB MOTOR

(image courtesy: imall.com)

- Regarding the battery used to power the motor, although it is common to use a rechargeable battery that can be charged by any direct current supply as the main source of power, a dynamo can be used along with the battery as an alternative source to reproduce energy in the form of electricity. This energy can be used to either run other electrical gadgets in the cycle or to recharge the battery for storage.

Fig - 6: Li-ion battery for e-cycle

Fig - 7: Dynamo attached to an e-cycle

- The controller used depends upon the rating of the battery and motor that is being used. The electronic controller is the brain to the whole set-up; it

receives input signals from the throttle cable and regulates the motor and battery outputs to give the desired performance. It gives the user indication of the battery status as well.

Fig -8: Functioning of the controller

(image courtesy: elecycles.com)

- The wiring harness connects all of the components to one another for it to function as a system. All the signals are passed through the harness to and from the controller. The throttle is the user end of the system to regulate the desired performance

Fig - 9: Throttle sensor for e-cycle

(image courtesy: Indiamart.com)

4. CONCLUSION

By the understanding of the evolution of bicycles, we can conclude at a strong point that necessity initiates change or improvement. So, the basic need of today is to protect the environment by making eco – friendly means of transportation and also to clear the clutter of peak traffic congestion and land space consumption by creating compact means of transportation. To meet this necessity, e-cycles have come into existence and it becomes a responsibility to adapt to this change in the best way possible as suggested earlier.

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