

Markov Gestured Controller

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OVERVIEW

We propose a Hidden Markov Model (HMM) based hand gesture recognition system. A gyroscope and accelerometer are mounted on the back of the palm. The hand gestures allow one to perform different maneuvers on an LED strip, such as a “train” effect where LEDs light up one after the other based on the acceleration and orientation of the hand.

PERIPHERALS

1. RGB LED Strip (GPIO)
2. Gyroscope (UART)
3. Accelerometer (UART)
4. Button (UART)

SOFTWARE DESIGN

The gestures will only be recognized when the button is pressed. For LED strip maneuvering, we will use an existing Adafruit NeoPixel library. We will use the General Hidden Markov Library (GHMV) for efficient data structures to store input states (beginning hand position). These input states will be predefined, and depend on the initial orientation of the hand. We will implement a Viterbi algorithm for intermediate hand transitions. The only feature extractions will be the orientation, linear acceleration, and angular velocity. These will be done through constant communication of the gyroscope’s and accelerometer’s readings.

GOALS

1. Recognize simple hand gestures (left, right, up, down)
2. Use simple gestures for LED maneuvering
3. Recognize more sophisticated hand gesture (eg: circular CW and CCW)
4. Control real-time LED action based on complex hand gestures

GROUP RESPONSIBILITIES

Adi will focus on developing an HMM for predictive modeling and recognition of hand gestures. Dali will focus on interfacing with the LEDs to produce different light patterns (train effect, fade effect, etc.) and describe each gesture in terms of HMM.