Software Requirements Specification

for

LiftN'Learn: Interactive RFID-Powered Resource Display for Enhanced Learning Experiences

Version 1.2

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Course: SOFTWARE DEVELOPMENT
Date: 10-13-24

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Revisions

Version	Primary Author(s)	Description of Version	Date Completed
Version 1.1	Diandre Dawson Brioso Gomez	Added Data Dictionary, images for hardware specifications, and fixed grammars based on what the project adviser noticed.	09-15-24
Version 1.2	Diandre Dawson Brioso Gomez	Revised panelists' suggestion like changing actors of use case, added reference to used video, and finished chapter 4.	10-05-24

1. Introduction

LiftN'Learn is a cutting-edge RFID-based system that allows users to interact with real items to display pertinent instructional content, improving the learning experience. For the current iteration of the project, this Software Requirements Specification (SRS) document offers a thorough summary of the features, needs, and constraints of the system. The document will serve as a guide for stakeholders and developers, ensuring that the system achieves its intended performance and functionality objectives. An overview of the main features, scope, and objectives of the system may be found in this section.

1.1. Document Purpose

The objective of this Software Requirements Specification (SRS) document is to describe the LiftN'Learn system's requirements, with a focus on the version or release number that is pertinent to this specification. The goal of the SRS is to give a thorough explanation of the LiftN'Learn Interactive RFID-Powered Resource Display's features, interfaces, and limitations. To make sure that development adheres to the stated needs and expectations, this document is meant to act as a blueprint for developers and stakeholders.

The primary features and functionalities of the RFID-powered resource display system are the subject of this SRS, which addresses the LiftN'Learn project's scope. Depending on the release number or version given, it might encompass modules or subsystems within the larger system. The components included in the document may represent a portion of the overall system or a particular functional area that is being developed or updated for this release. In any case, the document describes the intended behavior and performance requirements for the components.

1.2. Product Scope

A modern educational program called LiftN'Learn: Interactive RFID-Powered Resource Display for Enhanced Learning Experiences is set to completely change how resources are accessed and used in educational settings. The system offers a smooth and interactive method for users to connect with instructional materials by utilizing RFID technology. With the help of the system, users may easily lift and interact with RFID-tagged objects to bring up related information, educational materials, or interactive modules on a display that is connected.

The main advantages of LiftN'Learn include improved learning resource accessibility, higher engagement levels with interactive information, and a more structured method of handling instructional materials. By eliminating the need for manual searching and facilitating a more natural way to connect with materials, the system seeks to simplify the learning process. The project aims to enhance the effectiveness of resource retrieval, accommodate a range of learning styles, and develop a more engaging and productive learning environment.

1.3. Intended Audience and Document Overview

1.3.1 Types of Readers

1. **Developers:** Detailed technical specifications are needed by developers. The system architecture, data flow, interface designs, and functional and non-functional needs are all included in this. Their concerns center on the construction, integration, and upkeep of the system.

2. **Project Manager:** Project manager prioritizes deliverables, risks, scope, and timelines. They seek clarification on the objectives, schedule, dependencies, and necessary resources for the project. They monitor the project's development using this document to make sure it complies with the specified specifications.
3. **Marketing Staff:** The market positioning, user benefits, and high-level functionality are all of interest to the marketing team. To create promotional materials and product messages, they require information on the features and how they meet user wants.
4. **Users:** Users of the LiftN'Learn system will desire a comprehensive grasp of the system's functional operation. Use cases, user interfaces, and interactions with the RFID-powered system are of interest to them.
5. **Testers:** A thorough comprehension of the functional requirements and edge cases is necessary for testers. They require precise standards for success and failure, as well as information on how the system should behave in different scenarios. This aids in the creation of efficient test scenarios.
6. **Documentation Writers:** This group requires access to both the high-level system overview and the comprehensive operating manuals. They are responsible for translating this into technical documentation, training manuals, and user manuals.
7. **Client and Professor:** Both the functional features and the compatibility with academic and corporate goals are of interest to the professor and the clients. They must comprehend the system's functionality, main features, usability, and approach to meeting user and market demand.

1.3.2 Structure of the SRS

1. **Introduction**
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    - Intended Audience and Document Overview
    - Definitions, Acronyms and Abbreviations
    - Document Conventions
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1.3.3 Suggested Reading Sequence

1. **Developers:** To gain technical specifics, developers should start with the specific requirements and proceed to the overall description for a more comprehensive understanding. Next, go over the data structure and language in appendix A and the other non-functional requirements.
2. **Marketing Staff:** To grasp the features and advantages of the product, marketing staff should read the overall description. If more context is required, they can consult the introduction.
3. **Users:** To comprehend system interactions, users should evaluate the specific requirements, especially the use case model and functional requirements.
4. **Testers:** To comprehend system behavior, testers should concentrate on the specific requirements. They should next go over the other non-functional requirements for safety and performance, and for validation, they should consult appendix A.
5. **Documentation Writers:** The overall description should be the first section that documentation writers focus on, followed by the specific requirements for technical information and appendix A for terminology.
6. **Client, Professor, and Project Manager:** To grasp the goal and scope of the document, project managers and clients should begin with the introduction. From there, they can move on to the overall description for the overview of the final product. The specific requirements come next, with an emphasis on the use case model and functional requirements. Other non-functional requirements for performance and quality insights come last.

1.4. Definitions, Acronyms and Abbreviations

1. **RFID – Radio-Frequency Identification**
   LiftN'Learn's core technology allows users to pick up items with RFID tags and see specific resource displays.
2. **CPU – Central Processing Unit**
   The central part of the LiftN'Learn hardware configuration that handles commands and data processing.
3. **SRS – Software Requirements Specification**
   The document that lists every need for the LiftN'Learn system, both functional and non-functional.
4. **UI – User Interface**
   The layout and design of the LiftN'Learn interface, which allows users to engage and study educational resources.
5. **UX – User Experience**
   Used to describe how a user interacts with the LiftN'Learn system generally, with the goal of making learning simple and easy.

1.5. Document Conventions

1.5.1 Formatting Conventions

- **Font:** The primary font used throughout this document is Arial, 11pt for regular text.
  - Headings: Bold and sized appropriately to denote hierarchy.

  - Normal Text: Regular weight for body content.
  - Code: Monospace font (Courier New, 10pt) is used to represent code snippets, filenames, and inline code references.
- **Highlighting:**
  - **Bold:** Used for emphasis on important terms or definitions.
  - **Italic:** Used for referencing document sections, terms that require special emphasis, and for the names of the system's components or external documents.
  - **Underlined Text:** Reserved for hyperlinks or references within the document.
  - **Colored Text:**
    - **Blue Text:** Used for hyperlinks.
    - **Red Text:** Used to indicate errors or important warnings.
- **Lists:**
  - **Bulleted Lists:** Used for enumerating non-sequential items.
  - **Numbered Lists:** Used for step-by-step instructions or sequential items.

1.5.2 Naming Conventions

- **Component Names**: Names of components, such as "RFID Reader", are written in Title Case and italicized to distinguish them from regular text.
- **Variables and Functions**: Variable names and function names in code examples are written in `camelCase` (e.g., `readRFIDTag()`) to align with common programming conventions.
- **Document Sections**: All section headings and subheadings are numbered using Arabic numerals (e.g., 1.1, 1.2, 2.1) for clarity and easy reference.

1.5.3 Terminology Conventions

- **Technical Terms**: All technical terms, such as "RFID," and "microcontroller," are defined in the glossary section and are italicized upon first mention in the document.
- **Acronyms**: All acronyms are spelled out in full upon their first appearance, followed by the acronym in parentheses. For example, Radio-Frequency Identification (RFID).

1.5.4 Revision Conventions

- **Version Numbers**: The SRS document uses version numbers in the format X.Y.Z where:
  - **X**: Major revision with significant changes.
  - **Y**: Minor revisions with minor feature changes.
  - **Z**: Patches or minor corrections/updates.
- **Change Logs**: Each version will include a change log at the end of the document, detailing all changes made, their nature, and the person responsible for the update.

1.6. References and Acknowledgments

1.6.1 References

- **Cost management.** (2024). *Teeth Titans Draft*. SharePoint. https://nuph.sharepoint.com/:w:/r/sites/3T-ProjMan-IT212-BBR/Shared%20Documents/Group%2005%20-%20Teeth%20Titans/Documentations/Drafts/(4)%20Cost%20Management%20Teeth%20Titans%20Draft.docx?d=wb7cc15844ba94e34a8d1a6e01c70e568&csf=1&web=1&e=b1lbMY
- **Intersign.** (n.d.). *Controller with RS-232 Interface: Nexmosphere Xperience controller USB / 1x X-talk*. Intersign. https://www.intersign.dk/products/xperience-controller-usb-1x-x-talk
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BBR/Shared%20Documents/Group%2005%20-%20Teeth%20Titans/Documentations/Drafts/(2)%20Scope%20Management%20Teeth%20Titans%20Draft.docx?d=w7f954597db7b4468819729f6369c2f33&csf=1&web=1&e=Vlhtkr

- **Snap One.** (2024). *Digital signage / media player: BrightSign HD224 Standard I/O Player*. Snap One. https://www.snapav.com/shop/en/snapav/brightsign-hd224-standard-i-o-player-bs-hd224-a

YouTube Videos

- Smile and Learn - English. (2018, May 30). Learning Fruits - Fun Way to Build Your Child's Vocabulary [Video]. YouTube. https://youtu.be/KRqg3RJFWPo
- Smile and Learn - English. (2018, June 13). Parts of the head - The Human Body for kids - Vocabulary [Video]. YouTube. https://youtu.be/GwwKxEcyDso
- Smile and Learn - English. (2018, June 28). The Sun, Earth, and Moon - Solar System for Kids [Video]. YouTube. https://youtu.be/riMAITbLqZI
- Smile and Learn - English. (2019, July 23). Farm animals for kids - Vocabulary for kids [Video]. YouTube. https://youtu.be/hewioIU4a64

Note: *Permission was obtained from Smile and Learn to use their videos in this project. A screenshot of the approval email is included in the appendix.*

1.6.2 Acknowledgements

Our sincere appreciation goes out to **Jhamil G. Gutierrez**, who served as our project adviser. His constant assistance, helpful criticism, and depth of knowledge were crucial throughout the endeavor. He constantly led us in the correct direction, assisting us in overcoming obstacles and making sure we were laser-focused on our goals. His guidance genuinely improved the caliber of our work.

Additionally, we would like to thank **Bernardino B. Roda**, our project management instructor from the previous academic year. His crucial observations, helpful counsel, and support were crucial in assisting us in building a solid foundation for handling challenging assignments. His unwavering assistance enabled us to improve our processes, stay on course, and use the knowledge we gained in practical situations.

Lastly, we would like to express our sincere gratitude to **Stephann Tutorial Center**, our client, for their invaluable suggestions and comments that were crucial to the accomplishment of this project. Their cooperation, readiness to communicate their requirements and expectations, and insightful recommendations were crucial in determining the ultimate result. With the center's help, we were able to develop a project that would serve their educational objectives while also being useful.

2. Overall Description

2.1. Product Overview

LiftN'Learn is an interactive, self-contained learning system that uses RFID technology to increase participation. It is a new product designed specifically for childcare settings, offering a creative way to teach by fusing real items with virtual media. This system was created from the bottom up to meet the specific requirements of young learners and teachers; it is not a replacement for an existing product family.

The way the technology works is by linking educational video content with RFID-enabled props. The technology recognizes the RFID tag contained in a particular prop when a child lifts it, and it then starts playing the educational film on a display screen. Through interactive storytelling, the aim is to create a tactile learning environment that fosters curiosity and enhances knowledge retention.

Subsystems: the central processing unit (CPU), which handles RFID detection and initiates the videos, the video display system (screen), the RFID reader, and the props with embedded RFID tags.

External Interfaces: The device communicates with RFID tags placed in real props as well as a display screen for video output. Alternatively, RFID tag associations and video material can be managed via an admin interface that can be accessed from a PC or tablet that is linked to the CPU.

2.2. Product Functionality

2.2.1 Major Functions of the System

- **RFID Sensors:**

Figure 1 RFID Sensors

https://www.mediasolutions.ch/wp-content/uploads/2020/10/tags-1.png

  - Detect and identify objects equipped with RFID tags.
  - Transmit collected data wirelessly to the system's controller.
- **Wireless X-Tal Interface:**
  - Enable wireless communication between RFID sensors and the controller.
  - Ensure seamless data transmission for real-time system updates.
- **Controller with RS-232 Interface:**

Figure 2 Controller with RS-232 Interface

https://www.intersign.dk/products/xperience-controller-usb-2x-x-talk

- Process data received from RFID sensors and wireless interfaces.
- Manage communication with digital signage or media players.
- Provide an interface for external device communication via RS-232.

- **Digital Signage / Media Player:**

Figure 3 BrightSign Media Player

https://enlx.co.uk/wptemp/wp-content/uploads/2024/05/brightsignhd4_0002_-.jpg

- Display relevant content, such as information or media, based on RFID data inputs.
- Synchronize with the system controller to show interactive and context-specific information.

- **HDMI Cable (v2.0):**
  - Transmit high-quality video signals from the media player to the digital signage.
  - Support 4K resolution for clear and engaging content delivery.

2.3. Design and Implementation Constraints

The development of the LiftN'Learn: Interactive RFID-Powered Resource Display will be subject to several design and implementation constraints, which are essential to the successful deployment and functionality of the system. These constraints are outlined as follows:

2.3.1 Hardware Limitations

1. Wireless Pick Up Sensors: The system will utilize four wireless pick-up sensors equipped with RFID technology. The sensors must be compatible with the selected RFID tags and capable of reliable data transmission to the central controller within a specified range. The sensors should also have low power consumption to ensure sustainability and minimize maintenance.

2. Wireless X-Tal Interface: This interface will serve as the primary communication bridge between the RFID sensors and the microcontroller. The interface must support stable wireless

communication and be capable of handling multiple simultaneous connections without data loss or signal interference.

3. Controller with RS-232 Interface: The system's core processing unit will be a controller with an RS-232 interface. This controller must efficiently manage input from the RFID sensors and output commands to the digital signage/media player. It should have sufficient processing power and memory to handle real-time operations and ensure smooth, uninterrupted performance.

4. Digital Signage / Media Player: The project requires a media player capable of delivering 4K60p video in HDR. It should support interactivity and have flexible I/O options for USB, serial, GPIO, IR, and Ethernet to facilitate integration with the rest of the system components. The media player should also be compatible with HTML5 for web-based content display and have a robust operating system to manage multiple media types and formats.

5. HDMI Cable (v2.0): A 3-meter HDMI cable will connect the media player to a display screen. The HDMI cable must support version 2.0 specifications to ensure high-definition video output and compatibility with 4K HDR video requirements.

2.3.2 Other Constraints

1. Security Considerations: The system must be designed with security in mind, particularly in safeguarding user data and ensuring that no sensitive information is exposed during interactions. All communication between the sensors, controller, and media player must be encrypted to prevent unauthorized access.

2. Design Conventions and Programming Standards: The system must adhere to the customer's organization's programming standards and design conventions to facilitate future maintenance and updates. This includes consistent coding practices, documentation standards, and compliance with relevant industry standards.

2.4. Assumptions and Dependencies

The successful development and deployment of the LiftN'Learn: Interactive RFID-Powered Resource Display are based on several assumptions and dependencies. These factors are crucial as they could significantly affect the requirements and overall project outcome if they change or prove to be incorrect.

2.4.1 Assumptions

1. Availability of Hardware Components: It is assumed that all necessary hardware components, such as the wireless pick-up sensors, wireless X-Tal interface, controller with RS-232, digital signage/media player, and HDMI cables, will be readily available and function as specified by their manufacturers.

2. Compatibility of Components: It is assumed that all hardware components, particularly the RFID sensors, the microcontroller, and the media player, will be compatible with each other. This includes compatibility in terms of communication protocols, power requirements, and physical connections. Any incompatibility could require additional hardware or redesign, affecting the project's scope and budget.

3. Stable Operating Environment: It is assumed that the deployment environment (counseling clinic waiting rooms) will have stable power supply and Wi-Fi connectivity, which are essential for the system to function smoothly. Fluctuations in power or network availability could disrupt the operation of the interactive display.

4. User Interaction Expectations: It is assumed that users will be able to interact with the display without any prior training or technical knowledge. The design is based on the assumption that users will intuitively understand how to pick up an item to trigger a response from the system. Misunderstandings or usability issues could necessitate further design adjustments.

2.4.2 Dependencies

1. Third-Party Software Components: The project relies on third-party software components, such as firmware for the RFID sensors and the operating system of the digital signage/media player. Any changes or updates to these components could affect system compatibility and functionality, requiring adjustments in software design or implementation.

2. Reusable Software Components: The project intends to reuse existing software components from previous projects or open-source libraries to expedite development and reduce costs. These components must be compatible with the current project's architecture and meet all performance and security requirements. Dependence on external libraries could pose risks if those libraries are deprecated or contain vulnerabilities.

3. Vendor Support and Documentation: The project depends on the availability of comprehensive vendor support and documentation for all hardware and software components. This support is crucial for troubleshooting, firmware updates, and integrating components into the system. Insufficient support or documentation could hinder development and maintenance efforts.

4. Regulatory Compliance: The project assumes compliance with all relevant regulatory standards, including data privacy, electronic communication, and consumer protection laws. Any changes in regulations could necessitate design modifications to ensure compliance, potentially impacting the project's timeline and cost.

3. Specific Requirements

3.1. External Interface Requirements

3.1.1. User Interfaces

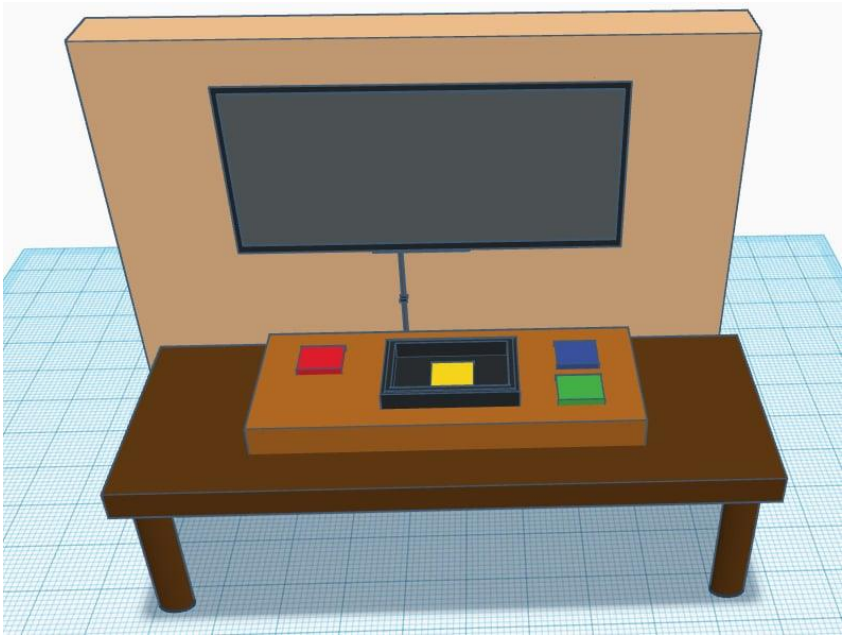

Figure 4 Prototype (Front Aerial View)

The user interface (UI) for the LiftN'Learn system is designed to be straightforward and user-friendly, providing an engaging experience for users in a tutorial center waiting room. The interface relies on a monitor that displays educational video presentations triggered by the interaction with RFID-tagged items.

UI Overview:

- **Monitor Display:** The primary user interface is a monitor that displays educational videos and presentations. The monitor automatically plays specific content based on the RFID-tagged item that a user picks up. There is no direct user interaction with the monitor itself, as it is solely used for content display.
- I**nteractive Video Presentation:** When a user picks up an RFID-tagged item, the system detects the tag and automatically starts a corresponding educational video presentation on the monitor. These videos provide helpful information and coping strategies related to the mental health or self-care topic represented by the item.
- **Passive Interaction:** The system is designed for passive interaction, meaning users do not need to touch or manipulate the monitor directly. Their engagement with the physical items on display triggers the content, allowing for a touchless experience.
- **Feedback and Instructions:** Although the monitor is not interactive, it will display brief instructions or messages within the video presentations to guide users. For example, the videos might suggest picking up another item for more information or placing the item back to reset the display.

User Interaction Flow:

1. **Initial Setup:** The monitor remains in standby mode, displaying a neutral or welcoming screen until an RFID tag is detected.
2. **Item Selection:** When a user picks up an RFID-tagged item, the RFID reader detects the tag and sends a signal to the media player.
3. **Content Display:** The media player responds by playing the relevant video content on the monitor. The content displayed is automatically selected based on the RFID tag associated with the item.
4. **Session End:** Once the video concludes or the user places the item back, the system returns to standby mode, ready for the next session.

The interface design focuses on simplicity and accessibility, ensuring that all users can easily engage with the mental health resources provided by the LiftN'Learn system without the need for any technical knowledge or direct interaction with the monitor.

3.1.2. Hardware Interfaces

The LiftN'Learn system includes several hardware components that interact with the system to provide a seamless, interactive user experience. The following outlines the logical and physical characteristics of each hardware interface involved in the system:

1. **RFID Sensors:**
   - **Description:** The system utilizes four wireless pick-up sensors equipped with RFID technology. Each sensor is responsible for detecting the presence of an RFID-tagged item when it is picked up by a user.
   - **Interface Characteristics:** The RFID sensors have a basic “read” interface that continuously scans for RFID tags within its detection range. When an RFID tag is detected, the sensor reads the unique identifier (ID) associated with the tag and transmits this data to the central controller for processing.
   - **Data Units:** The RFID sensors use English units and transmit data in the form of unique alphanumeric IDs representing the RFID-tagged items.
2. **Wireless X-Tal Interface:**
   - **Description:** The Wireless X-Tal Interface serves as the communication bridge between the RFID sensors and the central controller. It facilitates the wireless transmission of data from the sensors to the controller.
   - **Interface Characteristics:** The interface supports secure wireless communication, ensuring reliable data transfer without signal interference or data loss. It operates within a specified frequency range to maintain consistent connectivity between all connected sensors and the controller.
   - **Data Units:** This interface transmits data in digital format, primarily focusing on the unique RFID tag IDs detected by the sensors.
3. **Controller with RS-232 Interface:**
   - **Description:** The central controller processes the data received from the RFID sensors and manages the interaction between the hardware components of the system.
   - **Interface Characteristics:** The controller uses an RS-232 interface for serial communication with the media player. It receives input data (RFID tag IDs) from the sensors via the Wireless X-Tal Interface and processes these inputs to determine the appropriate response, such as playing a specific video on the monitor.
   - **Data Units:** The controller processes data in digital format and uses ASCII codes for serial communication via the RS-232 interface.
4. **Digital Signage / Media Player:**
   - **Description:** The media player is responsible for displaying educational videos and presentations on the monitor in response to the RFID-tagged items detected by the sensors.

- **Interface Characteristics:** The media player interfaces with the controller via an RS-232 connection and the monitor via an HDMI cable. It receives commands from the controller to play specific video content based on the detected RFID tags and outputs video signals to the monitor.
- **Data Units:** The media player accepts commands in digital format (ASCII codes via RS-232) and outputs video signals in HDMI format to the monitor.

5. **HDMI Cable (v2.0):**
   - **Description:** A 3-meter HDMI cable connects the media player to the monitor, ensuring high-quality video output.
   - **Interface Characteristics:** The HDMI cable supports version 2.0 specifications, allowing for 4K HDR video transmission from the media player to the monitor.
   - **Data Units:** The HDMI cable transmits video and audio data in digital format, supporting high-definition resolutions and color depths.

3.2. Functional Requirements

The LiftN'Learn system's precise functional requirements are described in this section. These specifications outline the precise actions, jobs, and functions that the system must carry out in order to satisfy the demands of the childcare setting. To guarantee that the system efficiently raises student learning experiences, boosts engagement, and lowers disruptive behaviors, each functional requirement is essential. The following is a list of needs, which goes from the system's essential functions to particular operational, managerial, and security elements.

3.2.1. **F1**: When a particular RFID-tagged item is lifted, the system is supposed to detect it.

3.2.2. **F2**: When an item is raised, the system should immediately start playing a matching video.

3.2.3. **F3**: Using a content management interface, the system will enable administrators to designate particular videos to every item.

3.2.4. **F4**: A secure interface will be offered by the system as a means of managing and updating video content.

3.2.5. **F5**: The system must accept a variety of video formats, such as AVI and MP4, in order to guarantee cross-platform compatibility.

3.2.6. **F6**: Every interaction, including the item lifted, the timestamp, and the length of the video playing, must be recorded by the system.

3.2.7. **F7**: Metrics pertaining to student participation, like the daily number of interactions, will be monitored and reported by the system.

3.2.8. **F8**: When an item is raised to validate an action, the system must give instantaneous visual or audio feedback.

3.2.9. **F9**: To guarantee dependability, the system must maintain a 99.9% uptime throughout operating hours.

3.2.10. **F10**: To protect security and privacy, the system will only allow authorized personnel to manage content and access data.

3.3. Use Case Model

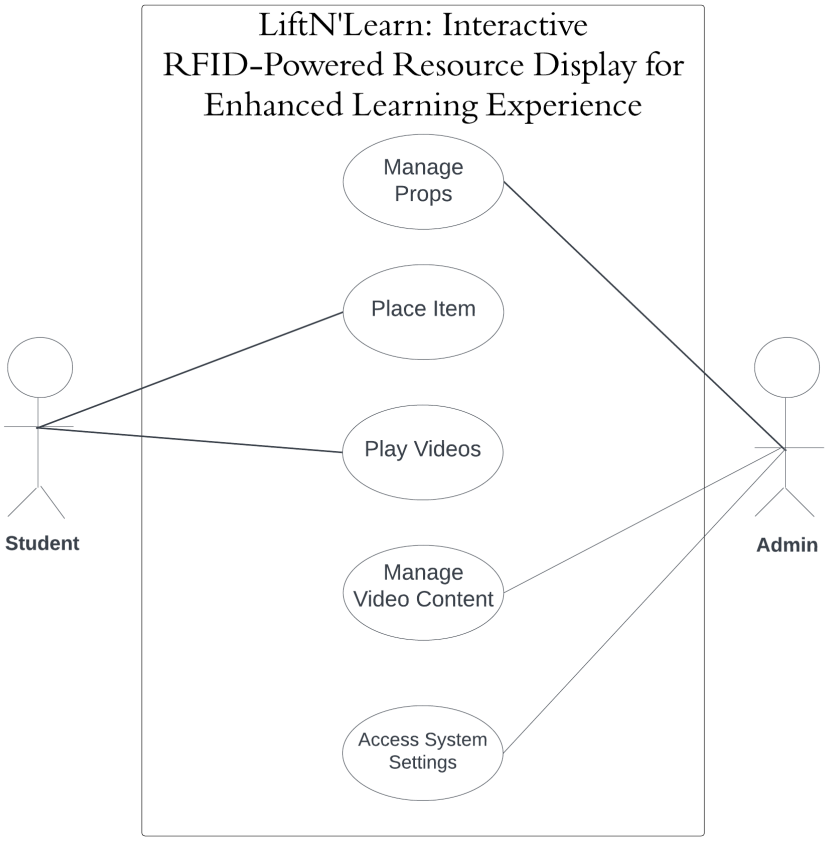

Figure 5 Use Case Model

3.3.1. Manage Props

- **Author:** Gomez, Diandre Dawson B.
- **Purpose:** Allow the admin to assign and update RFID tags for props and link them to specific videos.
- **Requirements Traceability:** F1, F3, F4
- **Priority:** High
- **Preconditions:** The system is operational, and RFID tags are available for use.
- **Postconditions:** Props are correctly associated with their corresponding videos.
- **Actors:** Admin
- **Extends:** None
- **Flow of Events:**
    1. The admin logs into the system.
    2. The admin selects an item to assign or update.
    3. The system prompts the admin to scan the RFID tag.
    4. The admin links a video to the item.
    5. The system saves the changes.

- **Alternative Flow:** If the RFID tag is already in use, the system notifies the admin and requests confirmation for reassignment.
- **Exceptions:** If the RFID tag cannot be scanned, the system displays an error message.

3.3.2. Place Item

- **Author**: Gomez, Diandre Dawson B.
- **Purpose**: Detect when an item is placed and identify the corresponding RFID tag.
- **Requirements Traceability**: F1, F2
- **Priority**: High
- **Preconditions**: The RFID system is functional, and props are equipped with active tags.
- **Postconditions**: The system correctly identifies the item that was placed.
- **Actors**: Students
- **Extends**: None
- **Flow of Events**:
    1. A student places an item on the designated area.
    2. The RFID reader detects the tag embedded in the item.
    3. The system identifies the RFID tag and prepares the corresponding video.
- **Exceptions**: If the RFID tag is not detected, the system does nothing or displays a generic error message.

3.3.3. Play Videos

- **Author:** Gomez, Diandre Dawson B.
- **Purpose**: Play the video linked to the lifted item on the display screen.
- **Requirements Traceability**: F2, F3, F5
- **Priority**: High
- **Preconditions**: The system has detected an item lift and identified the corresponding RFID tag.
- **Postconditions**: The video linked to the item is displayed on the screen.
- **Actors**: Student
- **Extends**: None
- **Flow of Events**:
    1. The system retrieves the video associated with the detected RFID tag.
    2. The video is displayed on the screen.
- **Alternative Flow**: If a video is already playing, the system waits until the current video ends before playing the next one.
- **Exceptions**: If the video file is not found, the system displays a default message.

3.3.4. Manage Video Content

- **Author:** Gomez, Diandre Dawson B
- **Purpose**: Allow the admin to upload, update, or remove video content for each item.
- **Requirements Traceability**: F4, F10
- **Priority**: Medium
- **Preconditions**: Admin is logged in with the appropriate permissions.
- **Postconditions**: Video content is successfully updated and linked to props.
- **Actors**: Admin
- **Extends**: None
- **Flow of Events**:
    1. The admin selects the item for which they want to upload or change the video.
    2. The system prompts the admin to upload a new video file or update the existing one.
    3. The admin uploads the video, and the system saves the changes.

- **Alternative Flow**: If the video format is not supported, the system alerts the admin to upload a compatible file.
- **Exceptions**: If there is insufficient storage space, the system displays an error message.

3.3.5. Access System Settings

- **Author:** Gomez, Diandre Dawson B.
- **Purpose**: Allow the admin to configure various system settings, such as video playback preferences.
- **Requirements Traceability**: F10
- **Priority**: Medium
- **Preconditions**: Admin is logged into the system with appropriate access rights.
- **Postconditions**: System settings are updated and applied.
- **Actors**: Admin
- **Extends**: None
- **Flow of Events**:
    1. The admin accesses the system settings menu.
    2. The system displays various configuration options (e.g., video playback settings).
    3. The admin updates the settings as needed and saves the changes.
- **Alternative Flow**: The system may offer a "reset to default" option for certain settings.
- **Exceptions**: If settings cannot be applied due to system limitations, an error message is displayed.

4. Other Non-functional Requirements

4.1.1. Performance Requirements

P1: The system must detect and respond to the lifting of an RFID-tagged item within 2 seconds to ensure a smooth and immediate learning experience for children.
P2: Video playback must begin within 1 second of detecting an RFID-tagged item to prevent lag that could disrupt the learning flow.
P3: The system must process and log every interaction (including item lifted, timestamp, and video duration) within 1 second after the action occurs to ensure accurate tracking without delay.
P4: Video playback should maintain a resolution of at least 720p with no visible lag or buffering for files up to 500 MB, ensuring consistent visual quality.
P5: During periods of peak usage (e.g., when the maximum number of students is interacting with the system), the system should not experience any noticeable performance degradation and should maintain a response time of 2 seconds or less for all operations.

4.1.2. Safety and Security Requirements

S1: Physical Safety
- The RFID-powered display system must not have exposed electrical components or sharp edges that could pose a risk to children.
- The display hardware should be securely mounted or enclosed in a child-safe case to prevent damage from falls or rough handling.
- The system's enclosure and associated hardware must not include any small, detachable parts that could pose a choking hazard to children.
- The height and placement of the system should be ergonomic and accessible to children aged 2-5 years. Display screens, interactive elements, and RFID-tagged items should be positioned at appropriate heights so that children can engage with them comfortably and without the need for assistance or excessive stretching.
- The system should not require excessive force for any physical interaction. RFID-tagged items should be light and easy to lift for young children to ensure safe, injury-free interactions.

S2: Software and Data Safety
- The system must ensure that all video content is pre-approved for age-appropriate use in daycare or counseling environments. Administrators must have the ability to filter and block inappropriate content, ensuring that only suitable media is played.
- The system should implement a basic but effective user access control system. Only authorized personnel (such as daycare staff or system administrators) should be able to change settings, upload new videos, or view interaction logs. This can be achieved through simple username and password authentication, with encrypted password storage using common encryption libraries such as bcrypt.

S3: Data Security and Privacy

S3.1: Secure User Authentication
- All access to the LiftN'Learn administrative interface, including the content management system, must require secure authentication methods. Multi-Factor Authentication (MFA) must be implemented to ensure that administrators use a combination of at least two security factors (e.g., password plus mobile verification code).
- Only authorized personnel with appropriate credentials should be able to manage video content, modify system settings, or access sensitive interaction data.

S3.2: Data Minimization Principle

- The system must implement the data minimization principle, ensuring that only the necessary data required for the operation of the LiftN'Learn system is collected. Any data collected must be relevant and limited to what is necessary for educational and operational purposes.
- Non-persistent interaction data should be anonymized to prevent any association with specific individuals, ensuring that even in the case of a data breach, no identifiable information about children is exposed.

S3.3: Secure Data Storage and Access Controls

- All data stored within the system must be kept in a secure environment that utilizes physical and digital security measures, including firewalls, intrusion detection systems, and secure access controls.
- Access to sensitive data must be role-based and restricted to authorized personnel only, using a principle of least privilege. This ensures that individuals can only access data that is necessary for their role, minimizing the risk of unauthorized access or data breaches

4.1.3. Software Quality Attributes

Reliability Requirement: The system must achieve 99.9% uptime during operating hours, using monitoring tools to promptly address any failures.

Usability Requirement: Administrators should complete tasks (e.g., uploading videos) within 5 clicks or less. Usability testing will refine the interface, prioritizing ease of use.

Maintainability Requirement: The software architecture will be modular, allowing updates with minimal downtime, targeting a frequency of once per month for enhancements.

Adaptability Requirement: The system must support future enhancements and integrations via standardized APIs, allowing easy addition of new features.

Interoperability Requirement: The system must interface with existing educational tools, adhering to data exchange standards (e.g., JSON or XML) and providing integration documentation.

Robustness Requirement: The system shall have robust error handling, ensuring that unexpected inputs do not cause crashes and provide user-friendly recovery options.

5. Other Requirements

5.1. System Flow

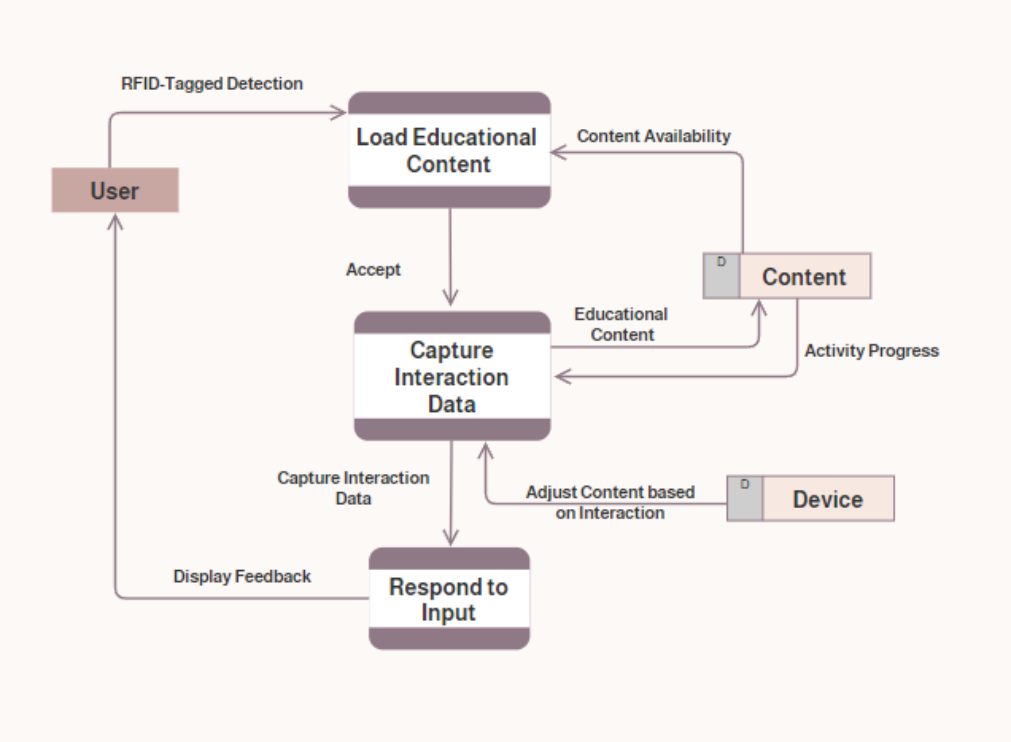

Figure 6 System Flow

The LiftN'Learn system uses RFID technology to improve user interaction with instructional information. The diagram shows how the system operates. The system checks for content availability when a user delivers an RFID-tagged object, initiating the process. When the necessary educational material becomes accessible, it gets loaded. After that, the system records information about the user's interactions and monitors the advancement of their activities. The technology ensures a smooth and interesting learning experience by modifying the displayed content and giving the user feedback based on this interaction data.

5.2. Limitations

- **Restricted Authority over Media:** Since the current system is just intended for playback, it does not have functionalities for the media player, such as pause, play, and skip.
- **Limits on the Admin Interface:** It is not possible to integrate a basic admin interface for basic content uploading because BrightSign and Nexmosphere's systems are not directly compatible.
- **RFID Tag Volume:** The number of RFID tags that the system can read at once is limited, which could have an impact on how the user interacts with various tagged objects.

- **Need for Internet Connectivity:** System upgrades and content management require constant access to a dependable internet connection, which could present difficulties in settings with erratic connectivity.

5.3. Future Considerations

- **Improved Media Functions:** Examine the potential for adding more sophisticated media player features that would let users manage playback and improve user engagement.

- **Better Interface Options:** Look for substitute programs or systems that can offer a smooth admin panel for managing material, making uploads and updates simpler.

- **The capacity to scale RFID tags:** As educational needs increase, consider future modifications that will enable RFID tags to be scaled. This will allow the system to support additional interactive resources.

- **Functioning Offline:** Think about creating offline features that would enable the system to operate well even in the absence of a steady internet connection, guaranteeing dependable access to learning resources in any setting.

Appendix A – Data Dictionary

Table 1
Data Dictionary

Field Name	Description	Type	Possible Values/States	Related Operations	Requirements
RFID_Tag_ID	Unique ID for RFID-tagged items	Varchar(50)	Unique alphanumeric ID (e.g., A12345RFID)	Read from RFID sensor, transmitted to controller	Must be unique and correctly paired with items
Item_State	The state of the item (lifted, placed)	Enum	Lifted, Placed	Trigger event when lifted, reset when placed	System must detect item state changes instantly
Video_File	Video file to be displayed based on RFID detection	Varchar(150)	Filename (e.g., animals.mp4)	Play, Stop	Supported formats: Youtube links
Video_Status	Current status of video playback	Enum	Playing, Stopped	Manage playback based on interaction	System must update status after each interaction
Content_Description	Description of video content linked to an item	Text	Descriptive text (e.g., "Different Animals")	Display during admin configuration	Admin must enter a description for each content
Admin_ID	Unique ID for the admin user	Integer(10)	Unique admin identifier (e.g., 1001)	Assign RFID tags, update content	Admin must log in to modify content
RS232_Command	Command sent via RS-232 to media player	Varchar(100)	RS-232 Protocol (e.g., "PLAY Video01")	Send command to media player	Must adhere to RS-232 protocol for media player

HDMI_Status	Status of the HDMI connection	Enum	Active, Inactive	Check connection before video playback	HDMI must be active to display content
Wireless_ Connection	State of the wireless connection between sensors and controller	Enum	Connected, Disconnected	Monitor connection for data transmission	Must be stable during operation
Power_Status	Power state of the system	Enum	On, Off	Power on/off the system	System must maintain uptime during operation
Lift_Action	User action of lifting an RFID-tagged item	Event	RFID tag detected by sensor	Trigger video playback	System must respond in real-time to lift events
Place_Action	User action of placing an RFID-tagged item back	Event	RFID tag no longer detected	Reset system state to standby	System must revert to standby after item is placed

Appendix B - Group Log

Project Name: LiftN'Learn: Interactive RFID-Powered Resource Display for Enhanced Learning Experiences

Date			
Progress and Achievements		Items for Escalation	

Milestones

Milestone Description	Date	Completion %	Owner	Comments
System Design	12/10/2024	100.0	Diandre Dawson Gomez	
System Functionality	12/10/2024	100.0	Diandre Dawson Gomez	
SRS Document	12/10/2024	100.0	Diandre Dawson Gomez	
Adressing Panelists' Revisions	12/10/2024	100.0	Diandre Dawson Gomez	
Test Plan/Test Case	12/10/2024	100.0	Diandre Dawson Gomez	

Figure 7 Group Log

Appendix C – Test Plan/Test Cases

Test Case:

	Project Name:	**LiftN'Learn: Interactive RFID-Powered Resource Display for Enhanced Learning Experiences**	**Test Designed by:**	**Diandre Dawson B. Gomez**				
	Module Name:	**LiftN'Learn System**	**Test Designed date:**	**10-2024**				
	Release Version:	**Version 1.2**	**Test Executed by:**	**Diandre Dawson B. Gomez**				
			Test Execution date:	**10-2024**				
Pre-condition	System is powered on, RFID tags are properly attached to multiple objects.							
Dependencies:	RFID tags must be functional and correctly configured, The display system must be operational.							
Test Priority	High: This test is essential to ensure that the system correctly handles multiple RFID tag interactions without errors.							
Test Case#	**Test Title**	**Test Summary**	**Test Steps**	**Test Data**	**Expected Result**	**Post-condition**	**Actual Result**	**Status**
TC-01	RFID Object Detection	Verify that the system detects an RFID-tagged object when lifted content for each RFID object.	1. Ensure the LiftN'Learn system is powered on. 2. Lift an RFID-tagged object. 3. Obeserve the display.	RFID-tagged object (e.g., book)	The display shows relevant educational content related to the object lifted.	The object is returned to its original position.	The system successfully detected an RFID-tagged object.	Passed
TC-02	Interactive Content Display	Verify that the system displays the correct content for each RFID object	1. Lift different RFID-tagged objects. 2. Check the content displayed for each object.	RFID-tagged objects (various)	The correct educational content is displayed for each lifted object.	The system is reset.	The system successfully detected the RFID-tagged object and displayed the correct content.	Passed
TC-03	Multiple Tag Detection	Verify that the system only displays the first detected RFID-tagged object without errors.	1. Ensure the LiftN'Learn system is powered on. 2. Lift multiple RFID-tagged objects simultaneously. 3. Observe the display.	Multiple RFID-tagged objects (e.g., book, globe)	Only the content for the first lifted object is displayed, no errors occur.	The system remains ready for further interactions.	The system only displays the first detected object without occuring errors	Passed
TC-04	System Reset	Ensure the system resets correctly after use	1. Complete interactions with RFID objects. 2. Initiate system reset.	N/A	The system returns to its initial state without errors.	The system is ready for next use.	The system is safely resets and is ready for next use.	Passed

Figure 8 Test Case

The following screenshot illustrates the key sections of our test plan, outlining the testing strategy and objectives. Here is the link to the Excel file for detailed information.

Test Plan:

The test plan's goal is to confirm that the LiftN'Learn system operates, is user-friendly, and functions as intended. To verify that the system satisfies the requirements and performs as intended, the test plan will include all the methods, test cases, and processes needed.

The several tests that will be carried out to confirm the system's RFID-based operation, user interface, and learning content integration are detailed in this test plan. Testing for robustness, usability, and alignment with the project's educational objectives will be done through functional, performance, and usability tests. Here is the link to the Test Plan File.

- **Start-to-Completion Requirement**
  It is not necessary for the system test to run uninterrupted from the beginning to the end. If there is a problem, such a broken sensor or strange behavior, the test can be stopped for changes and debugging.
- **Conditions for Resumption**
  Testing can go back on once the following has been confirmed:
  - The HDMI cord is plugged in correctly.
  - When the system is plugged in, the "StephAnn Tutorial Center" emblem appears.
  - To detect a single or several props, the RFID sensor's sensitivity may be precisely adjusted, guaranteeing optimal system performance.
- **Checkpoints**
  - **First Setup Checkpoint**: Confirm that when a prop is positioned, a video plays and the system logo appears as intended.
  - **Sensor Performance Checkpoint**: Monitor the system to make sure that props are correctly detected that only one video is shown at a time, and that the system is not having problems when several props are lifted or set.

Figure 9 Test Plan

Appendix D – Video Permission Approval

This appendix contains a screenshot of the email correspondence with **Smile and Learn**, in which we requested permission to use their educational videos for our project. Their prompt approval is greatly appreciated and demonstrates their support for educational initiatives.

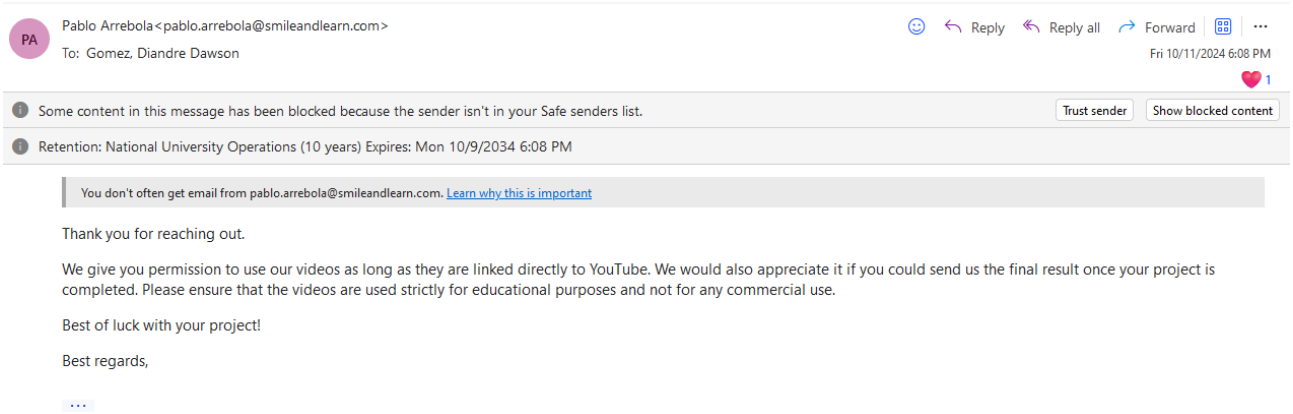

Figure 10 Video Permission Approval