MOOCS RECOMMENDER BASED ON LEARNING STYLES

USER ENGAGEMENT AND PREFERRED VIDEO STYLE

Software Requirement Specification
Project ID: 19-089

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Date of Submission: 2019-05-13

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Declaration

I hereby declare that the project work entitled “MOOCs Recommender Based on Learning Styles” 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 us and we have cited clearly any references we have made.

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1 Introduction

1.1 Purpose

The purpose of this Software Requirement Specification (SRS) document is to provide a comprehensive illustration on the requirements for Identifying user's preferred learning material type vertical of MOOCRec V2 research. The document will explain the purpose of developing the aforementioned vertical, the scope that is considered, the functional and non-functional requirements in developing the component, interfaces, functionalities that the aforementioned component of the system should perform, constraints that should be considered and such. Document description is mainly proposed for customers of the web application yet will likewise bear some significance importance for software engineers who develop and maintain the application as well.

1.2 Scope

This document is primarily prepared targeting stakeholders of MOOCRec V2 application. This module of the proposed system will function as a footprint for a new or existing user of the system to understand what online learning material type that best suits them, which can be quoted as the main objective of developing this module. And also generating decisions based on user input is another main objective of this module whereas this system will work as platform for users who do not know about their learning preferences, help choose their personalized learning material style out of the Massive Open Online Course (MOOC) video styles identified by our application. Other than that, this module is useful for MOOCs providers to get statistical information regarding users' interaction with provided MOOCs. Hence this document addresses the requirements in developing the aforementioned component of the system.

1.3 Definitions, Acronyms and Abbreviations

SRS	Software Requirement Specification
MOOC	Massive Open Online Course
HCI	Human Computer Interaction
FSLSM	Felder Silverman Learning style Model
ILS	Index of Learning Style
DOM	Domain Object Model

1.4 Overview

The end product is solely targeted for any e-learner who is interested in knowing their preferred learning material type in order to receive an interesting and an enduring e-learning experience. 'Identifying user's preferred learning material type' component is a sub component of the aforementioned system. This component identifies user's learning material type based on user interaction. And also, can be used by MOOCs providers to obtain the statistical information regarding user's interaction with MOOCs.

1. The SRS document comprises of a detailed description of functional and non-functional requirements that are in need, in developing the aforesaid component of the system. This is described in the document by three chapters.

The first chapter comprises of the purpose in developing the component, the scope and the overall overview while the second chapter comprises of an overall comparison of the software system with existing similar systems. This includes interfaces, functionalities that system should perform, constraints that should be considered, assumptions, dependencies and such. The second chapter is concluded with requirement allocation of the component. The third chapter is mainly for developers of the system. This comprises of the same details that are included in chapter two, but the technical aspect of the functional and non-functional requirements and other functionalities that are described in the second chapter is addressed.

The fourth and fifth chapters conclude the document providing references and other content to support the information that are mentioned in the SRS document.

2 Overall Descriptions

2.1 Introduction

In 'Identifying user's preferred learning material type' of a MOOCs user through HCI techniques phase, the system displays an interactive introductory video which consists of all MOOCs learning material types that are recognized by the proposed system such as animations, talking head, presentation slides, etc. that are suitable for all types of learners. During this, by using analytical HCI techniques such as mouse motion, getting user ratings, dropdown point analysis, etc. system determines during which phase of the interactive video session, the user was mostly engaged with the system. By doing so, we are left with a sizable amount of information about the engagement of the user across multiple video production styles that belong to different learning dimensions. Using this information, the application predicts the video production style(s) that is in tune with the user's learning dimension. This prediction result is derived through a decision-making algorithm. Finally, user's preferred learning style is identified by carrying out a mapping of MOOCs with FSLSM.

2.2 Product Perspective

Class Central, which is a top MOOCs provider available in the e-learning industry is one of the biggest challenging products for MOOCRec V2. Class Central recommends one's desired video style by the field of study that they are interested in. Further, they prompt the user to select the course provider and the university that they prefer, in order to receive recommendations from the respective choice they make. Also there's a limitation

where user has to select five or more than five areas that they prefer in order to proceed, which can be mentioned as an unnecessary effort for learners [1]. Yet, one's learning style is not identified as well as user's preferred way of learning the specific field of study is not identified.

My MOOC, which can be recognized as another major e-learning platform, provides MOOC recommendations by letting user search MOOCs as per their need. On the other hand, user can also select the subject area (e.g.: Science) that they want to follow up, and also, they can select the sub categories (e.g.: Chemistry) [2]. Other than that user needs to search for their proffered video style to learn the specific subject area.

MOOCRec which was a MOOCs recommender system that was introduced by targeting several drawbacks of the aforementioned leading e-learning platforms, is another challenging product for MOOCRec v2. In MOOCRec system, user's preferred learning style is identified by providing the user with an ILS questionnaire which consists of 40 questions. Depending on the results the system provides recommendations. But the drawback of the system was providing the user with a lengthy questionnaire in order to serve user with recommendations which match their needs [3].

Henceforth, by considering above facts, MOOCRec V2 is designed in a way that user experience is taken into consideration, thus providing an interactive introductory video session to conclude user's preferred leaning material type and also to provide the user future recommendations based on the interactive session's engagement results.

2.2.1 System Interfaces

- Database connectivity interface

2.2.2 User Interfaces

- MOOCRec V2 introductory video launch page.

Figure 2.1: Introductory Video Launching Page

- MOOCRec V2 video content rating page.

Figure 2.2: Video Content Rating Page

- MOOCRec V2 MOOCs recommender page.

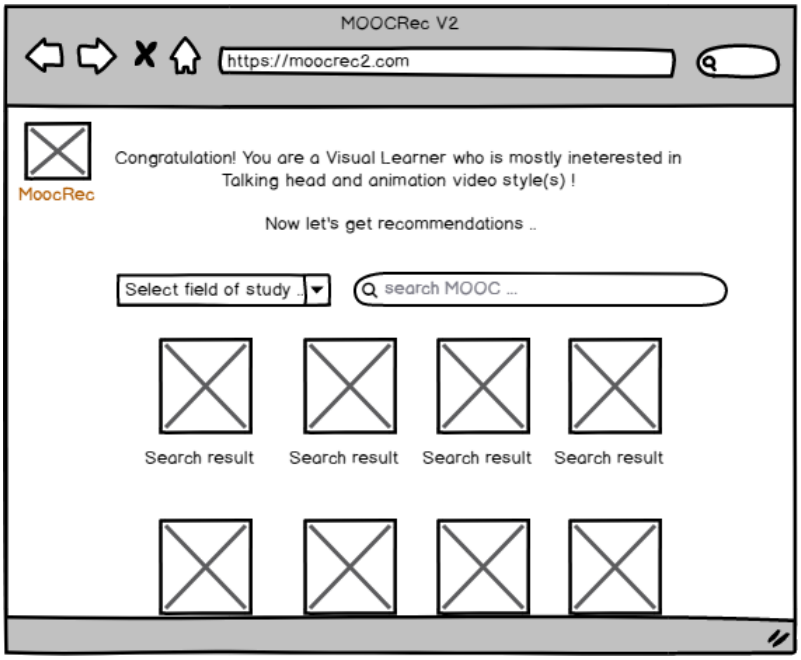

Figure 2.3: MOOCs Recommender Page

2.2.3 Hardware Interfaces

- A Linux server running CentOS/AmazonLinux2

2.2.4 Software Interfaces

- Browser DOM

2.2.5 Communication Interfaces

- No specific communication interfaces are needed.

2.2.6 Memory Constraints

- RAM 4 GB or higher for client side
- RAM 8 GB or higher for server side

2.2.7 Operations

- User should have an active internet connection.
- User can follow the interactive video session after logging in, to identify the preferred video production style and the learning dimension.
- User can select the field of study in order to narrow down MOOCs relevant to that field.

2.2.8 Site Adaption Requirements

- The site must be in English to cater for a wide range of audience.
- Interactive video session must contain English audio along with an English transcript.

2.3 Product Functions

- Record user activity and interactions.
  During the interactive video session, both active and passive user interactions are recorded. Interactive visual elements will be used to facilitate active user interactions highlighted below.
    - Skimming through the video.
    - Skipping sections of the video.
    - Rating sections of the video
    - Showing/hiding visual elements such as the video player itself, the transcript.

  Furthermore, the passive user interactions such as mouse movement, mouse clicks and keyboard activity will be recorded. The flow of activity will be mapped to the length of the interactive video session in order to identify the passive activity of a user at a given point of time.

- Analyze user engagement.
  Both active and passive interactions mentioned above will be used as inputs to analyze the user engagement during the interactive video session. Passive interactions are represented as a set of heat maps. This will be used to find the

sections of the interactive video clip that had highest activity as well as areas of the screen that had highest activity.
Furthermore, the active interactions of the user will be processed through a model that is defined with all the possible interactions to determine the engagement level of the user at each point in time. Together, the two outputs given based on the two inputs will be used to draw a conclusion as to which section of the interactive video session that user showed most engagement.

- Map learner style and make MOOC recommendations
  Based on the video style that the user showed most engagement, a learning dimension from Felder-Silverman model will be mapped to the user. The said video style will be used as the key search filter when recommending MOOCs that are indexed in the database. When making recommendations, the user's preferred video style, learning dimension will be used. Also, the forum activity associated with the recommended MOOCs will be considered when finalizing the said recommendations. The forum activity data will be provided by another component.

2.3.1 Use Case Diagram

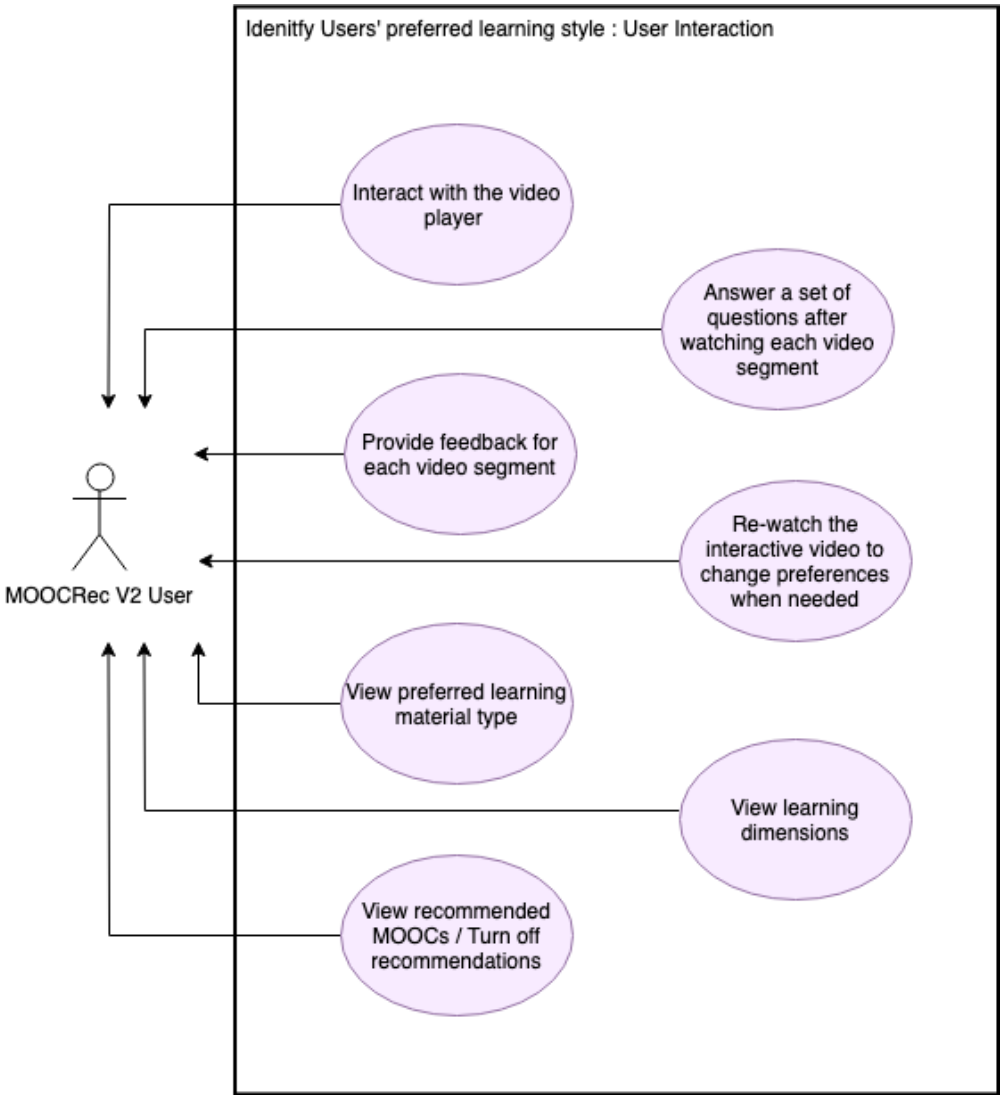

Figure 2.4: Identify Users' Learning Style User Interaction Use Case Diagram

2.3.2 Use Case Scenarios

Table 2.1: Use Case Scenario 1

User Case Name	View preferred learning material type
Pre-Condition	User should be logged in
Post-Condition	User should have completed watching the interactive session
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. Watch the interactive introductory video provided by MOOCRec V2 2. Actively participate throughout the video 3. Rate each video segment watched. 4. Answer the given questions after each video segment. 5. Proceed till the end of the interactive session.

Table 2.2: Use Case Scenario 2

User Case Name	Re-watch the interactive video to change preferences when needed
Pre-Condition	User should have already taken part in the interactive session or have skipped the session during initial sign in.
Post-Condition	No post condition
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. User navigates to account settings page. 2. User chooses 'change my preference' link 3. User participates to the interactive session.

Table 2.3: Use Case Scenario 3

User Case Name	Interact with the video player
Pre-Condition	User should be logged in.
Post-Condition	No post conditions.
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. User watches the interactive introductory video provided by MOOCRec V2 2. User performs view transcript/ skim through video/ skip video segments/ pause video/ mute sounds/ maximize the video player/ watch subtitles operations.

Table 2.4: Use Case Scenario 4

User Case Name	View learning dimensions
Pre-Condition	User should be logged in.
Post-Condition	User should have completed watching the interactive session and actively participated throughout the session.
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. User watches the interactive introductory video provided by MOOCRec V2 2. User rates each video segment watched. 3. User answers the given questions after each video segment. 4. User proceeds till the end of the interactive session.

2.4 User Characteristics

- The end-user is an eager e-learner who is looking for MOOCs that suit his or her preferences. As such, any user with basic computer literacy can navigate through the system effortlessly.

2.5 Constraints

- Server-side RAM should be 8 GB or higher
- Client-side RAM should be 4 GB or higher

2.6 Assumptions and Dependencies

- It is assumed that the user follows through the initial interactive process in order to receive more definite results.
- It is assumed that the user has a well-established internet connection.

2.7 Apportioning of Requirements

2.7.1 Essentials Requirements

- User should be able to rate, skip and skim through each segment of the interactive video session.
- User should be able to view transcript relevant to the intro video segment.
- Browser activity should be recorded for the duration of the interactive video session.
- Engagement of the user during each segment should be predicted based on both user input as well as the browser activity.
- System should display user's learner type depending on the learning material preference.
- MOOC recommendations must be based on the video production style the user showed most engagement with.

2.7.2 Desirable Requirements

- Users should be recommended MOOCs for video production style that showed the 2nd highest engagement.
- User should be able to re-interact with into video to update preferences in future as they need.

3 Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

While the figures 2.1, 2.2 and 2.3 provides how the user interfaces should look like, in order to capture the user inputs as well as user's browser activity during the interactive video session, this sections provides an overview as to how data and functions involved with aforementioned user interfaces come together from the perspective of a developer.

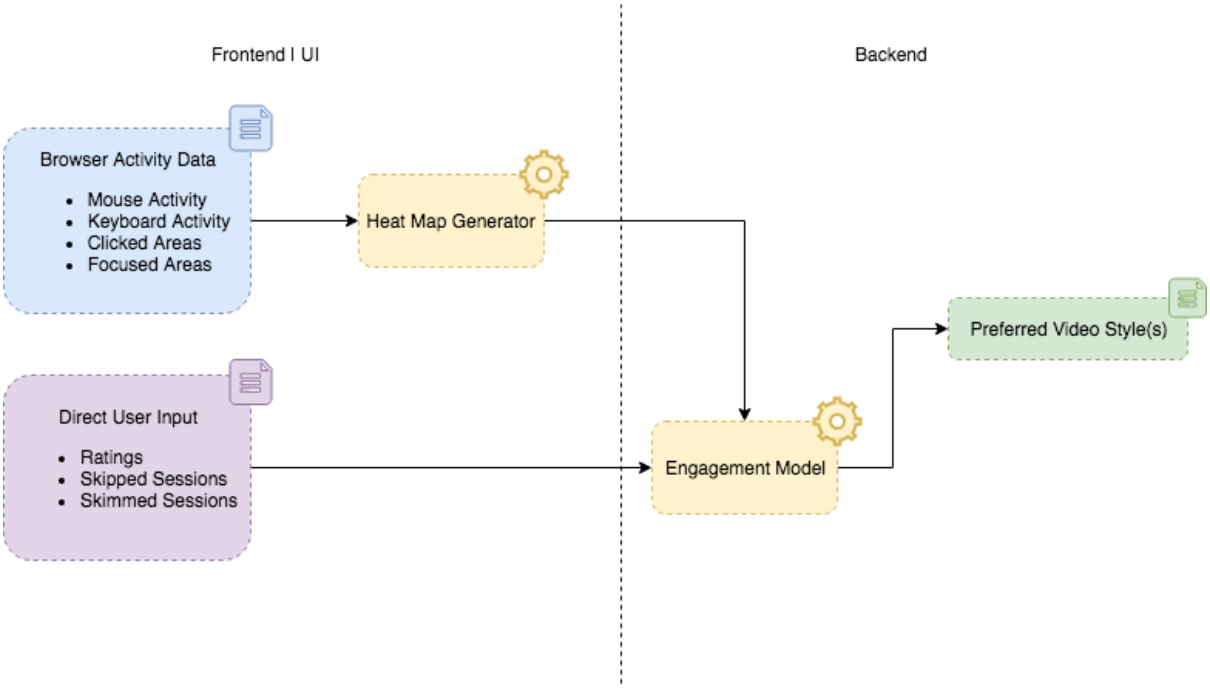

Figure 3.1: Data Flow within the User Interface

As shown in figure 3.1, browser activity data and user's direct input should be captured. This is achieved via user interfaces shown in figure 2.1 and 2.2. The responsibility of the user interfaces is to capture the above two sets of data.

Moreover, each user interface related to video session has to be verified using HCI techniques to see whether following goals are achieved.

- User is aware of the interactive elements
- Interactive elements represent the input needed from the user clearly
- Interactive area is smooth, and responsive
- Interactive area adapts to the video style that is playing at the moment

3.1.2 Hardware Interfaces

This component works on the frontend as well as in the backend. Therefore, some functionalities of the component will be exposed through the users' personal computers via a web browser.

For processing user inputs and recommending suitable MOOCs, a service will be running in the backend server thus it will be interfacing with following hardware.

- 100Mbit Network Interface
- EC2 instance with below specifications.
  - 8GB RAM
  - 8GB internal storage for the operating system
  - 4 or more vCPUs

3.1.3 Software Interfaces

The frontend of the component will primarily deal with the following software.

- Mozilla Firefox
- Google Chrome
- Microsoft Edge
- Opera

The backend service will interface with following software/libraries.

- Amazon Linux 2 operating system
- Java Runtime Environment (JRE 8)
- MongoDB
- Node.js API of MoocRec V2

3.1.4 Communication Interfaces

Since server sided infrastructure is created in AWS Cloud, all communication interfaces are managed by AWS and created when the servers are created.

3.2 Classes/Objects

Both user input as well as browser activity are represented in their own classes since the nature of two inputs are different. At the same time, the model/algorithm used to predict the engagement level of the user during each segment of the interactive video session is represented as its own class to enable reusability. By doing so, we can use the said model in predicting the engagement using the user input as well as the browser activity separately.

Finally, a recommender class is used to coordinate between all the above classes and their objects in order to analyze the database and recommend suitable MOOCs based on the output of above classes. This association of classes is depicted in figure 3.2.

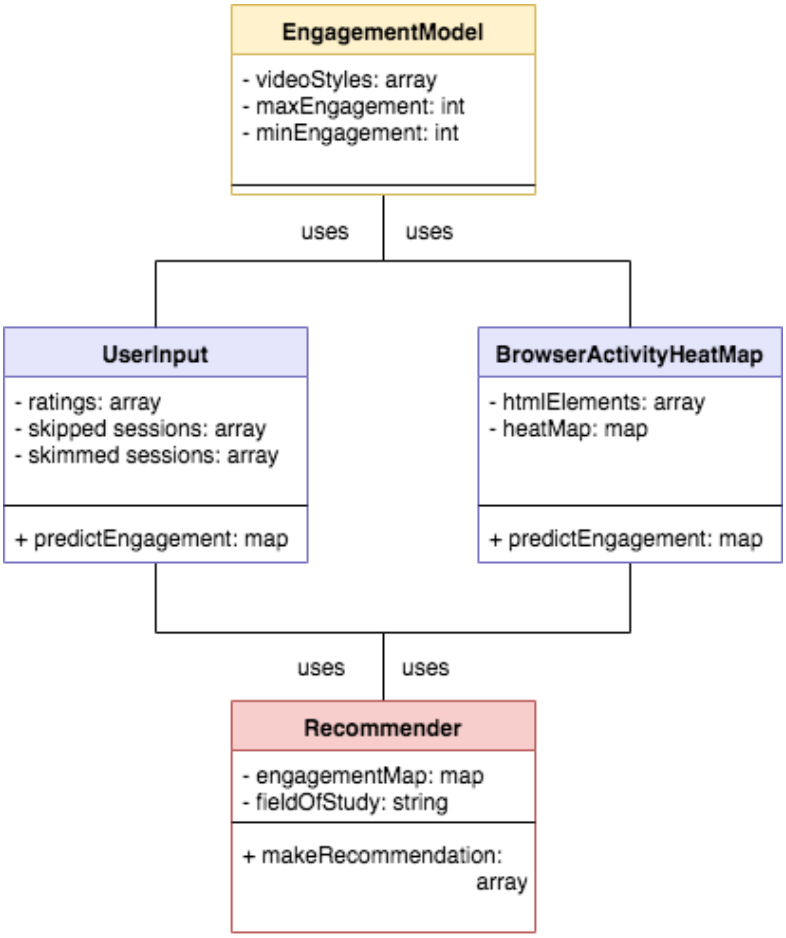

Figure 3.2: Association between Classes

3.3 Performance Requirements

- Since the user spends a considerable time with the interactive video session, which is crucial in finding the user's preferred video style, it is important that the user interface portion performance fluidly and efficiently.
- At the same time, MOOCs are recommended by going through an index of thousands of MOOCs. Therefore, it is equally important to perform searching tasks optimally.

3.3.1 Browser Performance Requirements

- Browser activity must be recorded with a minimum hit on browser performance.
- Browser should not be tasked with performing calculations/predictions.

3.3.2 Database Performance Requirements

- Proper indexes must be present to optimally analyze the database to retrieve results that belong to a certain video production style.

3.4 Design Constraints

- Introductory video only contains MOOC learning material types which are identified by MOOCRec V2. I.e. talking head, animation, code/tutorial, presentation slides, khan academy writing and forum discussions.

3.5 Software System Attributes

3.5.1 Accuracy

- The system should predict the engagement level of the user for each segment of the interactive video session with a high accuracy since this is the main factory we consider when recommending MOOCs.
- The result we get by letting a set of people fill the ILS questionnaire to identify their learning style and the result we get by allowing the same set of people to interact with our intro video should be approximately the same in order to validate the developed component.

3.5.2 Availability

- The system should show the user's preferred video production style along with the learning dimension within a short period of time after the conclusion of the interactive video session. Therefore, it is paramount that the backend service that analyze the data inputs perform efficiently

3.5.3 Performance

- Since the user's preferred video production style along with the learning dimension are shown in a short period of time after the conclusion of the interactive video session, the backend service must perform efficiently and fast in order to avoid making the user wait.

4 References

[1] P. Bowden, "Class Central #1 Search Engine for Free Online Courses and MOOCs," 13 05 2019. [Online]. Available: https://www.classcentral.com/help/moocs.

[2] M. MOOC, "Learn more about our platform and our community - My MOOC," My MOOC, 2019. [Online]. Available: https://www.my-mooc.com/en/about. [Accessed 13 May 2019].

[3] P. A. ,. M. S. Saugat Aryal, "Mapping of MOOCs with Learning Styles," *MOOCREC: LEARNING STYLES-ORIENTED MOOCS RECOMMENDER AND SEARCH ENGINE* , pp. 32-35, 2018.

5 Appendix