Lab 1 – AskMissy Product Description

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Table of Contents

List of Figures

1 Introduction

Students face many struggles in their pursuit of learning. Schools and students are losing reading resources vital to learning. Alongside time management and personal roadblocks, a common struggle is finding resources able to aid and reference their assignments. Without those resources, it becomes increasingly difficult for the students to find supplemental materials for their classes to assist with their learning. With limited knowledge of how to search for class required resources because of their lack of accessibility, student's underperform on Standards of Learning tests or SOLs.

Standards of Learning tests measure the performance and success of students in English, mathematics, history, and science and determine student class placement and a school's accreditation. If students perform poorly, a school's accreditation, its validation in the ability to effectively educate students, will be put at risk. Teachers need improved access to resources to refresh and modernize learning for students that struggle with learning.

Modernized learning allows teachers to introduce different resources better suited for their students. This will inherently give resources that go unnoticed more attention and exposure. Direct teacher access will allow them to connect with what students are currently reading and have interest in to better tailor their teaching plans and keep students interested and engaged.

Student performance is unoptimized due to a lack of resources tailored to their learning preferences. This is evident as SOL pass rates have decreased by an average of 9% for all students with a more evident decrease at 11% for minority and low-income students. The AskMissy software application will help users find the resources necessary for them to bridge the gap between conventional and digital learning for a more personalized learning experience.

AskMissy starts with books, the foundation of knowledge, and expands to include all types of resources. AskMissy will modernize how users access what they need and like in order to increase academic performance, with a focus on SOLs. This will improve how students prepare and learn throughout their academic career.

AskMissy searches for resources through its database, filtering results on books from a wide range of topics based on the user's preferences. Each resource found will provide statistics, summary, ISBN for books, reviews/ratings, and tags on resource content. The AskMissy search tool will allow the ability to search for specific subcategories through tags related to those resources. The search tool will also give users filter capability to sort through grade/difficulty levels of the resources. Users will be able to make personalized profiles and can choose whether to have them be public or private. This gives the user security in whether others can view their profile.

SOLs are used from grades 3-12, however academics in middle and high school start advancing technically, especially in STEM fields. AskMissy will focus on middle and high school students, grades 6-12, in allowing integrated access to school and personal resources using machine learning. To further AskMissy's efficiency for students, AskMissy will provide lesson plan integration for teachers to upload to their class groups.

2 Product Description

AskMissy is a web-based software application that provides tools to expand its users' capability to efficiently search for resources pertaining to lesson plans established by teachers and librarians. Machine learning algorithms are used to find recommended resources best suited to the user's needs based on the user's profile. This includes resource interactions, interests, and age.

With machine learning algorithms, AskMissy will improve resource finding capabilities for students, teachers, and librarians. Ease of access to previous resources and even giving exposure to undiscovered resources, such as other STEM textbooks, can help improve SOL preparation for students. Not only will recommended resources tailored to users' needs motivate them to keep seeking more resources, they will create more interactions within AskMissy and further allow users to learn under their preferred learning environment and style.

2.1 Key Product Features and Capabilities

The primary form of AskMissy's accessibility will be integrated authentication within a school system with access through the use of school identifications. School IDs are necessary to be a registered user and will allow access to AskMissy both inside and outside of the school system. However, the basics of AskMissy are still accessible without a school ID as an unregistered user.

Non-registered users are treated as guests within the system. Guests have limited access, being able to search for resources, but without the machine learning aspect that comes with AskMissy user profiles.

Registered users use the school system to authenticate their profile. Upon registration, AskMissy will request for the school identification. Upon submission, AskMissy will transfer the user for authentication to that school. Once users are authenticated, they are given general access to the AskMissy search algorithms. There are three different types of school users: students, teachers, and librarians.

Students will have access to AskMissy search algorithms and be able to share any resources with other users. Search algorithms provide the ability for a student to find resources pertaining to the specific search requirements, such as tags for resources. If one student finds a

resource that works especially well for them and then wants to share it so others can easily find and access that resource they have that benefit as well. Students have the ability to send messages to higher-tier users, being the teachers and librarians, and can send resource requests. They are given limited access to group navigation, being class or course groups, and can view reviews from other students within those groups.

Teachers have access to all student features and are granted full access to class/course group creation and management. Teachers are able to create and manage their lesson plans for student viewing and assisting them in locating recommended resources. Teachers are able to deny or accept and forward resource requests from students to the librarian, along with their own resource requests. They have access to view student reviews of resources within the groups.

Librarians have access to all student and teacher features, and have access to creating and managing school groups. Librarians are also able to manage and update the school library inventory within the AskMissy system. With inventory capabilities, librarians can manage the requests for resources and resources they want to add as well. For any technical support, librarians may contact administrators.

Administrators have access to all other users' features and primarily work to ensure data integrity. Administrators manage all external database access for user interaction within AskMissy. To allow smooth integration with these databases and AskMissy algorithms, they have access to all user profiles and metadata. Administrators authorize librarians to create school groups, as all new school groups become integrated with the rest of AskMissy metadata.

AskMissy includes reviews and ratings on all resources in the database. After a resource is recommended, a review/rating prompt is displayed. The feedback supplies data into the machine learning algorithm to further have an impact on the user experience. Specifically, the

trained algorithm will provide resources recommended specifically for the user based on how they leave feedback.

AskMissy uses internal and external databases. The internal database is the school database composed of school library and corollary resources. This database is managed by librarians and administrators as resources are added and removed, and any other changes that occur within the library.

The external database is accessed through apis, such as GoodReads. This is managed solely by the administrators, as all data will have to then integrate into AskMissy's system passed to the inventory accessed by the librarian.

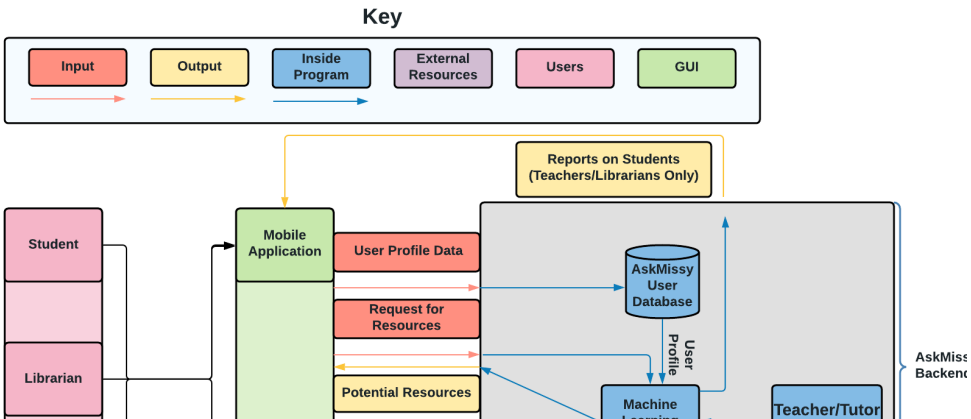
Machine learning algorithms are used to find personalized search results. The AskMissy algorithm uses and improves off feedback from recommendations. It also tracks tags that users commonly select. As users are more active on AskMissy, the machine learning algorithm continues to receive data and provide improved resource recommendations.

2.2 Major Components (Hardware/Software)

The main piece of hardware required is a device capable of accessing the internet. This allows the device to connect with the servers supporting all of AskMissy's functions. There are five servers, one main frontend server and four backend servers. The backend contains the main backend server, web scraping server, machine learning server, and the main database server.

Figure 1

Major Functional Components Diagram



The major components of the software are the frontend, backend, repository, and the database. The frontend is made and supported with HTML5, CSS3, and JavaScript, as AskMissy is web-based. The backend is made and supported by python as python has libraries that work very well with machine learning, scraping, and databases. PyCharm will be the IDE of choice and automatic navigation is under Flask. The repository utilized is Gitlab and databases will include Amazon RDS, mySQL, and connector/python. Python's scikit-learn library will power machine learning, and python in general will be used for natural language processing.

3 Identification of Case Study

AskMissy is for students, teachers, and librarians. AskMissy's primary focus is to provide students in middle school, grades 6-8, reliable access to resources they use for their academic and personal development. AskMissy is committed to being SOL based in providing the librarians, teachers, and students all the support necessary through its software.

The middle school case study group uses AskMissy to help students search for resources and request to join course/class groups. These groups allow course recommended resources to be shared. Machine learning will be able to learn a student's personal resource preferences and enable teachers and librarians to find appropriate resources.

Those that might benefit from AskMissy in the future will be resource publishers and students' parents. Resource publishers will be able to integrate publishing directly to AskMissy; new resources will be instantly available within AskMissy.

4 Product Prototype Description

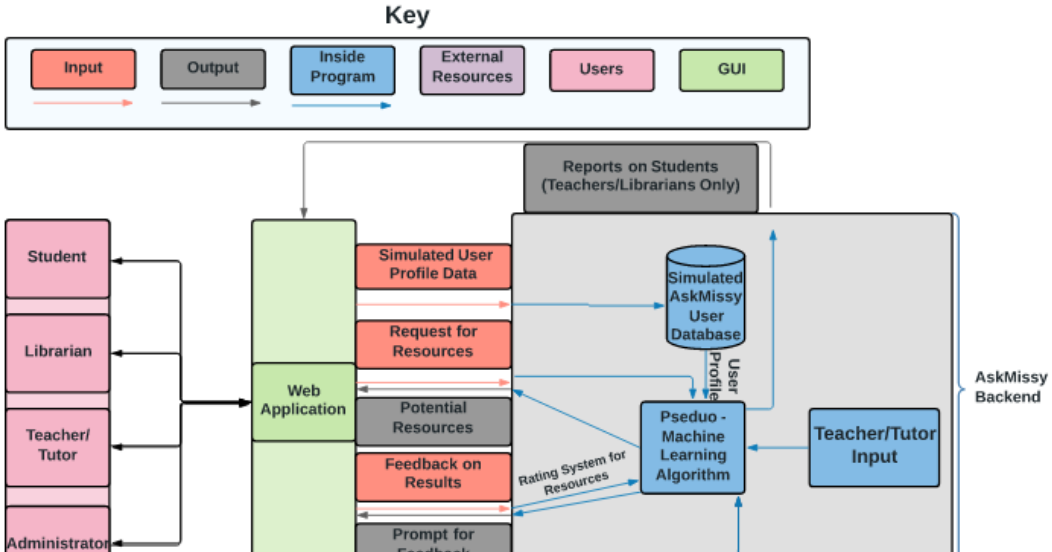
The purpose of AskMissy is to provide resources to students based on their personalized needs such as grade level, classes, and personal resource feedback. The AskMissy prototype will demonstrate these core aspects using machine learning algorithms for handling data. User types for guests, students, a teacher, and librarian are simulated through fake data to display the functionality each profile will provide. The search functionality will partially be implemented due to the nature of the simulation and the limited reference data available. AskMissy's machine learning algorithm is demonstrated through interactions with user feedback and ratings.

4.1 Prototype Architecture (Hardware/Software)

The AskMissy prototype only requires access to the internet and a computer device. No specialized hardware is required or necessary for using AskMissy. Software used is Flask, a python framework for web development, and Git for version control of the prototype's data. Front end within Flask will be HTML5, CSS, and Python.

Figure 2

Prototype Major Functional Component Diagram



The data is stored using MySQL databases and Amazon RDS. Within the databases are each user that is created along with all resource information available. The algorithm will be able to search for resources within the database based on each specific user, matching database data to inventory data. The search functionality displays matched information from the inventory database.

4.2 Prototype Features and Capabilities|

The core features of the AskMissy prototype will include that of the real-world prototype, but at a simulated, small scope scale. Data management in development will be within the prototype, but not the real-world product as the machine learning will fully handle our simulated data and testing within prototype demonstrations.

Security is partial to basic database login authentication with no encryption. For account management, profiles and groups are limited to fake data simulating what an actual profile and group provides. Users are allowed to register accounts into the database and login with the proper credentials created upon registration.

The AskMissy UI is partial to the limited data supplied to it for group interactions and user communication. The basic search and AskMissy search are able to pull resources from the

simulated resource database and display them to the webpage. The UI is dynamic only to the fake data limiting bug reports and personal data reports to proof of concept.

Table 1

RWP vs. Prototype

Category	Feature	RWP	Prototype	Reasoning
Security	Login/Authentication	Full	Partial	Limited test data as a proof of concept
	Data Encryption, moving	Full	None	Best practices will be put in place
	Data Encryption, resting	Full	None	Best practices will be put in place
Account Management	User Profile	Full	Partial	Limited test data as a proof of concept
	Feedback	Full	Full	
	Group Management	Full	Partial	Limited test data as a proof of concept
	Login/registration	Full	Full	
UI	Group Interaction	Full	Partial	Limited test data as a proof of concept
	Bug Report	Full	Partial	Limited test data as a proof of concept
	Basic Search	Full	Full	
	AskMissy Search	Full	Full	
	Communication	Full	Partial	Limited test data as a proof of concept
	Personal Data Report	Full	Partial	Limited test data as a proof of concept
Data Retrieval	Metadata Report	Full	Partial	Limited test data as a proof of concept
	Basic Search	Full	Full	
	AskMissy Search	Full	Full	
Data Management - Live Product	Machine Learning	Full	Partial	Limited test data as a proof of concept
	Source Tag Creation	Full	Full	
	Source Tag Management	Full	Full	
	Lesson Plans	Full	Partial	Limited test data as a proof of concept
	Internal Database Manipulation	Full	Full	
	External Database Manipulation	Full	Full	
Data Management - Development	Source Tag Development	None	Full	Use to develop default tags
	Machine Learning Training	None	Full	Use to develop algorithm defaults
	Simulated Data	None	Full	Use to fill database with simulated data for testing
	User testing reports	None	Full	Use to develop user interface

4.3 Prototype Development Challenges

AskMissy challenges are the requirements within database management and machine learning integration into the prototype. Demonstrating that the algorithms and interface are fully functional and successful for investors and school system integration rely heavily on the

application's response to each user interaction. Compiling the knowledge of each team member in these aspects, especially that of machine learning will take time and effort in successful implementation.

Glossary

Administrator: A user who is responsible for managing a majority of AskMissy's working data.

Agile: A set of frameworks and practices where solutions evolve through collaboration between self-organizing cross-functional teams.

AskMissy: A software application that will help users find more relevant resources.

Application Programming Interface (API): A software intermediary that allows two applications to talk to each other.

Data Retention: The continued storage of an organization's data for compliance or business reasons.

Database: An organized collection of structured information, data, typically stored in a computer system.

Economically Disadvantaged: A student eligible for Free/Reduced Meals who receives Temporary Assistance for Needy Families (TANF) or is eligible for Medicaid.

Exact Match Search: A search for a single specific type of resource.

File Server: A device that controls access to separately stored files.

Guest: A user who is not a student, teacher, librarian, or administrator; who has limited access to the AskMissy program.

Librarian: A user responsible for managing the library's inventory/database, communicating with teachers and students.

Personal Learning: An educational approach that aims to customize learning for each user's strengths, needs, skills, and interests.

Student: A user studying at a K-12 education institution in need of reliable resources.

Teacher: A user who helps K-12 students acquire knowledge. They are responsible for making plans and managing students' groups/communication.

Temporary Assistance for Needy Families (TANF): A program that provides eligible families with a monthly cash payment to meet their basic needs.

Tester: A user responsible for designing and conducting testing suites for usability testing. **User:** An individual using the AskMissy Interface.

Web Scraping: The process of extracting content and data from a website. **Web Server:** A computer program that distributes web pages as they are requisitioned.

Windows: A series of operating systems developed by Microsoft.

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LAB 1 – ASKMISSY PRODUCT DESCRIPTION 14

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