CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

S0221

Project Title

Less Sweat or Less Fatigue? My SmartBike Does the Rest!

Abstract

Objectives/Goals

I researched the physics of transferring power through moving gears. Unlike the traditional gear system, a Continuous Variable Transmission can provide a near infinite range of gear ratios. However previous attempts to build continuous transmissions have required the use of cones and/or belts, which are inherently less efficient. So, I set out to build and test a better bicycle transmission.

My hypothesis is: The use of a real-time microcomputer and a clever chain-drive CVT can convert more of my energy into bicycle movement than the conventional gear design.

Methods/Materials

My plan is to a) empirically model the inefficiencies of a conventional gear system; b) demonstrate how such mechanical inefficiencies would reduce cyclist road efficiencies; c) build an appropriate simulation model; d) design and then build a new Computer controlled CVT and e) test the hypothesis by comparing the new prototype to the conventional transmission design.

Results

One of my challenges was to maintain the high mechanical efficiency of a chain-drive transmission in a Continuously Variable Transmission. To my knowledge, this has never been accomplished before. Other attempts at CVT [in general] have used belts, which cannot transfer energy as well as the mechanical coupling of a chain on gear. The belt on a cone makes for an easy and continuous change of gear ratio. But, how do you accomplish this continuous ratio with chains?

The simulation results and the prototype showed that it is possible to build energy-efficient CVTs that could deliver up to 15% more power under certain road conditions.

Conclusions/Discussion

The concept of transferring mechanical energy from one point to another is fundamental to many devices and applications. This study shows how to apply computer controlled CVT technology for building energy-efficient vehicles

Summary Statement

Create a computer-controlled Continuous Variable Transmission for bicycles (and vehicles) which delivers more power.