Courtroom Audio-Visual System

Here's a sample requirements document for an **Audio-Visual (AV) System** intended for use in a court of law. This document outlines functional, non-functional, and technical requirements based on typical needs in a legal environment.

Requirements Document for Courtroom Audio-Visual System

1. Introduction

1.1 Purpose

The purpose of this document is to define the requirements for an Audio-Visual (AV) system designed for courtroom use. This system should enhance the functionality of court proceedings by enabling reliable audio and video capture, playback, and real-time streaming to support accurate record-keeping, remote participation, and evidence presentation.

1.2 Scope

The AV system must be capable of recording high-quality audio and video, displaying digital evidence, and supporting both in-person and remote participation. It should ensure security, reliability, ease of use, and compliance with legal standards.

1.3 Stakeholders

- Court administrators
- Judges and judicial staff
- Legal representatives (attorneys, prosecutors)
- Witnesses and participants (remote and in-person)
- Technical support and maintenance teams

2. Functional Requirements

2.1 Audio Capture and Playback

2.1.1 Microphones

- **Description**: High-quality, courtroom-grade microphones should be positioned at all relevant locations (e.g., judge's bench, witness stand, attorney desks).
- **Requirements**:
  - Microphones should capture clear, intelligible audio from all speaking participants.
  - Automatic volume leveling and noise cancellation should be included to reduce background noise.
  - System should support mute/unmute functionality for each microphone with indicator lights showing active status.

2.1.2 Speakers

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- **Description**: Speakers should be installed strategically to ensure all courtroom participants can hear proceedings clearly.
- **Requirements**:
  - Volume control should be accessible only to authorized personnel.
  - System should include acoustic feedback cancellation to avoid echo and interference.
  - There should be no audio delay between speaking and playback.

2.2 Video Capture and Display

2.2.1 Cameras

- **Description**: High-resolution cameras should capture video of all participants.
- **Requirements**:
  - Cameras should cover key areas, including the judge, witness stand, attorney tables, and audience seating.
  - Pan, tilt, and zoom (PTZ) capabilities for adjustable camera angles.
  - Automatic or manual switching between camera views.
  - Real-time streaming and recording of video with a minimum resolution of 1080p.

2.2.2 Display Monitors

- **Description**: Large displays or projectors should be installed to display digital evidence, remote participants, and other visual content.
- **Requirements**:
  - Displays should be visible from all seating areas in the courtroom.
  - Should support HDMI, USB, and other standard input connections.
  - Ability to split-screen or toggle between multiple sources (e.g., video conferencing, evidence presentation).

2.3 Evidence Presentation

2.3.1 Document Camera

- **Description**: Document camera to display physical evidence (e.g., paper documents, small objects).
- **Requirements**:
  - High-resolution capture with zoom capabilities.
  - Ability to display real-time on monitors and record evidence presentation.
  - Secure control for adjusting document camera settings.

2.3.2 Digital Evidence Integration

- **Description**: The system should support integration with digital evidence files (e.g., videos, images, audio recordings).
- **Requirements**:
    - Support for standard file formats (PDF, JPEG, MP4, MP3, etc.).
    - Evidence should be viewable on courtroom displays and recordable for archival purposes.
    - Digital evidence should be presented with a timestamp and linked to relevant segments of the transcript.

2.4 Remote Participation

2.4.1 Video Conferencing

- **Description**: Support remote participation via video conferencing for witnesses, legal representatives, and interpreters.
- **Requirements**:
    - Video conferencing system compatible with commonly used platforms (e.g., Zoom, MS Teams).
    - Secure connection with encrypted data transmission.
    - Ability to mute/unmute participants and control video feeds from the courtroom.

2.4.2 Real-Time Transcription and Interpretation

- **Description**: Support real-time transcription services and remote interpretation.
- **Requirements**:
    - Integration with certified transcription software to capture proceedings in real-time.
    - Support for remote interpretation with audio channel control to facilitate multilingual needs.

3. Non-Functional Requirements

3.1 Security and Privacy

- **Description**: The system must secure all audio and video data to comply with legal standards.
- **Requirements**:
    - Encrypted storage of all recorded data.
    - Access control for all system functions with role-based permissions.
    - Automatic logging of user activity for audit purposes.

3.2 Reliability and Availability

- **Description**: The AV system must provide reliable and consistent performance.
- **Requirements**:
  - Minimum uptime requirement of 99.9%.
  - System diagnostics and alerts for hardware/software malfunctions.
  - Backup power supply to prevent data loss during power outages.

3.3 Usability

- **Description**: Courtroom staff should find the AV system easy to use.
- **Requirements**:
  - Simple, intuitive control interface accessible from a central control panel.
  - Touchscreen or standard PC interface with clear labeling for each function.
  - Training materials and on-site training for all courtroom staff.

3.4 Maintainability and Scalability

- **Description**: The system should be easily maintainable and scalable.
- **Requirements**:
  - Modular design for quick hardware replacement or upgrades.
  - Compatibility with future AV technology standards.
  - Scalable to accommodate additional rooms or remote participants as needed.

4. Technical Requirements

4.1 Hardware Requirements

- **Microphones**: Courtroom-grade microphones with noise cancellation and mute/unmute capability.
- **Cameras**: High-resolution PTZ cameras with minimum 1080p recording.
- **Displays**: Minimum 65-inch 4K display monitors or equivalent projection equipment.
- **Server**: On-premises or cloud-based server for secure storage of recorded data and real-time processing.

4.2 Software Requirements

- **Control Software**: Software to manage audio, video, and remote conferencing controls from a single interface.
- **Evidence Management**: Software to display, annotate, and store evidence.
- **Backup and Recovery**: Automated data backup solution and disaster recovery plan.

4.3 Network Requirements

- **Wired and Wireless Connectivity**: Reliable wired connection for essential components, with wireless connectivity for redundancy.
- **Bandwidth**: Minimum bandwidth of 10 Mbps for HD video streaming.
- **Latency**: Low latency (below 100 ms) for real-time streaming.

5. Performance Requirements

- **Latency**: Audio and video latency should be minimized to ensure real-time synchronization.
- **Quality**: Minimum video quality of 1080p at 30fps for all recordings.
- **Scalability**: Must support up to 50 remote participants and store recordings for a minimum of 5 years.

6. Compliance and Regulatory Requirements

- **Data Protection**: Comply with applicable data protection regulations (e.g., GDPR).
- **Accessibility**: Ensure system accessibility for participants with disabilities (e.g., hearing-impaired services).
- **Legal Recording Standards**: Comply with court standards for recording and evidence management.

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7. Appendices

Appendix A: Glossary

- **PTZ**: Pan, Tilt, Zoom capabilities of cameras.
- **HD**: High Definition, typically 1080p resolution.
- **4K**: A resolution of 3840x2160 pixels.

This document provides a comprehensive overview of the requirements for an AV system used in a court of law. Each section focuses on a critical aspect, from capturing high-quality audio and video to ensuring secure, reliable, and easy-to-use functionality for courtroom participants.

I am a test analyst, and I have to create some automation test scripts in playwright using python. I need these scripts test audio visual equipment for functionality

To get started with testing audio-visual equipment functionality in Playwright using Python, you'll need to consider which specific features or components of the equipment require testing. Here are a few approaches you might take:

1. **Control Interface Testing**: If the equipment has a web-based control interface, use Playwright to test buttons, sliders, and other controls for expected behavior.

2. **Audio and Video Streaming Tests**:
    - **Audio**: Test if the audio playback functions correctly by validating control buttons and ensuring audio streams as expected.
    - **Video**: Verify that video streams load and render correctly. Playwright can capture screenshots, so you might compare images at certain frames to confirm correct rendering.
3. **Network Connectivity**: Use Playwright to interact with connectivity options or network settings if they are accessible through a web interface. Verify the equipment’s response to network changes, such as connecting or disconnecting from Wi-Fi.
4. **Error Handling and Alerts**: Test how the system responds to simulated errors, such as low battery warnings, disconnections, or other issues. Check for proper alert dialogs or notifications.
5. **Multimedia Format Compatibility**: If the equipment supports various multimedia formats, use Playwright to navigate to settings or input areas and verify that different formats play without issues.

Would you like help with example code snippets for specific functionality?

Certainly! I'll provide you with detailed example scripts in Playwright and Python to help test various functionalities of audio-visual equipment. These examples will focus on simulating user interactions and verifying the expected outcomes for key features like control interfaces, audio/video playback, network settings, and alert handling.

1. Setting Up Playwright in Python

First, if you haven’t already, install Playwright for Python:

```
pip install playwright

playwright install
```

2. Launching the Browser and Accessing the Equipment Interface

This example initializes Playwright, launches the browser, and navigates to the audio-visual equipment’s control interface.

```
from playwright.sync_api import sync_playwright


def launch_browser():

    with sync_playwright() as p:

        browser = p.chromium.launch(headless=False)

        context = browser.new_context()

        page = context.new_page()
        # Replace with the URL of your equipment interface
        page.goto("http://localhost:8080/control-panel")

        # Verify the page title to ensure you’re on the correct interface
        assert "Control Panel" in page.title()

        return page

# Launch the page and return the page object for further testing
page = launch_browser()
```

3. Testing Control Interface Interactions

Audio-visual equipment often has interactive buttons or sliders. Here’s how you could automate the testing of power controls, volume adjustments, and source selection.

Example: Power Button Toggle

```
def test_power_button(page):
    # Locate the power button and click to toggle power on
    power_button = page.query_selector("#power-button")
    power_button.click()

    # Assert that the equipment status changes (assuming it updates a label)
    status_text = page.query_selector("#status-label").inner_text()
    assert "On" in status_text, "Power toggle failed to turn on the equipment"

    # Toggle off
    power_button.click()
    status_text = page.query_selector("#status-label").inner_text()
    assert "Off" in status_text, "Power toggle failed to turn off the equipment"
```

Example: Volume Control Slider

```
def test_volume_control(page):
    # Locate the volume slider and set it to 50%
    volume_slider = page.query_selector("#volume-slider")
    volume_slider.set_input_files("50")

    # Validate the volume label updates to reflect the change
    volume_level = page.query_selector("#volume-level").inner_text()
    assert "50%" in volume_level, "Volume control did not update as expected"
```

4. Audio and Video Playback Tests

To verify that media files play correctly, simulate playback controls (play, pause) and check if audio/video elements are functioning.

Example: Play and Pause Video

```
def test_video_playback(page):
    # Locate the video element and click play
    video_element = page.query_selector("#video-player")
    play_button = page.query_selector("#play-button")
    play_button.click()

    # Wait for a few seconds to simulate playback
    page.wait_for_timeout(3000)  # 3 seconds

    # Check if video is playing (e.g., by checking currentTime property)
    current_time = page.evaluate("document.querySelector('#video-player').currentTime")
    assert current_time > 0, "Video did not play as expected"

    # Click pause and verify it stops
    pause_button = page.query_selector("#pause-button")
    pause_button.click()
    page.wait_for_timeout(1000)

    paused_time = page.evaluate("document.querySelector('#video-player').currentTime")
    assert paused_time == current_time, "Video did not pause as expected"
```

Example: Audio Playback and Mute Control

```
def test_audio_playback(page):
    # Locate the audio element and play it
    audio_element = page.query_selector("#audio-player")
    play_button = page.query_selector("#audio-play-button")
    play_button.click()

    # Verify audio is playing by checking the 'paused' property
    is_paused = page.evaluate("document.querySelector('#audio-player').paused")
    assert not is_paused, "Audio did not play as expected"

    # Mute audio and verify
    mute_button = page.query_selector("#mute-button")
    mute_button.click()
    is_muted = page.evaluate("document.querySelector('#audio-player').muted")
    assert is_muted, "Audio mute failed"
```

5. Network Connectivity Tests

For network-dependent features, simulate changes in connectivity and verify that the equipment handles it as expected.

Example: Checking Connectivity Status

```
def test_network_connectivity(page):
    # Trigger a network check by clicking a 'Check Connection' button
    network_button = page.query_selector("#network-check-button")
    network_button.click()

    # Verify network status displays 'Connected'
    status = page.query_selector("#network-status").inner_text()
    assert "Connected" in status, "Network connectivity check failed"
    # Test disconnection simulation if supported
    disconnect_button = page.query_selector("#disconnect-button")
    disconnect_button.click()
    status = page.query_selector("#network-status").inner_text()
    assert "Disconnected" in status, "Network disconnection failed"
```

6. Error Handling and Alert Testing

To ensure equipment responds correctly to issues (like low battery or network loss), test alert messages and responses.

Example: Checking Low Battery Alert

```
def test_low_battery_alert(page):
    # Simulate a low battery condition if possible
    battery_simulate_button = page.query_selector("#simulate-low-battery")
    battery_simulate_button.click()

    # Verify alert appears
    alert_text = page.query_selector("#battery-alert").inner_text()
    assert "Low Battery" in alert_text, "Low battery alert did not display as expected"
```

7. Multimedia Format Compatibility Test

If the equipment supports multiple file formats (e.g., MP3, MP4), ensure it correctly plays each one.

```
def test_multimedia_formats(page):
    # Assume there's a dropdown to select file format
    formats = ["MP3", "MP4", "AVI"]
    for fmt in formats:
        page.select_option("#file-format-dropdown", fmt)

        # Play and verify playback for each format
        play_button = page.query_selector("#play-button")
        play_button.click()

        # Wait and check if playback starts
        page.wait_for_timeout(2000)
        is_playing = page.evaluate("document.querySelector('#media-player').currentTime > 0")
        assert is_playing, f"{fmt} format did not play correctly"

        # Pause playback before next format
        page.query_selector("#pause-button").click()
```

8. Teardown and Close the Browser

Finally, it’s essential to properly close the browser after tests:

```
def close_browser(page):
    page.context.close()
    page.browser.close()

# Clean up after tests
close_browser(page)
```

These scripts cover various scenarios for testing audio-visual equipment using Playwright with Python. Each test is focused on a specific functionality, simulating user interactions and verifying the expected outcomes.

Does any of this require a feature file

A feature file is typically used when you're following **Behavior-Driven Development (BDD)** principles, often in conjunction with a framework like **Cucumber** or **Behave** for Python. Feature files are written in **Gherkin language** and define tests in a structured way using Given, When, Then statements. They describe the behavior and expected outcomes of the system from the end-user’s perspective, which makes tests more readable and maintainable, especially in collaborative teams.

When to Use a Feature File

If you're working on a project where:

- Requirements need to be clearly defined in a user-centric way.
- There are complex test scenarios or a need for cross-functional teams to understand the tests.
- BDD is a preferred methodology in your team or company.

Then using feature files can add value, as they outline expected functionality in a readable format for all stakeholders.

Sample Feature File for Audio-Visual Equipment Testing

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Here's an example feature file that could complement the Playwright tests provided above, focused on testing the functionality of audio-visual equipment.

Feature File Structure

Save this as audio_visual_testing.feature.

```
Feature: Audio-Visual Equipment Functionality


  Scenario: Power button toggles the equipment on and off
    Given I am on the equipment control panel
    When I click the power button
    Then the equipment status should display "On"
    When I click the power button again
    Then the equipment status should display "Off"


  Scenario: Adjusting the volume slider
    Given I am on the equipment control panel
    When I set the volume slider to "50%"
    Then the volume level should display "50%"


  Scenario: Video playback functionality
    Given I am on the equipment control panel with a video loaded
    When I press the play button
    Then the video should start playing
    When I press the pause button
    Then the video should stop playing


  Scenario: Network connectivity status
    Given I am on the equipment control panel
    When I check the network connection
    Then the network status should display "Connected"
    When I disconnect from the network
    Then the network status should display "Disconnected"


  Scenario: Low battery alert notification
    Given I am on the equipment control panel
    When a low battery condition is simulated
    Then a "Low Battery" alert should display
```

Implementing Feature Steps in Python Using Behave

1. **Install Behave for Python**:
2. pip install behave
3. **Creating Step Definitions**

In a BDD framework, each step in the feature file maps to a function in a "step definitions" file, typically located in the steps folder. Here’s how you can implement step definitions for the feature file.

steps/audio_visual_steps.py

```
from playwright.sync_api import sync_playwright


# Initialize Playwright and launch the page once for all tests
def before_all(context):
    context.playwright = sync_playwright().start()
    context.browser = context.playwright.chromium.launch(headless=False)
    context.page = context.browser.new_page()
    context.page.goto("http://localhost:8080/control-panel")


def after_all(context):
    context.browser.close()
    context.playwright.stop()


# Step Definitions
@given('I am on the equipment control panel')
def step_on_control_panel(context):
    assert "Control Panel" in context.page.title()
```

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```
@when('I click the power button')
def step_click_power_button(context):
    context.page.query_selector("#power-button").click()

@then('the equipment status should display "{status}"')
def step_verify_status(context, status):
    status_text = context.page.query_selector("#status-label").inner_text()
    assert status in status_text

@when('I set the volume slider to "{volume}"')
def step_set_volume(context, volume):
    volume_slider = context.page.query_selector("#volume-slider")
    volume_slider.set_input_files(volume)

@then('the volume level should display "{volume}"')
def step_verify_volume(context, volume):
    volume_level = context.page.query_selector("#volume-level").inner_text()
    assert volume in volume_level

@when('I press the play button')
def step_press_play_button(context):
    context.page.query_selector("#play-button").click()

@then('the video should start playing')
def step_verify_video_play(context):
    current_time = context.page.evaluate("document.querySelector('#video-player').currentTime")
    assert current_time > 0

@when('I press the pause button')
```

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```
def step_press_pause_button(context):
    context.page.query_selector("#pause-button").click()


@then('the video should stop playing')
def step_verify_video_pause(context):
    paused_time = context.page.evaluate("document.querySelector('#video-player').currentTime")
    assert paused_time == 0


@when('I check the network connection')
def step_check_network(context):
    context.page.query_selector("#network-check-button").click()


@then('the network status should display "{status}"')
def step_verify_network_status(context, status):
    network_status = context.page.query_selector("#network-status").inner_text()
    assert status in network_status


@when('a low battery condition is simulated')
def step_simulate_low_battery(context):
    context.page.query_selector("#simulate-low-battery").click()


@then('a "{alert}" alert should display')
def step_verify_alert(context, alert):
    alert_text = context.page.query_selector("#battery-alert").inner_text()
    assert alert in alert_text
```

Running the Feature File

To execute the tests, run:

```
behave
```

This command will:

- Read your .feature files.

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- Execute the mapped steps in audio_visual_steps.py.
- Output test results in a user-friendly format, indicating pass/fail statuses for each scenario.

Benefits of Using Feature Files

- **Readability**: The Gherkin syntax in feature files makes it easy for non-technical stakeholders to understand the test cases.
- **Maintainability**: As requirements evolve, feature files can be updated to reflect new behaviors, and the step definitions can be reused across tests.
- **Modularity**: BDD allows for a clear separation between test intent (in the feature file) and implementation (in the step definitions).

Using feature files is optional, but they provide a structured and collaborative approach to testing if that’s beneficial for your workflow.