Ahsanullah University of Science and Technology

Department of Electrical and Electronic Engineering

Open Ended Lab (Project Proposal)

Course No : EEE 3208

Course Title : Communication Theory Lab

Section : B2

Group No : 02

Group Members :

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Project Name:

1. Audio Speech Transmission App Design using

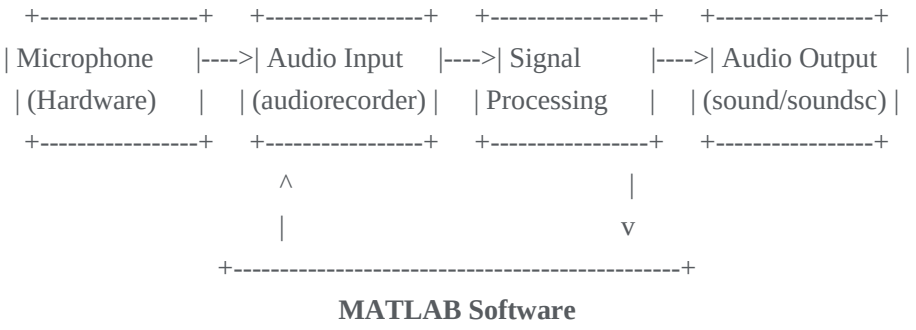
Lab Report: Audio Speech Transmission App using MATLAB

1. Objective:

The objective of this lab is to develop a basic audio speech transmission application using MATLAB. This involves recording speech from a microphone, optionally applying signal processing techniques, and then playing back the recorded or processed audio. This exercise aims to familiarize students with audio acquisition, basic signal processing, and audio playback in MATLAB, providing a foundation for understanding more complex communication systems. While this lab focuses on local playback, the principles learned are applicable to network-based audio transmission.

2. Circuit Diagram:

(Since this lab is primarily software-based using MATLAB, there isn't a traditional hardware circuit diagram. However, we can represent the flow of the audio signal and the software processing steps in a block diagram.)



Explanation:

1. **Microphone:** The external microphone (or the computer's built-in microphone) captures the analog speech signal.
2. **Audio Input (audiorecorder):** The audiorecorder function in MATLAB acts as the interface to the audio hardware. It digitizes the analog signal, converting it into a digital representation that MATLAB can process. Parameters like sample rate, bit depth, and number of channels are configured here.

3. **Signal Processing:** This block represents the optional signal processing steps that can be applied to the recorded audio. Examples include noise reduction, compression, or feature extraction. In this basic lab, a simple gain adjustment might be used for demonstration.
4. **Audio Output (sound/soundsc):** The sound or soundsc function plays back the digital audio signal through the computer's speakers or headphones, converting it back to an analog sound wave.

3. Working Principle:

The application operates based on the following principles:

1. **Analog-to-Digital Conversion (ADC):** The microphone captures the analog speech signal, which is continuous in time and amplitude. The audiorecorder function performs ADC, sampling the analog signal at regular intervals (defined by the sample rate) and quantizing the amplitude of each sample into a digital value. This creates a discrete representation of the audio signal that can be processed by a computer.
2. **Digital Signal Processing (DSP):** MATLAB is well-suited for DSP. The recorded digital audio data can be manipulated using various functions. In this lab, basic operations like adjusting the volume (gain) can be performed. More advanced processing could involve filtering to remove noise, compressing the audio data for efficient storage or transmission, or extracting features from the speech for analysis.
3. **Digital-to-Analog Conversion (DAC):** To play back the audio, the digital data must be converted back to an analog signal. The sound or soundsc function handles this DAC process. The digital samples are used to reconstruct the analog waveform, which is then sent to the speakers to produce sound.
4. **MATLAB Implementation:** The MATLAB code implements these steps. The audiorecorder object is used to capture audio from the microphone. The getaudiodata function retrieves the recorded data. Signal processing operations are performed on this data. Finally, the sound or soundsc function plays the processed audio. A GUI can be created to provide a user-friendly interface to control the recording, processing, and playback.

4. (Optional) Results and Discussion:

(In a full lab report, this section would include the results of your experiments. For example, you might include plots of the recorded waveforms, discuss the effects of different signal processing techniques, and analyze the quality of the playback. Since this is a conceptual outline, this section is omitted here.)

5. Conclusion:

This lab provided hands-on experience with audio recording, basic signal processing, and playback in MATLAB. By developing this simple audio transmission application, we gained a better understanding of the fundamental principles of digital audio and how MATLAB can be used for audio processing and communication-related tasks. This serves as a starting point for exploring more complex audio applications, including real-time processing and network-based streaming.