

Lab 1 - FlixPicks Product Description

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4/15/2024

Version 3

Table of Contents

1. Introduction.....	3
2. FlixPicks Description.....	4
2.1. Key Features and Capabilities.....	4
2.2. Major Components (Hardware/Software).....	7
3. Identification of Case Study.....	9
4. FlixPicks Prototype Product Description.....	11
4.1 Major Components (Hardware/Software).....	11
4.2 Prototype Features and Capabilities.....	12
4.3 Prototype Development Challenges.....	13
5. Glossary.....	15
6. References.....	19

List of Figures

Figure 1: FlixPicks Major Functional Component Diagram.....	8
Figure 2: FlixPicks Prototype Major Functional Component Diagram.....	12

List of Tables

Table 1: FlixPicks Features Table.....	5
Table 2: FlixPicks RWP vs Prototype Table.....	10
Table 3: FlixPicks Case Study Table.....	13

1. Introduction

The consumption of video entertainment has evolved significantly since its conception. What started as a limited set of channels with a fixed airing schedule has been replaced with expansive libraries of on-demand content, readily available from almost anywhere, anytime. In August 2022, streaming represented 34.8% of visual viewership, surpassing cable television (TV) for the first time (Fischer, 2022). Streaming is projected to grow by an annual rate of 9%, while projected cable TV growth is a mere 4% annually (Raj, 2023). The continued growth of streaming services comes at a time when the average household is already subscribed to 2.8 services, costing \$39 per month (Glover, 2023). As of 2023, there are over 200 paid streaming platforms available globally, giving users an overabundance of options to choose from (Cook, 2023). This includes popular services such as Netflix, Hulu, and Max. From these three services alone, a person would have the option of over 7,500 movies to watch (Clark, 2022).

The cornucopia of content ushered in by the rise of streaming has induced a paradox of choice for many streaming platform subscribers. For example, even after a subscriber has already decided to use Netflix, they spend an average of 17.8 additional minutes browsing selections each time they use the platform according to a 2016 study (Mostcaritolo, 2016). A study from 2020, estimated that the average person spends up to 187 hours a year searching for media, or roughly 30 minutes a day (Ward, 2020). This phenomenon is often referred to as Decision Fatigue and/or Choice Overload.

FlixPicks, an online application, alleviates Decision Fatigue and Choice Overload by providing users with comprehensive tools to aid in deciding what to watch. FlixPicks eliminates the strain associated with decision-making and provides a Quick Click for all content options, seamlessly navigating users to their subscribed content.

2. FlixPicks Description

FlixPicks is an online application that consolidates content from many of the most popular streaming services for Registered Users, a user who has created an account. Creating a Library that is an agglomeration of content unique to the Linked Subscriptions, self-reported ownership of a Streaming Service, for a Registered User. FlixPicks incorporates a Taste Profile, set up at the registration of a new user through a Survey, to influence content displayed to individual Registered Users. FlixPicks utilizes both Recommendation and Apriori Algorithms to dynamically change which content is displayed for a Registered User. FlixPicks main goal is to eliminate Decision Fatigue and Choice Overload through five key features (Section 2.1): Taste Profile, HotPicks, CineWheel, CineRoll, and CineMap, all of which will be elaborated on in subsequent sections. The innovative design solution is defined by the Major Components (Section 2.2).

2.1 Key Features and Capabilities

FlixPicks offers a Library encompassing content from all Linked Subscriptions a Registered User has self-reported ownership to. Linked Subscriptions have the ability to be toggled on or off, allowing for content to be displayed for Subscriptions that a user does not own. Registered Users are able to select which Streaming Services they are Subscribed to at any time. If a Guest attempts to use a feature that is not available to them, they are prompted to register for an account. A Representative, a user designated to an employee of a Streaming Service, has the ability to view analytics provided by FlixPicks. Analytics provide insight to a Representative. The Admin role oversees the operational integrity of FlixPicks. FlixPicks allows for a multitude of User Roles, Table 1 defines the access that those roles have.

Table 1*FlixPicks Features Table*

Category	FlixPicks Feature	Guest	Registered User	Admin	Representative
Subscription Service Management	User Account Registration	Access	N/A	Access	N/A
	Account/Subscription Service Management	Unavailable	Access	Access	Access
	User Subscription Integration	Unavailable	Access	Access	Access
	User Tier Level Feature Access	Unavailable	Access	Access	Access
Taste Profile	Taste Profile	Unavailable	Access	N/A	N/A
	Taste Profile Survey	Unavailable	Access	N/A	N/A
	Taste Profile Content-Based Filtering	Unavailable	Access	N/A	N/A
	Taste Profile Collaborative Filtering	Unavailable	Access	N/A	N/A
Recommendations	Recommendations	Unavailable	Access	N/A	N/A
	Filtered Recommendations (Criteria based)	Unavailable	Access	Access	N/A
Movie Library	Browse/Search Filtering	Access	Access	Access	N/A
	HotPicks	Access	Access	Access	N/A
CineRoll	CineRoll	Unavailable	Access	Access	N/A
CineWheel	CineWheel	Access	Access	Access	N/A
CineMap	CineMap Overlay	Unavailable	Access	Access	N/A
	CineMap Commenting	Unavailable	Access	Access	N/A
	CineMap Export Data	Unavailable	Unavailable	N/A	N/A
	CineMap Data Analyzing	Unavailable	Unavailable	N/A	N/A
Analytics	Data analytics testing	Unavailable	Unavailable	Access	Access
	Analytics	Unavailable	Unavailable	Access	Access
	Summary reporting for user/stakeholders	Unavailable	Unavailable	Access	Access
Simulation	Simulation	Unavailable	Unavailable	Access	Unavailable
Movie Info	Create/edit Movie Info	Unavailable	Unavailable	Access	Unavailable
Feedback	Feedback	Access	Access	Access	Access

Taste Profiles encompass both user characteristics and the ability to filter information based on the characteristics associated with a Registered User. Taste Profiles are initially generated by a Survey a user must complete when registering. The Survey responses facilitate type grouping, where an analysis of survey responses generates a characteristic. Two users providing identical responses will have the same initial characteristic. Taste Profile

characteristics are dynamically updated when new content is viewed. This ensures the most accurate grouping of a user. Taste Profile characteristics are an indicator of a strong correlation between content users would enjoy watching, similar Taste Profile characteristics are used to filter recommendations.

HotPicks shows Users what is currently popular across streaming platforms. HotPicks determines popularity with an API call to TMDB, a third-party API providing movie data. HotPicks is displayed as a tile list on the FlixPicks homepage. Providing Quick Click access to any trending content displayed. HotPicks is updated every time a user refreshes the page, accurately portraying what is popular at any given moment. Registered Users have the option to toggle their Linked Subscriptions, allowing for the display to reflect what is trending across all Subscription Services or just their Linked Subscriptions.

CineWheel is populated by a user input of up to ten unique media titles. The inputted titles are visually represented on a wheel. CineWheel randomly selects media content to view by displaying an animation of a spinning wheel, landing on a randomly generated choice. CineWheel also provides the user with a Quick Click for the selected content. CineWheel is a purely random selection and does not require profile-specific data, such as Taste Profiles, to generate the selection.

CineRoll is the most comprehensive tool provided by FlixPicks. CineRoll uses both Apriori and Recommendation Algorithms to generate recommendations for a user. User-specific data, including Watch History, all media content a user has viewed, and Taste Profiles, is required to make recommendations on what a user would enjoy watching. An Apriori Algorithm is used, mining associations within users' Watch History to reveal patterns in watched content. Associations are then altered using support and confidence values to filter out weak associations.

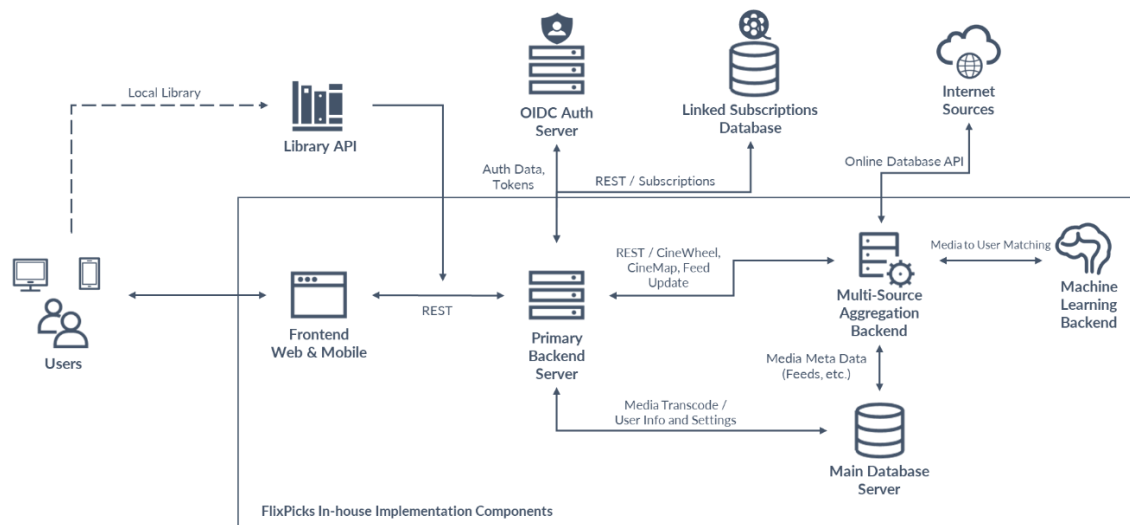
Remaining associations are then compared to an individual's Watch History to make recommendations to display to a user. Feedback from users is used to update support and confidence values to improve the quality of recommendations made. Taste Profiles are used in the Recommendation Algorithm to display content to a user based on their Taste Profile. The Recommendation Algorithm filters content based on a user's Taste Profile.

CineMap allows users to provide real-time Reactions, a comment along with one of five predetermined emoticons, for the content they are watching to FlixPicks. CineMap is an overlay for the media that a person is streaming in their Streaming Service. CineMap allows Reactions to be posted about the current scene a user is watching. A Reaction and timestamp are associated with the media. Admins and Representatives have access to view the data of the Reactions as a part of a complete data analysis to provide additional information on what is currently popular, including timestamped insight to support why. CineMap allows users to have an interactive experience, allowing time-stamped Reactions to be viewed by others.

2.2 Major Components (Hardware/Software)

FlixPicks consists of a web application and browser extension. The browser extension is used to collect data that is stored in a backend server database, while the web application is used to collect, access, maintain, and make predictions based on this data. FlixPicks' web application provides an interface for the use of the tools. Figure 1 illustrates the functional components of FlixPicks.

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Figure 1*FlixPicks Major Functional Component Diagram*

The user interface is available from any device that can access the internet with a browser that supports the FlixPicks extension such as Chrome. The web application and browser extension is programmed using HTML, CSS, and JavaScript. The user interface can also be accessed on smart devices and Smart TV's. For Apple devices swift is used, while Java is used for Android devices.

Data is stored in a MySQL Server, containing the data gathered from The Movie Database (TMDB), a third-party API. Apache Tomcat is used for the application server. AWS Machine Learning and Artificial Intelligence are used along with Amazon Personalize to generate personalized recommendations. Version control is achieved through Git. The repository is stored using GitHub and its features. VSCode and Eclipse are used as the IDEs for project management and issue tracking.

Backend algorithms are programmed in Python. Backend algorithms utilize data stored in the database. Backend algorithms are encapsulated within Docker containers. Dynamically building and tearing down on a schedule to ensure resource conservation.

3. Identification of Case Study

The real-world development of FlixPicks is aimed at all households that own Subscriptions to any number of Streaming Services and Representatives from all Streaming Services. Households that have members that travel receive additional benefits as streaming service libraries change based on geographical location. Representatives gain additional insight into what shows and movies are popular, allowing them to better invest in future content creation and acquisition.

The prototype case study consists of a minimal number of simulated users, with diverse ownership of streaming services and roles. The diverse ownership model's real-world usage to provide realistic data collection. Roles include users who are Guests, Registered Users, and Representatives. All roles in the prototype are tester-driven. Table 2 defines the simulated users in the case study.

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Table 2*FlixPicks Case Study Table*

Name & Information	Description
John Doe, Registered User	<ul style="list-style-type: none"> • John is subscribed to Hulu, Netflix, and Amazon Prime Video. • He constantly finds himself annoyed switching from different streaming platforms while browsing for content to watch. • Because of work, he only has a few hours left to consume entertainment at the end of the day. • He watches with his family.
Jane Plain, Registered User	<ul style="list-style-type: none"> • Jane is subscribed to Hulu and Netflix. • She regularly hangs out with groups of friends and one of their regular activities is watching a movie as a group. • Her and her friends constantly find themselves disagreeing over which movie to watch together.
Tim Brown, Guest	<ul style="list-style-type: none"> • Tim is not subscribed to any streaming services. • He regularly finds himself unsure what content he wants to watch. • He wants to find good shows to watch but doesn't know where to start without being subscribed to anything.
Jack Smith, Registered User	<ul style="list-style-type: none"> • Jack is subscribed to Hulu, Netflix, and Amazon Prime Video. • He regularly watches movies and shows at home by himself. • After watching something he typically searches youtube reviews to see what others thought about specific parts of the movies he watches.
Nick White, Representative	<ul style="list-style-type: none"> - Nick is an advertising representative for Netflix. - He is looking for user data about the most interacted with parts of movies and shows. - Netflix doesn't provide interactions during viewing of media so he needs to outsource this data.

A reduction in possible Library data is also seen in the prototype, limiting the number of movies and shows stored to a maximum of 10,000 from five Streaming Services. The chosen streaming services in the case study are Netflix, Amazon Prime, Hulu, Disney+, and Max. Beyond the specified users, the case study also presents up to 1000 generated users containing

permutations of user data from the case study, ensuring data integrity, to strengthen algorithm correlations.

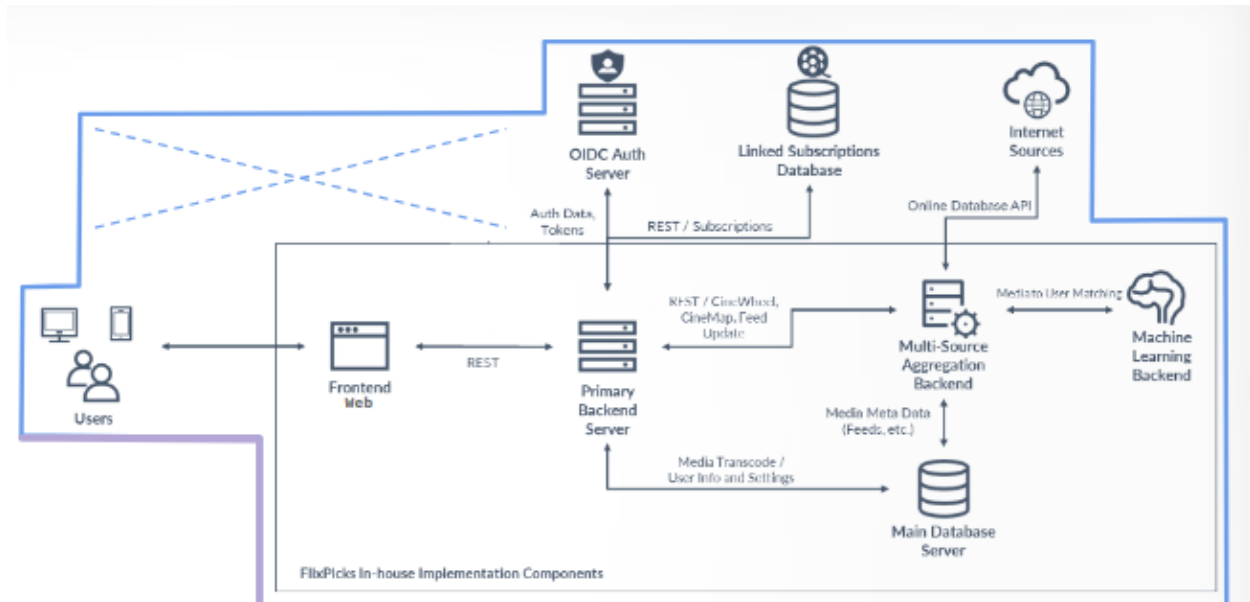
4. FlixPicks Prototype Product Description

The FlixPicks prototype includes a majority of the functionality of the real-world product (RWP), depicted in Table 3. The FlixPicks prototype serves as a proof of concept. Simulation of user data is used in the prototype, providing analytics and allowing for risk mitigation. The prototype is crucial in demonstrating that FlixPicks is an innovative solution to the problem.

4.1. Prototype Architecture (Hardware/Software)

The prototype is hosted on the Old Dominion University infrastructure. Data is collected from TMDB for subscription services. The FlixPicks prototype consists of a web application and browser extension. Figure 2 illustrates the functional components of the FlixPicks prototype.

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Figure 2*FlixPicks Prototype Major Functional Component Diagram*

FlixPicks prototype uses an ODU Linux-based virtual machine. The prototype back-end is developed in Python. SQLite is implemented as the database and Docker is used for facilitating data management. The front-end is written in HTML, CSS, and JS and is connected using Flask. GitHub is used for version control. VSCode and Eclipse are used as the IDEs for project management and issue tracking.

4.2. Prototype Features and Capabilities

The prototype of FlixPicks includes full implementations of CineWheel, CineRoll, and Taste Profile. CineMap is limited in implementation with restrictions on data exportation and analysis. All user data is simulated. Movie data is both simulated or pulled through third-party APIs. Table 3 defines functional differences between features in the real-world product and the prototype.

Table 3*FlixPicks RWP vs Prototype Table*

Category	FlixPicks Feature	RWP	Prototype
Subscription Service Management	Account/Subscription Service Management	Fully Implemented	Fully Implemented
	User Account Creation/Registration	Fully Implemented	Fully Implemented
	User Subscription Integration	Fully Implemented	Partially Implemented
Taste Profile	Taste Profile	Fully Implemented	Fully Implemented
	Taste Profile Form Pop-Up	Fully Implemented	Fully Implemented
	Taste Profile Content-Based Filtering	Fully Implemented	Fully Implemented
	Taste Profile Collaborative Filtering	Fully Implemented	Fully Implemented
Reccomendations	Recommendations	Fully Implemented	Fully Implemented
	Filtered Recommendations (Criteria based)	Fully Implemented	Fully Implemented
Filtering	Browse/Search Filtering	Fully Implemented	Fully Implemented
CineRoll	CineRoll	Fully Implemented	Fully Implemented
CineWheel	CineWheel	Fully Implemented	Fully Implemented
CineMap	CineMap Overlay	Fully Implemented	Fully Implemented
	CineMap Commenting	Fully Implemented	Fully Implemented
	CineMap Export Data	Fully Implemented	Partially Implemented
	CineMap Data Analyzing	Fully Implemented	Partially Implemented
Analytics	Data analytics testing	Fully Implemented	Partially Implemented
	Analytics	Fully Implemented	Partially Implemented
Simulation	Simulation	Eliminated	Fully Implemented
Movie Info	Create/edit Movie Info	Eliminated	Fully Implemented
Reporting	Summary reporting for user/stakeholders	Eliminated	Fully Implemented
Feedback	Feedback	Fully Implemented	Partially Implemented

Real-world user restrictions are adhered to in the prototype. Testers have access to pre-populated Registered User credentials, which include User Taste Profiles, Watch History, movies, genres, and interaction. Algorithms and machine learning to generate recommendations for users are fully implemented using simulated data.

4.3 Prototype Development Challenges

A large challenge is the simulation of data. Without patterns generated in the data for watch history and user Taste Profiles, any recommendations would not follow a logical path. This requires fine-tuning and manual configuration of the simulated data sets to ensure proper logic is taking place. Gathering large enough sample sizes for machine learning also comes into play. Large enough datasets need to be used and algorithms need to be optimized to only run with properly pruned data to return generated recommendations in a reasonable time. Third-party

APIs being used also pose a key risk as these can be changed and come with rules on how the data gathered is allowed to be used and stored. Data management can further become an issue as concurrency issues can occur where the database is updated by multiple users and can impact the data used as recommendations are being made. This can be mitigated in the prototype by staging database calls and using best practices for database management.

5. Glossary

Administrator: A user who, beyond having access to the full slate of features a Registered user has and the data available to a Representative, can manipulate FlixPicks data.

Android: An operating system for mobile devices manufactured by Google, Samsung, and other companies.

Apache Tomcat: An open-source implementation of the Java Servlet, Java Server Pages, Java Expression Language, and WebSocket technologies. Tomcat provides a “pure java” HTTP web server environment in which Java code can run.

API: An Application Programming Interface is an interface that allows for interactions between multiple software applications or mixed hardware-software intermediaries.

Apriori Algorithm: Association mining that allows for common patterns in a users watch history to be used to help suggest content for other users.

Choice Overload: The phenomenon that choosing between a large variety of options can be detrimental to the decision-making process.

CineFeatures: CineFeatures is the collective name of the three features in FlixPicks: CineRoll, CineWheel, and CineMap.

CineMap: FlixPicks extension that is enabled when a user is watching media. It overlays their media and allows the user to see and make their own time-stamped comments and Reactions that are stored on the FlixPicks DB.

CineRoll: FlixPicks feature that generates random selections based on a user’s interests.

CineRoll uses the Taste Profile to generate selections for a user based on their recommendations and chooses one for the user. The user has the option to reroll if they aren’t satisfied with the selection.

CineWheel: FlixPicks feature that randomly selects from a set of user-inputted choices. The user provides the feature with media options and the feature randomly selects from a maximum of ten options.

CSS: Cascading Style Sheets is a style sheet language used for customizing the appearance of a document written in a markup language such as HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

Decision Fatigue: The fatigue from deciding what to watch can take the joy out of watching anything.

Git: Software for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development.

Guest: An unregistered user who has limited access to features offered by FlixPicks.

HotPicks: A micro-experience tile for showing popular and trending media. Dynamically creates the list upon page refresh. Available for Registered Users and Guests.

HTML: Hyper Text Markup Language. HTML is the standard markup language for creating web pages. HTML elements tell the browser how to display the content and define the structure of web pages.

IDE: An integrated development environment is a software application that provides comprehensive facilities to computer programmers for software development.

iOS: An operating system used for mobile devices manufactured by Apple Inc.

JavaScript: A scripting or programming language that allows you to implement complex features and interactivity on web pages.

Library: Aggregated content that is shown to users. Guest users only have access to HotPicks but Registered Users can see aggregated content from HotPicks and their personalized recommendations.

Linked Subscriptions: User's subscription data that will be used to filter what media is shown in the Library, users can change this in settings if they want to only view their subscriptions.

MySQL: An open-source relational database management system.

Netflix: A subscription-based streaming service that allows members to watch TV shows and movies on internet-connected devices.

Quick Click: A link from FlixPicks that redirects the user to the selected streaming media.

Reactions: Small images that the user attaches to their comment to describe a variety of emotions that the user feels about the media.

Recommendation Algorithm: An algorithm that uses a dynamically built input Library and information filtering system based upon the Taste Profile that provides suggestions for media content that is most relevant to a particular user.

Registered User: A user who completed registration and Taste Profile Survey, having full access to features offered by FlixPicks.

Representative: A user who is an affiliate of a particular streaming service who has access to non-account-specific data analytics of Registered Users.

Stakeholder: A person with interest or concern in something, especially a business.

Streaming: A method of transmitting or receiving data over a computer network as a steady, continuous flow, allowing playback to start while the rest of the data is being processed.

Streaming Service: A streaming service is a digital platform that delivers multimedia content over the internet, allowing users to watch or listen to it in real-time without downloading.

Examples include Netflix, Spotify, and Disney+.

Subscription: A user's enrollment with a Streaming Service provider, providing them access to media available through the service.

Survey: A questionnaire to establish the initial information for recommendations in the Taste Profile.

Taste Profile: A user profile on FlixPicks that stores data about user streaming subscriptions, recommended media, and user preference information. As a user makes selections the Taste Profile recommendations become more refined to the users' preferences.

User Roles: Guest, Registered User, Representative, and Administrator are the user roles for FlixPicks.

Watch History: A comprehensive list of past content viewed by a user.

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