

6.111 Final Project – Abstract

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This project's goal is to create a full motion dance machine. We hope that the main functionality of the dance machine will include the recording and processing of user motion and the comparison of the motions to predetermined dance moves.

The system will have four main components: video, audio, system control, and user interface. Video of a user will be displayed on a computer screen. The video components will detect colored swatches that the user wears and from that data, determine the location of various body parts. An algorithm will be developed to determine if the user is moving, and the relative location of the body parts over time. From this information, we can process the video to determine the user's motion and beat. The user position will be indicated on the screen with a stick figure, which will give the user general feedback about his or her location.

The audio component starts with building an understanding of the encoding of audio files and how to store them in memory. Obviously, due to memory constraints, any desirable length of music will require significant downsampling and a low bitrate. Because of the downsampling, the music will have to be upsampled on the front end of the audio player. Additionally, we will derive the beats from the audio signals. To do so, we will examine the relative power, or magnitude, of the song relative to a larger-time-scale local power. When the instantaneous power exceeds the local power, a beat can be detected. This processing will be coded. Eventually, the beats determined within the song will be coupled with the frequency of the dance moves required.

The system control component compares the beat from the user and the beat from the music. It first displays the beat determined from the music onto the screen so that the user can attempt to mimic this beat. The system will display the user's beat as he or she attempts to match the music beat, and compute the difference between the two. The system will also tell the user to do simple dance moves, such as moving the hand to certain parts of the screen. The system will compute an overall score depending on how well the user mimics the beat of the song and follows dance move directions.

Finally, a user interface component will allow the user to control which song is played and the type of song, display the user and song beats, and draw a stick figure representation of the user on the screen. The overall system will allow the user to experience a full motion dance experience.

Nominally, Jonathan will focus on the video component, Kevin on the audio component, and Chris on the system control and interface components. In actuality, we all want to get a feel for the entire project, so each member will work on modules within all of the components.