Design Development and Analysis of E-Bycycle

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Abstract- This project is proposed in order to design the electric bicycle that use for the travelling and can be used in long distance. The designing of the electric bicycle is included of the frame design, motor control and gearing system design and the riding comfort for the rider. The design is done in group but with separate task and objective, which is each of people done different part for the electric bicycle. In this proposal, the motor control and gearing system design will be proposed.

Keywords- design development and analysis

I. INTRODUCTION

The automobile is the mode of transportation used by most Canadians to commute to work. In 2000, the rate of automobile use in Canada was 524 automobiles per1.000 in habitants. Although the transportation industry continues to be a major employer that contributes significantly to the national economy and provides countless services for the travelling public, it is unfortunately still responsible for about 38 percent of greenhouse gas emissions. Since the green movement emerged in the 1980s, bicycles have generated keen interest and made a real comeback in Canada, primarily in Quebec. The bicycle market across Canada is soaring with 656,000 bicycles sold in 1995.The bicycle fad should gain momentum if parallel measures, such as the building of bicycle paths and bicycle parking areas, as well as the adoption n of policies promoting.

The inclusion of bicycles in community transportation systems, are developed and widely implemented. According to a Vélo Québec study on the status of bicycles entitled L'état du vélo au Québec en 1995 et 1996, 79 percent of cyclists use their bicycles only for recreation, 13 percent occasionally use them as a mode of transportation and 8 percent use the mass a primary mode of transportation. The study also says that the use of bicycles for physical exercise decreases with age and that only 12 percent of cyclists are over 65.Although generally used by active people and for recreation, bicycles would improve the physical fitness and efficiency of the population and help lower health costs by reducing city pollution and smog levels. A controller for an electric bicycle must deliver power that varies from zero to the rated peak of the propulsion-motor, at motor speeds corresponding to bicycle speeds from zero to 48 km per hour (30 mph).With DC propulsion motors, power can be controlled with pulse-width modulated (PWM) transistors.

II. LITERATURE REVIEW

E-bikes are zero-emissions vehicles, as they emit no combustion by-products. However, the environmental effects of electricity generation and power distribution and of manufacturing and disposing of (limited life) high storage density batteries must be taken into account. Even with these issues considered, e-bikes are claimed to have a significantly lower environmental impact than conventional automobiles, and are generally seen as environmentally desirable in an urban environment. The environmental effects involved in recharging the batteries can of course be minimized. The small size of the battery pack on an e-bike, relative to the larger pack used in an electric car, makes them very good candidates for charging via solar power or other renewable energy resources. Sanyo capitalized on this benefit when it set up "solar parking lots," in which e-bike riders can charge their vehicles while parked under photovoltaic panels. The environmental credentials of e-bikes, and electric / human powered hybrids generally, have led some municipal authorities to use them, such as Little Rock, Arkansas with their Wave crest electric power-assisted bicycles or Cloverdale, California police with Zap e-bikes. China's e-bike manufacturers, such as, are now partnering with universities in a bid to improve their technology in line with international environmental standards, backed by the Chinese government who is keen to improve the export potential of the Chinese manufactured e-bikes. Both land management regulators and mountain bike trail access advocates have argued for bans of electric bicycles on outdoor trails that are accessible to mountain bikes, citing potential safety hazards as well as the potential for electric bikes to damage trails. A study conducted by the International Mountain Bicycling Association, however, found that the physical impacts of low-powered pedal-assist electric mountain bikes may be similar to traditional mountain bikes.

A recent study on the environment impact of e-bikes vs other forms of transportation found that e-bikes are:18 times more energy efficient than an SUV 13 times more energy efficient than a sedan 6 times more energy efficient than rail transit and, of about equal impact to the environment as a conventional bicycle. One major concern is disposal of used lead batteries, which can cause environmental contamination if not recycled. There are strict shipping regulations for lithium-ion batteries, due to the safety reason. In this regard, lithium iron phosphate batteries are safer than lithium cobalt oxide batteries. 3.2 Commuting Or Getting Around Town As a commuter, you won't arrive to work sweaty and out of breath. You'll arrive refreshed and relaxed with no need to shower or change clothes before work. Parking becomes a breeze! You no longer have to circle the block in search of a spot or pay for expensive city parking. Simply lock your bike up and be on your way. Just one of the many benefits of electric bicycles! No more waiting in traffic. Reduce stress and exposure to polluted air by not spending hours parked on the road! Sometimes an electric bike can beat the speed of public transportation! This is a great alternative to your usual commute. Wake up with a refreshing bike ride instead of a car ride that lulls you back to sleep. The fresh air will help you start your day off right! 3.3 Health Even with the electric motor, you will become more active and achieve your fitness goals by manually pedaling when you can and switching to the electric motor when you are tired. Rather than having a regular

bike collect dust in your closet, you'll find yourself looking forward to the next ride on an electric bike because of the reduced pain point of not having to always pedal. Biking helps improve coordination! This keeps your mind sharp and can impact all areas of your life – from interaction with energetic, young loved ones to general physical ability. Even if you haven't ridden a bike in years, it's a skill that is easily picked up again. The electric motor is there for you to rely on in challenging moments on the trail! You'll find yourself spending more time outdoors in the fresh air. Your commute will be less stressful, resulting in a calmer beginning to your work day that will carry through until it's time to bike home. The benefits of electric bicycles are endless. 3.4 Lifestyle.

III. COMPONENTS OF MODEL

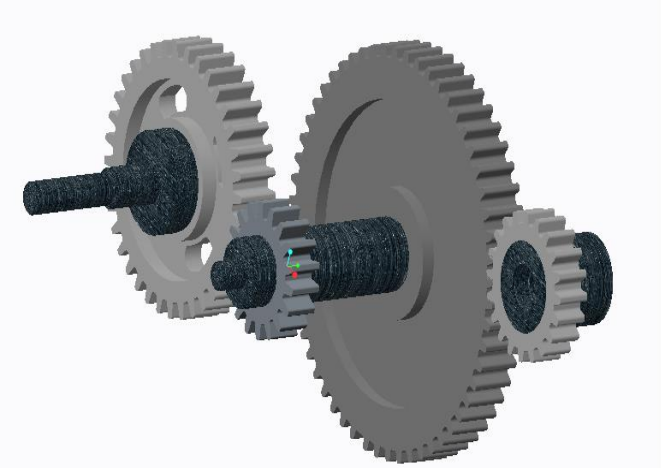

Fig.1- Gear box assembly

Fig.2- Chassi assembly

IV. DESIGN CALCULATION

3.1 Load To Carry With Bike : 220 kg

3.2 Power transmission :

Motor specification: 1) 24volt current
2) 2800 rpm speed
3) 1.98 nm torque

3.*3Force required to move* : 265.892 kg / 76 N

3.4 Design :

Gear ratio

Total gear ratio= (Tb/Ta)*(Td/Tc)*(Tf/Te)
= (56/20)*(32/16)*(22/18)
= 2.8*2*1.22
Total gear ratio = 6.844

3.5Torque available at last sprocket:

Total gear ratio* torque of input gear=
= 6.84444*1.98
= 13.552 Nm
= 1355.2 Ncm

3.6 Torque : force* radius

Force*50 =135.52 …….. (Radius of Wheel=50cm)
Force=1355.2/50
Force=27.104 N
Force= 27.104*9.81
Force=265.892 kg

3.7 Speed of bike : 3000rpm given

Rotational Speed of Wheel = Motor speed / total gear ratio
=3000/6.844
=438.9 rpm

Now
Speed In Km/Hr = rotational speed * circumference of wheel
= 438.9*3.14*0.5
= 689.073 m/sec
= 689.073*60
Speed of bike =41.34438 km/hr

Table 1 : E- Bike riders evaluation of the riding experience

Parameters	Very good	Good	Poor	Very poor
Comfort	44%	50%	6%	0%
Convenience	50%	43%	6%	0%
Power	47%	47%	0%	6%
Stability	47%	35%	18%	0%

V. ADVANTAGES

1. More economical than fuel powered cars and motorcycle and cheaper than buying electrical vehicle for the city.
2. You can adapt your traditional bike using a kit, and you can do it yourself in a few minutes, so you don't need to buy a new one.
3. No contamination, forget about CO2 emissions!
4. Depending on the person's physical condition, the type of terrain or the distance, the electrical bike can be more comfortable since it allows the rider to cover more distance or climb hills when more moderate physical exercise is required. The bicycle does not do the riding for you**,** it provides a slight impulse when you start off or ride uphill with a smooth, fluid movement
5. Electric bikes have a lot of advantages and in this article I want to state some of them.
6. It can help you save money.

VI. LIMITATIONS

1. Battery costs;-
   We all know that electric cycles are powered by batteries and all batteries have useful time. So when the battery on the bike gets old, we should buy a new one. However, the old batteries pollute the environment heavily and the new battery costs can be high.
2. Heavy to carry;-
   Usually speaking, an electric bicycle is heavy and some cheaper ones may be heavier because they use lead acid batteries. So if the battery runs out on the way, you will feel difficult to pedal.
3. Battery recharge
   You need to recharge the battery daily or very often and it always takes several hours for the battery to recharge fully. So before going somewhere, you should firstly make sure that the battery is full charged or you will have to pedal it.

VII. CONCLUSION

That the Electric Bike 2000 Project was a tremendous success can be seen in the level of interest it generated in cyclists and participating organizations. Moreover, the sustained media attention received throughout the evaluation project was an indication of the enthusiasm felt for this new mode of transportation. Because the e-bikes were tested in actual-use situations by people of all ages in various cities, the study and its findings are widely applicable.

The study showed that cyclists did not view the e-bikes as a safety risk, whether they were assisted (EABs) or propelled (EPBs) by a motor. The test findings also showed that both types of e-bikes were considered equally safe. It was suggested that no restrictions on motor start-up methods should be included in the new regulations.

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