Software Requirements Specification

for

FaceTime Call Management and Interaction

Version 1.2

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Revision History

Name	Date	Reason For Changes	Version
James Stevens	01 Oct 2024	Initial version	1.0
James Stevens	11 Oct 2024	Corrections after feedback from 09 Oct 2024	1.1
James Stevens	13 Oct 2024	Corrections after feedback from 13 Oct 2024	1.2

1. Introduction

1.1 Purpose

This Software Requirements Specification (SRS) document outlines the functional and non-functional requirements for the FaceTime Call Management and Interaction software on iPhone, version 1.0. This document covers the full scope of the software, including core features such as call management, device handoff, video and audio adjustments, accessibility features like live captions, and collaborative tools like document sharing and SharePlay. The document highlights eight high-level features intended for development and implementation, ensuring comprehensive coverage of user interaction, performance, security, and integration with the iOS ecosystem. The intended audience includes developers, project managers, and quality assurance teams.

1.2 Document Conventions

This document follows the IEEE 830-1998 standard for Software Requirements Specifications (SRS). The following typographical conventions are applied consistently throughout the document:

- **Bold** is used to denote section headers, allowing for easier navigation of major topics.
- ***Italics*** *highlight key terms, definitions, or points of emphasis to ensure these items stand out for clarity.*
- **`Courier New`** font is used for system functions, code snippets, or technical references, distinguishing them from general narrative text.

Feature numbers correspond to those used in the requirements specification section to maintain consistency and provide clear references between sections. Each requirement—whether high-level or detailed—has its own explicitly assigned priority to ensure clarity in its implementation. Priority inheritance from higher-level requirements to detailed requirements is not assumed, which guarantees that each requirement is individually assessed based on its importance and impact.

1.3 Intended Audience and Reading Suggestions

This document is intended for various stakeholders involved in the design, implementation, testing, and documentation of the FaceTime Call Management and Interaction software. These stakeholders include:

- **Project Managers**: For planning, scheduling, and overseeing the implementation of the features described in the document.
- **Developers**: To understand the technical requirements and design specifications needed for software implementation.
- **Quality Assurance Personnel**: To verify that the software meets the functional and non-functional requirements.
- **Testers**: To ensure that the software functions as expected and to identify any defects through test cases.
- **Documentation Writers**: To provide user manuals, help documents, and tutorials for end users.
- **Users**: To gain a basic understanding of the software's features and capabilities (if applicable).
- **Marketing Staff**: To gain insight into the features and value proposition of the software for communication to customers.

Document Organization

- **Section 1: Introduction**

  Outlines the purpose, scope, intended audience, and document conventions for the FaceTime Call Management and Interaction software. This section also includes references to relevant Apple and IEEE documentation.

- **Section 2: Overall Description**

  Provides a detailed overview of the system, including product perspective, system context, product features, user classes, operating environment, design constraints, user documentation, and assumptions.

- **Section 3: System Features**

  Details the system's key features, such as Handoff between Apple devices, Live Captions, video and audio settings customization, and AR reactions.

- **Section 4: External Interface Requirements**

  Specifies the system's user, hardware, software, and communication interfaces.
- **Section 5: System Features/Modules**

  Describes the various system modules in-depth, outlining how each feature is structured and implemented, along with its functional requirements.
- **Section 6: Nonfunctional Requirements**

  Focuses on system performance, security, usability, scalability, reliability, and compatibility.

Reading Suggestions

- **Project Managers** should start with **Section 2** to understand the system's overview and features, then proceed to **Section 3** for high-level system features, **Section 5** for specific modules, and **Section 6** for non-functional requirements.
- **Developers** should begin with **Section 3**, which outlines the system features guiding development, followed by **Section 5** for module details and **Section 4** for external interface requirements to ensure system integration.
- **Quality Assurance Personnel** should focus on **Sections 3 and 5** for stimulus/response sequences, interface requirements, and feature breakdowns. **Section 6** should also be reviewed for performance and reliability criteria.
- **Testers** should prioritize **Sections 3, 4, and 5**, particularly for details on functional requirements and test case development, ensuring alignment with system behavior and error-handling mechanisms.
- **Documentation Writers** should focus on **Sections 2, 3, 5, and 6** to ensure user manuals and technical documents provide comprehensive coverage of system features, interface descriptions, and user interactions.
- **Users** (if applicable) may refer to **Section 2** for an overview of the system's features and its intended use, particularly in terms of device handoff, video/audio customization, and accessibility.
- **Marketing Staff** may review **Section 2** to understand the system's core features and value propositions for promotional purposes.

1.4 Product Scope

The FaceTime Call Management and Interaction software is designed as an extension of Apple's iPhone operating system, offering advanced features that enhance the video and audio call capabilities of FaceTime. This software enables users to seamlessly manage their FaceTime interactions across multiple Apple devices, promoting greater flexibility, collaboration, and user engagement. Key features include task handoff between devices, real-time video adjustments, augmented reality (AR) filters, live captions for accessibility, and document collaboration during calls.

The primary purpose of the software is to empower users with enhanced tools to manage their FaceTime interactions effortlessly, whether for personal or professional use. Its key objectives are to:

- Enhance productivity by facilitating collaboration during FaceTime calls through document sharing and real-time video adjustments.
- Improve accessibility through features like live captions, ensuring that users with hearing impairments can fully participate in conversations.
- Promote seamless device integration, allowing users to switch between Apple devices (iPhone, iPad, Mac) during calls without interruptions, fostering a fluid experience across the Apple ecosystem.

This software supports Apple's goal of creating an integrated ecosystem that provides effortless communication and collaboration across its devices. By improving user interaction and device interconnectivity, the software enhances both personal and professional use cases, driving greater customer satisfaction and retention within Apple's ecosystem. It aligns with Apple's broader strategy of boosting cross-device engagement and deepening customer loyalty by offering tools that simplify and enhance the overall communication experience.

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2. Overall Description

2.1 Product Perspective

The FaceTime Call Management and Interaction software is a new extension of Apple's FaceTime feature, which has been a core part of the iPhone operating system since its introduction. This system builds upon the existing FaceTime infrastructure to introduce advanced call management, collaboration tools, and enhanced audio/video customization features. While FaceTime has traditionally supported basic video and audio calls, this software represents the next evolution of its capabilities, focusing on seamless device handoff, collaborative tools, and advanced customization for professional and personal use.

This software is not a standalone product, but rather a component of the larger iOS ecosystem, meant to improve FaceTime interoperability across Apple devices such as iPhones, iPads, Macs, and Apple Watches. It complements Apple's objective of offering a tightly integrated user experience across devices, making it easier for users to manage calls, media, and interactions effortlessly, regardless of the device they are using.

This solution does not replace any existing system, but instead extends the capabilities of the current FaceTime application. It specifically addresses growing user needs for advanced call management, real-time collaboration, and improved accessibility features, particularly in response to the increasing demand for remote work solutions and cross-device integration.

2.2 Product Features

The FaceTime Call Management and Interaction software supports the following major features, organized by functionality:

Collaboration and Device Integration

- **Hand off tasks between Apple devices**: Users can seamlessly switch FaceTime calls or other tasks between Apple devices (iPhone, iPad, Mac) without interrupting the ongoing call or task.
- **Request or give remote control in a FaceTime call**: Users can request or grant remote control of their device during a FaceTime call, enabling remote assistance or demonstrations.

Audio and Video Customization

- **Change FaceTime video settings**: Users can adjust video settings during a call, including switching cameras, enabling Portrait mode for background blur, and adjusting brightness.
- **Change FaceTime audio settings**: Users can customize the audio experience by selecting features like noise cancellation, Voice Isolation, or Wide Spectrum mode.
- **Change your appearance in a FaceTime call**: Users can apply filters, use Memoji, or add stickers, labels, and shapes to enhance their visual appearance during video calls.

User Engagement and Reactions

- **Add reactions in a video call**: Users can use augmented reality (AR) effects, such as hearts or confetti, triggered by hand gestures or on-screen controls to express reactions during a FaceTime call.

Accessibility

- **Turn on Live Captions in a FaceTime call**: Users can activate real-time Live Captions, which transcribe spoken words into text to improve accessibility for users with hearing impairments.

Capturing Moments

- **Take a Live Photo in FaceTime**: Users can capture Live Photos during a FaceTime video call, preserving key moments from the conversation.

2.3 User Classes and Characteristics

The intended target users of the FaceTime Call Management and Interaction software are divided into several key user classes, each with unique characteristics and requirements:

Standard User

- **Characteristics**: Standard users primarily use FaceTime for personal communication, such as video calls with friends and family. They typically have basic technical expertise and use common features like call initiation, video switching, and adding simple effects.
- **Frequency of Use**: Moderate to frequent.
- **Functions Used**: Basic FaceTime features, such as starting and managing calls, turning the camera on/off, applying basic filters, and using reactions. They are unlikely to use advanced collaboration tools such as document sharing or remote control.

- **Security/Privilege Levels**: Standard users have access to core FaceTime functions but may have limited access to advanced controls such as remote assistance or multi-device handoff.
- **Importance**: Standard users are important to satisfy, particularly regarding usability and accessibility. Their needs are generally simpler than those of professional users.

Professional User

- **Characteristics**: Professional users rely on FaceTime for work-related communication and remote collaboration. They tend to have higher technical expertise and are more likely to utilize advanced features like document collaboration, and remote device control.
- **Frequency of Use**: Frequent to daily.
- **Functions Used**: Advanced features, including document sharing, multi-device handoff, remote control, and customized video/audio settings (such as Voice Isolation). They require a seamless and reliable experience to enhance productivity.
- **Security/Privilege Levels**: Professional users may have elevated access to collaboration tools, remote control functionality, and multi-device integration.
- **Importance**: Professional users are critical to satisfy due to their reliance on FaceTime for productivity, collaboration, and high performance.

Accessibility User

- **Characteristics**: Accessibility users rely on specific features to assist with disabilities, such as Live Captions for hearing impairments. They may have varied technical expertise but need simple, clear, and highly functional accessibility tools.
- **Frequency of Use**: Occasional to frequent.
- **Functions Used**: Accessibility features such as Live Captions, voice commands, and other assistive technologies.
- **Security/Privilege Levels**: Accessibility users generally have access to the same functions as Standard Users, with additional focus on personalization and usability for their specific needs.
- **Importance**: Highly important to satisfy, as this group depends on the availability of accessibility tools for a positive experience.

Occasional User

- **Characteristics**: Occasional users are individuals who use FaceTime less frequently, often for specific events or infrequent personal communication. They have limited technical expertise and prioritize ease of use over advanced functionality.
- **Frequency of Use**: Infrequent.
- **Functions Used**: Basic call management and possibly simple effects or audio/video settings. Advanced features like document sharing are rarely utilized.
- **Security/Privilege Levels**: Occasional users have basic access to core FaceTime features.
- **Importance**: Less important to satisfy than other groups, but their needs for ease of use and simplicity must still be addressed.

Prioritization of User Classes

While all user groups are important, the Professional Users and Accessibility Users are the primary focus due to their more complex needs and reliance on advanced features. Standard Users and Occasional Users are secondary, with the focus on ensuring usability and accessibility.

2.4 Operating Environment

OE-1: The FaceTime Call Management and Interaction software shall operate within Apple's iOS ecosystem.

- OE-1.1: The system shall operate on iOS devices, including iPhones.
- OE-1.2: The system shall operate on iPadOS devices, including iPads.
- OE-1.3: The system shall operate on macOS devices, including Macs.

OE-2: The software shall be compatible with the following hardware and software platforms:

- OE-2.1: iPhones (iPhone SE 2nd generation and later, running iOS 12.1.4 or later).
- OE-2.2: iPads (running iPadOS 13 or later).
- OE-2.3: Macs (running macOS X 10.14.3 Supplemental Update or later).
- OE-2.4: Apple Watches (for notifications and Handoff capabilities).

OE-3: The software shall require FaceTime-compatible hardware such as:

- OE-3.1: Camera for video calls.
- OE-3.1: Microphone for audio input.
- OE-3.1: Speakers for audio output.

OE-4: Supported Operating Systems

- OE-4.1: iOS 12.1.4 and later for iPhones.
- OE-4.1: iPadOS 13 and later for iPads.
- OE-4.1: macOS X 10.14.3 Supplemental Update and later for Macs.

OE-5: Integration with Other Software Components

- OE-5.1: iCloud for document sharing and collaboration across devices.
- OE-5.1: AirPlay & Handoff for seamless task and call switching between Apple devices.
- OE-5.1: Siri for voice-activated commands to manage calls and video settings.
- OE-5.1: Apple Watch for managing FaceTime notifications and handoff between devices.

OE-6: Coexistence with Other Applications

- OE-6.1: The software shall ensure minimal resource consumption.
- OE-6.2: Efficient use of system resources such as memory, CPU, and battery.
- OE-6.3: Compatibility with third-party apps that may use the camera, microphone, or network resources.
- OE-6.4: The software shall respect system-level security protocols.
- OE-6.5: The software shall not conflict with third-party apps that may also use the camera, microphone, or network resources.

OE-7: Battery Optimization

- OE-7.1: FaceTime's resource usage shall be optimized for extended video and audio call durations, balancing performance with energy consumption.

2.5 Design and Implementation Constraints

DIC-1: iOS and Apple Ecosystem Compatibility

- DIC-1.1: The software shall be fully compatible with iOS APIs and hardware across the range of Apple devices (iPhones, iPads, Macs).
- DIC-1.2: It shall adhere to Apple's Human Interface Guidelines (HIG) to ensure a consistent user experience across devices.

DIC-2: Hardware Limitations

- DIC-2.1: Developers shall account for hardware constraints such as memory limitations, battery optimization, and performance requirements, particularly for devices running iOS 15 or later.
- DIC-2.2: Real-time video effects, live captions, and multitasking shall be optimized to ensure smooth operation on older or lower-tier hardware.

DIC-3: Security Considerations

- DIC-3.1: All features shall comply with Apple's security policies and regulatory requirements (e.g., GDPR, CCPA).
- DIC-3.2: Remote control, document sharing, and call handoff features shall use end-to-end encryption.
- DIC-3.3: Secure authentication and session management shall be required.

DIC-4: Interfaces to Other Applications

- DIC-4.1: The software shall integrate seamlessly with iCloud.
- DIC-4.2: The software shall integrate seamlessly with AirPlay.
- DIC-4.3: Any integration with third-party apps or services shall comply with Apple's App Store Review Guidelines.
- DIC-4.4: Secure protocols like OAuth shall be used when interacting with external systems.

DIC-5: Corporate and Regulatory Policies

- DIC-5.1: Developers shall ensure compliance with accessibility guidelines (e.g., WCAG).
- DIC-5.2: Compliance with data privacy regulations (e.g., GDPR, CCPA) shall be required for user consent and data collection.

DIC-6: Parallel Operations and Multitasking

- DIC-6.1: The software shall support multitasking and background operations without degrading device performance.
- DIC-6.2: Document collaboration and live video effects shall not excessively drain battery life or interfere with other background apps.

DIC-7: Programming Standards and Technologies

- DIC-7.1: Development shall use Swift and Objective-C within Xcode, following Apple's programming standards.

- DIC-7.2: Key frameworks shall include Core Data, Core Animation, and ARKit for video effects.
- DIC-7.3: All code must adhere to Apple's best practices for maintainability, performance, and compatibility.

2.6 User Documentation

UD-1: The user documentation for the FaceTime Call Management and Interaction software shall include the following components:

- UD-1.1: Online Help Manual
    - UD-1.1.1: An online help manual shall be available, accessible through Apple's support website.
    - UD-1.1.2: The manual shall cover core features such as call management, video settings, and remote control.
    - UD-1.1.3: The manual shall provide providing step-by-step instructions for both Standard and Professional Users.
    - UD-1.1.4: The manual shall be able to refer to the manual to understand how to navigate and utilize the various features of the FaceTime Call Management and Interaction software.
- UD-1.2: Interactive Tutorial (Suggested Implementation)
    - UD-1.2.1: A built-in interactive tutorial shall be implemented to guide users through the basic and advanced features of FaceTime.
    - UD-1.2.2: Following Apple's iOS Human Interface Guidelines, the tutorial shall include interactive elements to assist users in learning functionalities like device switching and video effects.
    - UD-1.2.3: The tutorial shall enhance the user experience and simplify the onboarding process for new users.
- UD-1.3: Quick Start Guide (Suggested Implementation)
    - UD-1.3.1: A concise PDF Quick Start Guide shall be developed and made available for download from Apple's support website.
    - UD-1.3.2: The Quick Start Guide shall offer essential steps for setting up FaceTime and using its features, both for personal and professional purposes.

    - UD-1.3.3: The Quick Start Guide shall be valuable for users seeking a simple and direct way to get started with the software.
- UD-1.4: Video Tutorials
    - UD-1.4.1: Short video tutorials shall be hosted on Apple Support's YouTube channel and the Apple website.
    - UD-1.4.2: These videos shall cover Live Captions, SharePlay, and task handoff between devices
    - UD-1.4.3: The videos shall provide visual guides for complex features.
- UD-1.5: Frequently Asked Questions (FAQ)
    - UD-1.5.1: A FAQ section shall be available online, addressing common user issues.
    - UD-1.5.2: The FAQ shall provide troubleshooting tips for quick resolution of problems.

UD-2: Delivery Formats and Standards

- UD-2.1: Delivery Formats
    - UD-2.1.1: The online help manual shall be delivered in HTML format, optimized for both mobile and desktop views.
    - UD-2.1.2: Video tutorials shall be delivered in streaming video format (MP4) via YouTube and the Apple Support website.
- UD-2.2: Standards
    - UD-2.2.1: All documentation shall follow Apple's iOS Human Interface Guidelines.
    - UD-2.2.2: The documentation shall comply with WCAG 2.1 accessibility standards, ensuring usability for all users, including those with disabilities.

2.7 Assumptions and Dependencies

This section outlines the key assumptions and dependencies that could affect the requirements and functionality of the FaceTime Call Management and Interaction software:

Assumptions

- **Dependence on iCloud Services**

  The software relies on iCloud services for document sharing, collaboration, and storage. Any disruptions or limitations in iCloud availability could negatively impact these features.

- **FaceTime-Compatible Devices**

  It is assumed that users will be using FaceTime-compatible devices, specifically:

  - **iPhones** running iOS 12.1.4 or later.
  - **iPads** running iPadOS 13 or later.
  - **Macs** running macOS X 10.14.3 Supplemental Update or later. Users with older devices or unsupported platforms may experience degraded functionality.

- **Network Connectivity**

  It is assumed that users will have a stable Wi-Fi or cellular network connection. Real-time video effects, remote control, and other collaboration features depend heavily on network performance, and poor connectivity may lead to degraded performance.

- **Battery Life and Device Performance**

  The software assumes that devices will have sufficient battery life and processing power to handle resource-intensive features like video effects and task handoff. These features may not perform optimally on older devices or devices with low battery levels.

- **User Knowledge and Behavior**

  It is assumed that users have basic knowledge of iOS and FaceTime functionalities. Minimal training may be required for advanced features, and in-app tutorials will provide necessary guidance.

Dependencies

- **Apple Ecosystem**

  The software assumes that all devices are part of Apple's ecosystem, with no cross-platform compatibility required (e.g., with Android or Windows). The software relies on the continuity and stability of Apple APIs for FaceTime, iCloud, and AirPlay.

- **Third-Party App Integration**

  Although the software primarily integrates with Apple services (e.g., iCloud, AirPlay), it assumes that any third-party apps used for document collaboration or other purposes will comply with Apple's App Store Review Guidelines and security protocols.

- **Security Compliance**

  The system assumes that Apple's security policies and end-to-end encryption for FaceTime calls remain unchanged. Any changes to these security standards could affect the system's ability to provide secure communication.

Potential Impact of Changes

Any disruptions in iCloud services, changes to Apple's security standards, or limitations in network connectivity could significantly affect the software's performance and functionality.

3. System Features

The FaceTime Call Management and Interaction software includes several features designed to enhance user experience across different Apple devices. These features allow users to seamlessly hand off tasks between devices, customize video and audio settings, and apply augmented reality effects during FaceTime calls. The following features provide an overview of the system's capabilities.

3.1 Hand off tasks between Apple devices

Users can seamlessly transfer active FaceTime calls between devices (iPhone, iPad, Mac) using Handoff technology, ensuring no interruptions during calls. This feature allows users to switch devices mid-call and continue with the same settings.

3.2 Turn on Live Captions in a FaceTime call on iPhone

Users can activate live captions during a FaceTime video call, providing real-time transcription of spoken words for enhanced accessibility. This feature is particularly beneficial for users with hearing impairments.

3.3 Change FaceTime video settings on iPhone

During a FaceTime call, users can modify video settings such as switching between cameras, turning on or off Portrait Mode, and adjusting Studio Light to improve video quality.

3.4 Add reactions in a video call on iPhone

This feature allows users to add reactions and augmented reality (AR) effects to video calls. Using hand gestures or selecting from a menu of effects, users can apply visual elements like confetti, fireworks, or emoji reactions to the video stream.

3.5 Change FaceTime audio settings on iPhone

Users can control audio settings during FaceTime calls, including options for Spatial Audio, Voice Isolation, and Wide Spectrum modes to adjust sound clarity based on the environment.

3.6 Change your appearance in a FaceTime call on iPhone

Users can change their appearance using filters and become their Memoji during FaceTime video calls. This feature allows users to apply digital effects to their faces, making conversations more fun and personalized.

3.7 Request or give remote control in a FaceTime call on iPhone

Users can request or grant remote control of their device during a FaceTime call, allowing another participant to control their screen for assistance or demonstration purposes.

3.8 Take a Live Photo in FaceTime on iPhone

Users can take Live Photos during FaceTime video calls, capturing moments in real-time. Both participants are notified when a photo is taken.

4. External Interface Requirements

4.1 User Interfaces

EIR-1.1: The system shall integrate with the iPhone's existing FaceTime User Interface (UI).

EIR-1.2: The system shall provide an intuitive graphical user interface (GUI)for task handoff, live captions, video/audio adjustments, and other features.

EIR-1.3: The interface shall be based on Apple's Human Interface Guidelines, ensuring a consistent and user-friendly experience across all supported devices (iPhone, iPad, Mac).

EIR-1.4: Task Handoff

- EIR-1.4.1: Users shall initiate a task handoff by tapping an icon that appears on the target device (iPhone, iPad, or Mac).
- EIR-1.4.2: A notification shall appear on the secondary device, prompting the user to switch the active FaceTime call.
- EIR-1.4.3: Once the switch is complete, the user shall receive a visual confirmation that the call has been handed off.

EIR-1.5: Live Captions

- EIR-1.5.1: During a video call, users shall activate Live Captions by tapping a button within the FaceTime settings.
- EIR-1.5.2: The captions shall appear at the top of the screen, displaying real-time transcription of the conversation, along with the name of the speaker for context.
- EIR-1.5.3: Users shall receive feedback as captions synchronize with the audio in real-time.

EIR-1.6: Video/Audio Adjustments

- EIR-1.6.1: Users shall access video and audio settings through a control panel within the FaceTime app.
- EIR-1.6.2: Video settings shall allow users to switch cameras, turn Portrait Mode on or off, and adjust lighting (e.g., Studio Light).
- EIR-1.6.3: Audio settings shall provide options such as Voice Isolation, Wide Spectrum, and Spatial Audio.
- EIR-1.6.4: As users make changes, he system shall provide visual feedback, such as toggling between different camera views or switching audio modes.

EIR-1.7: The system shall be entirely GUI-based, featuring buttons, icons, and sliders for all settings and features.
EIR-1.8: The interface shall support standard iOS gestures, such as tapping, swiping, and pinching to adjust video size or switch between different controls.

4.1.1 Minimum Interface Requirements

MIR-1.1: The user interface shall follow the established Apple Human Interface Guidelines, ensuring consistency in button placement, icons, and interactions.
MIR-1.2: Buttons for Core Functions

- MIR-1.2.1: Each screen shall feature standard buttons for task handoff, video/audio settings, and Live Captions.
- MIR-1.2.2: These buttons shall be clearly labeled, consistent across devices, and always accessible during a call.

MIR-1.3: Screen Layout Constraints

- MIR-1.3.1: The layout shall adapt to different screen sizes (iPhone, iPad, Mac), with controls placed in easy-to-reach areas.
- MIR-1.3.2: For mobile devices, buttons shall accommodate one-handed use, with key controls anchored at the bottom for easier thumb access.
- MIR-1.3.3: On larger screens (iPad, Mac), the layout shall adjust to maximize ease of use while ensuring that frequently used buttons are not obscured by other content.

MIR-1.4: Error Messages and Visual Feedback

- MIR-1.4.1: Error messages shall be displayed as banners at the top or as modal pop-ups when a task handoff fails, or the system cannot connect to another device.
- MIR-1.4.2: Visual indicators such as color-coded icons (green for active features, red for errors) and animated toggles shall inform users when features like Live Captions or Voice Isolation are active or have encountered an issue.

MIR-1.5: Keyboard Shortcuts

- MIR-1.5.1: On Macs, common functions such as muting audio, switching cameras, and activating Live Captions shall be available through keyboard shortcuts.
- MIR-1.5.2: These shortcuts shall follow standard macOS conventions, allowing users to navigate the interface efficiently.

MIR-1.6: Accessibility Standards

- MIR-1.6.1: The interface shall meet WCAG 2.1 standards, ensuring that users with disabilities can access all features.
- MIR-1.6.2: Live Captions shall support users with hearing impairments.
- MIR-1.6.3: Voice control options shall cater to users with motor impairments.
- MIR-1.6.4: Keyboard navigation options shall cater to users with motor impairments.

4.2 Hardware Interfaces

HI-1: General Hardware Interface Overview

- HI-1.1: The FaceTime Call Management and Interaction software shall interact with several key hardware components on supported Apple devices (iPhone, iPad, Mac).
- HI-1.2: The system shall include both logical and physical characteristics of the hardware interfaces used.
- HI-1.3: The system shall define the nature of data interactions with the hardware components.
- HI-1.4: The system shall define the nature of control interactions with the hardware components.
- HI-1.5: The system shall specify the communication protocols (e.g., Bluetooth, Wi-Fi) used for interaction between the devices.

HI-2: Camera Interface

- HI-2.1: The software shall interface with the device’s front and rear cameras to capture and transmit video during FaceTime calls.
    - HI-2.1.1: It shall support HD and 4K resolution, depending on the device's hardware capabilities.
    - HI-2.1.2: Users shall control the camera (e.g., switching cameras, applying Portrait Mode, using AR filters) via the FaceTime UI.
- HI-2.2: Data Interaction
    - HI-2.2.1: The system shall capture live video feeds, processes video effects.
    - HI-2.2.2: The system shall transmit the data in real-time over Wi-Fi or cellular networks.

- HI-2.3: Control Interaction
    - HI-2.3.1: Users shall toggle camera settings via in-app controls, including switching between cameras and activating Portrait Mode or AR effects.

HI-3: Microphone Interface

- HI-3.1: The system shall utilize the built-in microphone to capture audio, with support for Voice Isolation, Wide Spectrum, and noise-cancellation modes.
- HI-3.2: Data Interaction
    - HI-3.2.1: The system shall capture raw audio, which is processed for real-time transmission alongside video.
    - HI-3.2.2: The system shall audio synchronization to occur over Wi-Fi or cellular networks.
- HI-3.3: Control Interaction
    - HI-3.3.1: Users shall toggle audio modes and mute/unmute the microphone via the control panel.

HI-4: Speakers/Headphones Interface

- HI-4.1: The system shall output audio through the device’s internal speakers or connected Bluetooth headphones (e.g., AirPods).
- HI-4.2: The system shall support Spatial Audio, enhancing the sound by simulating directional audio based on the participants' positions on the screen.
- HI-4.3: Data Interaction
    - HI-4.3.1: The system shall decode and play audio from other participants.
    - HI-4.3.2: The system shall support Spatial Audio to process the sound to match the visual arrangement of participants.
- HI-4.4: Control Interaction
    - HI-4.4.1: Users shall adjust volume and audio modes via hardware buttons and software settings.

HI-5: Display Interface

- HI-5.1: The software shall render real-time video on the device’s display, supporting Picture-in-Picture for multitasking.
- HI-5.2: The system shall adjust the layout automatically based on screen size and orientation.

- HI-5.3: Data Interaction
    - HI-5.3.1: The system shall display video feeds, system notifications, and status messages in real-time, adapting to device resolution.
- HI-5.4: Control Interaction
    - HI-5.4.1: Users shall resize video streams, switch between portrait/landscape mode
    - HI-5.4.2: Users shall use Picture-in-Picture with pinch-to-zoom gestures.

HI-6: Bluetooth and Wi-Fi Protocols

- HI-6.1: The software shall use Bluetooth for pairing external devices (e.g., AirPods) and Wi-Fi or cellular networks for transmitting real-time video and audio.
- HI-6.2: Bluetooth Low Energy (BLE) and Wi-Fi 6 shall be supported for efficient, high-speed communication.
- HI-6.3: Communication Protocols
    - HI-6.3.1: Bluetooth shall be used for managing external devices.
    - HI-6.3.2: Wi-Fi/cellular shall be used for call data transmission and synchronization across devices.

HI-7: Face ID and Sensors

- HI-7.1: For devices with Face ID, the system shall leverage the TrueDepth camera system for Memoji and other face-tracking features.
- HI-7.2: Data Interaction
    - HI-7.2.1: The system shall capture facial expressions and shall apply them to animated Memoji during calls.
- HI-7.3: Control Interaction
    - HI-7.3.1: Users shall enable/disable Memoji or face-tracking features during a call.

HI-8: Security Protocols

- HI-8.1: All data transmitted, including audio, video, and control inputs, shall be encrypted using end-to-end encryption.
- HI-8.2: Secure Sockets Layer (SSL) shall be used for Bluetooth and Wi-Fi communication to ensure secure data transfer between devices.

4.3 Software Interfaces

SI-1: The FaceTime Call Management and Interaction software shall integrate with several essential components within the Apple ecosystem.

SI-2: The integration shall enhance real-time communication between devices.

SI-3: The integration shall enable seamless transitions between devices during FaceTime

SI-4: Key Connections

- SI-4.1: Handoff between Devices (Supported by iPhones running iOS 12.1.4 or later, iPads running iPadOS 13 or later, and Macs running macOS X 10.14.3 Supplemental Update or later)
    - SI-4.1.1: The system shall use Handoff to allow users to seamlessly transfer active FaceTime calls between their devices (e.g., iPhone to Mac) without interruptions.
    - SI-4.1.2: Data In
        - SI-4.1.2.1: Call data, including participant information, call duration, and current call state, shall be received from one device during an active FaceTime session.
    - SI-4.1.3: Data Out
        - SI-4.1.3.1: Handoff request data shall be sent to a secondary device, including the call state and active user credentials.
    - SI-4.1.4: Service Communication
        - SI-4.1.4.1: The Continuity framework shall handle communication between devices using Bluetooth, Wi-Fi, and Handoff APIs.
        - SI-4.1.4.2: It shall ensure that the user's Apple ID credentials are securely transmitted between devices.
    - SI-4.1.5: Implementation Constraint
        - SI-4.1.5.1: Devices shall run iOS 12.1.4 or later, iPadOS 13 or later, or macOS X 10.14.3 Supplemental Update or later.
        - SI-4.1.5.2: Both devices shall be logged into the same Apple ID and connected to the same network (Bluetooth and Wi-Fi) for Handoff to function.

- SI-4.2: Memoji and AR Filters (Supported by iPhones running iOS 12.1.4 or later, iPads running iPadOS 13 or later, and Macs running macOS X 10.14.3 Supplemental Update or later)
    - SI-4.2.1: The system shall leverage Memoji and ARKit to provide users with real-time facial animations and AR filters during FaceTime calls.
    - SI-4.2.2: Data In
        - SI-4.2.2.1: Facial tracking data shall be captured via the device's TrueDepth camera (if available), used to animate the Memoji or apply AR filters.
    - SI-4.2.3: Data Out
        - SI-4.2.3.1: Video stream data, including the applied Memoji or AR filters, shall be transmitted to other participants.
    - SI-4.2.4: Service Communication
        - SI-4.2.4.1: The system shall use ARKit APIs to apply real-time effects to the user's face.
        - SI-4.2.4.2: The system shall use TrueDepth API to capture facial expressions.
    - SI-4.2.5: Implementation Constraint
        - SI-4.2.5.1: Devices shall run iOS 12.1.4 or later, iPadOS 13 or later, or macOS X 10.14.3 Supplemental Update or later.
        - SI-4.2.5.2: Memoji and AR filters shall require a device with a TrueDepth camera system.
        - SI-4.2.5.3: Devices without this hardware shall not be able to use this feature.
- SI-4.3: Audio and Video Adjustments (Supported by iPhones running iOS 12.1.4 or later)
    - SI-4.3.1: Users shall be able to adjust audio and video settings during a FaceTime call, such as switching between cameras, enabling Voice Isolation, Wide Spectrum, or turning on Portrait Mode for better video quality.
    - SI-4.3.2: Data In
        - SI-4.3.2.1: User preferences for audio and video modes, including camera selections and audio adjustments, shall be captured.
    - SI-4.3.3: Data Out
        - SI-4.3.3.1: Adjusted video and audio streams based on user settings shall be transmitted to other participants.

    - SI-4.3.4: Service Communication
        - SI-1.4.3.4.1: The system shall
          use CoreMedia and AVFoundation frameworks for processing audio and video data in real time.
    - SI-4.3.5: Implementation Constraint
        - SI-4.3.5.1: Audio and video effects shall adapt to the device's hardware capabilities, especially for older devices with limited processing power.
- SI-4.4: Remote Control Feature (Supported by iPhones running iOS 18 or later)
    - SI-4.4.1: Users shall be able to request or grant remote control of their device during a FaceTime call, enabling another participant to assist with troubleshooting or demonstrate features remotely.
    - SI-4.4.2: Data In
        - SI-4.4.2.1: Request data, including the control session, shall be sent from the controlling user.
    - SI-4.4.3: Data Out
        - SI-4.4.3.1: Control actions such as screen taps, swipes, or typing, shall be processed on the controlled device in real time.
    - SI-4.4.4: Service Communication
        - SI-4.4.4.1: The system shall use end-to-end encryption to secure communication between the devices during the remote control session.
    - SI-4.4.5: Implementation Constraint
        - SI-4.4.5.1: Both devices shall run iOS 18 or later.
        - SI-4.4.5.2: Remote control shall only be available between trusted contacts who are already saved in each other's contact lists.
- SI-4.5: Live Captions (Supported by iPhones running iOS 12.1.4 or later)
    - SI-4.5.1: The system shall provide Live Captions, which transcribe spoken dialogue into text in real time during FaceTime video calls, enhancing accessibility for users with hearing impairments.
    - SI-4.5.2: Data In
        - SI-4.5.2.1: Spoken conversation shall be captured through the microphone is converted to text using built-in speech-to-text APIs.

- SI-4.5.3: Data Out
  - SI-4.5.3.1: Transcribed captions shall be displayed on the screen in sync with the video feed.
- SI-4.5.4: Service Communication
  - SI-4.5.4.1: The system shall use speech recognition APIs for real-time transcription, ensuring that text captions are accurately synchronized with the audio feed.
- SI-4.5.5: Implementation Constraint
  - SI-4.5.5.1: Live Captions may not be available in all languages and regions.
  - SI-4.5.5.2: The accuracy of the captions shall depend on network quality and the clarity of the audio feed.

5. System Features/Modules

5.1 Hand off tasks between Apple devices

5.1.1 Description and Priority

This feature allows users to seamlessly continue tasks on one Apple device that were started on another using the Handoff capability. For example, a user can start browsing a webpage on their Mac and continue on their iPhone or transfer a FaceTime call from an iPhone to a Mac. Handoff works across various Apple apps such as Safari, Mail, FaceTime, and Maps, as well as some third-party apps. The priority of this feature is High, as it significantly enhances multi-device productivity and user experience.

5.1.2 Stimulus/Response Sequences

Stimulus: The user taps `System`, then `General`, then `AirPlay & Continuity`

Response: The system opens AirPlay & Continuity section.

Stimulus: The user toggles the Handoff button to on (green)

Response: The system activates Handoff and turns the button green.

Stimulus: During a FaceTime call on the iPhone, the user taps the FaceTime button () in the menu bar (Mac) or status bar (iPad) followed by tapping the `Switch` button.

Response: The system opens FaceTime call menu, with the “Join” button (on Mac) and `Switch` button (on iPad).

Stimulus: The user taps the `Join` button (on Mac) or `Switch` button (on iPad) to transfer the call.

Response: The system transfers the call to the iPad or Mac and sends a notification to the iPhone that the call is now on the Mac or iPad.

Stimulus: During a FaceTime call on the iPad, the user taps the FaceTime button () in the menu bar (Mac) or status bar (iPhone) followed by tapping the `Switch` button.

Response: The system opens FaceTime call menu, with the `Join` button (on Mac) and `Switch` button (on iPhone).

Stimulus: The user taps the `Join` button (on Mac) or `Switch` button (on iPhone) to transfer the call.

Response: The system transfers the call to the iPhone or Mac and sends a notification to the iPhone that the call is now on the Mac or iPhone.

Stimulus: During a FaceTime call on a Mac or iPad and the FaceTime app is open on the iPhone, the user swipes up from the bottom edge and pauses in the center of the screen to open the App Switcher screen on the iPhone.

Response: The system opens the App Switcher, which displays the FaceTime app in the form of a menu bar at the bottom of the App Switcher screen

Stimulus: The user taps the FaceTime menu bar at the bottom of the App Switcher screen.

Response: The system opens the FaceTime call menu, displaying the `Switch` button.

Stimulus: The user taps the `Switch` button.

Response: The system transfers the call to the iPhone and sends a notification to the Mac or iPad that the call is now on the iPhone.

Stimulus: During a FaceTime call on a Mac, the user taps the FaceTime button. () in the status bar (iPhone or iPad).

Response: The system opens the FaceTime menu bar with the `Switch` button.

Stimulus: The user taps the `Switch` button.

Response: The system opens the FaceTime menu, displaying the `Switch` button.

Stimulus: The user taps the `Switch` button.

Response: The system transfers the call to the iPhone and sends a notification to the Mac that the call is now on the iPhone or iPad.

Stimulus: The user taps on an app compatible with Handoff on the iPhone, Mac or iPad.

Response: The system opens the app.

Stimulus: On a different iPhone, the user swipes up from the bottom edge and pauses in the center of the screen to open the App Switcher screen.

Response: The system displays the task in the form of a menu bar at the bottom of the App Switcher screen.

Stimulus: The user taps the task menu bar at the bottom of the App Switcher screen.

Response: The system opens the app on the iPhone.

Stimulus: The user taps on an app compatible with Handoff on the iPhone, Mac or iPad.

Response: The system opens the app.

Stimulus: On a different Mac or iPad, the app appears at the right end of the Dock. The user taps on the app or presses `Command-Tab` on a Mac.

Response: The system opens the app on the iPhone, Mac or iPad. If Command-Tab is pressed on a Mac, the system quickly switches to the app that has the Handoff icon.

5.1.3 Functional Requirements

REQ-5.1.1: Upon detecting a compatible task being started on one Apple device (e.g., opening Safari, making a FaceTime call), the system shall display the Handoff icon on nearby Apple devices that are signed in to the same Apple Account and have Handoff enabled.

REQ-5.1.2: Upon selecting the Handoff icon on a receiving device, the system shall seamlessly transfer the task (e.g., a webpage or FaceTime call) to the new device without data loss or interruption.

REQ-5.1.3: The system shall notify the user on the original device that the task has been handed off and offer a button to switch the task back to the original device if desired.

REQ-5.1.4: The system shall verify that both devices have Wi-Fi and Bluetooth enabled and are within a range that allows Handoff functionality before displaying the Handoff icon.

REQ-5.1.5: Upon performing Handoff between devices, the system shall respond within a reasonable timeframe (e.g., within 2-3 seconds) to ensure a smooth user experience without lag or noticeable delay.

REQ-5.1.6: The system shall ensure that the Handoff feature is only available to users who are signed into the same Apple ID account across devices and meet security requirements for both devices.

REQ-5.1.7: If the Handoff transfer fails (e.g., due to a lost connection or device going offline), the system shall display a notification on both devices informing the user of the failure and offer a retry option.

REQ-5.1.8: The system shall encrypt all Handoff data transfers that involve sensitive information (e.g., emails, documents) to ensure privacy and display a privacy warning if the destination device does not meet minimum security standards (e.g., no passcode or biometric security enabled).

REQ-5.1.9: The system shall allow users to restrict Handoff functionality on shared or public devices, ensuring that tasks are only handed off to trusted devices marked by the user.

REQ-5.1.10: If a task is initiated on a device that is incompatible with the receiving device (e.g., trying to hand off a FaceTime call to an older macOS version), the system shall notify the user of the incompatibility and provide alternative options (e.g., continue the task on the original device).

5.2 Turn on Live Captions in a FaceTime call on iPhone

5.2.1 Description and Priority

The Live Captions feature transcribes spoken dialog into text and displays it in real-time during a FaceTime call. It is designed to assist users who have difficulty hearing by providing on-screen captions of the conversation. The priority for this feature is high, as it significantly improves accessibility and inclusivity for users with hearing impairments.

5.2.2 Stimulus/Response Sequences

Stimulus: While on a FaceTime call, the user taps the screen.

Response: The system displays the FaceTime controls.

Stimulus: The user taps the `i` icon located at the top of the controls bar.

Response: The system expands the FaceTime controls bar, displaying additional options.

Stimulus: On the Live Captions section, the user taps the white switch.

Response: The system moves the switch to the right, turning the left side green.

Stimulus: If it the first time captions is being used, the system displays a warning, notifying the user that live captions should not be relied upon in high-emergency situations.

Response: The user taps `ok`.

Stimulus: The user taps `Done`.

Response: The system closes the expanded FaceTime controls section and displays transcriptions.

Stimulus: To turn off Live Captions, the user taps the `i` icon located at the top of the controls bar.

Response: The system expands the FaceTime controls bar, displaying additional options.

Stimulus: On the Live Captions section, the user taps the white switch.

Response: The system moves the switch to the right, turning the left side green.

Stimulus: The user taps `Done`.

Response: The system closes the expanded FaceTime controls section. The system no longer displays transcriptions.

5.2.3 Functional Requirements

REQ-2.1: Upon tapping the screen during a FaceTime video call, the system shall display the FaceTime controls within 0.5 seconds on supported devices.

REQ-2.2: Upon the user tapping the Info button, the system shall display the additional options, including the Live Captions toggle.

REQ-2.3: Upon turning on Live Captions, the system shall display a warning notifying the user that Live Captions should not be relied upon in high-risk or emergency situations.

REQ-2.4: Upon the user confirming by tapping `OK`, the system shall close the warning, begin transcribing the spoken conversation in real time, and display the captions near the top of the screen.

REQ-2.5: Upon toggling off Live Captions from the Info panel, the system shall immediately stop displaying the transcriptions and remove the Live Captions window from the screen.

REQ-2.6: The system shall display the name of the speaker, accompanying the transcribed text during the call.

REQ-2.7: If the call recipient mutes the call or no audio input is detected, the system shall stop displaying the transcriptions. *(Future modification: The system should notify the user that Live Captions are paused due to the lack of audio input, enhancing user awareness.)*.

REQ-2.8: The system shall resume Live Captions automatically if audio input is restored, without the user needing to re-enable the feature.

REQ-2.9: The system shall allow users to adjust the font size, color, and background of Live Captions to enhance readability based on personal preferences.

REQ-2.10: The system shall allow users to export Live Caption transcriptions at the end of the call as a text file for reference.

REQ-2.11: The system shall notify the user when network instability affects Live Caption accuracy and give an option to disable captions for the remainder of the call.

5.3 Change FaceTime video settings on iPhone

5.3.1 Description and Priority

This feature allows users to change video settings during a FaceTime call on an iPhone, such as enabling Portrait mode, switching between front and rear cameras, and turning the camera on or off. It also includes the ability to control Studio Light mode and adjust background blur intensity. Error conditions, invalid inputs, and usability aspects are considered to ensure a seamless user experience. The priority for this feature is high, as it significantly enhances video quality and flexibility, improving the overall video calling experience.

5.3.2 Stimulus/Response Sequences

Stimulus: During a FaceTime call, the user swipes down from the top-right corner of the screen.

Response: The system opens the Control Center.

Stimulus: The user taps > next to FaceTime Controls.

Response: The system opens the Audio & Video options of FaceTime Controls.

Stimulus: If the `Portrait` button is dark gray, the feature is off. The user taps the `Portrait` button.

Response: The system activates Portrait and turns the button light gray.

Stimulus: The user taps > next to the `Portrait` button.

Response: The system opens the Portrait option, displaying the Depth slide bar.

Stimulus: The user moves the slide bar to the left.

Response: The system moves the slide bar to the left, decreasing background blur while keeping the user in focus.

Stimulus: The user moves the slide bar to the right.

Response: The system moves the slide bar to the right, increasing background blur while keeping the user in focus.

Stimulus: The user taps ˅ next to the `Portrait` button.

Response: The system closes the Portrait option.

Stimulus: If the `Studio Light` button is dark gray, the feature is off. The user taps the `Studio Light` button.

Response: The system activates Studio Light and turns the button light gray.

Stimulus: The user taps > next to the `Studio Light` button.

Response: The system opens the Studio Light option, displaying the Intensity slide bar.

Stimulus: The user moves the slide bar to the left.

Response: The system moves the slide bar to the left, decreasing the intensity of the studio light illuminating the user's face blur.

Stimulus: The user moves the slide bar to the right.

Response: The system moves the slide bar to the right, the intensity of the studio light illuminating the user's face.

Stimulus: The user taps ˅ next to the `Studio Light` button.

Response The system closes the Studio Light option.

Stimulus: The user swipes up.

Response: The system closes the FaceTime controls section.

Stimulus: The user taps their photo tile to display options.

Response: The system shows the display options.

Stimulus: User taps the camera switch icon () to change from the front camera to the rear camera during a FaceTime call.

Response: The system switches to the rear camera, allowing the user to select one of enlarge options of the rear camera by 0.5x or 1x.

5.3.3 Functional Requirements

REQ-3.1: Upon tapping their tile during a FaceTime call, the system shall display video control options, including toggling the camera on/off, switching between cameras, and enabling/disabling Portrait mode.

REQ-3.2: Upon enabling Portrait mode through FaceTime Controls, the system shall blur the background, allow the user to adjust the blur intensity, and display a visual indicator when Portrait mode is active.

REQ-3.3: Upon enabling Studio Light mode through FaceTime Controls, the system shall dim the background and illuminate the user's face, allow the user to adjust the light intensity, and display a visual indicator when Studio Light mode is active.

REQ-3.4: Upon tapping the camera switch icon during a FaceTime call, the system shall switch between the front and rear cameras and provide options to enlarge the rear camera image by 0.5x or 1x. The system shall allow the user to adjust the zoom dynamically without interrupting the ongoing call.

REQ-3.5: Upon tapping the camera off button during a FaceTime call, the system shall turn off the camera and display the user's avatar or a placeholder image.

REQ-3.6: Upon switching from the rear to the front camera (or vice versa), the system shall maintain the ongoing call without any interruptions.

REQ-3.7: The system shall allow the user to toggle Studio Light and Portrait mode simultaneously during the same call without affecting call quality or performance.

5.4 Add reactions in a video call on iPhone

5.4.1 Description and Priority

This feature enables users to enhance their video call experience by adding 3D augmented reality (AR) effects, such as hearts, balloons, fireworks, and more, using hand gestures or by manually tapping on icons during the call. The feature is intended to create a more fun and interactive environment during video calls. The priority is medium because, while it provides a significant improvement to user engagement and enjoyment, it is not critical for the essential functionality of the video call.

5.4.2 Stimulus/Response Sequences

Stimulus: During a FaceTime call, the user swipes down from the top-right corner of the screen.

Response: The system opens the Control Center.

Stimulus: The user taps > next to FaceTime Controls.

Response: The system opens the Audio & Video options of FaceTime Controls.

Stimulus: If the `Reactions` button is dark gray, the feature is off. The user taps the `Reactions` button.

Response: The system activates Reactions and turns the button light gray.

Stimulus: The user swipes up.

Response: The system closes the FaceTime controls section.

Stimulus: The user forms a heart shape using both hands (🫶) during the call.

Response: The system displays multiple animated flying heart icons.

Stimulus: The user makes a single thumbs-up gesture (👍) using one hand during the call.

Response: The system displays an animated 3D thumbs-up emoji.

Stimulus: The user makes a single thumbs-down gesture (👎) using one hand during the call.

Response: The system displays an animated 3D thumbs-down emoji.

Stimulus: The user shows a victory/peace sign (✌) with one hand during the call.

Response: The system releases multiple animated 3D balloons.

Stimulus: The user shows two thumbs down (👎) using both hands during the call.

Response: The system darkens the screen and displays a rainstorm.

Stimulus: The user displays a victory/peace sign (✌) with both hands during the call.

Response: The system showers the screen with falling confetti.

Stimulus: The user makes a "Rock on" sign (🤘) with both hands during the call.

Response: The system darkens the screen and generates laser bursts.

Stimulus: The user gives two thumbs up (👍) using both hands during the call.

Response: The system darkens the screen and generates fireworks.

Stimulus: The user taps and holds their video tile and selects the heart shape (🫶) during the call.

Response: The system displays multiple animated flying heart icons.

Stimulus: The user taps and holds their video tile and selects the single thumbs-up icon (👍) during the call.

Response: The system displays an animated 3D thumbs-up emoji.

Stimulus: The user taps and holds their video tile and selects the single thumbs-down gesture (👎) during the call.

Response: The system displays an animated 3D thumbs-down emoji.

Stimulus: The user taps and holds their video tile and selects the single victory/peace sign (✌)during the call. Response: The system releases multiple animated 3D balloons.

Stimulus: The user taps and holds their video tile and selects the two thumbs down (👎) during the call.

Response: The system darkens the screen and displays a rainstorm.

Stimulus: The user taps and holds their video tile and selects the double victory/peace sign (✌)during the call.

Response: The system showers the screen with falling confetti.

Stimulus: The user taps and holds their video tile and selects the double "Rock on" sign (🤘) during the call.

Response: The system darkens the screen and generates laser bursts.

Stimulus: The user taps and holds their video tile and selects the double thumbs up (👍) during the call.

Response: The system darkens the screen and generates fireworks.

Stimulus: If the Reactions button is light gray, the feature is on. The user taps the Reactions button.

Response: The system deactivates Reactions, turns the button dark gray and gestures no longer trigger animations.

Stimulus: The user swipes up.

Response: The system closes the FaceTime controls section.

5.4.3 Functional Requirements

REQ-4.1: The system shall provide visual feedback by turning the `Reactions` button light gray when Reactions are enabled and dark gray when disabled in the Control Center.

REQ-4.2: The system shall allow users to toggle the Reactions feature on and off via FaceTime Controls, with immediate effect on the user's ability to trigger animations.

REQ-4.3: Upon detecting a valid hand gesture (e.g., thumbs-up, thumbs-down, heart), the system shall display the corresponding 3D AR effect in the camera frame within 0.5 seconds on supported devices.

REQ-4.4: Upon the user tapping and holding their video tile and selecting an AR effect icon, the system shall display the selected effect on the screen in real-time.

REQ-4.5: The system shall provide feedback to the user by briefly displaying a notification (e.g., a sound or visual indicator) when a gesture has been successfully recognized, with customizable options for feedback.

REQ-4.6: The system shall only allow AR effects to be used when the front camera is active and notify the user if an attempt is made to use effects on the rear camera.

REQ-4.7: If more than one person is in the frame, the system shall prioritize gestures from the person closest to the camera or display a message to the user suggesting optimal gesture positioning.

REQ-4.8: The system shall allow users to turn off AR effects for specific participants in Group FaceTime calls, preventing their screen from displaying visual effects.

5.5 Change FaceTime audio settings on iPhone

5.5.1 Description and Priority

This feature allows users to change audio settings in the FaceTime app on supported devices. Users can choose between four distinct audio modes: Automatic, Standard, Voice Isolation, and Wide Spectrum, each providing unique benefits such as dynamic sound adjustment, balanced audio, filtering out background noise, or including all surrounding sounds. Additionally, users can mute and unmute their microphone during calls. This feature is essential for enhancing the audio experience during FaceTime calls and is assigned a high priority due to its impact on call quality and user experience.

5.5.2 Stimulus/Response Sequences

Stimulus: During a FaceTime call, the user taps on the screen.

Response: The system displays FaceTime call settings.

Stimulus: During a FaceTime call, the user taps the white speaker button.

Response: The system turns off the speaker. The system changes the button color to gray.

Stimulus: During a FaceTime call, user taps the gray speaker button.

Response: The system resumes audio transmission via the speaker. The system changes the button color to white.

Stimulus: During a FaceTime call, the user taps the gray mute button.

Response: The system turns off the speaker. The system changes the button color to white.

Stimulus: During a FaceTime call, user taps the white mute button.

Response: The system unmutes the microphone and resumes audio transmission. The system changes the button color to gray.

Stimulus: During a FaceTime call, the user swipes down from the top-right corner of the screen.

Response: The system opens the Control Center.

Stimulus: The user taps ‘>’ next to FaceTime Controls.

Response: The system opens the Audio & Video options of FaceTime Controls.

Stimulus: The user taps `Automatic`.

Response: The system activates the Automatic audio option, turns the button light gray, and adjusts the audio dynamically, optimizing for clarity based on the environment and background noise.

Stimulus: The user taps `Standard`.

Response: The system activates the Standard audio option, turns the button light gray, and delivers a balanced audio experience, without prioritizing specific sounds.

Stimulus: The user taps `Voice Isolation`.

Response: The system activates the Voice Isolation audio option, turns the button light gray, and isolates the user's voice by filtering out background noise for clearer communication.

Stimulus: The user taps `Wide Spectrum`.

Response: The system activates the Wide Spectrum audio option, turns the button light gray, and transmits the user's voice along with surrounding sounds for a richer audio experience.

5.5.3 Functional Requirements

REQ-5.1: Upon user selection of Automatic mode during a FaceTime call, the system shall dynamically adjust audio settings based on the environment and background noise to enhance clarity.

REQ-5.2: Upon user selection of Standard mode during a FaceTime call, the system shall maintain balanced audio without prioritizing specific sounds or voices.

REQ-5.3: Upon user selection of Voice Isolation mode during a FaceTime call, the system shall prioritize the user’s voice and filter out background noise to improve voice clarity.

REQ-5.4: Upon user selection of Wide Spectrum mode during a FaceTime call, the system shall transmit both the user's voice and surrounding ambient sounds.

REQ-5.5: The system shall notify the user if their mic is muted while they are speaking, along with the visual indication that the mic is muted.

REQ-5.6: The system shall also display a brief visual or auditory notification indicating that the mic is unmuted.

REQ-5.7: The system shall support the Automatic, Standard, Voice Isolation, and Wide Spectrum audio modes on iPhone SE (2nd generation and later) and newer supported models.

5.6 Change your appearance in a FaceTime call on iPhone

5.6.1 Description and Priority

This feature allows users to customize their appearance during a FaceTime video call using filters, Memoji, stickers, labels, and shapes. The feature enhances the user's experience by enabling creative, real-time customization of their visual appearance. The priority of this feature is Medium, as it provides personalization but is not critical to the core functionality of the FaceTime application.

5.6.2 Stimulus/Response Sequences

Stimulus: During a FaceTime call, the user taps the Effects button (). If not visible, tap the screen.

Response: The system enlarges the user's video tile and displays a bar with available filters for the user to choose from.

Stimulus: The user taps the Memoji sticker icon ().

Response: The system displays the available Memoji stickers.

Stimulus: The user selects a Memoji sticker by tapping the sticker's icon.

Response: The system displays the selected sticker on the screen. The system allows the user to drag and position it on the screen.

Stimulus: The user taps the Memoji Sticker.

Response: The system displays an "x" on the top left of the Memoji sticker.

Stimulus: The user taps the "x"

Response: The system removes the Memoji sticker.

Stimulus: The user taps the Memoji character icon ().

Response: The system displays the available Memojis.

Stimulus: The user selects a Memoji character by tapping the character's icon.

Response: The system captures the user's facial movements and expressions, transmitting them as the selected Memoji during the call. The system allows the user to drag and position it on the screen.

Stimulus: The user taps the Memoji character.

Response: The system displays an "x" on the top left of the Memoji character.

Stimulus: The user taps the "x"

Response: The system removes the Memoji character.

Stimulus: The user taps the Filters button () to open the available filters.

Response: The system displays the available filters.

Stimulus: The user selects one of the available filters by tapping the filter.

Response: The system applies the selected filter to the video feed.

Stimulus: The user taps the Text button () to open the available text labels.

Response: The system displays the available text labels.

Stimulus: The user selects one of the available labels and types their text to display on their video feed.

Response: The system displays the label with the text on the user's tile. The system allows the user to drag and position it on the screen.

Stimulus: The user taps the text label.

Response: The system displays an "x" on the top left of the text label.

Stimulus: The user taps the "x"

Response: The system removes the text label.

Stimulus: The user taps the Shapes button () to add it to the call.

Response: The system displays the available shapes.

Stimulus: The user selects one of the available shapes.

Response: The system displays the label with the text on the user's tile. The system allows the user to drag and position it on the screen.

Stimulus: The user taps the shape.

Response: The system displays an "x" on the top left of the shape.

Stimulus: The user taps the "x"

Response: The system removes the shape.

5.6.3 Functional Requirements

REQ-6.1: Upon tapping the Effects button during a FaceTime call, the system shall display a bar with available filters, Memoji, labels, stickers, and shapes for the user to interact with.

REQ-6.2: Upon selecting the Memoji option, the system shall capture the user's facial movements and expressions in real-time and transmit them as the selected Memoji during the call.

REQ-6.3: Upon selecting a Memoji sticker, the system shall display the sticker on the video feed, allowing the user to drag and position it on the screen.

REQ-6.4: Upon selecting a filter, the system shall apply the chosen filter to the user's video tile and update the feed accordingly.

REQ-6.5: Upon selecting a text label, the system shall allow the user to type text and drag the label to a desired location on their video feed.

REQ-6.6: Upon selecting a shape or sticker, the system shall display the shape or sticker on the user's tile, allowing the user to drag and position it on the screen.

REQ-6.7: Upon tapping any label, sticker, or shape, the system shall display an "x" icon on the element, allowing the user to tap the "x" to remove the element from the video feed.

REQ-6.8: If a Memoji, filter, or sticker fails to load, the system shall notify the user and continue the video call without the selected enhancement.

REQ-6.9: The system shall support simultaneous use of Memoji, filters, labels, stickers, and shapes without compromising the video quality or call performance.

REQ-6.10: If the internet connection weakens, the system shall prioritize the video and audio feed over visual effects, such as Memoji or filters, to maintain call quality.

REQ-6.11: The system shall allow the user to preview visual effects (e.g., filters, Memoji) before applying them during the call.

REQ-6.12: The system shall allow the user to save a preset combination of visual effects (e.g., filters and stickers) for quicker application in future calls.

REQ-6.13: If the connection weakens to the point of losing video entirely, the system shall notify the user that visual effects cannot be applied due to insufficient video quality.

5.7 Request or give remote control in a FaceTime call on iPhone

5.9.1 Description and Priority

This feature enables a FaceTime call participant to request remote control of the other party's iPhone screen or to give control of their own screen to a trusted participant. Remote control can be helpful in providing assistance or demonstrating app usage. Only participants saved in each other's contacts can request or give control. Both participants must be running iOS 18 or later. The priority of this feature is High due to its potential use in technical support scenarios and remote assistance, especially in situations where immediate help is required. In addition to convenience, this feature also demands strong security controls due to the sensitive nature of granting screen access.

5.9.2 Stimulus/Response Sequences

Stimulus: A participant in a FaceTime call taps Share button ( ).

Response: The system displays the option to share the screen or request viewing of the recipient's screen.

Stimulus: Participant 1 taps `Share My Screen` to share their screen with Participant 2.

Response: The system performs a countdown from 3 to one then starts screen sharing. The system notifies the Participant 1 and Participant 2 of active screen sharing.

Stimulus: Participant 1 taps `Ask to Share`.

Response: The system notifies Participant 2 of Participant 1's request to view their screen.

Stimulus: Participant 2 taps `Not now`.

Response: The system declines screen sharing. The system does not notify Participant 1 nor Participant 2 of declination.

Stimulus: Participant 1 taps `Ask to Share`.

Response: The system notifies Participant 2 of Participant 1's request to view their screen.

Stimulus: Participant 2 taps `Share`.

Response: The system performs a countdown from 3 to one then starts screen sharing. The system notifies the Participant 1 and Participant 2 of active screen sharing.

Stimulus: Participant 1 taps the shared screen.

Response: The system expands the photo tile, displaying the request Control icon () on the lower right of tile.

Stimulus: Participant 1 taps the Request Control icon ().

Response: The system sends notification to Participant 2 for remote control. The system displays `waiting for user to accept` on Participant 1's screen and `User wants to control your iPhone`, giving Participant 2 the option to select `Don't Allow` or `Allow`.

Stimulus: Participant 2 taps `Allow`.

Response: The system denies remote control and closes the request screen.

Stimulus: Participant 2 taps `Share`.

Response: The system grants remote control of Participant 2's screen to Participant 1, allowing Participant 1 full control of the device as permitted.

Stimulus: The participant controlling the screen performs tasks such as tapping, swiping, or typing.

Response: The system processes these actions and performs the corresponding tasks on the controlled iPhone, subject to restrictions (e.g., inability to modify critical settings).

Stimulus: The controlled participant tries to perform an action at the same time as the remote participant.

Response: The system prioritizes the controlled user's action and overrides the remote input.

Stimulus: The internet connection becomes unstable or drops during remote control.

Response: The system terminates the remote control session automatically, notifies both participants, and continues the FaceTime call if possible.

5.9.3 Functional Requirements

REQ-9.1: Upon the initiation of a screen share, the system shall allow a participant to request remote control by tapping the screen sharing window.

REQ-9.2: Upon receiving a remote control request, the system shall display a notification to the other participant, allowing them to `Allow` or `Don't Allow` the request.

REQ-9.3: Upon the acceptance of the request, the system shall allow the requesting participant to perform tasks such as app interactions and text input on the controlled iPhone. The system shall also disable Face ID/Touch ID and prevent changes to critical settings (e.g., Apple Account, Face ID, making payments).

REQ-9.4: The system shall allow either participant to terminate the remote control session by tapping `Stop` in the screen sharing window or by ending the FaceTime call.

REQ-9.5: Upon the termination of a remote control session, the system shall resume standard FaceTime functionality, with screen sharing continuing if applicable.

REQ-9.6: The system shall detect and handle interruptions such as network instability or disconnection, terminating the remote control session and notifying both participants. Screen sharing will continue only if the FaceTime call persists.

REQ-9.7: The system shall display a warning message before accepting a remote control request, alerting the controlled user of the risks and tasks that can be performed by the other participant. The message shall encourage the user to only approve trusted participants.

REQ-9.8: The system shall restrict remote control from making security-sensitive changes (e.g., erasing the device, modifying Face ID or passwords, making purchases).

REQ-9.9: The system shall have a delay of no more than 200 milliseconds in processing remote control inputs to ensure smooth user experience and usability.

REQ-9.10: The system shall secure all remote control communications using end-to-end encryption to protect user data from unauthorized access during the session.

REQ-9.11: The system shall ensure that remote control requests are logged and tracked to prevent abuse, with an option to report misuse if necessary.

REQ-9.12: The system shall be resilient, automatically reconnecting if minor connectivity issues arise, and seamlessly resuming remote control functionality without user intervention.

REQ-9.13: The system shall allow the user to pause and resume remote control during the session without terminating the call.

REQ-9.14: The system shall provide an option to temporarily limit remote control access to specific apps or areas of the screen (e.g., limit control to an open document or app only).

5.8 Take a Live Photo in FaceTime on iPhone

5.10.1 Description and Priority

This feature enables users to capture a FaceTime Live Photo during a video call, preserving both video and audio from just before and after the moment the photo is taken. Notifications are sent to both the user and the recipient when a Live Photo is taken. The Live Photo is saved in the user's Photos app for later viewing. This feature is a high priority as it enhances user interaction and memory preservation during FaceTime calls.

5.10.2 Stimulus/Response Sequences

Stimulus: The user taps `Settings`.

Response: The system shall open the settings options.

Stimulus: The user taps `Apps`.

Response: The system shall open the list of apps.

Stimulus: The user taps `FaceTime`.

Response: The system shall open the FaceTime options.

Stimulus: If the FaceTime Live Photos button is on (green in color), this indicates photos can be taken during a call. If gray, the user toggles the switch to on.

Response: The system shall toggle the switch to on, change the color to green and activate the ability to take live photos during a FaceTime call.

Stimulus: During a FaceTime call, the user taps the white circle on the lower left aspect of the screen.

Response: The system shall capture a Live Photo, including audio and video from just before and after photo is taken. The system shall notify all participants a live photo was taken.

Stimulus: During a Group FaceTime call, the call participant selects a participant's photo tile and taps the white circle on the lower right aspect of the photo tile's screen.

Response: The system shall capture a Live Photo of the selected participant's screen, including both video and audio. The system shall notify the user and the selected participant that a Live Photo has been taken.

Stimulus: The user opens the Photos app after taking a Live Photo in FaceTime.

Response: The system shall display all photos, including recently taken Live Photo, allowing the user to select and view the captured Live Photo and hear the accompanying audio.

Stimulus: To activate/deactivate FaceTime Live photos, the user taps `Settings`.

Response: The system shall open the settings options.

Stimulus: The user taps `Apps`.

Response: The system shall open the list of apps.

Stimulus: The user taps `FaceTime`.

Response: The system shall open the FaceTime options.

Stimulus: If the FaceTime Live Photos button is off (gray in color), this indicates photos cannot be taken during a call. If green, the user toggles the switch to off.

Response: The system shall toggle the switch to off, change the color to gray and deactivate the ability to take live photos during a FaceTime call.

Stimulus: During a FaceTime call, the user taps the white circle on the lower left aspect (lower right aspect for Group FaceTime) aspect of the photo tile's screen.

Response: The system shall display an error message informing the user that the feature must be enabled on both devices to take FaceTime Live Photos.

5.10.3 Functional Requirements

REQ-10.1: Upon tapping the photo icon during a one-on-one FaceTime call, the system shall capture a Live Photo, which includes both video and audio from just before and after the tap, and save it in the user's Photos app.

REQ-10.2: Upon tapping the photo icon during a Group FaceTime call, the system shall capture a Live Photo of the selected participant's video feed, including audio and video from just before and after the action, and save it in the user's Photos app.

REQ-10.3: Upon successfully capturing a Live Photo, the system shall send a notification to both the user who took the Live Photo and the recipient, informing them that a Live Photo has been taken.

REQ-10.4: If the user attempts to take a Live Photo and the FaceTime Live Photos feature is disabled on either device, the system shall display an error message notifying the user that the feature must be enabled on both devices to take FaceTime Live Photos.

REQ-10.5: The system shall allow users to view and replay Live Photos in the Photos app, where the user can see the captured video and hear the accompanying audio.

REQ-10.6: If the user attempts to take a Live Photo without sufficient storage space, the system shall display an error message indicating that the Live Photo cannot be saved due to insufficient storage.

REQ-10.7: The system shall include an option in the FaceTime settings to disable the ability to take Live Photos for added privacy.

REQ-10.8: The system shall require explicit consent from all participants before enabling Live Photo capture in any FaceTime call, ensuring that all participants are aware that Live Photos can be taken.

6. Nonfunctional Requirements

6.1 Performance

NF-1.1: The system shall switch between devices within 2 seconds of user input.

NF-1.2: Video effects shall be applied with no more than a 1-second delay.

NF-1.3: The system shall maintain consistent video and audio synchronization during transitions between devices using Handoff, ensuring no more than a 0.5-second lag during transitions.

6.2 Security

NF-2.1: The system shall encrypt all data transmitted during FaceTime calls.

NF-2.2: Remote control requests must be authenticated by the recipient.

NF-2.3: The system shall log all remote control requests and actions for audit purposes, with the logs being stored securely and only accessible by authorized users.

NF-2.4: All Live Photo captures during FaceTime calls shall be encrypted both in transit and at rest, ensuring privacy and protection of the captured media.

NF-2.5: The system shall verify both devices in a Handoff transaction meet the latest security updates before allowing sensitive data to be transferred between them.

NF-2.6: The system shall enforce Multi-Factor Authentication (MFA) for users attempting to hand off sensitive tasks (e.g., handling personal data or financial transactions) across devices.

6.3 Usability

NF-3.1: The system shall provide intuitive feedback for all user actions within 1 second (e.g., toggling video effects, adjusting audio settings).

NF-3.2: The system shall be accessible to users with disabilities, supporting features such as Live Captions and voice commands for accessibility.

NF-3.3: The system shall provide clear visual indicators (e.g., color changes or icons) for connectivity issues, low battery notifications, or insufficient storage space when attempting to take Live Photos or perform Handoff.

NF-3.4: The system shall support customizable accessibility options for Live Captions, including font size, font style, and caption background color, to accommodate a wide range of visual preferences.

6.4 Scalability

NF-4.1: The system shall support group calls with up to 32 participants without degrading video or audio quality.

NF-4.2: The system shall scale efficiently to handle larger data loads during group SharePlay sessions.

NF-4.3: The system shall support Handoff and Remote Control functionality across multiple devices simultaneously, allowing users to hand off tasks from multiple sources (e.g., from a Mac to both an iPhone and iPad).

6.5 Reliability

NF-5.1: The system shall have a 99.9% uptime guarantee, ensuring high availability for FaceTime services.

NF-5.2: In the event of a network disruption, the system shall reconnect FaceTime calls automatically within 10 seconds of network restoration.

NF-5.3: In case of device failure during Handoff, the system shall automatically retry the handoff up to three times within a 30-second window before prompting the user to manually attempt the transfer again.

NF-5.4: The system shall ensure data integrity during Handoff transactions, verifying that data transferred between devices remains intact and uncorrupted, especially during network interruptions.

6.6 Compatibility

NF-6.1: The system shall be compatible with all Apple devices running iOS 12.1.4, iPadOS 13, and macOS X 10.14.3 Supplemental Update or later.

NF-6.2: The system shall seamlessly integrate with third-party apps supporting Handoff and SharePlay.

NF-6.3: The system shall be backward compatible with third-party apps supporting Handoff on older devices, allowing for limited Handoff capabilities when using legacy apps.

NF-6.4: The system shall support integrations with third-party security and privacy tools, allowing users to manage Handoff permissions and privacy settings through compatible security apps.