Nebula Net Interactive Feed (NIFF)

Software Requirements Specification

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Overview:
This document serves as Software Requirements Specification (SRS) for the Computer Science 422 Software Methodologies Project 2 assignment Nebula Net Interactive Feed (NNIF). This document functions as the comprehensive requested feature set that is set by the ideation of project stakeholders. This document will spell out the justification, optional feature set, user types, system performance standard, user interface requests, and performance standards. This is an initial draft of this document and will be submitted upon completion and will undergo revisions in response to feedback provided by the instructor.

1. SRS Revision History:

Date	Author	Description
14FEB2024	Simon Zhao	Creation of initial SRS document for the JWST interactive feed website.
15FEB2024	Simon Zhao	Finished rough draft of SRS document.
20FEB2024	Daniel Willard	Reworking Document layout
23FEB2024	Daniel Willard	Poshishing statements
25FEB2024	Daniel Willard	Rework Requirements
27FEB2024	Daniel Willard	Finalizing for first submission

2. Introduction:

- The Nebula Net Interactive Feed website aims to provide a comprehensive platform for the public to access and explore captivating images captured by the National Aeronautical and Space Administration's (NASA) James Webb Space Telescope (JWST) in an interactive image gallery. This System Requirements Specification document outlines the functional and non-functional requirements necessary for the development and deployment of the website.

3. The Concept of Operations (ConOps)

3.1. Current System or Situation:

- Currently, users access James Webb Space Telescope (JWST) observations through various scattered sources provided by NASA and third parties in a disjointed and decentralized way. There is no singular, interactive platform that shows the current mission of JWST consolidates and provides detailed information and user engagement through a centralized and interactive feed. Nor is there a website that then collects and shows the completed missions. This not only creates s

3.2. Justification for a New System:

- A unified platform is necessary to enhance the accessibility and educational value of JWST images. There is a clear need for a system that not only displays these images but also allows users to interact with the data, customize their viewing experience, and receive updates on discoveries.

3.3. Operational Features of the Proposed System:

3.3.1. Real-time connection to JWST feed:

- The proposed system shall establish a real-time connection to the James Webb Space Telescope (JWST) feed, ensuring that the website is continuously updated with the most current publicly released images and data. This real-time integration will enable users to access the latest images and information captured by the JWST, providing an immersive and up-to-date experience.

3.3.2. Historical Log Since Launch (12JUL2024):

- A comprehensive historical log shall be maintained for each day since the launch of the James Webb Space Telescope on 12th July 2024. This log will serve as an invaluable archive, allowing users to explore past missions and observations conducted by the JWST. By providing access to historical data, the system enhances the educational value of the website, enabling users to track the progress of the mission over time.

3.3.3. Detailed Annotations and Celestial Object Information:

- The system shall incorporate detailed annotations and information for each image captured by the JWST. These annotations will provide context and insight into the celestial objects depicted in the images, enhancing the educational and scientific value of the website. Users will have access to comprehensive data provided by NASA..

3.3.4. Historical Gallery Organized by Date:

- The system shall feature a historical gallery organized chronologically by date, allowing users to navigate through past observations and missions conducted by the JWST. This organization scheme enhances usability and facilitates efficient exploration of the vast image database.

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3.3.5. Interactive Features for Image Viewing:

- The proposed system shall offer interactive features for image viewing, including zooming and downloading capabilities. Users will have the ability to zoom in on images to explore details with enhanced clarity, facilitating closer examination of celestial objects and phenomena. Furthermore, users will be able to download images for personal use or further analysis, fostering engagement and scientific exploration.

3.4. User Classes:

- The proposed system will cater to a diverse range of user classes, each with unique needs and expectations. The following user classes have been identified:

3.4.1. Astronomy Enthusiasts:

- Astronomy enthusiasts represent a significant user class who are deeply interested in acquiring detailed celestial information. These users seek to delve into the intricacies of space exploration and astronomical phenomena. They desire access to comprehensive data, including high-resolution images, detailed annotations, and scientific insights provided by experts in the field. Astronomy enthusiasts engage with the system to satisfy their curiosity and passion for understanding the universe.

3.4.2. Educators and Students:

- Educators and students form another crucial user class who utilize the system's images for educational purposes. They rely on the platform to access visually captivating imagery that enhances learning experiences in classrooms, laboratories, and educational settings. Educators integrate the system into their curriculum to illustrate key concepts in astronomy and astrophysics, while students utilize the images for research projects, presentations, and academic exploration. The system plays a vital role in facilitating knowledge dissemination and fostering a deeper understanding of celestial phenomena among educators and students alike

3.4.3. Casual Browsers:

- Casual browsers comprise a diverse user class consisting of individuals with a general interest in space imagery. These users may not possess a specialized background in astronomy but are drawn to the beauty and wonder of the cosmos. They visit the system to explore stunning images captured by the James Webb Space Telescope, seeking inspiration, entertainment, and awe-inspiring experiences. Casual browsers appreciate the accessibility and user-friendly interface of the system, which allows them to effortlessly browse through captivating imagery and learn about celestial objects and phenomena at their own pace.

3.5. Modes of Operation:

- The proposed system will operate through various modes to accommodate the diverse needs and interactions of users. Each mode represents a distinct scenario or use case in which users engage with the system. The following mode of operation has been identified:

3.5.1. Use Case 1: Image Exploration and Personal Gallery Creation:

3.5.1.1. Description:

- In this mode of operation, a user engages with the system to explore high-resolution images of celestial objects, focusing on a galaxy of interest. The user utilizes interactive features to zoom in on specific areas of the image, examining details with precision. Additionally, the user has the option to save favorite images to a personal gallery for future reference and enjoyment.

3.5.1.2. Steps:

- **1) Accessing the System:** The user navigates to the system's homepage using a web browser or mobile device.
- **2) Exploring Images:** The user browses through the image gallery and selects a high-resolution image of a galaxy for exploration.
- **3) Zooming In:** Upon selecting an image, the user utilizes the zoom feature to magnify specific areas of interest within the galaxy image, such as star clusters, nebulae, or spiral arms.
- **4) Examining Details:** The user carefully examines the detailed features of the galaxy image, observing intricate structures and phenomena captured by the James Webb Space Telescope.
- **5) Saving Favorite Images:** While exploring the galaxy image, the user identifies particularly captivating views and selects the option to save them to a personal gallery.
- **6) Creating a Personal Gallery:** The system prompts the user to create a personal account or log in if not already authenticated. Once logged in, the user navigates to their profile and accesses the personal gallery feature.
- **7) Saving Images to Personal Gallery:** The user selects the option to save their favorite images to their devices as a personal gallery, categorizing them for easy retrieval and organization.
- **8) Viewing Personal Gallery:** The user can access their gallery on their device at any time to view the saved images, reflecting on their favorite celestial views and sharing them with others if desired.

3.5.1.3. Outcomes:

- By engaging in this mode of operation, the user experiences an immersive journey through the cosmos, exploring high-resolution images of galaxies captured by the James Webb Space Telescope. The ability to zoom in on specific details and save favorite images to a personal gallery enhances the user's connection to the celestial realm, fostering a sense of wonder and appreciation for the beauty of the universe.

4. Specific Requirements:

4.1. External Interfaces:

4.1.1. Image Feed Interface:

- The system shall interface with the Mikulski Archive for Space Telescopes (MAST) database to pull real-time images and data from the James Webb Space Telescope (JWST). This interface will facilitate the continuous updating of the website with the latest imagery and scientific information captured by the JWST. Through this interface, the system will retrieve image files in the Portable Network Graphics (PNG) format, along with accompanying metadata provided by the National Aeronautics and Space Administration (NASA). The image feed interface will ensure the availability of detailed annotations and celestial object information, enhancing the educational and scientific value of the website.

4.1.2. User Interface:

- The system shall provide a user interface for interaction with the website, offering intuitive navigation and functionality for users to explore, and interact with JWST imagery and data.Through the user interface, users will be able to browse the image gallery and see specific images organized by date. Interactive features such as zooming and downloading will be available to enhance user engagement and exploration of celestial imagery and accessibility to JWST photos.

4.1.3. Hosting Environment:

- The system will be hosted on a Linux server environment, specifically designed to accommodate the requirements of the application. Additionally, the system may utilize Amazon Web Services (AWS) for cloud hosting services, ensuring scalability, reliability, and efficient resource utilization. The Linux server and/or AWS hosting environment will provide the necessary infrastructure to support the functionality of the website, including image storage, data processing, and web server capabilities. By leveraging these external interfaces, the system will deliver a seamless and robust platform for accessing and interacting with JWST imagery and data.

4.2. Functional Requirements:

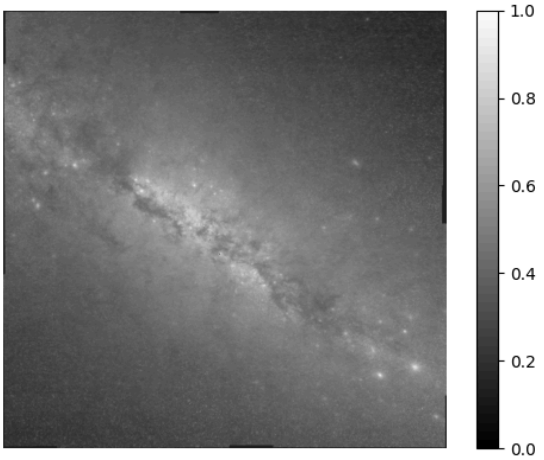
4.2.1. Validation:

- Unit tests shall be conducted to validate the system's functionality before deployment.
- The MAST API shall be executed weekly to check for new photos and update the website accordingly.

4.2.2. Image display:

- The system shall provide a real-time feed of images and data from the James Webb Space Telescope (JWST) as they become publicly available.
- Each image displayed on the website shall be accompanied by relevant metadata, including the date of capture and any additional data provided by the National Aeronautics and Space Administration (NASA).
- Detailed annotations of celestial objects captured in the images shall be provided by NASA and displayed alongside the corresponding images.
- The website shall support the display of images in the Portable Network Graphics (PNG) format due to its lossless compression bitmap characteristic and flexibility for storage and display.
- Users shall have the ability to download images directly from the website.
- The system shall support the expansion of images to enable users to view finer details and explore celestial objects in greater depth.
- Conversion of photos from .fits to .png format shall be performed to ensure viewability and accessibility of images.
- The most recent photos released to the public shall be accessible first to users.

4.2.2.1.1. Image Display Example:



(Scale on the side slow light emission by percentage representative of a single float value. {0.0 = no light, 1.0 = all spectrums of light} No data is shown here but information should be shown in a clean and understandable format below the photo.)

4.2.3. Image Metadata Management:

- Administrators shall have the capability to manage image metadata, including adding, editing, and deleting metadata entries.
- Changes to image metadata shall be reflected accurately and promptly on the website

4.3. Optional Functional Requirements:

4.3.1. Responsive Design:

- The website shall be responsive across various devices and screen sizes, including desktops, laptops, tablets, and smartphones.
- Content layout and navigation shall adapt dynamically to provide an optimal viewing experience on different devices.

4.3.2. Dynamically Hosted Website:

- The website shall be dynamically hosted on Amazon Web Services (AWS) to support seamless updates and modifications.
- Content updates, including image additions and metadata changes, shall be reflected on the website without disruption to user access.

4.4. Nonfunctional Requirements:

4.4.1. Performance Requirements:

- SQL database updates shall occur within 24 hours of receiving new data.
- File conversion processes, specifically from .fits to .png format, shall be completed within one hour to ensure timely availability of images.
- The cumulative size of the photo directory shall not exceed 10 gigabytes at any given time.

4.4.2. System Environment:

- The website shall be capable of running in static mode to ensure reliability and stability.
- The system shall be compatible with Linux-based environments, specifically, the ix-dev Linux server hosted by the University of Oregon.

4.4.3. Accreditation and Compliance:

- All images displayed on the website shall be accredited appropriately, adhering to copyright and usage guidelines.
- Any libraries or third-party components utilized in the system must be approved by the designated authority, Professor Anthony Hornof overseeing the project.
- The total expenditure on AWS services shall remain under $50 to maintain cost-effectiveness.
- The corresponding data shall be presented alongside the photos to provide context, information, and accreditation.

4.5. Usability Requirements:

4.5.1. Intuitive Navigation:

- The user interface shall feature intuitive navigation controls, to enable users to easily browse through images and access desired content.
- The navigation menu shall be logically organized, with clear labels and hierarchical structure, facilitating efficient exploration of website content.

4.6. Software System Attributes:

4.6.1. Maintainability:

- The system shall be designed with modular and well-structured code, facilitating easy updates and maintenance of the image feed.
- Code documentation shall be comprehensive and up-to-date, providing guidance for developers and administrators during maintenance activities.
- Changes to the image feed, including updates to image sources or metadata structures, shall be implemented efficiently and with minimal disruption to system functionality.
- Version control systems, such as Git, shall be utilized to track changes to the codebase and facilitate collaboration among development team members.
- Automated testing suites shall be implemented to verify system integrity after updates or modifications to the image feed, ensuring that new changes do not introduce regressions or unexpected behavior.

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6. Acknowledgments:

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