21 Speed Bike Automatic Transmission Control
153B Final Project Proposal
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Overview

We plan to create an automatic control system for the gear shifters on a 21 speed bicycle. The device would interface with a standard bike with varying speed gears by controlling the shifter cables that run from the bike's chain derailleur while reading the speed of the wheels and position of the pedals. The goal would be to create a real time control system that would use the data gathered from the speed and pedal position in order to select the right gear ratio for the current speed. There will be a servo attached to the control end of the shifter cable at the handle bars and a tachometer reading the speed of the rear wheel attached to the main frame of the bike. There will also be a Hall effect sensor reading the position of the pedals to guarantee engagement of the current gear before indexing the next gear in rapid gear change situations such as starting and stopping on a bike. The microcontroller and power source for our peripherals will be stored in the storage basket attached to the handle bars of the bicycle. The system will also prompt the user with three LED notifications for upshifting, downshifting, and user pedal to engage chain.

Peripherals

- Servo with positional encoding
- Tachometer
- Hall Effect Sensor
- LEDs x 3
- Accelerometer (Optional)

Software Design

We plan to implement our system with grand loop and finite state machine. The software will continually check at constant intervals, the speed of the bike, the current gear setting, and pedal position. The program will determine if the current speed is either above or below the programmed gear setting and will either initiate a downshift or upshift to get to an appropriate setting. When either shifting case occurs the servo will index the gear number up or down while the

user is notified with a LED notification of which type of shift is occurring and to pedal to engage the chain with the new gear. The challenges that will accompany this project will be interfacing with the peripherals, getting the correct speed to gear number ratios and timing of the whole system.

Goals

1. The primary goal of this project is to provide accurate and fast shifting automatically by implementing the servo, tachometer, and Hall Effect sensor to work as feedback based control system.
2. The secondary goal of this project will be to provide a simple LED user interface to keep the rider of the bike informed on the actions and state of the bike during use.
3. The optional goal of this project will be to include an accelerometer as a sensor in the system in order to improve responsiveness and predict successive shifts for rapid changes in speed. This would utilize an interrupt that would override the state machine in stopping and starting cases.

Group Responsibilities

- Chris will be in charge of the finite state machine/grand loop, and tachometer implementation.
- Zachary will oversee the electromechanical use and control of the servo.
- Jacob will manage the interface between the Hall Effect sensor and LED notifications with the microcontroller.