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Test Plan

Unit Test:

Power Supply

1. Check if the Raspberry Pi gets a steady **5V** from the power adapter.
2. Verify that the 3.3V GPIO pin powers the RFID reader correctly.
3. Confirm the motor driver and LCD screen are powered from the 5V GPIO pin without overloading.

RFID Reader

4. Test if valid RFID tags embedded in mini-records are detected.
5. Check that unregistered tags are ignored.
6. Verify consistent detection when scanning multiple tags in a row.

Spinning Disk Motor

7. Confirm the motor spins when a control signal is sent from the Raspberry Pi GPIO pin.
8. Test the motor's speed consistency while running.
9. Ensure the motor stops spinning when playback is paused.

Audio System

10. Verify sound output through the speakers is clear.
11. Test volume control to ensure it adjusts levels up and down as expected.
12. Check for distortion at maximum volume.

Physical Controls

13. Pressing the **play button** starts playback.
14. Pressing the **pause button** stops playback.
15. The **skip button** advances to the next track.
16. Volume buttons change the audio level accurately.

Spotify Integration

17. Verify the Spotify API triggers the correct song/playlist based on the RFID tag.
18. Ensure playback state (is_playing) updates correctly.
19. Check system response to Spotify errors like no internet connection.

LCD Screen

20. Ensure the LCD powers on and displays text correctly.
21. Check if it shows the current track and artist name.
22. Test scrolling for long song or artist names.

Verification Tests:

1. **Mini-record triggers playback:**
   Placing a mini-record with an embedded RFID tag starts playback of the associated Spotify song or playlist.
2. **Mini-record stops playback:**
   Removing the mini-record pauses Spotify playback and stops the spinning disk.
3. **Play button starts playback:**
   Pressing the physical "Play" button resumes Spotify playback.
4. **Pause button stops playback:**
   Pressing the "Pause" button pauses Spotify playback and stops the spinning disk.
5. **Skip button advances track:**
   Pressing the "Skip" button skips to the next track in the playlist.
6. **Volume up increases sound level:**
   Pressing the "Volume Up" button increases the volume through the built-in speakers.
7. **Volume down decreases sound level:**
   Pressing the "Volume Down" button decreases the volume.
8. **LCD updates current track:**
   When playback starts, the LCD displays the current track name and artist.
9. **Scrolling for long text:**
   If the track name or artist exceeds 16 characters, the LCD scrolls the text smoothly.
10. **Spinning disk starts with playback:**
    The motorized disk starts spinning when Spotify playback begins.
11. **Spinning disk stops when paused:**
    The spinning disk halts when playback is paused or stopped.

12. **Unregistered RFID tag has no effect:**
    Scanning an unregistered RFID tag does not start playback, display a track, or spin the disk.
13. **Register new RFID tag to a playing song:**
    While a song is playing, register a new RFID tag to that song. After registering, scanning the tag should immediately trigger playback of the registered song.
14. **Prevent re-registering a card:**
    If a registered RFID tag is scanned during a registration process, the system should display a message on the LCD (e.g., "Card already registered") and reject the re-registration.

Validation Tests:

Must Requirements:

1. Playback starts with mini-record: Placing a mini-record with an RFID tag starts Spotify playback and spins the disk.

2. Playback stops with mini-record removal: Removing the mini-record pauses Spotify playback and stops the spinning disk.
3. Correct song/playlist triggers:
   The system plays the correct Spotify song or playlist associated with the RFID tag.
4. Handle unregistered tags:
   Scanning an unregistered RFID tag displays "Tag not recognized" on the LCD and does not affect playback.
5. Track display on LCD:
   The LCD shows the current Spotify track name and artist during playback.
6. Playback controls work:
   - Play/pause buttons resume and pause playback.
   - Skip button advances to the next track.
   - Volume buttons adjust audio levels smoothly.
7. Spinning disk synchronizes with playback:
   The motorized disk spins only during playback and stops immediately when playback halts.
8. Wi-Fi and Spotify connection:
   The system connects to Wi-Fi and interacts with the Spotify API to retrieve and control playback.
9. Clear audio output:
   The audio plays through the speakers without distortion.

Should Requirements

10. Scroll long text on LCD:
    If the track name or artist name exceeds 16 characters, the LCD scrolls the text smoothly.
11. Volume sync with Spotify app:
    Changes to volume on the system are reflected in the Spotify app and vice versa.
12. Prevent duplicate registration:
    Attempting to register a tag already associated with a song displays "Card already registered" and rejects re-registration.
13. Delete RFID tag registration:
    The system allows users to remove a tag's association with a song, and the tag is no longer recognized.
14. Error messages for network issues:
    If the system loses Wi-Fi or Spotify access, the LCD shows an appropriate error message, like "No internet connection."
15. Recover from network loss:
    The system reconnects to Wi-Fi and Spotify automatically after losing connection.

16. Power cycle recovery:
    The system resumes functionality without losing data or requiring reconfiguration after a power cycle.
17. Unregistered tag feedback:
    Scanning an unregistered RFID tag provides feedback like "Tag not recognized" on the LCD.
18. Error recovery:
    The system gracefully handles unexpected conditions like invalid RFID scans or Spotify API rate limits without freezing.

May Requirements

19. Mute functionality:
    The system provides a mute function to silence audio without stopping playback.
20. Manual disk stop:
    A button allows the user to stop the spinning disk manually while playback continues.
21. Stereo output:
    The system supports stereo audio output if connected to stereo speakers.
22. Multiple device playback compatibility:
    The system functions correctly even if the Spotify account is in use on another device.