

DESIGN AND FABRICATION OF ELECTRIC CYCLE

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ABSTRACT

As the worldwide population is growing day by day and there is increasing demand for the product from the manufacturing industry a simple, reliable, eco-friendly, safety, and less costly product. One of them is electric vehicles. One type of such an electric vehicle is the electric cycle (e-cycle). E-cycle typically incorporates a battery, which can be charged at an ordinary domestic power socket, linked to an electric motor in the bicycle transmission system. Increase in fuel price of Petrol bike along with the consideration of the environmental factors uses a bicycle over a motor vehicle for short distance traveling. The rider has the power to controls the output power from motor i.e. speed using a handlebar mounted throttle and controller. The term 'e-bike' is generic and includes a combination of different electrically powered two-wheelers some of which function by simply turning a throttle. In this paper, a comparative and in depth study of supporting component of the electric cycle is carried out. This project is based on a combination of the standard geared bicycle with an electric power motor. The system is modified in such a way that the rider can make choice of which mode he prefers i.e. he can either choose the bicycle to be driven completely with the electric motor or he can choose it to be driven manually by himself.

Keyword: - Cycle, Electric cycle, Battery, Eco-friendly, transportation, Pollution, etc.

1. INTRODUCTION

As worldwide population is growing day by day and there is increase in manufacturing and using of fuel powered. This vehicle require fossil fuel to run and it a limited source of energy which will be over after some period and to cop up with this need, the revolution for the eco-friendly cycles were the most depended modes of transportation, along with this the consideration of the increase in fuel price and the environmental factors we must admit that it is far more better to use a cycle over a motor vehicle for short distance travelling. Imagine how useful would the cycle be if even the small effort applied by man for riding on rough terrain. This project is based on combination of the standard geared cycle with an electric power motor. The system is modified in such a way that the rider can make choice of which mode he prefers i.e. he can either choose the cycle to be driven completely with the electric motor or he can choose it to be driven manually by himself. The idea of mounting the motor and it's support assembly onto a geared cycle was to reduce the effort to-be applied for extra little weight that the rider will have to take along with the cycle. The unit has been designed in such a way that people of any age group can depend on it. Our idea of implementation of the project was mainly biased towards providing inter college transportation. E-Bicycle typically incorporates a battery, which can be charged at an ordinary domestic power socket, linked to an electric motor in the Bicycle transmission system. The rider have the power to controls the output power from motor i.e. speed using a handlebar mounted throttle and controller. The term 'e-bike' is generic and includes a combination of different electrically powered two-wheelers some of which function by simply turning a throttle. This Bicycle is designed and made in very less cost as compared to original cost, so any one can afford this Bicycle. As we know that due fuel powered vehicles, the emission of toxic gases is increasing day by day, due to this 4.3 million people

die or survive from dangerous diseases all over the world. To overcome this problem and to travel from one place to another an ecofriendly Bicycle with manually and motor power controlled Bicycle is made with all the accessories similar to bike. E- Bikes are difficult to compare directly across different types. Normally in every electric Bicycles there are two common parts which is consider while making it i.e. motor and manually operated paddle. Our Bicycle consists of 6 gear speed, through which any person can drive this Bicycle manually with the help of this gears easily without any fatigue. At a same time there is another arrangements is made in which battery powered motor is use to drive the Bicycle. For power transmission from motor shaft to the sprocket chain drive is use. This chain is connected is such a way that it can be fixed according to vary in chain cause due to environmental or mechanical problems which creates tension in chain. Apart from all motor & battery arrangement three is an indicators, tail light, gearing arrangement, horn & front light.

2. LITERATURE SURVEY

The Bicycle, in its present upright form, called a “Safety Bicycle” and introduced by the Rover model in 1885, is a relatively cheap method of extending the range, increasing the speed, and improving the energy efficiency of human powered transport. It can coast down hills, roll easily along the flat, and make use of gearing to tackle steep hills. Many Bicycle alternatives exist, ranging from recumbent models to chunky off-road machines; however the “safety Bicycle” shape remains most common. Electric Bicycles, with more than a century of commercial history (the first patents for electric Bicycles were granted in the 1890s), have long been available, and found adopted in small numbers in many countries. Their relative lack of popularity until recently may be attributed to technological or economic factors, however the fact of their existence means that they are already covered by legislation in most countries. In terms of personal electro-mobility alternatives, there are a plethora of amazing inventions ranging from the Segway, the Yike Bike, Ryno, various electric scooters, skateboards, power skates, and electric quad bikes and so on. Ignoring the fossil-fuelled variants, recent alternatives have been released which are powered by compressed air, flywheel, fuel cell and probably other unusual power sources. However the vast majority of experimental machines use a combination of electrical motor and battery. Battery solutions tend to be limited to the robust but weighty lead-acid cells in cheaper or older systems, through surprisingly few NiMH variants, to Lithium Ion (predominantly LiFePO₄ or LiMn₂O₄ based cells) in more modern and expensive variants. The Segway is one of the most imaginative and innovative personal mobility solutions to have been developed in recent years, with a loyal following of users, and several niche application areas. However the Segway has not attracted widespread adoption on campus to date. General Motors have used the Segway as the foundation for their P.U.M.A. (Personal Urban Mobility & Accessibility) project which effectively adds car-like features to the Segway; a seat, roof and steering wheel. Whilst this is exciting and extremely attractive from a technological point of view, it leads to a very expensive transport solution, requires significant thoroughfare space, and may require licensing for use in certain locations (for example, even the basic Segway is not currently legal for use in public areas within Singapore). Electric quad bikes are likewise expensive, bulky to park and have few advantages over an electric Bicycle. In fact, all of the devices mentioned are expensive, certainly significantly more so than a standard Bicycle, and most work on the premise of simply adding a motive power source to a Bicycle- type system (or scooter/skateboard/skates). However it is by no means certain that lack of such power assistance is the main reason why Bicycles may not have been more widely adopted in many campus environments. Thus, adding motive power alone may not lead to the more widespread adoption of electric Bicycle-type transport.

3. OBJECTIVE

To develop a simple vehicle model and simulation for sizing of powertrain components followed by selection of powertrain components. To propose and develop a simple control strategy for the plug-in hybrid electric two-wheeler suitable for city driving conditions. To assess the annual saving of gasoline and reduction of CO₂ emission for the span of next 10 years. To give the maximum travelling by Bicycle of 15-20 km/hr. without peddling of Bicycle. To reduce the air pollution and too keep our region pollution free and to keep the e-Bicycle noise free. To give benefit of having accessible, affordable and sustainable transportation for customers. To give maximum efficiency with a minimum weight of e Bicycle.

4. SYSTEM DEVELOPMENT

4.1 Designing of Motor Support

a. DC Motor

A brushed DC motor is an internally commutated designed to be run from DC power source. Brushed motors were the first commercially important application of electric power to driving mechanical energy, and DC distribution systems were used for more than 100 years to operate motors in commercial and industrial buildings. Brushed DC motors can be varied in speed by changing the operating voltage or the strength of the magnetic field. Specification is 24 volts and 2700 rpm.



Fig. 1 DC Motor

b. T Slot for Motor Mounting

In many traditional electric Bicycle when Motor is started it gives initial torque very high when we use to transmitted the power of motor to the sprocket through chain then there will be chances of failure of bracket due to motor torque. To overcome this problem a new type or self-design arrangement which is similar to an letter 'T' is done which is shown in Fig. This arrangement is built in such a way that if there is any deflection is there in chain which connects the sprocket can be adjusted by tightening or loosening of nut. On the given 'T' slot Dc motor is fixed with the help of 2 mm thin long strip as shown in fig. The given figure shows the 2 Dimensional view of the motor and T arrangement assembly.

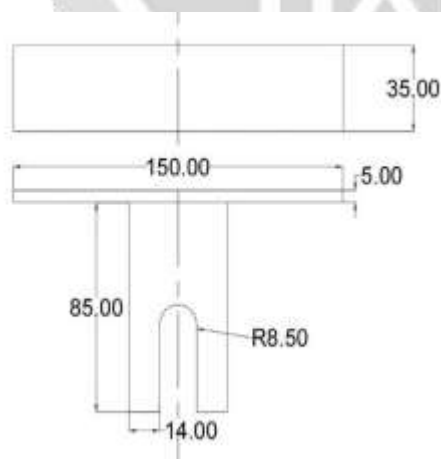


Fig. 2 T Slot



Fig. 3 Mounting

There are many changes and modification has taken place. The motor is mounted on the Bicycle with the help of 'T' arrangement as shown in Fig. The reason behind this arrangement is that there is high initial torque of motor due to which another arrangement failed in front of this motor torque .this arrangement is bolted to the Bicycle axel with the help of 6mm ID nut and wiser. But the motor having very high initial torque there the arrangement is welded at the end of resting face of motor. As it is shown the battery is located in the middle of Bicycle, there are two batteries with rectangular frame to hold the battery properly due to which it can be easily fixed or removed. Natural cooling is provided hence it is safe. Below the batteries there is ECU is placed with the help of nuts and it is mounted with black cello tape which will prevent it from dust & water. ECU consists of all the electrical connection from key port to motor. Apart from battery and motor there are many connections are done.

4.2 Battery

Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electrode materials and electrolytes are used, including lead-A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times. This battery is mounted on a rectangular frame made up of mild steel strips. As motor require 24V voltage therefore 2 batteries are connected in series.



Fig. 4 Battery

4.3 Accessories

a. Tail Light and Indicator

LED tape lights are a versatile solution for bias lighting, under stair lighting, railing lighting, under cabinet lighting, pathway lighting, cove lighting, and so much more. It's available in a variety of solid colors or RGB color changing kits when paired with an RGB controller. LED tape light can be used to reduce the energy consumed to light display cases or closets while also reducing the heat put off by puck lights or traditional overhead lighting.



Fig. 5 Tail Light and Indicator

b. Front Light and Horn

Bicycle lighting is illumination attached to Bicycles whose purpose above all is, along with reflectors, to improve the visibility of the Bicycle and its rider to other road users under circumstances of poor ambient illumination. A secondary purpose is to illuminate reflective materials such as cat's eyes and traffic signs. A third purpose may be to illuminate the roadway so that the rider can see the way ahead. White LEDs have a higher luminous efficacy than halogen lights and are sufficiently powerful to provide the front light for a Bicycle.



Fig. 6 Front Lights and Horn

c. Speedometer

Typical Bicycle speedometers measure the time between each wheel revolution, and give a readout on a small, handlebar-mounted digital display. The sensor is mounted on the bike at a fixed location, pulsing when the spoke-mounted magnet passes by. In this way, it is analogous to an electronic car speedometer using pulses from an ABS sensor, but with a much cruder time/distance resolution - typically one pulse/display update per revolution, or as seldom as once every 2–3 seconds at low speed with a 26-inch (2.07m circumference, without tire) wheel. However, this is rarely a critical problem, and the system provides frequent updates at higher road speeds where the information is of more importance. The low pulse frequency also has little impact on measurement accuracy, as these digital devices can be programmed by wheel size, or additionally by wheel or tire circumference in order to make distance measurements more accurate and precise than a typical motor vehicle gauge.



Fig. 7 Speedometer

d. GPS Tracking System

A GPS tracking unit is a navigation device normally carried by a moving vehicle or person that uses the Global Positioning System (GPS) to track the device's movements and determine its location. The recorded location data can either be stored within the tracking unit or transmitted to an Internet- connected device using the cellular (GPRS or SMS), radio, or satellite modem embedded in the unit. This allows the location to be displayed against a map backdrop either in real time or when analyzing the track later, using GPS tracking software. Data tracking software is available for smartphones with GPS capability. A GPS tracking system uses the Global Navigation Satellite System (GNSS) network. This network incorporates a range of satellites that use microwave signals that are transmitted to GPS devices to give information on location, vehicle speed, time and direction. So, a GPS tracking system can potentially give both real-time and historic navigation data on any kind of journey.



Fig. 8 GPS System

e. Charging System

Electric chargers are used for recharging the battery. There are different kinds of chargers which are suitable for different batteries. Every new electric Bicycle should come with its own designated charger. Proper charging will ensure a long battery life. Plugging in the charger will recharge the battery to full capacity at any time. You can partially charge and disconnect the battery even if the green light has not come on and use the battery, just be aware that you will not have a full charge capacity. You can charge the battery when it disconnected from the e-bike, and you can charge the battery when it connected to the bike just be sure that the e-bike is not turned on. The electric Bicycle charger standard power-source is the wall AC socket. But, because of the very low power demands of a typical e-bike, other alternative sources of energy can also become handle.



Fig. 9 Charging Socket



Fig. 10 Charger

f. Electronic Control Unit

Digital technology furnishes an extensive array of options for open and closed-loop control of automotive electronic systems. A large number of parameters can be included in the process to support optimal operation of various systems. After receiving the electric signals transmitted by the sensors, the ECU processes these data in order to generate control signals for the actuators. The software program for closed-loop control is stored in the ECU's memory. The program is executed by a microcontroller. The ECU and its components are referred to as hardware. The Motor ECU contains all of the algorithms for open and closed-loop control needed to govern the engine management processes. Shows the image of typical ECU used in Bicycle Overview the PMDC motor had to be regulated by a mechanism which involved a DC motor driver. This driver had specifications able to withstand up to 14A which was key to this project as varying loads would undoubtedly draw more current. So the rated current rating had to be high enough to withstand this. As this electric Bicycle consists many electrical control accessories due to which there will be varying current require to each part. Fig. shows the connection of ECU to the different accessories.

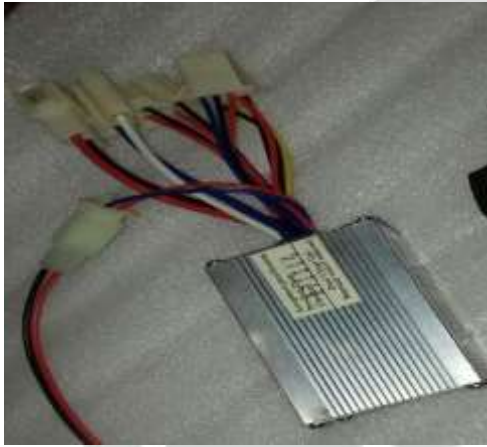


Fig. 11 ECU

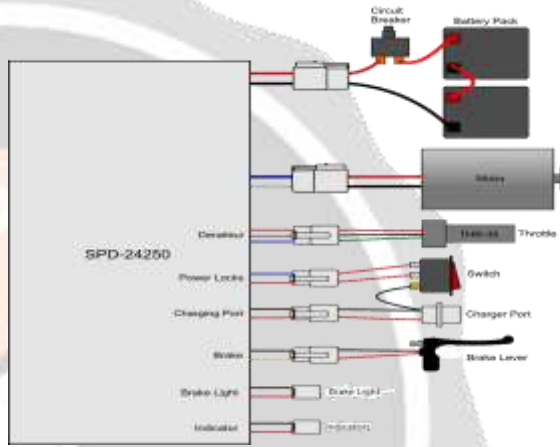


Fig. 12 Connection of ECU

All the components of the Bicycle are assembled in such a way that, the Bicycle will not look messy and the weight of components does not affect to the Design of Bicycle. Key port is given in middle of handle bar which controls all the electrical circuits as shown in shows the fully assembled Bicycle which is actually an Electric Bicycle.



Fig. 13 Complete Fabricated Electric Cycle

5. CONCLUSIONS

With increasing prizes of fuel and pollution alternative choice can be available which is traditional but in new modify version of cycle. In this research paper we are able to design and modify an e-bike which may be the solution to our problems which we are experience now a days like traffic congestion, parking difficulties and pollution from fossil fueled vehicles. We have modify and assembled the devices required the cycle and make the less prize Electric cycle compared to market. It has been noted that the electric bicycle is not only an alternative for transportation, but also a way of practicing daily sports to promote healthy living. After completing the analysis on e-cycle; it is observed that the life of people is very fast so no one can purchase e-cycle. Only the countries with a large number of inhabitants are interested in electric bicycles because they are a sustainable form of mobility, transport, and countries with high environmental awareness. Now the data analyzed related to the electric bicycle shows an increase in scientific and technological interest in this subject because people promoted by the attraction caused by the price, much less than a scooter, and by its speed and lightness in use, in addition to having a simple and inexpensive recharge. We modify an idea to develop an e-bike which is manually operated as well as automatic on electric battery. This paper presents the less costly, light in weight, pedal can be used when power not in use and effectively use of e-cycle. This paper identifies potential barriers of electric bicycle

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