

Sri Lanka Institute of Information Technology



MOOCs Recommender Based on Learning Style

Project ID: 18-036

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Software Requirements Specification - CDAP-I

User Profile Modeling and Advanced search

**Bachelor of Science Special (Honors) in Information Technology
Specializing in Software Engineering**

Title : User profile modeling and advanced search

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Declaration

I hereby declare that the project work entitled “MOOCs Recommender Based on Learning Styles” (User profile modeling and advance search) submitted to the Sri Lanka Institute of Information Technology, is a record of original work done by our group under the guidance of Mr. Nuwan Kodagoda (Supervisor) and Ms. Kushnara Suriyawansa (Co- Supervisor), and this project work is submitted in the fulfillment for the award of the Bachelor of Science (Special Honors) in Information technology Specialization in Software Engineering. The results embodied in this report have not been submitted to any other University or Institute for the award of any degree or diploma. The diagrams, research results and all other documented components were developed by myself and I have cited clearly any references I have made.

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Thoradeniya S. D.

1. Introduction

1.1 purpose

The purpose of this SRS document is to outline the requirements and present a detailed description of the process needed for User profile modeling and advanced Search. The document contains the necessary requirements of the system, as well as the process to create and discover them. It will explain the functional and non-functional requirements, purpose and features of the component, the interfaces of the component, design constraints, project approach, what the component will do, the constraints under which it must operate and how the component will interact with other external applications. The information is organized in such a way that the developers will not only understand the boundaries within which they need to work, but also what functionality needs to be developed and in what order. This document is intended to be proposed to a customer for approval and also this document is targeting the, designers, developers and other stakeholders as its audience.

1.2 Scope

The model will allow users to identify their learning style, Users can interact with a creative dashboard in our system and Using the ILS questionnaire, user's learning style will be captured and stored in database. Hence, the learner's profile will be modelled accordingly. The MOOCs data extracted from the platforms are labelled with a particular learning style and given a ranking based on standard algorithms and literature review. And hence, based on the learning styles the most appropriate MOOCs are presented to the learner in a ranked order. Profile will be personalized based on their preferences and Moocs they like. This model will learn the user thoroughly and recommend similar Moocs and smart suggestions using advanced ML and deep learning algorithms and allow users to have personalized search suggestions and a personalized smart search engine.

1.3 Definitions, Acronyms, and Abbreviations

MOOCs	Massive Open Online Courses
CNN	Convolutional Neural Network
OS	Operating System
RAM	Random Access Memory
SRS	Software Requirement Specification
GPU	Graphics Processing Unit
FSLM	Felder- Silverman's learning model

ILS	Index of learning style
NLP	Natural language processing
ML	Machine learning
LOM	Learning Object Metadata
MEAN	MongoDb,ExpressJS,AngularJs,NodeJs

1.4 overview

The remaining sections of this document provide a general description, including characteristics of the users of this project, the product's hardware, and the functional and data requirements of the product. General description of the project is discussed in section 2 of this document. Section 3 gives the functional requirements, data requirements and constraints and assumptions made while designing the User profile modeling and Smart search engine. It also gives the user viewpoint of product. Section 3 also gives the specific requirements of the product. Section 3 also discusses the external interface requirements and gives detailed description of functional requirements. Section 4 is for supporting information.

2. Overall Descriptions

Various researches are being carried out to incorporate learning styles into technology enhanced learning. This model will be centered on Personalization into e-learning and provides Ability to suggest the right learning materials to the learners based on their preferences and interests. FSLSM model is adopted in the system as our major focus is in computer programming courses which falls under engineering education. Provides an in-depth analysis of FSLSM based on data from the ILS questionnaire in order to get more information for a better application of learning styles in technology enhanced environment. Therefore, they associated each dimension of FSLSM with semantic groups (such as the preference for spoken language or the preference for concrete learning material), and analyzed the impact of each group for each learning style. A hybrid approach was used for detecting interesting features both from research and from application viewpoint. This component will model the learning objects by matching each dimension of FSLSM with IEEE LOM meta-data elements and finally, recommending appropriate learning objects to the learners. Four weight values are calculated for each learning object. Our system uses Utility-Based Recommendation technique to recommend LOs based on three aspects: subject, personal preference and Learning Style.

Furthermore, this component will come with a very creative interactive dashboard to track previous Moocs, learning style history and based on previous subscriptions and likes, model

will learn the user in deep and suggest best fitted Moocs mapped with the learning style. This component will act as a personalized smart search engine allowing user to search through different Moocs using NLP and ML algorithms, this model provides users a better search experience with semantic search by enabling the search engine to index key phrases, entities, and sentiment. This will allow user to focus the search on the intent and the context of the articles instead of basic keywords.

2.1 Product perspective

Although significant steps have been made towards the direction of providing enhanced, personalized educational services, there is still a great volume of research that needs to be further conducted with a view to rendering these services fully personalized and adaptable. In this component the user preferences hold a primary role and dictate the structure and functionality of the entire educational system. there are massive systems of providing user profile modelling for e-learning, yet a platform that is able to adapt to the user's personal needs and requirements ,not only from the information provided directly by the user or by identifying his/her learning style through the questionnaire , but also monitoring his overall behaviour during his navigation in our platform and predicting the future preferences and interests by observing desired parameters and user's actions within the system. Systems like Coursera,plural sight also have personalized user profile ,but not mapped with the learning style of the user.

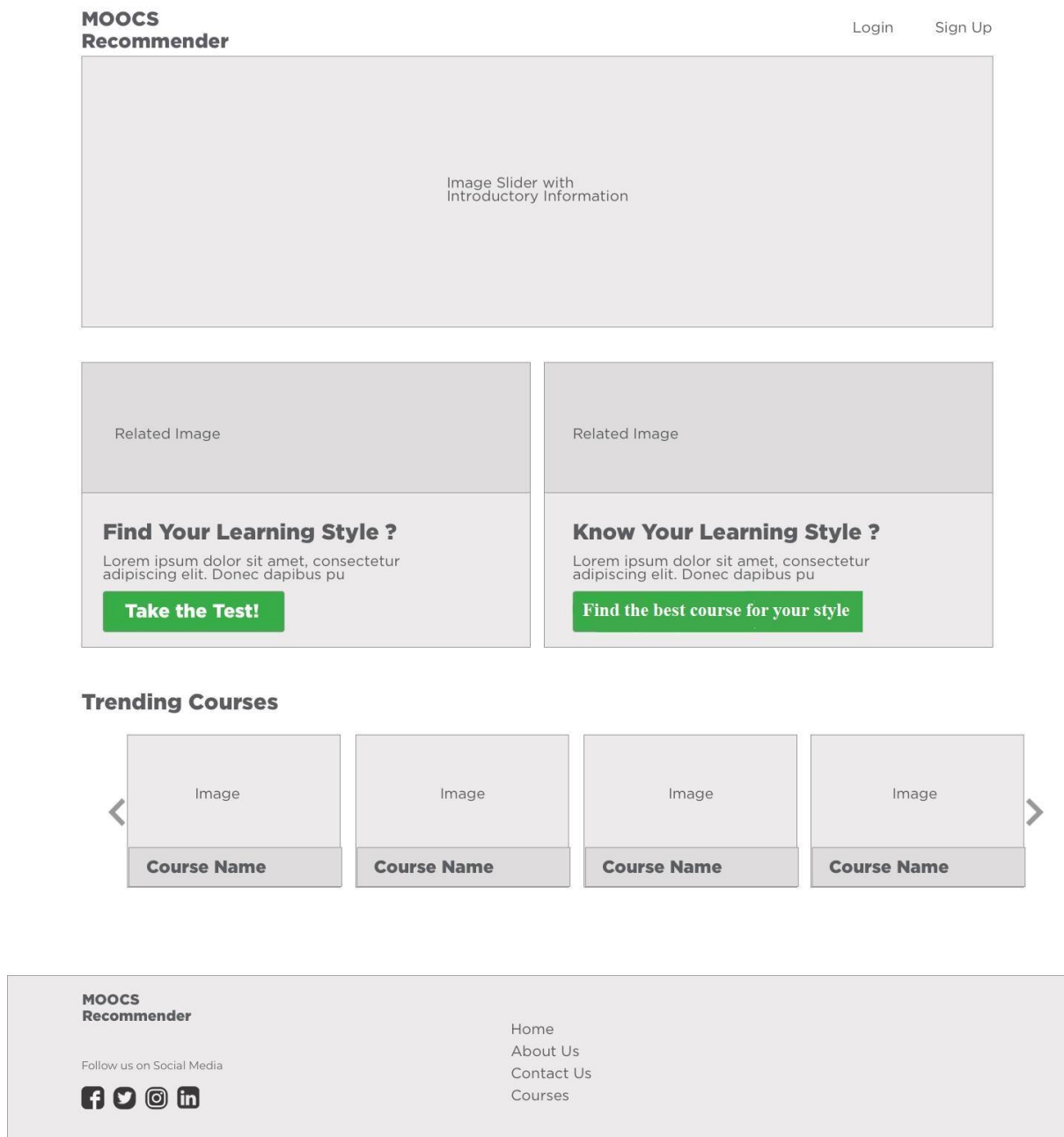
Unlike in other systems , our system with user profile modelling will allow user to have semantic search , not only just keywords ,but key phrases,entities and sentiments and preferences (learning style) and have a better search experience.

2.1.1 System interfaces

- Database connectivity interface
- Video classification interface
- Topic modeling interface

2.1.2 User interfaces

Home interface with login ,Signup functions and finding learning style of the user and many more features including trending courses etc.



Questionnaire interface with 40 questions.

MOOCS Recommender

Hi sachini

ILS Questionnaire

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec dapibus purus non nisl faucibus bibendum. Pellentesque sit amet dolor ipsum. Duis ac purus a orci dapibus elementum vitae at nibh. Integer nec malesuada quam. Proin euismod lectus eu metus semper, quis eleifend nunc hendrerit. Nunc nec justo ex. Donec eget odio nibh.

Duis aliquam sem in aliquet aliquam. In nunc turpis, efficitur sed rutrum et, feugiat sed felis. Vivamus mollis ante et tortor malesuada fringilla. Quisque sit amet aliquet jus

Tick the Correct Answer

1. Question

- ☐ Answer 1 ☐ Answer 2 ☐ Answer 3 ☐ Answer 4

2. Question

- ☐ Answer 1 ☐ Answer 2 ☐ Answer 3 ☐ Answer 4

3. Question

- ☐ Answer 1 ☐ Answer 2 ☐ Answer 3 ☐ Answer 4

4. Question

- ☐ Answer 1 ☐ Answer 2 ☐ Answer 3 ☐ Answer 4

MOOCS Recommender

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Result of the Questionnaire with the learner's learning style -Interface

**MOOCS
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Hi Sachini

You are a Visual Learner !

Here are some best courses for Visual Learners.



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If learner already knows the learning style this is where user can search for a particular course with the preferences

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Hi Sachini

Lets find Courses for your Style !

Most popular Courses of the month



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2.1.3 Hardware interfaces

No special hardware devices are needed other than the usual PC or Laptop.

2.1.4 Software Interfaces

- Jupiter Notebook
- DialogFlow
- Keras- deep learning library
- Amazon comprehend NLP
- Amazon elastic Search

2.1.5 Communication interfaces

To connect to internet router/ modem is required. Https will be used as the communication protocol to make it secure.

2.1.6 Memory constraints

RAM of 6 GB or higher

2.1.7 Operations

Maintain customer profile.

- The system shall allow user to create profile and set his credential.
- The system shall authenticate user credentials to view the profile.
- The system shall allow user to update the profile information.
-

Provide Advanced Search facility.

- The system shall enable user to enter the search text, phrase ,entities, sentiments on the screen.
- The system shall display all the matching Moocs based on the search
- The system shall enable user to navigate between the search results.
- The system shall notify the user when no matching Mooc is found on the search.

Provide personalized profile

- The system shall display both the active and completed course history in the customer profile.
- The system shall display estimated time to learn a particular course based on previous course time consuming
- The system shall allow user to select the Mooc from the Mooc history.
- The system shall display the detailed information about the selected Mooc.
- The system shall display the most frequently searched Mooc by the user in the profile.
- The system shall allow user to register for newsletters and surveys in the profile.
- The system shall allow user to compare selected Moocs

2.1.8 Site adaptation requirements

Since the user can be of any nationality the user interface must be created for English language.

2.2 product functions

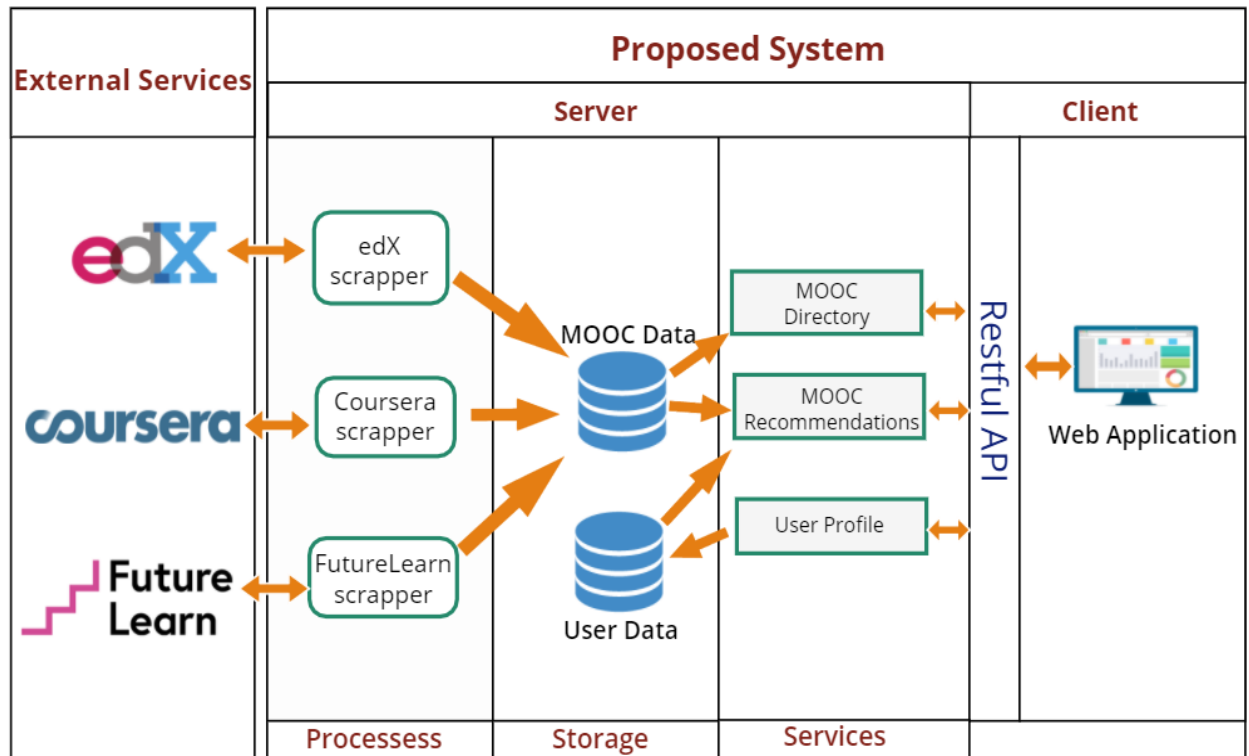


Figure 1: High Level System Architecture

In this component , user's learning style is identified and mapped with the video style and recommend the most appropriate MOOC to the user.

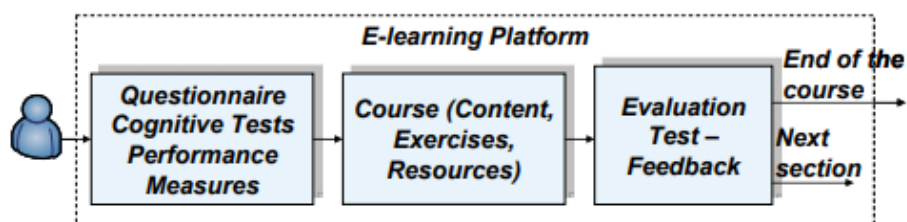


Figure 2 :User profile navigation in the e-learning platform

Above diagram shows the navigation of the platform , user takes ILS questionnaire and using cognitive tests , performance measures ,learning style is captured and mapped with the video

style and recommend the best course ,learn user more by giving evaluation tes, feedback and measure the knowledge and time consumption to complete a course

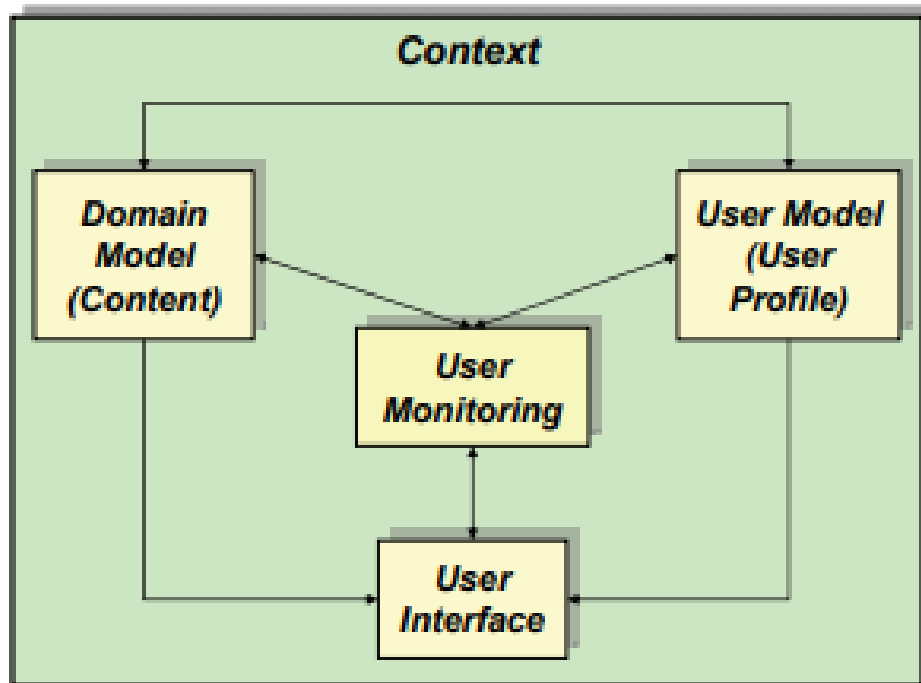


Figure 3:E-learning system's architecture

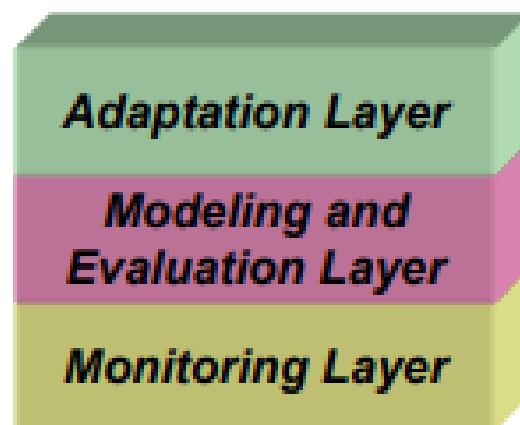


Figure 4:Functional layers of the user profile model

How profile will be adapted to user's preferences and likes and user will be constantly monitored and personalize the suggestions

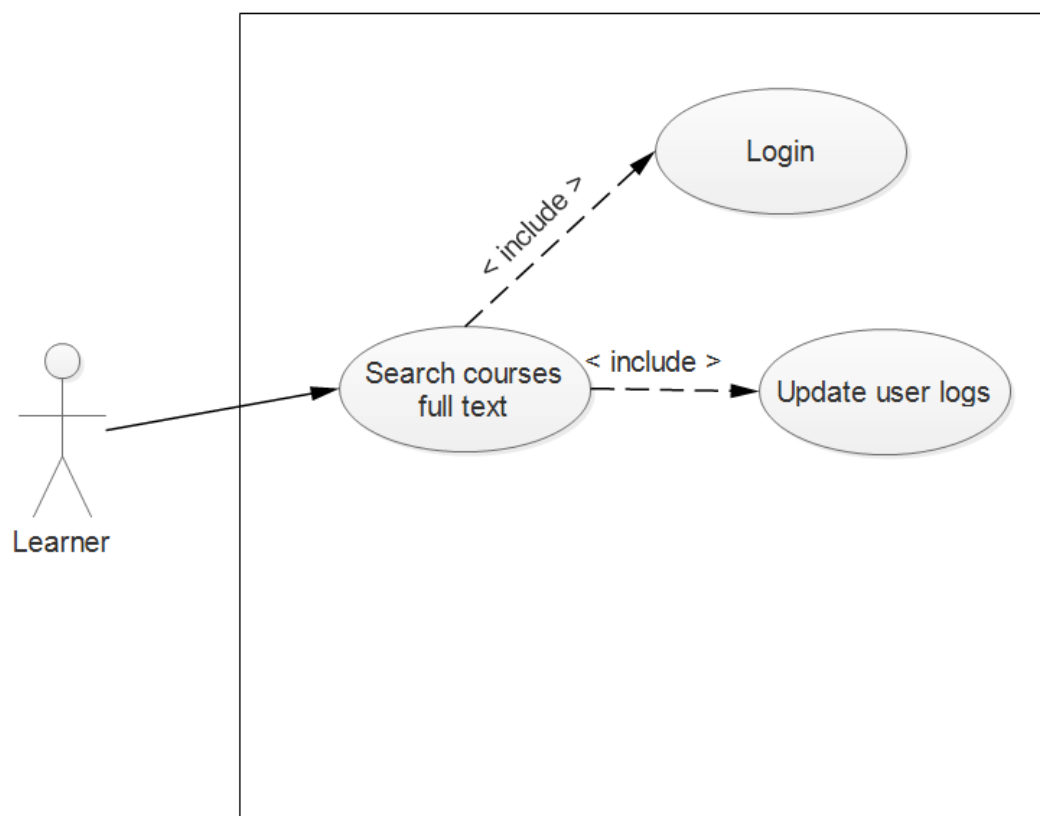
2.2.1 Use Case Scenarios

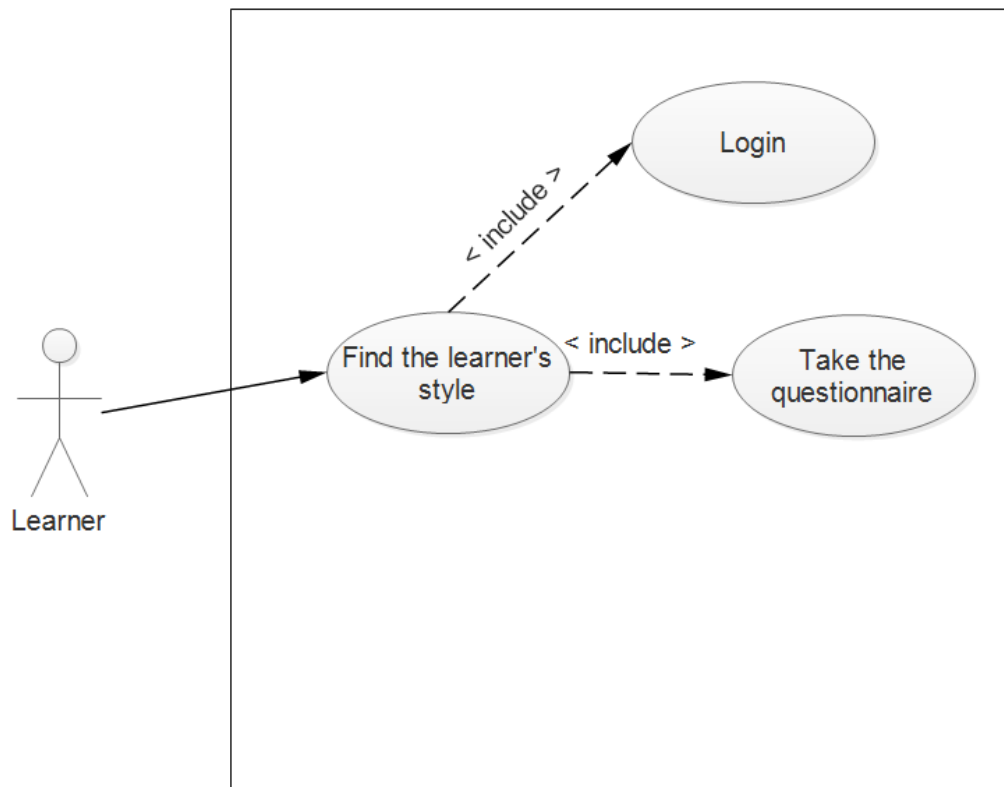
Use case Name	Identify user's learning style
Pre –Condition	Provide ILS questionnaire of 40 questions and provide answers
Post-Condition	Identify user's learning style analyzing the score
Actor	User
Main Success Scenarios	<ol style="list-style-type: none">1. Take the questionnaire2. identify the learning style using standard ILS method and score3. The use case ends with successfully identifying the user's learning style and store it in to the database
Extension	<ol style="list-style-type: none">1a. questionnaire is not completed1.b not start the process without questionnaire completed

Use case Name	Mapping learner's style with video style
Pre –Condition	Identify characteristics,attributes of the particular learning style of the learner
Post-Condition	Map identified characteristics and variables with video style attributes using algorithms
Actor	Backend System
Main Success Scenarios	<ol style="list-style-type: none">1. Select the learners learning style from database2. map the characteristics of learner's style with video style

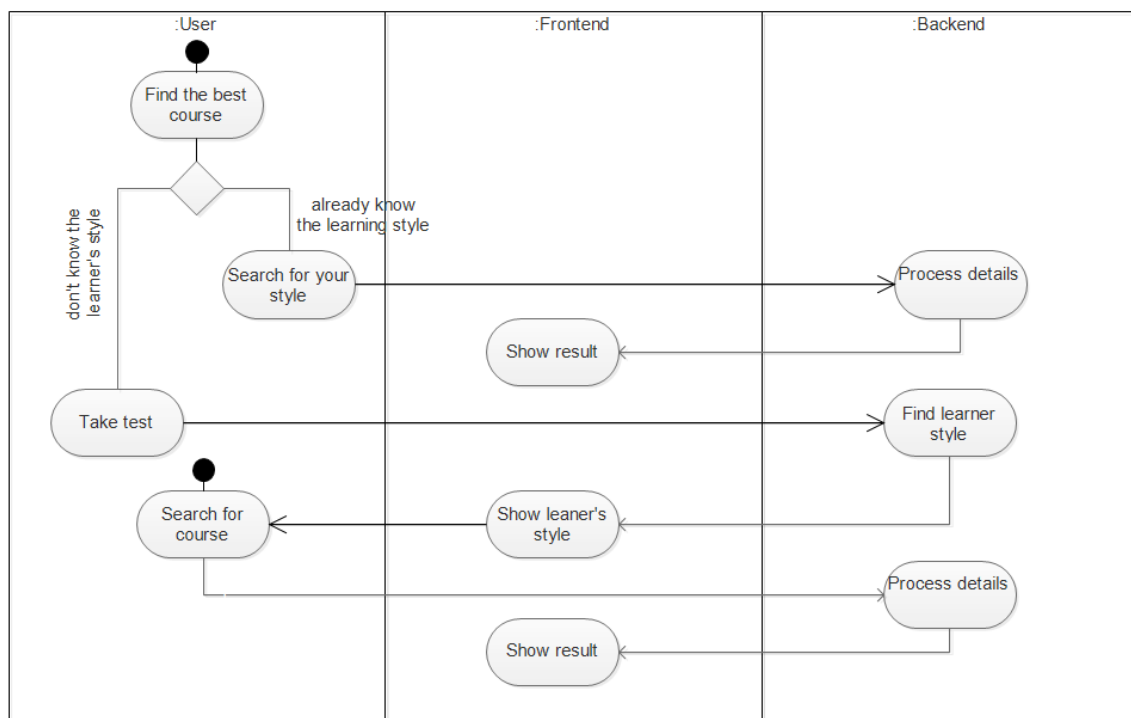
	3.find the best fitting Mooc for the identified video style in a ranking way
Extension	1a. no result for the identified learning style 1b. Show an error message

2.2.2 Use Case Diagram





2.2.3 Activity Diagram



2.3 User characteristics

The user profile modelling and advanced search components deal with the backend process and front end process as well and involves developing web application with home interface, search result interface, user profile dashboard interface with MEAN technology and a framework to learn the user and personalize results accordingly using Amazon comprehend and Dialogflow NLP and ML components. Developers should have knowledge about those area for the develop the system.

2.4 Constraints

The backend process of Scrapping, web scrawling and schedule and monitoring process involves heavy computational tasks. The constraints of the process are mentioned below:

- System should be deployed to AWS S3 bucket.
- MongoDB, ExpressJS, Angular ,NodeJS.
- DialogFlow ML framework for Advanced search and personalized profile modeling Document database instant (like MongoDB).
- Amazon comprehend service for topic modeling and semantic search along with amazon elastic search
- Cloud base email services.

2.5 Assumptions and Dependencies

- The operating system for the User profile modeling and advanced search component is selected to be Windows.
- The internet connectivity can be established with ease on request.

2. 6 Apportioning of Requirements

Essential Requirements:

1. Identify user's learning style by ILS questionnaire or using user's behavior and monitoring constantly
2. Mapp the learning style with the video style using scores and in a ranking way

3. Observe the user in terms of educational level, familiarity with a specific subject, overall performance, key phrases user searches for etc
4. modeling of the user's profile according to the observed information
5. Suggest similar courses based on what user likes
6. Observe other users with similar learning style and recommend courses based on all the users of same learning style
7. Advanced search experience by semantic search, through key phrases, entities and sentiments.
8. Compare MOOCS with same learning style
9. Suggest similar courses by looking at completed course history and based on what user likes

Desirable Requirement:

1. Visualize the results graphically to generate analysis and reports.
2. Observe time consuming per course and estimate time to complete next courses in a graph

3. Specific requirements

3.1 External interface requirements

3.1.1 User interfaces

Home page interface – landing page of our website as illustrated in 2.1.2 with all the functions linked to the main page such as Login page, sign up page, trending courses, finding the users learning style and taking questionnaire, search for the course if knows the style etc.

Questionnaire interface – ILS 40 questions to select the right answer, as illustrated in 2.1.2

Result interface (after finding the learner's learning style) - it shows the learner's learning style and most popular courses for the particular learning style, user can also search for specific courses and results will be shown for the particular learning style

Search interface – if user already knows the style of learning or doesn't want to take the questionnaire, our advanced search will provide a content oriented search and by analyzing preferences, user's navigations, and behavior, our system will identify the user's learning style and show the best results for the identified learning style and personalized.

User dashboard – this interface will show the history of completed courses , smart suggestions for the identified learner style ,time taken to complete a course and estimated time to complete a course in future, information's are presented graphically in graphs and bars

3.1.2 Hardware interfaces

- Development team must have a computer that has 3.0 GHz processing power in order to do this project. Minimum 8 GB RAM and 2 GB GPU space and 5400 RPM hard disk drive also can consider as hardware requirements.
- For deployment purposes development team requires a cloud base environment with AWS S3 bucket

3.1.3 Software interfaces

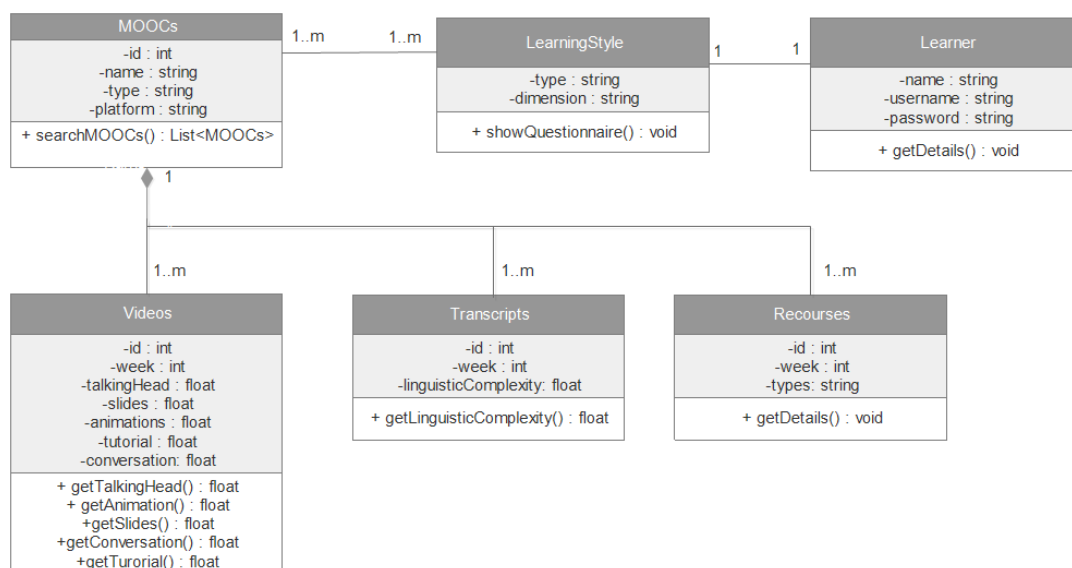
- Google Colaboratory: It is free cloud service offered by Google that provides free GPU. That distinctive feature makes it different than other cloud services. Using this service, users can develop deep learning applications using popular libraries such as, Keras, TensorFlow, OpenCV etc.
- AWS cloud services like amazon comprehend and elastic search
- TensorFlow: It is a computational framework for building machine learning models. It provides wide variety of toolkits that allows the users to construct models at the preferred level of abstraction. It comes in-built with Google Colab.
- Dialogflow - (formerly Api.ai, Speaktait) is a Google-owned developer of human–computer interaction technologies based on natural language conversations

- Keras: It is a very popular deep learning library written in Python. We can quickly build and test a neural network with minimal lines of code. It is capable of running on top of TensorFlow and also available in Google Colab.
- Visual studio code and visual studio
- MongoDB compass
- NodeJS, ExpressJS, Angular

3.1.4 Communication interfaces

The backend service along with the database is hosted on the cloud. Hence, the communication between them requires internet connectivity. The connection can range from minimum of 3G to fast 4G (LTE).

3.2 Classes/Objects



3.3 Performance requirements

It is expected that the user profile modeling component will perform all the requirements stated under the product functions section. Some performance requirements identified are listed below:

- Time taken to recommend Mooc after identifying user's learning style shouldn't be exceeding more than 10 seconds
- Home page loading time should be not more than 5 seconds
- Storing user's learning style on database time should be not more than 3 seconds
- Advanced search time shouldn't be exceeding more than 7 seconds

The performance shall depend upon hardware components of the client/customer

3.4 Design constraints

- MOOC courses only from three platforms: edX, Futurelearn and Coursera are considered.
- Courses should focus on one domain (programming, computer science)

3.5 Software system attributes

In this section, we are explaining the attribute that we are going to offer through the system. There are some explanations in follow.

3.5.1 Reliability and Availability

The system is required stay to up and running 24/365 as the emergencies are unpredictable. Although it is not possible to achieve an availability of 100%. Strict measures are necessary to be followed to make sure maximum level of availability. For instance,

- Periodical (Every two days) performance checks
- Server heartbeats
- On demand and Automated restart.
- AWS Logging mechanisms to identify interruptions.
- Database performance

3.5.2 Security

External developers who would be using the API as their data source is required to obtain an API key (Token) to authenticate.

In addition to encrypting usernames and passwords all other sensitive data must be encrypted. Specially if there are personally identifiable information like names, emails, locations.

Link Facebook pages to the system securely.

3.5.3 Maintainability

Due to the progressive development of the product it is prone to change time to time with new updates.

For the ease of tracking and maintaining a good code base version controlling software must be use. Specifically, public GIT repository to make it open source. Other developers would be able to contribute to the project after the first stage of the research is completed.

Proper coding standard and best practices, easily readable code and proper testing documentation required.

3.6 Other requirements

Personalization: This requirement suggests that the learning process needs to take into account the user's preferences and personal needs. This implies either that the user is in position to explicitly specify these preferences or that the system has the ability to infer them through a monitoring process. The latter is far more convenient for the end-user and, thereby, constitutes a highly desirable feature.

Adaptability: The user's preferences change over time and the system must be able to track them and properly adjust to them. By 'properly' it is implied that the whole history of the user's learning behavior must be taken under consideration, and not just his latest (most recent) actions.

Extensibility: system has to be extensible in terms of the learning material it provides. The incorporation of new courses and resources must be an easy to accomplish task.

Interoperability: system must be able to both access content from and provide content to digital libraries and other e-learning systems. In this way, the provision of enriched and updated content is feasible. Regarding the client side, the interoperability requirement imposes that there should be no need of specific software, in order for a user to gain access to the e-learning platform.

4. Supporting information

4.1 Appendices

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