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Inspired by the idea of learning how to drive a stick-shift, I wanted to develop a device that would allow interested students, who share the same desire as I do, to learn this skill in the easiest way possible. Initially, the method of learning is very intimidating. There are many approaches to teaching this, I only aim to try one approach when viewing the problem at the signal processing perspective. The problem that I had experienced with trying to drive a manual transmission is the difficulty in integrating a coordinated sequence between the clutch, pedal and gearbox. To address this issue, a Texas Instruments TMS c5000 Digital Signal Processor was used with assistant of the students in Douglas L. Jones lab to implement a system that provides instant feedback. In gathering the necessary components to create a successful project, a little understanding the mechanics of a vehicle was required to create a successful project. While developing the program, I had the pleasure of first-hand experience "stalling" and performing terribly when driving a stick-shift vehicle. This led me to seek instruction from a local teacher for advice on creating the device. Although the instructor was very knowledgeable, his advice was very biased and is directed to what driving a stick-shift means to him.

The signals that were acquired for the device are from a camera placed on the dashboard to record the tachometer gauge, and an electromyogram placed on the calf. The tachometer measures the rotation of the crankshaft, and provides essential information in determining when to shift gears in the vehicle. An EMG device is placed on the left calf based on the argument that the tone of the structure is correlated to the extent of pressing the clutch. As such, the amount of force applied to the clutch relates to the ability to convert engine power into movement of the vehicle. To provide feedback for the driver, tactile response and auditory cues were transmitted by the device.

To prove this concept, I tested the device on myself after development, and the results show promise. On the contrary, latency between the sensors and external triggers were observed. Of which, may be contributed to the processing of the DSP used in this device.

Creating the video:

The first scene, the introduction uses a sound generated from Lab 5, filtering a frog signal using a notch filter to remove 2441 Hz noise.

In transitions between scenes, synthesized speech using formant frequencies were used. Edge detection in Lab 3 was used for the program to identify the gauge reading in the tachometer (1:53 – 2:26). Resynthesized natural speech, the "ah" vowel sound was programmed as an auditory cue in the developed device. In addition, image de-noising of the gauge may be necessary due to the quality of the camera sensor used.

A Feedback echo with 0.03*Fs sample delay was used to create an emphasis on a quote that has great value to me. "If you can't see it, you can't do it" was reiterated numerous times by an instructor and close friend in Vet-Med. Throughout the semester, she has continued to motivate me and my work here in Illinois. The equation for the feedback echo is $y[n] = x[n] - 0.9*y[n- 0.03*Fs]$.

Lab 7 is shown by a slow-motion grayscale video of the vehicle entering the driveway (3:35).