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Project Deliverable #4: Simulator Implementation User Manual

This system supports the ability to track multiple data streams, since there is a switch between live mic input and the JSON data stream. There is an additional switch that allows the user to switch between various JSON data channels. This switch will take effect when the simulator is reading the JSON data. While the JSON data is being read, the system will track various data channels (breathing patterns, tremor and stress, patient interaction, doctor notification, and doctor instructions) and respond accordingly. Based on the audio change or the visual cues that the doctor receives, the doctor can send a response to the patient.

My system also prioritizes and schedules how data is sonified depending on the sensor data values, since it mixes continuous streams of sonifications with the filters and the amplitude envelope. Additionally, it supports two modes- one reading the JSON data file and sonifying it, and the other that's reading the live mic input and letting the user control the audio via the filters.

How to use the Simulator:

To use the simulator, you may choose between live mic input and the JSON data. The buttons on the left allow you to start, pause, and stop the JSON data stream. The middle buttons allow you to switch between the JSON data and live mic input, as well as manipulate the frequency of the WavePlayer UGen. The buttons on the right allow you to choose the filter to apply to the audio, whether it is the WavePlayer audio or the live mic input. Below all that is a visualization of the sonification. The graph depicts the frequencies that are being emitted.

Here's how the system notifications work: When the voice tremor data is elevated, the pitch changer will produce a higher-pitched sound utilizing the amplitude envelope, a gain element, and the WavePlayer. Subsequently, text-to-speech will be employed in response to any detected tapping by the patient. If there are recurring sounds indicative of tapping or shaking, the text-to-speech feature will notify the doctor for attention. Users have the flexibility to activate or deactivate the provided filters and adjust the audio frequency emitted by the WavePlayer UGen. Users can either choose to have the system read and sonify all the JSON data channels at the same time, or pick a particular one for the system to sonify. They can change these system preferences via an on-screen switch.

How to Experience all the Different Scenarios/Data Ranges:

There are 5 different data channels: breathing patterns, tremor and stress, patient interaction, doctor notifications, and doctor instructions. Different scenarios can play out when various scenarios arise. They are as follows:
- When the doctor receives a notification that they need to do something, they will be notified via on-screen text of what they need to do.
- When the doctor receives an instruction from the simulation, they will be instructed to take action via the text-to-speech feature.

- If the simulation senses irregularities in either the breathing patterns or the patient's tremors and stress, the WavePlayer frequency will automatically shift to 2000 Hz, letting the doctor know that something is wrong.
- If the patient interaction data indicates that the patient is not satisfied, then there will be a beeping noise that emits from the simulator. That noise lets the doctor know to check in with the patient.

Individuals have the option to either enable the system to audibly interpret and represent all the JSON data channels simultaneously or select a specific one for sonification. These system preferences can be modified through an on-screen switch.

My Sonification Scheme:

The data modify the sounds in different ways, depending on what the data indicates. There are 5 different data channels, breathing patterns, tremor and stress, patient interaction, doctor notification, and doctor instructions.

This simulator uses the low pass filter to smooth out sudden changes in the sonification, letting the doctor/researcher better hear abrupt changes in the patient's audio and alert the doctor if those happen. If the doctor hears/sees something out of the ordinary on the visual display, they can act on it. It uses the high pass filter to filter out low-frequency background noise, letting the doctor/researcher better hear higher sounds from the patient. It uses the pitch changer for the voice tremor intensity (using JSON data). If the voice tremor data is high, then the pitch changer will emit a higher pitch sound using both the amplitude envelope, a gain element, and the WavePlayer. Finally, the text-to-speech will be used for any tapping from the patient. If there are sounds that are repeated or indicative of tapping or shaking, the text-to-speech feature will alert the doctor to address that. The user can turn the filters provided on and off, as well as modify the frequency of the audio emitted by the WavePlayer UGen. There is also an amplitude envelope that is applied to the audio.

Aspects of the Project Description:
1. User Manual
   a. The user manual describes how to use the simulator, how to experience all of the different scenarios/data ranges, and the sonification scheme (how the data modify the sounds).
2. Simulator Appropriateness
   a. The overall design and functionality of the simulator is effective, as the buttons are organized logically and are clearly labeled. There is also a frequency graph visually depicting the sound emitted from the simulator, as well as visual indicators for doctor instructions.
   b. This simulator allows the user to experience all the different ways the system would sonify data (depending on the data types, values, and context), as the

system will modify the WavePlayer frequency, and notify the doctor via on-screen text and verbal speech depending on what the data shows.

    c. This system also allows for reproducibility and consistency in the experience, since there are user controls that let the doctor/researcher change what mode they want to experience.

3. Data and Event Handling Functionality
    a. This system is designed to receive JSON data in real time. There are three JSON files (patient1_data, patient2_data, and patient3_data) that the system will receive and respond to accordingly.
    b. Events/data can also be triggered and manipulated via researcher UI controls in real time, such as the filters, the data channels for the system to sonify, and the WavePlayer audio frequency.

4. Data Handling Thoroughness and Quality
    a. This system receives and dispatches the JSON data properly. It explores all the possible scenarios that the user could create/encounter, and reacts appropriately depending on what the data indicates.
    b. Users have the option to either select the simultaneous reading and sonification of all JSON data channels or choose a specific channel for the system to sonify. These system preferences can be modified through an on-screen switch.

5. Sonification Functionality
    a. The simulator creates continuous (or semi-continuous) real-time sonifications based on the sensor data inputs. When the voice tremor data registers a high level, the pitch changer will produce an elevated pitch using the amplitude envelope, a gain element, and the WavePlayer. Subsequently, the text-to-speech function will engage in response to any detected tapping from the patient. If there are recurring sounds suggestive of tapping or shaking, the text-to-speech feature will notify the doctor for attention. Users have the flexibility to enable or disable the provided filters and adjust the frequency of the audio emitted by the WavePlayer UGen.
    b. The sonification engine goes beyond the simple act of directly triggering binary sounds in response to sensor data. Instead, it adapts the sonification scheme dynamically according to context, prioritizing and scheduling the sonification of data based on the values derived from sensor data.

6. Sonification Sound Design
    a. The sonifications change in sophisticated ways based on changes in the data, since the system notifies the user in different ways depending on which part of the data is concerning. The sound designs in this project create pleasing individual sonifications which convey the data effectively to the user, as they sonically and thematically fit various channels of sound together.

7. Text-to-speech

     a. I use the text-to-speech function to indicate to the doctor when there is a doctor instruction. The instruction is communicated verbally using the text-to-speech feature.

8. Programmatic Sounds
     a. Some aspect of the sound environment is created by the generation and manipulation of base waveforms, as this system uses a WavePlayer and manipulates its frequency depending on what the data indicate.

9. Filters & Effects
     a. My simulator makes use of filters and/or effects UGens to manipulate your sound environment in some manner. I use the Low Pass Filter, High Pass Filter, Band Pass Filter, and WavePlayer UGens in this simulator.

10. Amplitude Envelope
     a. My simulator uses amplitude envelopes to modify the base sounds.